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## UPSTREAM RESERVOIRS

The major existing dams with significant storage located above Stillwater are listed in Table No. 6. In addition, there are a number of smaller dams with minor storage capacities located on the various tributaries above Stillwater. It is obvious that the largest single block of storage is contained in the Sacandaga Reservoir behind the Conklingville Dam, with a volume greatly in excess of all other reservoirs combine. Failure of the Conklingville Dam would release the largest confined volume of water in the basin and would result in the highest conceivable stage at Stillwater if it should occur coincident with flood conditions.

## CONKLINGVILLE DAM

The Conklingville Dam, completed in 1930, is located on the Sacandaga River, as shown on Figures 1 and 2. It is an earth dam founded on rock and earth, with a concrete gravity spillway built on rock. The earth dam was built by the semi-hydraulic fill method. It has a crest width of 43 ft. at El. 794.5 and a base width of 650 ft. at its maximum height of 96 ft., the width-to height ratio being 6.75 to 1. At spillway crest El. 771.0, the reservoir has a total capacity of 37.8 billion cubic feet. The reservoir volume above El. 768.0 is reserved for flood control purposes. The diversion canal and spillway are located in a rock section away from and to the left of the earth dam. The outlet works consists of three 8 ft. diam. Dow Valves and two 18 ft. by 8 ft. siphons. The spillway is an ungated free overflow section 405 ft. long.

The dam was designed for large surcharge, having a freeboard height of 23.5 above the spillway crest. The maximum level attained by the reservoir during the 38 years of operation was

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El. 769.43, 1.57 ft below the spillway crest. When routing the probable maximum flood through the reservoir, the maximum stage reached was El. 784.0, 10.5 ft below the crest of the earth dam.

The dam was built by the State of New York and is maintained and operated by the Hudson River – Black River Regulating District. Subsequent to award of the construction contract, the rock excavation for the spillway channel was increased. This rock material was spoiled at the downstream toe of the dam, providing an unusually large rock toe section. The dam has an ample cross section, is inherently stable, and has proven its ability to withstand severe earthquakes, as mentioned below.

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18.

A series of significant earthquakes have occurred in the area since completion of the dam. The highest recorded earthquake occurred on April 20, 1931, at Lake George, New York. This earthquake was recorded at Intensity VII (Modified Mercalli Scale) and was perceptible over an area of 60,000 square miles. The Sacandaga Reservoir level was at E. 752.2 at the time. Following the earthquake, a two-day inspection of the dam and reservoir was conducted and no damage was found.

there is no reason to believe that the Conklingville Dam would fail from earthquake, overtopping, or any other natural cause. However, because it does contain the largest volume of stored water in the entire basin, it was used in determining the stage at Stillwater from an assumed dam failure.

It was assumed that failure would occur with the reservoir at its maximum possible level, El. 784.0, which is caused by runoff generated by the probable maximum precipitation. At this surcharged elevation, the reservoir contains approximately 54 billion cubic feet of water.

It was further assumed that Stewarts Bridge Dam would fail prior to Conklingville Dam. This assumption is based on the fact that, in routing the maximum flood through the tow reservoirs, it is found that the freeboard at the Conklingville Dam would be 10.5 ft as compared to 3.5 ft at the Stewart Bridge Dam. While this shows that neither of the dams would be overtoppped during the maximum probable flood, in the event of a catastrophe, the smaller freeboard at the Stewart Bridge Dam would make it more likely to fail first.

MODE OF FAILURE

In a hypothetical study of this type, the first assumption to be made concerns the mode in which the structure fails, for this will greatly effect the resulting hydrograph. Earth fill structures such as Conklingviell Dam generally fail progressively, failure starting from an initial breach which increases in size by erosion of material under influence of the current. This mode of failure produces a hydrograph with an initially low discharge, increasing with time to a maximum, then decreasing as the reservoir elevation drops. The quantitative determination of this type hydrograph depends on the assumption of size and location of the initial breach, and rate of erosion, both of which are subject to question.

The maximum discharge rate would be obtained if failure were assumed to be instantaneous and complete and, for a discrete



volume of water, produces a hydrograph of shortest duration, maximizing the flow concentration. This is the most conservative mode of failure that can be assumed, and was used for this study.

## DAM BREAK HYDROGRAPH

The physical laws governing unsteady flow in natural channels caused by a dam failure are among the most complex in the field of hydraulics. The first attempt to solve the problem was carried out by Saint-Venant who gave two differential equations bearing his name. These are based on a series of hypotheses which render them applicable only to gradually unsteady flow. While no integration of the equations is possible in the general case, certain simplifications and additional hypotheses have been used which have allowed integration and furnished solutions of limited applicability. Contributions based on theory and experiments have been made by many researchers including Ritter[15] Schocklitsch [16], Re[17], Pohle[18], Levin[19], Dressler[20-21], Stoker[22], Snyder[24], and U.S. Army Engineers[25].

Essentially, the sudden destruction of a dam results in a positive wave, advancing in downstream direction in the river channel, and a negative wave propagating in upstream direction into the storage reservoir. The wave velocity and profile depend on many factors including height of dam, channel and reservoir cross-section, channel resistance initial stream flow conditions, and length of storage reservoir. The simplifications commonly adopted by most researchers with a view to reducing the mathematical complexity of the problem included consideration of a prismatic, rectangular channel, horizontal channel bottom, and negligible flow resistance. The analytical methods which have been developed based on these simplifications have been confirmed by model studies, and as such can now be used as an engineering tool for determining flow conditions generated a sudden dam failure.

The objective of the Conklingville Dam failure study, as related to determination of the maximum possible stage at Stillwater, was to calculate a dam-break hydrograph to be used in flood routing. The hydropraph was determined by two independent approaches.

The first approach is essentially based on Stoker's method[22] which is the outgrowth of most of the theoretical and analytical work carried out to date. According to this method, the water depth in a rectangular channel at the dam site is 4/9 of the head in the reservoir until the negative wave reaches the end of the reservoir. To apply this method to they hypothetical failure of Conklingville Dam, the channel cross section at the Dam was approximated by three rectangles with a total area equaling that





of the actual section. The downstream depth of flow was taken equal to that determined for the total flow at any time. The total releases were determined by the summation of the flows from each rectangle under a given head in the reservoir. The water surface in the reservoir was considered horizontal at any time and the drops in water level ranged between 0.5 ft and 5 ft, depending on stage. By plotting the calculated releases versus time, the Dam-break hydrograph was obtained. The results have been closely checked by the more recent work of the U.S. Army Corps of Engineers[24].

The second approach was developed as an independent check of the previously discussed method and was aimed at determining a conservative upper limit for the releases after hypothetical dam failure. It is assumed that flows are controlled only by the reservoir stage and channel characteristics and no energy is expended for negative wave motion. Critical depth is assumed to prevail at the dam section throughout the period under consideration and for all the flows after dam break. Essentially, this would mean that the channel bottom at the control section forms a broad-crested weir over which the water from the reservoir must flow. This would not be inconsistent with the relative steepness and geometry of the Sacandaga River channel below the dam. This assumption is the most conservative, since for a given head, the maximum flow is always released at critical depth. In determining the releases, a minor adjustment was made for head losses due to a change in channel cross section upstream of the dam. The results were again based on the assumption that the water surface in the reservoir is horizontal at any time. By plotting the calculated releases versus time, the dam-break hydrograph was obtained.

The hydrographs obtained with the two independent approaches described above are as follows:

| | Stoker's Method | | Critical Depth Method | |
|---|---|---|---|---|
| Time, Hr | Discharge, Cfs x $10^3$ | Total Outflow, Cu ft x $10^9$ | Discharge, Cfs x $10^3$ | Total Outflow, Cu ft x $10^9$ |
| 0 | 990 | 0 | 1,410 | 0 |
| 5 | 780 | 14.5 | 980 | 20.0 |
| 10 | 616 | 25.9 | 690 | 33.3 |
| 15 | 482 | 34.3 | 479 | 42.1 |
| 20 | 380 | 40.8 | 336 | 48.2 |
| 25 | 300 | 46.0 | 215 | 52.0 |



21.

As anticipated, the critical depth method, which was used as an upper limit verification for Stoker's method, leads to higher flows, with the peak discharge 42 percent greater, and the volume released in the first 25 hours 11 percent greater.

ROUTING OF DAM BREAK WAVE

The downstream movement of the dam break wave is described as unsteady flow governed by the principles of conservation of energy and conservation of matter. Continuity and dynamic equations which mathematically describe the phenomenon of unsteady flow were first presented in the 19th century by Saint-Venant and are found in most texts dealing with unsteady flow. The equations have been verified by observations and experiments. However, owing to their mathematical complexity, an exact integration of the equations is almost impossible. Solutions therefore must be made by methods based on simplifying assumptions and approximate step methods.

The stream channels of the Sacandaga River and Hudson River between Conklingville Dam and Stillwater are of widely varying characteristics. The river has many sharp bends, man-made and natural constrictions and abrupt drops, all of which made the use of wave theory impracticable. The method used was the same as described in the section on routing the maximum probable flood. This method neglects the energy relationship and is based on the conservation of matter and, in effect, is a storage routing procedure. Because the energy relationship is neglected, the results obtained by using this method are very approximate for locations a short distance downstream of a breached dam. However as the reach length increases, the storage relationship becomes the more predominate factor in wave attenuation and results are of greater accuracy. Stillwater is approximately 60 miles downstream of the Conklingville Dam and it is believed that the storage routing procedure produces results within the accuracy of available physical data.

In routing, no advantage was taken of the storage available in the Sacandaga River. This reach is about six miles long, with a relatively narrow channel, without flood plains, containing a very small amount of valley storage, and it was conservatively assumed that the dam outflow hydrograph would be transposed to the confluence of the Sacandaga and Hudson Rivers undiminished.

The stage-storage-discharge relationships for the reaches downstream of the confluence were determined as described under the probable maximum flood routing section with the exception of the reach above Palmer Falls, which includes the mouth of the Sacandaga. It was recognized that a large flow from the Sacandaga would divide when it reached the Hudson River and flow



would be in the upstream as well as the downstream direction. This storage upstream of the confluence was calculated from the stage at the confluence determined by steady state backwater calculations from Palmer Falls, assuming a horizontal water surface upstream of the confluence. An adjustment in this volume was made by subtracting the volume occupied by the flow in the Hudson River at the time the dam break wave arrives.

It was assumed that all the dams downstream of the mouth of the Sacandaga River would pass the Conklingville Dam break wave without failure. It is realized that for some of the dams this assumption is not valid. However the combined volume impounded by all the dams on the Hudson River above Stillwater is about 1 billion cubic feet. This is about 2 percent of the total volume in the Sacandaga Reservoir at the time of the hypothetical failure and considerably less than the difference in the two dam break hydrographs discussed in the previous section. To include this volume in the computations would greatly increase the compexity of the solution without increasing the validity of the results.

The dam break hydrographs determined by both methods were routed to Stillwater using a time increment of 20 minutes. Tributary inflow and river bank runoff from the probable maximum precipitation were combined with the dam break wave in the proper time sequence as the wave was routed.

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23.

## DISCUSSION OF RESULTS

### PROBABLE MAXIMUM FLOOD

The probable maximum flood at Stillwater reaches a peak discharge of 300,000 cfs and a river stage elevation of 110 ft approximately 64 hours after the start of the precipitation. The maximum 24 hour mean discharge is 260,000 cfs. Figure 3 shows the hydrograph of the flood at the site.

At the existing Bakers Falls Dam the probable maximum flood has a peak discharge of 230,000 cfs and a maximum headwater elevation of 221 ft.

It has been said that no method has been devised which can accurately indicate the frequency of large floods in the absence of stream flow records over long periods [25]. If the large flood being considered is several times larger than any observed evetn, as is the case for the predicted probable maximum flood of this study, the above statement can hardly be questioned. In fact, the probable maximum flood by definition has a frequency which is extremely large. However, in an attempt to bring some degree of perspective to the question of flood probability on the Hudson River at Stillwater, discharge-frequency curves based on a statistical evaluation of the available date were prepared, as shown on Figure 5, and extended to 10,000 years.

The data used for plotting the curves were based on USGS flow records at the Mechanicville gage from 1911 to 1956. Maximum daily discharge at Stillwater was obtained by correcting the Mechanicville flow for discharge from the Hoosic River and, prior tp 1930, for discharge from the Sacandaga River which would have been impounded by the Conklingville Dam.

the two curves, plotted on extreme value paper, are based on two of the numerous methods which have been suggested for estimating discharge-frequency relationships. These curves are thought to define the extremes of these relationships for the Hudson River at Stillwater. Curve A, based on a Type I extreme value distribution as suggested by Gumbel, represents an unsymmetrical data distrubution with a fixed skew. When the data are plotted, the flood of record falls considerably above the curve. Curve B is based on a graphical fit of the data distributed according to a method used by the U.S. Geological Survey[26]. The points plotted are for the latter distribution, but they are located approximately in the same position for both methods. The graphical fit shown by Curve B assumes a difference in the distribution parameters for the four floods with return periods exceeding 10 years. It has been suggested that outstanding



floods may in fact follow some law of their own which comes into operation at very long interval.,[25].

From Figure 5, the estimated discharge for a flood with a frequency of 10,000 years is as follows:

| | Discharge – Cfs | |
|---|---|---|
| | Mean Daily | Peak=Mean Daily x 1.15 |
| Curve A | 121,000 | 139,000 |
| Curve B | 232,000 | 267,000 |

The factor of 1.15 used to determine the peak discharge from the mean daily, is the ratio of these discharges found for the probable maximum flood.

Based on the above analysis, the peak discharge for a flood with a return period of 10,000 years would fall between 139,000 and 267,000 cu. ft. per second. These results indicate that the maximum flood predicted has a return period well in excess of 10,000 years and meets the requirements of obtaining a flood that has a change of occurance approaching zero.

It should be noted that the predicted maximum flood produces stages along the river which would inundate large areas, including many existing communities. However, it is recognized by most experts that all work can not be economically protected against such remote occurance and lesser floods are normally used for most design purposes.

Often the U.S. Army Corps of Engineers use a lesser flood designated as the Standard Project Flood for design. This flood represents critical concentration of runoff from the most severe combination of precipitation that is considered “reasonably characteristic” of the drainage basin involved. The Standard Project Flood Peak discharge and volume is usually equal to 40 percent to 60 percent of the probable maximum flood for the same drainage basin[1]. There are some other design floods criteria used, which consider the degree of risk, hazzards involved and consequences of failure. The use of probable maximum flood as a design flood is not always justified or warranted for all projects and the design flood should be selected only after a complete study of all the factors involved.

DAM BREAK WAVE

The decision to assume that Conklingville Dam would fail in determining the effect of a dam break wave at Stillwater was based only on determining a hypothetical stage Stillwater. We believe that the probability of a





failure of Conklingville Dam is extremely remote. The probable maximum flood study clearly indicates the reservoir has sufficient storage and the dam ample freeboard to pass this flood safely without danger of overtopping. The dam has successfully withstood a significant earthquake without damage. However, because a hypothetical failure of Conklingville Dam would cause the highest possible stage at Stillwater this possibility was included in the study.

The determination of the maximum river stage at a point almost 60 miles downstream from a hypothetical dam failure is, at best, a rough estimate, greatly dependent on a large number of assumptions for solution. A conscientious effort was made to make all assumptions as reasonably conservative as possible. Two different approaches were used in determining the initial dam break hydrograph. Stoker's method is the most reasonable based on the present state of knowledge. The critical depth approach was used only as an upper limit verification, since it is admittedly ultraconservative. By routing the dam-break

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hydrographs obtained with the two approaches to Stillwater the following results were obtained:

| | Stoker's Method | Critical-Depth Method |
|---|---|---|
| Max Discharge at Conklingville | 990,000 cfs | 1,410,000 cfs |
| Max Discharge at Stillwater | 670,000 cfs | 810,000 cfs |
| Max Stage at Stillwater | El. 124 | El. 128 |

From the above tabulation it is apparent that in terms of maximum state at Stillwater the results obtained with the two independent approaches are reasonably close, In our opinion, this confirms the validity of Stoker's method which is itself based on many conservative assumptions. As pointed out before, the results obtained with this method were closely checked with a more recent work of the U.S. Army Corps of Engineers. Therefore, the maximum possible river stage at Stillwater resulting from the failure of Conklingville Dam coincident with the maximum flood is El. 124.

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REFERENCE LIST

1. Definition of Terms, "Survey Conducted by the Committee on Failure and Accidents to Large Dams Other Than in Connection with the Foundations," United States Committee on Large Dams, Feb. 1968

2. Hydrometerological Report No. 33 "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" U.S. Department of Commence, Weather Bureau, U.S. Government Printing Office, 1956

3. "Report on Project Flood for Review of Reports on Flood Controls for the Connecticut River Basin" Unpublished Report, U.S. Army Corps of Engineers, Providence District, August 1946

4. Gilman, C. S., Chief Hydrometeorological Section, U.S. Weather Bureau, Memorandum to Mr. A. L. Cochran, Civil Works, Office of Chief of Engineers, "Preliminary Estimate of Probable Maximum Precipitation for the Delaware River at Tocks Island Dam Site," July 3, 1956

5. Hydrometeorological Report No. 28, "Generalized Estimate of Maximum Possible Precipitation Over New England and New York," U.S. Department of Commerce, Weather Bureau, U.S. Government Printing Office, 1952

6. Hydrometeorological Report No. 40, "Probable Maximum Precipitation – Susquehanna River Drainage Above Harrisburg, Pa.", U.S. Department of Commerce, Weather Bureau, U.S. Government Printing Office, 1965

7. "Unit Hydrographs, Part I – Principles and Determinations," Civil Works Investigation, Project 152, U.S. Army Engineer District, Baltimore: Corps of Engineers, Baltimore, Md., 1963

8. "Hydrology Guide for Use in Watershed Planning," National Engineering Handbook, Sec. 4, Supplement A, U.S. Department of Agriculture, Soil Conservation Service Central Technical Unit, Beltsville, Md., 1957

9. Newton, D. W., and Vinyard, J. W., "Computer-Determined Unit Hydrograph from Floods," Proceeding ASCE, Journal of the Hydraulic Division, Vol. 93, Hy-5, September 1967

QUIRK, LAWLER & MATUSKY ENGINEERS

10. Taylor, A. B., and Schwartz, H. E. , "Unit-Hydrograph Lag and Peak Flow Related to Basin Characteristics," Trans. Amer. Geophysical Union, Vol. 33, No. 2, April 1952

11. "Design of Small Dams," U.S. Department of Interior, Bureau of Reclamation, U.S. Government Printing Office, Washington, D.C., 1965

B-29

2

12. "Routing of Floods Through River Channels" U.S. Army Corps of Engineers, Engineering and Design Manuals EM 1110-2-1408, U.S. Government Printing Office, Washington, D.C., March 1960

13. Chow, V. T., "Open Channel Hydraulics," McGraw-Hill Book Company, New York 1959

14. Barnes, H. H., Jr., "Roughness Characteristics of Natural Channels," Geological Survey Water Supply Paper 1849, U.S. Government Printing Office, Washington, D.C., 1967

15. Ritter, A., "Die Fortpflanzung der Wasserwellen," (Propogation of Waves) , Zeitschrift des Verelines deutscher Ingenieure, Vol. 36, No. 33, pp. 947-954, Aug. 13, 1892

16. Shocklitsch, A., "Uber Dambruchwellen," (On Waves Produced by Broken Dams), Stilzungsberichte, Mathematisch-naturwess-enschaftliche Klasse, Akademie der Wissenschaften in Wien, Vol. 126, Part IIa, pp. 1489-1514, Vienna, 1917

17. Re., R., "Etude de Lacher Instantane d'une Retenue d'eau Dans un Canal par La methods Graphique," (Study of the Instantaneous Release of Water in a Reservoir to a Canal by the Graphic method), La Houille Blanche, 1st year, No. 3,

pp. 181-187, Grenoble, May 1946

18. Pohle, F. V., "Motion of Wave Due to Breaking of a Dam and Related Problems," Paper No. 8, in Symposium on Gravity Waves, U.S. National Bureau of Standards, Circular 521, pp. 47-53, 1952

19. Levin, L., "Mouvement Non Permanent Sur Le Cors d'eau a la Suite de Ruptrue de Barrage' (Unsteady Flow in Channels Following the Rupture of Dam), Revue Generale de l'Hydraulique, Vol. 18, No. 72 pp. 293-315, Paris, Dec. 1952

20. Dressler, R. F., "Hydraulic Resistance Effect Upon the Dam-Break Functions," Paper 2356, Journal of Research, U.s. National Bureau of Standards, Vol. 49, No. 3, pp. 217-225, Sept. 1952

21. Dressler, R. F., "Comparison of Theories and Experiements for the Hydraulic Dam-break Wave," Assemblee Generale de Rome, 1954, International Association of Scientific Hydrology, Publication No. 38, Vol. 3, pp. 319-328, 1954

22. Stoker, J. J., "Water Waves, " Vol. IV of "Pure and Applied Mathematics," Interscience Publishers, Inc. New York, 1957

23. Snyder, F. F. "Hydrology of Spillway Design; Large Structures Adequate Data" Proceedings of ASCE, Journal of the Hydraulics Division, Vol. 90, HY-3, May 1964



24. "Floods Resulting from Suddenly Breached Dams" Miscellaneous Paper 2-374, Conditions of Minimum Resistance Report No. 1, February 1960, Condition of High Resistance Report No. 2, November 1961, U.S. Army Engineers Waterways Experiment Station, Viksburg, Mississippi

QUIRK, LAWLER & MATUSKY ENGINEERS

25. "Review of Flood Frequency Methods," Final Report of the Subcommittee of the Joint Division Committee on Floods, Transactons, ASCE vol. 118, pp. 1220-1230, 1953

26. Riggs, H. C., Frequency Curves, Chap. A2, "Techniques of Water Resources Investigations of the United States Geological Survey," U.S. Department of the Interior, U.S. Government Printing Office, Washington, D.C. 1968

B-31

OTHER SOURCES

Chow, V. T., "Handbook of Applied Hydrology," McGraw-Hill Book Company, New York, 1964

Lensley, R. K., Jr., Kohler, M.A., and Paulkus, J.C. H. "Applied Hydrology," McGraw-Hill Book Company, New York, 1949

Davis, C.V., "Handbook of Applied Hydraulics,"McGraw-Hill Book Company, New York, 1952

"Backwater Curves in River Channels," U.S. Army Corps of Engineers, Engineering and Design Manual EM 1110-2-1409, U.S. Government Printing Office, Washington, D.C., December 1952, Change 1, September 1960

Topographic Maps – Entire Basin, 7.5 Min and 15 Min Quadrangles and 1:250,000 Scale, U.S. Department of Interior Geological Survey, Topographic Division, Washington, D.C.

Topographic Maps – Hudson River, Fort Edward Dam to Palmer Falls Dam, Scale 1 In. = 200 ft, Niagara Mohawk Power Corporation

Topographic Maps – Hudson River, Palmer Falls Dam to Curtis

Falls Dam, Scale 1 In. – 100 Ft, International Paper Company, 1966

Topographic Maps – Hudson River, Hadley to Mouth of the Schroon River, Scale 1 In. = 400 Ft, Niagara Mohawk Power Corporation, 1922

U. S. Lake Survey Chart No. 180, New York State Barge Canal System, U. S. Army Corps of Engineers, Detroit, Michigan, 1964

River Soundings, Fathometer Readings, Hudson River, Troy Locks to Corinth Bridge, U.S. Geological Survey, Albany, New York, 1967

Field Cross Sections and River Soundings, Clarkeson and Clough Associates, Albany, New York, 1968

Precipitation Records of Stations Within and Adjacent to Basin, National Weather Records Center, Asheville, North Carolina

Water Supply Papers, U.S. Department of Interior Geological Survey, Water Resources Division, U. S. Government Printing Office, Washington, D.C.

Unpublished Stage Recordings and Rating Tables, U.S. Department of Interior, Geological Survey, Water Resources Division, Albany, New York





Unpublished Gage Readings, Champlain Barge Canal, Lock 3c to Lock 7C, New York State Barge Canal, Canal Engineer, Waterford, New York

"Report on the Water Power and Storage Possibilities of the Hudson River" New York Water Power Commission, State of

QUIRK, LAWLER & MATUSKY ENGINEERS

New York, 1922

U. S. Army Corps of Engineer "308 Report," Hudson River Basin, House Document No. 149, 72nd Congress, 1st Session, December 1931

Plans and data on the following dams were obtained from the listed owners:

| Dam | Owner |
|---|---|
| Indian Lake Dam | Indian River Company |
| Conklingville Dam | Board of Hudson RIver-Black River Regulating District |
| Stewarts Bridge Dam | Niagara Mohawk Power Corporation |
| Curtis Falls Dam | International Paper Company |
| Palmer Falls Dam | International Paper Company |
| Spiers Falls Dam | Niagara Mohawk Power Corporation |
| Sherman Island Dam | Niagara Mohawk Power Corporation |
| Feeder Dam | State of New York, Moreau Manufacturing Corporation |

| | |
|---|---|
| Glens Falls Dam | Finch, Pruyn & Company, Inc., Niagara Mohawk Power Corporation |
| Bakers Falls Dam | Niagara Mohawk Power Corporation |
| Crockers Reef | State of New York |

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| Dam | Owner |
|---|---|
| Fort Miller Dam | Fort Miller Pulp & Paper Company |
| Thomson Dam | United paperboard Corporation, Thomson Paper Company |
| Stillwater Dam | Niagara Mohawk Power Corporaiton |
| Upper Mechanicville Dam | State of New York, West Virginia Pulp and Paper Company |
| Winnies Reef | Niagara Mohawk Power Corporation |

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APPENDIX C

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## NOTATIONS & SYMBOLS USED IN THE REPORT

| | | |
|---|---|---|
| A | = | Cross-sectional area |
| a | = | $0.5(1/v_2 - 1/v_1)$ |
| $A_n$·$A_n$+1 | = | Area bounded by isohyets number n and n+1 |
| B | = | Channel width |
| C | = | Constant equal to 4 feet $^{1/2}$/second determined from data supplied |
| D | = | River depth |
| D' | = | $\frac{dy}{dx}$ |
| dg/dy | = | Slope of discharge rating curve at a station whose cross-section is representative of the reach for steady flow |
| $F_E$ | = | Vertical component of earth pressure acting on downstream face, i.e. weight of earth mass vertically above the downstream face, acting through the centroid of that mass. |
| $F_H$ | = | Horizontal component of hydrostatic pressure, acting along a line H/3 feet above the base. $1/2yH^2$, where y = specific weight of water |
| $F_u$ | = | Uplift force on base of dam, as determined by foundation seepage analysis, and integration of point pressure intensities over base area; if foundation is homogeneously |

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permeable, pressure varies approximately linearly from full hydrostatic head at the heel to full tailwater head, and $F_u$ is approximately 1/2γHB, acting at B/3 from the heel. This value is often multiplied by some fraction less than 1 if the foundation is relatively impermeable, but it is on the safe side to assume uplift over the entire base area.

$F_v$ = Vertical component of hydrostatic pressure. Weight of fluid mass vertically above the upstream face, acting through the centroid of that mass.

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<u>NOTATIONS & SYMBOLS USED IN THE REPORT</u> (Continued)

H = Resultant of all forces acting on the dam, equal to R but in the opposite direction.

H = Total head (elevation of the energy line) above a horizontal datum. The mean sea level was selected in this study as the datum.

H' = Water head above the spillway crest in feet

h = Depth of impounding water

$h_e$ = Eddy loss. For convenience of computation, this loss was considered part of the friction loss $h_f$.

$h_f$ = Friction loss between two end sections i and i+1

h = Depth of water below the dam

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o

| | | |
|---|---|---|
| I | = | Rate of inflow into reservoir |
| i | = | Hydraulic quadient. It is equivalent to the slope of the seepage curve dy/dx. |
| $I_1, I_2$ | = | Inflow at upstream end of reach 1 and 2 |
| K | = | Permeability coefficient (ft/sec) |
| k | = | Time of travel of flood wave and also the change of storage per unit change of discharge |
| L | = | Distance from dam |
| L′ | = | Length of Spillway or weir |
| n | = | Manning's roughness coefficient |
| n, n+1 | = | subscripts denoting successive intervals of time of length $t_{n+}1 - {}^{t}n$ |
| O | = | Rate of outflow from the reservoir |

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NOTATIONS & SYMBOLS USED IN THE REPORT (Continued)

| | | |
|---|---|---|
| $0_1{}'0_2$ | = | Outflow from reach 1 and 2 |
| $P_1{}'P_{n+1}$ | = | Average depth of rainfall over the areas bounded by Isohytes 1 and 2 |

| | | |
|---|---|---|
| Q | = | River discharge |
| Q′ | = | Flow resulting from dam failure at a distance L Downstream of the dam site |
| $Q_o$ | = | Initial discharge after dam failure |
| $\mathcal{L}$ | = | Seepage (cfs/ft) |
| R | = | Resultant of foundation shear and bearing pressures: Horizontal component, $R_H = F_H + F_E$ acting along the base; Vertical component, $R_V = W + F_V - F_U$ acting at a distance X from the toe that can be determined by the requirement For rotational equilibrium of the dam, by equating to zero the sum of the moments of all the foregoing forces about the toe of the dam. |
| $R_h$ | = | Hydraulic radius |
| S | = | Available storage above spillway level |
| $S_f$ | = | Friction slope taken as the average of the slopes at the two end stations, i.e. $\bullet_f = ½ (S_i + S_{i+1})$ |
| So | = | Slope of river bed |
| T | = | Time after dam failure |
| V | = | River velocity and is equal to Q/A |
| $V_1$ | = | Velocity of wave front |
| $V_2$ | = | Velocity of wave tail |
| Vn'Vn+1 | = | Values of isohyets number n and n+1. These numbers refer to the lettered isohyets shown in Figure III-8 |

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$V_W$ = Rate of movement of flood wave.

W = Weight of dam – (area of cross-section of dam) (Sy) where S = specific gravity of masonry, approximately 2.4 or 2.5, acting through centroid of cross-section

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<u>NOTATIONS & SYMBOLS USED IN THE REPORT</u> (Continued)

$W_O$ = Amount of water stored in reservoir

X = A dimensionless constant representing an index of the wedge storage in a routing reach

x = Distance measured from dam site

Y = Water surface elevation above mean sea level

Y' = Depth at the crest of the wave

y = Depth of seepage curve

$Z_1$ = Water surface elevation above mean sea level

θ° = Angle between horizontal line and upstream face of the dam.

$\Delta t$ = Length of the routing period having a maximum value of $2K_x$ and may be taken as equal to k. The routed hydrograph is relatively insensitive to the value bf $\Delta t$

ℓ = Energy coefficient. This coefficient was assumed to be unity because of the fairly straight alignment and regular cross-section of the river between the Battery and Indian Point

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# APPENDIX D

## REFERENCES

1. U. S. Department of Commerce, Weather Bureau, Hydrometeorological Report No. 40, PROBABLE MAXIMUM PRECIPITATION, SUSQUEHANNA RIVER DRAINAGE BASIN ABOVE HARRISBURGH, PA., Washington, May 1965

2. U. S. Department of Commerce, Weather Bureau, Hydrometeorological Report No. 33, SEASONAL VARIATION OF THE PROBABLE MAXIMUM PRECIPITATION EAST OF THE 105$^{TH}$ MERIDIAN FOR AREAS FROM 10 TO 1,000 SQUARE MILES AND DURATION OF 6, 12, 24, AND 48 HOURS, U. S. Government Printing Office, 1956.

3. U. S. Army Corps of Engineers, Unpublished Report, REPORT ON PROJECT FLOOD FOR REVIEW OF REPORTS ON FLOOD CONTROLS FOR THE CONNECTICUT RIVER BASIN, Providence District, August, 1946.

4. Stone & Webster Engineering Corporation, FLOOD STUDY OF UPPER HUDSON RIVER BASIN, Boston, Mass., March 21, 1969.

5. U. S. Army Engineer District, Baltimore Corps of Engineers, Civil Works Investigations, Project 152, UNIT HYDROGRAPHS, PART I, PRINCIPLES AND DETERMINATIONS, Baltimore, Maryland, 1963.

6. U. S. Army Corps of Engineers, Engineering and Design Manuals EM 1110-2-1405, FLOOD HYDROGRAPH ANALYSIS AND COMPUTATIONS, U. S. Government Printing Office, Washington, D. C., August 31, 1959.

7. U. S. Army Corps of Engineers, Engineering and Design Manuals EM 1110-2-1408, ROUTING OF FLOODS THROUGH RIVER CHANNELS, U. S. Government Printing Office, Washington, D. C., March 1, 1960.

8. State of New York Hudson River Valley Commission, THE HUDSON WATER RESOURCES, New York, 1966

9. New England, New York Inter-Agency Committee, THE RESOURCES OF THE NEW ENGLAND-NEW YORK REGION, Part Two, Chapter XXXVII Subregion E (Hudson River Basin), New York, Vermont, Mass., 1955

QUIRK, LAWLER & MATUSKY ENGINEERS

10. Water Pollution Control Board, New York State Department of Health, LOWER HUDSON RIVER DRAINAGE BASIN SURVEY SERIES REPORT NO. 5, New York, 1953

D-1

11. Water Pollution Control Board, New York State Department of Health, LOWER HUDSON RIVER DRAINAGE BASIN SURVEY SERIES REPORT NO. 8, New York, 1960.

12. Summary Report of the Hudson River Valley Commission, THE HUDSON, New York, February 1, 1966.

13. Hudson River Valley Commission of New York, HUDSON RIVER ECOLOGY, New York, October, 1966.

14. Water Resources Commission, State of New York Conservation Department, Bulletin 61, THE HUDSON RIVER ESTUARY, A Preliminary Investigation of Flow and Water-Quality Characteristics, New York, 1967.

15. Quirk, Lawler & Matusky, HUDSON RIVER DISPERSION CHARACTERISTICS; Memo Report to Con Ed, October, 1965.

16. Several telephone conversations with Mr. Robert Forrest, Chief Engineer, Board of Hudson River-Black River Regulating District, March-April, 1970.

17. Several meetings and telephone conversations with Mr. Dwight E. Nunn, the Atomic Energy Commission, and Mr. P. Carpenter, FWPCA, March-April, 1970.

18. United States Geological Survey, FLOODS OF AUGUST-OCTOBER 1955, NEW ENGLAND TO NORTH CAROLINA, Water Supply Paper No. 1420.

19. Gilcrest, B. R., FLOOD ROUTING, Chapter X in Engineering Hydraulics, John Wiley & Sons Inc., New York, 1950.

20. Listvan, L.L., RASCOT MAKSIMALNOGO RASCHODA VODY OT PRORYVA NEKAPITALNYCH PLOTIN PRI PROJEKTIROVANII MOSTOVYCH PERECHODOR in Russian, or Computation of Flow after Dam Break for Design of Bridges, STPMS, Moscow, 1948.

21. Chow, Ven Te, OPEN-CHANNEL HYDRAULICS, McGraw-Hill Book Company, Inc., New York, 1959.

22. Data and Correspondence supplied by New York City Department of Water Resources concerning Ashokan Dam and Reservoir.

23. Morris, Henry M., APPLIED HYDRAULICS IN ENGINEERING, the Ronald Press Company, New York, 1963.
D-2

24. A meeting with Mr. Andrew Matusky of the U. S. Army Engineers District, Baltimore, February, 1970.

25. Prasad, Ramanand, A NUMERICAL METHOD OF COMPUTING GRADUALLY VARIED FLOW PROFILES, Presented to the Specialty Conference of the Hydraulics Division ASCE, at the Massachusetts Institute of Technology, Cambridge, Massachusetts, August 21, 1968.

26. Several telephone conversations between the author, Karim A. Abood of Q. L. & M. and Mr. Kenneth I. Darmer, Supervisory Hydrologist, Water Resources, Division, U.S.G.S., Albany, N.Y., March-April, 1970.

27. Baltzer, R. A. and Shen, J., FLOWS OF HOMOGENEOUS DENSITY IN TIDAL REACHES, U.S.G.S., Washington, September, 1961, Reprinted July, 1966.

28. Lai, Chintu, FLOWS OF HOMOGENEOUS DENSITY IN THE REACHES, SOLUTION BY THE METHOD OF CHARACTERISTICS, U.S.G.S., open file report, Washington, D.C., 1965.

29. Lai, Chintu, , FLOWS OF HOMOGENEOUS DENSITY IN TIDAL THE REACHES, SOLUTION BY THE IMPLICIT METHOD, U.S.G.S., open file report, Washington, D.C., 1965.

30. Lai, Chintu, , NUMERICAL SIMULATION OF WAVE-CREST MOVEMENT IN RIVERS AND ESTUARIES, Extract of "The Use of Analog and Digital Computers in Hydrologie," Symposium of Tucson, December, 1968.

31. Lai, Chintu, COMPUTATION OF TRANSIENT FLOWS IN RIVERS AND ESTUARIES BY THE MULTIPLE-REACH IMPLICIT METHOD, U.S.G.S. Prof. paper 575-B, 1967.

32. Lai, Chintu, COMPUTATION OF TRANSIENT FLOWS IN RIVERS AND ESTUARIES BY THE MULTIPLE-REACH METHOD OF CHARACTERISTICS, U.S.G.S. Prof. paper 575-D, 1967.

QUIRK, LAWLER & MATUSKY ENGINEERS

33. J. J. Dronkers, TIDAL COMPUTATIONS IN RIVERS AND COASTAL WATERS, Interscience publishers, Division of John Wiley and Sons, N. Y., 1964.

34. U.S.C. & G.S., TIDAL AND CURRENTS IN HUDSON RIVER, Special publication No. 180 by Paul Schureman, Washington, 1934.

D-3

35. Darmer, Kenneth I., HYDROLOGIC CHARACTERISTICS OF THE HUDSON RIVER ESTUARY, presented at the 2nd HRVC Hudson River Symposium, 1969.

36. Gofseyeff, S. and Panuzio, Frank L., HURRICANE STUDIES OF NEW YORK HARBOR, Journal of the Waterways and Harbors Division, proceedings of the ASCE, February 1962.

37. Wilson, B., THE PREDICTION OF HURRICANE STORM-TIDES IN NEW YORK BAY, Technical Memorandum No. 120, Beach Erosion Board Corps of Engineers, 1960.

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## 2.6 Meteorology

The description of site meteorology is given in Section 2.6.1 while a brief discussion of specific site meteorological and atmospheric diffusion studies are given in section 2.6.2. The technical reports pertaining to these site specific studies are also include. The safety analysis presented in section 2.6.3 and 2.6.4 is based on the site specific studies discussed in section 2.6.2. Section 2.6.5 provides a brief description of the onsite meteorological monitoring program.

The discussion of site meteorology given in section 2.6.1 is based on selected individual years in which analysis of meteorological data was performed. It should be pointed out that although the years selected are representative of the site meteorology, at least some year to year variability in the meteorological parameters will occur.

### 2.6.1 Site Meteorology

#### Winds

An important meteorological characteristic of the Indian Point Environment is that both northerly and southerly winds occur at maximum frequency. This is evident in all meteorological data collected at Indian Point from 1955 to the present.

Figures 2.6-1 a, b, and c present some constructed wind roses prepared using meteorological data collected during 1984 from the onsite 122 meter meteorological tower [1,2,3,4]. These wind roses provide an example of typical wind direction and frequency distributions that occur at Indian Point, on a quarterly basis for the 10 meter, 60 meter, and 122 meter levels of the tower. These wind roses show clearly the bidirectional frequencies in the wind directions, with frequency maximas in the north and south direction.

A comparison of the 10 meter level wind roses between each of the four quarterly periods during 1984 (Figure 2.6-1a) shows that north winds had the highest frequency during the period January-March, while northeast winds dominated during the remaining three quarterly periods. The period July-September had the highest frequency of northeast and south winds. South winds occurred with the lowest frequency during the period January-March.

At both the 60 meter and 122 meter levels (Figures 2.6-1b, 2.6-1c), a distinct peak in frequency of north winds occurred for all four quarterly periods. The 60 meter level, like the 10 meter level also displayed a peak in frequency of northeast winds particularly during the July-September period. This peak in northeast winds was not nearly as pronounced at the 122 meter level. The frequency of south and southeast winds was lowest during the period January-March and more pronounced during the remaining three quarterly periods. These figures also indicate a smaller third peak in the frequency of northwest winds which was most pronounced during the January-March period at all three tower levels. The relatively low frequency of south winds and the third peak in the frequency of northwest winds is likely to be the result of the stronger large scale (gradient) winds during the January-March period.

These wind characteristics for 1984 are generally consistent with wind observations collected during other years, with the most significant feature being the tendency for air flow along the axis of the valley. Differences in wind distributions that do occur between years can be attributed to year to year variability in the strength and movement of synoptic scale weather systems (cyclones and anticyclones).

The 1984 data, as well as analysis of meteorological data from other years (see section 2.6.2), suggests that winds in the region are controlled primarily by topography. It appears that both terrain channeling and a thermally driven valley wind is contributing to the observed wind direction frequency distribution.

Terrain channeling occurs when surface air flow at some angle to the valley, is deflected by the elevated valley walls and forced to flow along the valley axis. Terrain channeling is dependent only on the orientation of the valley, and the strength and direction of large scale winds. The thermally driven valley winds are induced by differential heating between one region of the valley and an adjacent region with different topography. The differential heating induces an along valley pressure gradient which drives the up or down-valley wind. Up-valley winds are confined during the daytime when surface heating is occurring while down-valley winds are primarily nocturnal, when there is significant surface radiative cooling. Consequently, up-valley winds will occur during hours with unstable stability classes while down-valley winds are characteristic of hours when low level inversions are occurring and stability classes are stable. These up and down-valley winds are most prevalent during the summer and fall season when the large scale (gradient) winds are weakest. Under these conditions it is common to observe north or northeast winds during the night and early morning at Indian Point, with a shift to southerly winds occurring within a few hours of sunrise, when surface heating commences. Thus, diurnal variations in winds at Indian Point will have the highest frequency of occurrence during the summer and fall season.

The diurnal variation of the vector mean wind as measured 70-feet above river during September-October 1955 is shown in Figure 2.6-2 for conditions in which the large scale flow was virtually zero (12 days) and in Figure 2.6-3 for conditions in which the large scale flow (gradient wind) was less than 16 MPH (35 days). It may be seen that for these virtually stagnant prevailing wind conditions, there is a regular diurnal shift in wind direction and that the mean vector wind associated with the down-valley flow is on the order of 6 MPH.

A measure of the reliability of the diurnal shift in wind direction is shown in figure 2.6-4 where the steadiness of the wind (vector) mean speed over the mean scalar speed is shown as a function of time and the strength of the prevailing flow. Where the steadiness is close to one (an extraordinarily high value for meteorological wind systems in this latitude), the reliability of a given wind direction is very high, It may be seen that the down-valley nocturnal flow is extremely reliable from 20-08 hours while the up-valley flow is as reliable from about 14-16 hours under zero pressure gradient conditions. For weak pressure gradient conditions the nocturnal flow direction is very probable from 24 to 08 hours and thereafter becomes quite unreliable. In short, these data indicate that a consecutive 24 hours down-valley flow with light wind speeds and inversion conditions is extremely improbable.

## Atmosphere Stability

Tables 2.6-1, 2.6-2 and 2.6-3 provide the wind direction percent frequency distribution as a function of stability at the 10 meter level of the 122 meter meteorological tower.(5) The Pasquill stability classes are based on vertical temperature gradients (0C/100 meters) and are the same as the NRC classification of atmospheric stability (6). Table 2.6-1 shows the joint frequency distribution for a one year period while Table 2.6-2 and 2.6-3 give distributions for the summer season (May – October) and winter season (November – April), respectively.

Inspection of tables 2.6-1, 2.6-2 and 2.6-3 show that stability Class E occurred with the highest frequency for all wind directions (total) both for the one year period and for the summer and winter seasons. For the one year period it occurred 37.17% of the time. Similar percent frequencies are shown for the summer and winter seasons. This stability class occurred most frequently during south southwest winds with a second peak in frequency occurring for northeast winds. The total percent frequencies show stability Class D occurs with the second highest frequency while Class G had the lowest frequency occurring only 1.69% of the time for the one year period. Again similar percent frequencies are indicated for the summer and winter seasons.

Joint Frequency Distributions

Tables 2.6-4 (sheets 1 through 28) provides recent joint frequencies of wind direction, wind speed and atmospheric stability for the quarterly periods in 1986. Sixteen wind directions, seven wind speed categories including calm winds and seven Pasquill stability classes (A-G) are used. The stability classes are determined from 61-10 meter vertical temperature difference (delta-T). Data recovery during 1986 was 99 percent (13 missing hours) during the April-June period and 100 percent for the remaining quarterly periods.

Thunderstorms

Thunderstorms, although not unique to the Indian Point Site, are important since they can produce wind and precipitation patterns in the Indian Point environment that have considerable spatial and temporal variability. An important characteristic of thunderstorms is a downdraft of relatively cold air which spreads radially outward at the earth's surface. This cold air outflow, commonly called a gust front, can at times travel significant distances from the immediate storm environment. A typical gust front will appear as a sharp change in wind speed and direction and a drop in ambient air temperature.

Figure 2.6-5 shows the mean annual distribution of days with thunderstorms for the northeast United States. (7) This map is based on data from the period 1952-1962. Figure 2.6-5 shows that in the vicinity of Indian Point an average of between 20 and 30 days per year will have thunderstorms. Most of these thunderstorm days will occur during the summer season.

## 2.6.2 Meteorological and Atmospheric Diffusion Studies at Indian Point

New York University under a contract with Consolidated Edison Company made extensive tests on the meteorological conditions at the Indian Pont site. The testing program started in 1955 and was completed in 1957. Site meteorology (wind direction, wind speed and vertical temperature gradient) and atmospheric diffusion characteristics as determined from this testing program are described in three technical reports prepared by the New York University staff under the immediate direction of Professor Benjamin Davidson. The original New York University reports, or applicable excerpts there from, which were reviewed by Professor Davidson and the Consolidated Edison staff, are provided on pages Q1-Q44 and R1-11. In addition, information on precipitation, the prevalent wind directions associated with precipitation, a table of wind directions during thunderstorms and associated wind roses are given on pages R12-R20.

Due to questions concerning the relevancy of certain meteorological data obtained in the 1956-1957 period a new meteorological monitoring program in the Hudson River Valley was initiated to try to verify the results of the old study. The locations of the meteorological towers erected for the new program did not correspond to the locations of the towers used in the earlier program, and the data were not reliable, due to instrumentation difficulties. The two sets of data were, therefore, difficult to compare although it was evident that no substantial change occurred in the valley meteorology from 1956-1969.

The experimental program was reorganized in the fall of 1969, and a new meteorological tower site was selected as close to the original 1956 one as was possible under current conditions. Wind observations were made at this 100-foot tower at Indian Point and at a ship anchored in the Hudson River northwest of Indian Point. The results of the program for the period 26 November 1969 to 1 October 1970 are presented in Dr. Halitsky's report NYU-TR-71-3 (see pages Y-1 to Y-32).

The conclusions, as stated in the report, are:

1) Annual average statistics of wind speed direction and vertical temperature differences were substantially the same for 1956 and 1970.

2) Average wind hodographs, as the ships exhibited the same diurnal reversal pattern and the same 2.5 m/sec nighttime down-valley speed in both years. The average wind hodograph at the tower showed a similar pattern of reversal, but the nighttime down-valley speed was about 2 m/sec.

3) All sixteen daily wind hodographs used for calculating the average hodograph at the tower showed the diurnal reversal and exhibited considerable variability in speed and direction from day to day through a complete cycle.

4) Maximum persistencies of low-speed inversion winds in the critical 005-020 sector were 2 hours, 4 hours and 3 hours for 1, 1.5 and 2 m/sec speeds, respectively, during the entire ten-month data record.

Additional data acquired from 1 January 1970 to 31 December 1971 is presented in NYU-TR-73-1 (see pages Z-1 to Z-82).

In addition to these meteorological studies, several diffusion studies pertaining to atmospheric diffusion modeling applied to the Indian Point Site were conducted. The final reports pertaining to these diffusion studies are given on pages 2.6.K-1 to 2.6.K-15, 2.6.L-1 to 2.6.L-67 and 2.6.M1 to 2.6.M-11.

### 2.6.3 Application of the Site Meteorology to the Safety Analysis of the Loss-of Coolant Accident

The atmospheric dispersion factors required for the safety analysis of Chapter 14 have been computed for the worst possible meteorological conditions which could prevail at the Indian Point site.

A search of the records indicates that the most protracted consecutive period during which the wind direction was substantially from the same directions was five days. The winds in this case were from the northwest and speeds ranged from 15 to 30 MPH. In view of the large wind speeds and slightly unstable to adiabatic range of thermal stability associated with this period of maximum wind direction duration, this case does not represent the most conservative meteorology associated with the Loss-of-Coolant Accident.

The most frequent wind flow at low heights under inversion conditions is down the axis of the valley. This direction, roughly 010-030o, is also the direction of maximum wind frequency at the 100 ft. tower level. Because of the relatively high frequency of inversion conditions associated with this wind direction, the safety analysis assumed that the distribution of wind speed and thermal stability during the hypothetical accident is exactly that measured at the 100 ft. tower level for the 005-020o wind direction. The valley wind is diurnal in nature, i.e., up-valley during unstable hours and down-valley during stable hours.

The safety analysis of the Loss-of-Coolant Accident assumed that the accident occurs during down-valley inversion flow conditions and that these conditions persisted for 24 hours with average wind speeds slightly less than 2 m/sec. Figures 2.6-2 and 2.6-3 indicate that the duration of the down-valley flow is about 12 hours rather than 24 hours, and that the vector mean wind speeds are on the order of 2.5 m/sec.

In view of the discussion above, it must be concluded that the safety analysis for the first 24 hours was conservative to within a factor of about two.

The remainder of the safety analysis assumed that for the next 30 days, 35% of the winds are in the 20o sector corresponding to the nocturnal down-valley flow and that wind speed and thermal stability were as observed over the period of one year as measured at the 100 ft. tower location. If the observations were distributed uniformly throughout the year, slightly over 100 hours per month of 005-020o winds could be expected to occur. The analysis assumes 276 hours of 005-020o winds occur in the first 31 days after the accident, and that about 130 of these hours are characterized by inversion conditions. Approximately 35 weak pressure gradient days were observed in September-October 1955 or about 430 hours per month. From Figure 2.6-4, the hours during which the down-valley flow is quite reliable under weak pressure gradient conditions are from 00-08 hours. Assuming that the reliability is 1.0 during these hours (it is fact about 0.9 or less), the number of down-valley inversion winds per month during September and October is on the order of 140 hours per month. This indicates that the meteorology assumed in the safety analysis beyond the first 24 hours is about right for the worst months (September and October) and is undoubtedly conservative, with varying degrees of conservatism, for about ten months of the year.

The inversion frequency assumed for the 30-day accident case is conservative because the evaluation was made from joint assumptions concerning the postulated meteorological conditions viz.,

1) Inversion conditions prevail for 42.4% of the time
2) The wind direction is within a narrow 20o sector, for 35% of the time

This is equivalent to assuming that in the model 20o sector, the inversion frequency is 14.8 percent for the 30-day period. The observed annual maximum inversion frequency for a 20o sector is 6.2% (p.29, Table 3-3, NYU Tech. Report 372.3, Section 1.6). If we assume that the inversion frequency is spread uniformly throughout the year, almost three months worth of inversion in the model 20o sector are considered to occur in the first 31-day month after the accident. The assumptions of uniform spread of inversion frequency over the year are examined above, where an attempt was made to isolate those local meteorological conditions at Indian Point which might yield the highest 30-day dose. It is concluded that the "worst" meteorological conditions are associated with the nocturnal down-valley flow which is most frequent during September and October.

2.6.4 Conservatism of Indian Point Site Meteorology with Respect to Calculation of Off-Site Doses

The conservatism of the site meteorology was evaluated with respect to wake dilution factors, Pasquill categories for stability classification and site shaping characteristics.

Building wake dilution factors, documented in reports by Dr. Halitsky titled "An Analysis of the Con Edison and AEC-DRL Wake Diffusion Models as Applied to the Indian Point Site", (see pages 2.6.K-1 to 2.6-K-15) and "An Analysis of the Con Edison and AEC-DRL Accident meteorology models as Applied to the Indian Point Site", (see pages 2.6.L-1 to 2.6.L-67) demonstrate that limiting the building wake dispersion correction factor to a value of 3, as required by AEC Safety Guide No. 4, is overly conservative. Both the Con Edison wake model and the Safety Guide model, without limiting the building wake dispersion correction factor, are realistically conservative when compared to actual field and wind tunnel measurements. The reports also evaluate the overall conservatism of the Con Edison accident diffusion model. Specific investigations of the turbulence characteristics and wind persistence for the site are presented.

In addition, these two reports show that the classification of atmospheric stability using the criteria documented in Safety Guide No. 23 is not appropriate for the Indian Point site. The significance of the valley influence in generating lateral dispersion, and meandering of the wind, create horizontal standard deviations of greater magnitude than those determined by using vertical temperature gradients. The data indicate Pasquill categories measured under inversion conditions with horizontal wind fluctuations similar to a Pasquill D category while, vertically, Pasquill categories are E, F, or G.

Pickard, Lowe and Garrick of Washington D.C., in the report, "A Study of Atmospheric Diffusion Condition Probabilities using the Composite Year of Indian Point Site Weather Data" (see pages 2.6.M-1 to 2.6.M-11), illustrate the effects of the site shaping technique for estimating the 95% confidence level of the annual average dispersion coefficient at the exclusion area envelope. In addition, the report shows the effect of using the "split sigma" model to account for the lateral wind meander observed in the valley.

The composite year of measured meteorological data was compiled in a form compatible with AEC Safety Guide No 23 in sheets 8 to 14 of Table 2.6-5. In order to conform with the sensor heights specified in Safety Guide No. 23 the measured $\Delta T$ was multiplied by a $\Delta T$ correction factor. The method used to determine this factor assumes an exponential relationship between temperature and height, such that measured temperature difference between any two heights can be represented as a temperature difference between two other heights, according to the following relationship:

$$\Delta T \text{ correction factor} = 1n\ (h_{ue}/h_{le}) / 1n\ ({}^{h}um/{}^{h}lm)$$

where:

| | |
|---|---|
| $h_{ue}$ = | height of upper extrapolated temperature (ft) |
| $h_{le}$ = | height of lower extrapolated temperature (ft) |
| $h_{um}$ = | height of upper measured temperature (ft) |

$h_{lm}$ = height of lower measured temperature (ft)

Sheets 1 to 7 of Table 2.6-5 show data normalized to the sensor heights specified in Safety Guide No. 23.

The composite year reflects those periods in which data recovery was the greatest. The composite year consists of January through July of 1970, August 1971, September and October 1972 and November and December of 1970.

Incorporation of the aforementioned characteristics unique to the Indian Point valley site into diffusion calculations, insure that off-site doses following a loss-of-coolant accident are within the limitations outlined in 10 CFR 100.

2.6.5 Onsite Meteorological Measurements Program

The meteorological measurement program consists of three instrumented towers, redundant power and ventilation systems, redundant communication systems, and a mini-computer processor/recorder. The meteorological measurement program complies with the acceptance criteria stated in Section 2.3.3. and in Section 17.2 of NUREG-75/087 Revision 1 (superseded by NUREG-0800, Rev. 2, July 1981) with the former section dealing with meteorological sensors and recorders, and the latter dealing with the Quality Assurance Program. The meteorological measurements program consists of primary and backup systems. The accuracy of the meteorological sensor and recording systems meet the system specifications given in the Section C.4 of proposed Revision 1 to Regulatory Guide 1.23.

Primary System

A 122-meter, instrumented tower is located on the site and provides:

1. Wind direction and speed measurement at a minimum of two levels, one of which is representative of the 10-meter level:

2. Standard deviations of wind direction fluctuations as calculated at all measured levels;

3. Vertical temperature difference for two layers (122-10 meters and 60-10 meters);

4. Ambient temperature measurements at the 10-meter level;

5. Precipitation measurements near ground level;

6. Pasquill stability classes as calculated from temperature difference.

To assure acceptable date recovery, the meteorological measurements system and associated controlled environmental housing is connected to a power supply system which has a redundant power source. A diesel generator has been installed to provide immediate power to the meteorological tower system in the event of a power outage. The generator becomes fully powered within 15 seconds after an automatic transfer switch is tripped. Various support systems include an uninterruptible power supply, dedicated ventilation systems, halon fire protection, and dedicated communications.

The meteorological data is transmitted simultaneously to two data loggers located at the Primary Tower site. One data logger transmits 15-minute average meteorological data to a computer to determine joint frequency distributions, and the second data logger transmits 15-minute average meteorological data to a computer located in the Buchanan Service Center, which provides the capability for accessing the meteorological data remotely.

Meteorological data can be transmitted simultaneously to the IP3 / IP2 emergency response organization and the NRC in a format designated by NUREG-0654/FEMA-REP-1.

Fifteen minute averages of meteorological parameters covering the 12-hour period previous to a recall command is available upon interrogation of the system.

Backup Systems

In the event of a failure of the primary meteorological measurement system, a backup meteorological system is used at the Indian Point site. This system is independent of the primary system and consists of an instrumented meteorological tower (a backup tower located approximately 2700 feet north of the primary tower). The associated data acquisition system for the backup tower is located in the Emergency Operations Facility. The backup system provides measurements of the 10-meter level of wind direction and speed, and an estimate of atmospheric stability (Pasquill category using sigma theta which is a standard deviation of wind fluctuation). The backup system provides information in the real-time mode. Changeover from the primary system to the backup system occurs automatically. In the event of a failure of the backup meteorological measurement system, a standby backup system exists at the 10-meter level of the Buchanan Service Center building roof. It also provides measurements of the 10-meter level of wind direction and speed, and an estimate of atmospheric stability (Pasquill category using sigma theta which is a standard deviation of wind fluctuations). The changeover from the backup system to the standby system also occurs automatically.

As in the case of the primary system, the backup meteorological measurements system and associated controlled environmental housing system is connected to a power system which is supplied form redundant power sources.

In addition to the backup meteorological measurements system, a backup communications line to the meteorological system is operational. During an interim period, the backup communications is provided via telephone lines routed through a telephone company central office separate from the primary circuits.

Atmospheric Dispersion Factors for Routine Releases

Extensive analyses and calculations were carried out in 1991[(8)] to reevaluate the atmospheric dispersion factors for routine releases at Indian Point. The primary objective was to ensure the applicability of the dispersion factors in the Offisite Dose Calculation Manual (ODCM) in view of potential changes in the meteorological conditions at the site.

In the analyses, consideration was given to an extended meteorological database and up-to-date analytical models. Briefly, use was made of the following:

1. 10 years' worth of hourly meteorological data collected on site for the period 1981 through 1990.

2. Mixed-mode releases, whereby released plumes can be totally elevated, totally at ground level, or in between,

3. Valley-flow considerations for the assessment of channeling and recirculation effects (based on a site specific study[9]), and

4. Analytical models which permit the computation of radiation exposures due to inhalation and due to immersion in finite clouds of radioactive material.

The locations of interest were the site boundary, the nearest residences in each sector, and milking animals at 5 miles. See Ref. 8 for complete details and results.

References

1. Kaplan, Edward J. and B. Wuebber 1984(a), Quarterly Summary of Meteorological Data from Indian Point Meteorological Systems, First Quarter, January 1 – March 31, 1984, Prepared for the New York Power Authority, May 1984, Project No. 01-4251-02-1.

2. Kaplin, Edward J. and B. Wuebber, 1984(b), Quarterly Summary of Meteorological Data from Indian Point Meteorological Systems, Second Quarter, April 1 – June 30, 1984. Prepared for the New York Power Authority, September 1984, Project No. 01-4251-02-1.

3. Kaplin, Edward J. and B. Wuebber, 1984(c), Quarterly Summary of Meteorological Data from Indian Point Meteorological Systems, Third Quarter, July 1 – September 30, 1984. Prepared for the New York Power Authority, December 1984, Project No. 01-4251-02-1.

4. Kaplin, Edward J. and B. Wuebber, 1985, Quarterly Summary of Meteorological Data from Indian Point Meteorological Systems, Fourth Quarter, October 1 – December 31, 1984, prepared for the New York Power Authority, June 1985, Project No. 01-4251-05-1.

5. Kaplin, Edwar J., B. Wuebber (1981) Facility Safety Analysis Report (FSAR), consolidated Edison Company of New York, Inc., Indian Point Nuclear Generating Unit No. 2, Meteorological update, September 1981, YSC Project No. 01-4122.

6. Nuclear Regulatory Commission, 1980, Proposed Revision 1 to Regulatory Guide 1.23, Meteorological Programs in Support of Nuclear Power Plants. U.S. Nuclear Regulatory Commission, Washington D.C.

7. Bryson Reid A. and F. K. Hare, 1974, World Survey of Climatology, volume 11, Climatology, volume 11, Climate of North America, Helmut Landsbert, Editor in Chief.

8. NYPA Corporate Radiological Engineering Calculation IP3-CALC-RAD-00001, "IP3 – Revised ODCM Atmospheric Dispersion Parameters (Multi-Year Hourly Data, Mixed-Mode Releases and Valley Effects" (10/1191)

9. Kaplin, Edwar J., "Wind Field Analysis at Indian Point," York Services Corporation, Stamford, CT, Technical Report No. 4873-02 (3/19/91)

Table 2.6-1

ANNUAL SUMMARY OF WIND DIRECTION PERCENT FREQUENCY DISTRIBUTION
AS A FUNCTION OF STABILITY - 10M LEVEL
(JANUARY 1, 1979 - DECEMBER 31, 1980)

| Wind Direction | Stablility Class | | | | | | |
|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G |
| N | 1.28 | 0.36 | 0.48 | 3.39 | 2.67 | 0.50 | 0.09 |
| NNE | 1.76 | 0.40 | 0.46 | 3.15 | 3.33 | 0.80 | 0.17 |
| NE | 0.63 | 0.35 | 0.58 | 4.22 | 4.66 | 2.12 | 0.40 |
| ENE | 0.06 | 0.07 | 0.17 | 1.59 | 2.61 | 1.84 | 0.43 |
| E | 0.01 | 0.03 | 0.03 | 0.64 | 1.49 | 0.59 | 0.11 |
| ESE | 0.01 | 0.01 | 0.01 | 0.27 | 0.73 | 0.21 | 0.04 |
| SE | 0.03 | 0.01 | 0.02 | 0.23 | 0.67 | 0.26 | 0.02 |
| SSE | 0.09 | 0.03 | 0.04 | 0.45 | 1.04 | 0.31 | 0.05 |
| S | 2.04 | 0.25 | 0.29 | 1.74 | 3.39 | 0.76 | 0.11 |
| SSW | 2.58 | 0.51 | 0.38 | 2.14 | 5.04 | 0.72 | 0.05 |
| SW | 1.16 | 0.33 | 0.35 | 1.89 | 3.03 | 0.51 | 0.03 |
| WSW | 0.49 | 0.17 | 0.16 | 0.96 | 1.44 | 0.39 | 0.02 |
| W | 0.56 | 0.22 | 0.17 | 1.40 | 1.64 | 0.43 | 0.06 |
| WNW | 0.47 | 0.15 | 0.26 | 1.64 | 1.49 | 0.21 | 0.03 |
| NW | 0.70 | 0.31 | 0.32 | 2.36 | 1.85 | 0.10 | 0.01 |
| NNW | 0.80 | 0.40 | 0.49 | 3.26 | 1.60 | 0.17 | 0.04 |
| CALM | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| MISSING | 0.12 | 0.05 | 0.03 | 0.21 | 0.51 | 0.15 | 0.02 |
| TOTAL % | 12.80 | 3.66 | 4.23 | 29.56 | 37.17 | 10.08 | 1.69 |
| NO. OF HOURS | 2244 | 641 | 742 | 5183 | 6519 | 1768 | 297 |

Table 2.6-2
[Historical Information]

SUMMARY OF WIND DIRECTION PERCENT FREQUENCY
DISTRIBUTION AS A FUNCTION OF STABILITY
SUMMER SEASON - 10M LEVEL
(MAY 1, 1979, 80 - OCTOBER 31, 1979, 80)

| Wind | Stability Class | | | | | | |
|---|---|---|---|---|---|---|---|
| Direction | A | B | C | D | E | F | G |
| N | 1.68 | 0.26 | 0.37 | 1.25 | 2.06 | 0.57 | 0.07 |
| NNE | 2.65 | 0.42 | 0.43 | 2.90 | 2.41 | 1.01 | 0.18 |
| NE | 0.58 | 0.31 | 0.46 | 3.46 | 4.44 | 3.17 | 0.35 |
| ENE | 0.11 | 0.10 | 0.24 | 1.38 | 2.66 | 2.62 | 0.39 |
| E | 0.02 | 0.07 | 0.01 | 0.57 | 1.57 | 0.61 | 0.05 |
| ESE | 0.01 | 0.01 | 0.00 | 0.31 | 1.01 | 0.36 | 0.06 |
| SE | 0.05 | 0.02 | 0.01 | 0.17 | 0.84 | 0.40 | 0.02 |
| SSE | 0.15 | 0.06 | 0.05 | 0.50 | 1.07 | 0.40 | 0.08 |
| S | 3.32 | 0.36 | 0.43 | 2.47 | 3.58 | 0.85 | 0.05 |
| SSW | 4.10 | 0.75 | 0.59 | 2.93 | 5.70 | 0.85 | 0.01 |
| SW | 1.84 | 0.49 | 0.48 | 2.23 | 3.03 | 0.51 | 0.05 |
| WSW | 0.87 | 0.20 | 0.18 | 0.94 | 1.05 | 0.34 | 0.00 |
| W | 0.88 | 0.28 | 0.19 | 1.38 | 1.42 | 0.34 | 0.07 |
| WNW | 0.80 | 0.09 | 0.25 | 0.94 | 1.03 | 0.15 | 0.05 |
| NW | 1.05 | 0.19 | 0.17 | 0.84 | 0.63 | 0.10 | 0.02 |
| NNW | 0.78 | 0.19 | 0.24 | 0.97 | 0.74 | 0.20 | 0.02 |
| CALM | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| MISSING | 0.22 | 0.06 | 0.01 | 0.31 | 0.68 | 0.22 | 0.03 |
| TOTAL % | 19.11 | 3.86 | 4.11 | 23.54 | 33.92 | 12.69 | 1.48 |
| NO. OF HOURS | 1687 | 341 | 363 | 2078 | 2994 | 1120 | 131 |

Table 2.6-3

SUMMARY OF WIND DIRECTION PERCENT FREQUENCY DISTRIBUTION AS A FUNCTION OF STABILITY WINTER SEASON - 10M LEVEL (NOVEMBER 1, 1979,80 - APRIL 30, 1979,80) [Hisotrical Information]

Table 2.6-4
(Sheet 1 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT JAN-MAR 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS A

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 7. | 49. | 20. | 0. | 0. | 0. | 76. |
| NNE | 3. | 7. | 0. | 0. | 0. | 0. | 10. |
| NE | 7. | 2. | 0. | 0. | 0. | 0. | 9. |
| ENE | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| E | 2. | 0. | 0. | 0. | 0. | 0. | 2. |
| ESE | 2. | 1. | 0. | 0. | 0. | 0. | 3. |
| SE | 6. | 4. | 0. | 0. | 0. | 0. | 10. |
| SSE | 12. | 21. | 0. | 0. | 0. | 0. | 33. |
| S | 8. | 18. | 6. | 0. | 0. | 0. | 32. |
| SSW | 7. | 11. | 7. | 0. | 0. | 0. | 25. |
| SW | 2. | 2. | 1. | 0. | 0. | 0. | 5. |
| WSW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| W | 4. | 6. | 5. | 1. | 0 | 0. | 16. |
| WNW | 0. | 29. | 13. | 0. | 0. | 0. | 42. |
| NW | 4. | 35. | 16. | 0. | 0. | 0. | 55. |
| NNW | 12. | 33. | 7. | 0. | 0. | 0. | 52. |
| TOTAL | 77. | 218. | 75. | 1. | 0. | 0. | 371. |
| CALM | 0. | | | | | | |

Table 2.6-4
(Sheet 2 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT JAN-MAR 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS B

| WIND DIRECTION | WIND SPEED (MPH) |
|---|---|

| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 5. | 14. | 8. | 0. | 0. | 0. | 27. |
| NNE | 2. | 1. | 0. | 0. | 0. | 0. | 3. |
| NE | 3. | 0. | 0. | 0. | 0. | 0. | 3. |
| ENE | 3. | 0. | 0. | 0. | 0. | 0. | 3. |
| E | 3. | 0. | 0. | 0. | 0. | 0. | 3. |
| ESE | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| SE | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| SSE | 2. | 1. | 0. | 0. | 0. | 0. | 3. |
| S | 4. | 5. | 2. | 0. | 0. | 0. | 11. |
| SSW | 3. | 5. | 0. | 0. | 0. | 0. | 8. |
| SW | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| WSW | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| W | 0. | 0. | 1. | 0. | 0 | 0. | 1. |
| WNW | 3. | 6. | 6. | 0. | 0. | 0. | 15. |
| NW | 2. | 9. | 8. | 0. | 0. | 0. | 19. |
| NNW | 5. | 8. | 1. | 0. | 0. | 0. | 14. |
| TOTAL | 38. | 52. | 26. | 0. | 0. | 0. | 113. |

CALM 0.

Table 2.6-4
(Sheet 3 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT JAN-MAR 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS C

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 4. | 7. | 3. | 0. | 0. | 0. | 14. |
| NNE | 7. | 6. | 0. | 0. | 0. | 0. | 13. |
| NE | 3. | 0. | 0. | 0. | 0. | 0. | 3. |
| ENE | 3. | 0. | 0. | 0. | 0. | 0. | 3. |
| E | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| ESE | 3. | 0. | 0. | 0. | 0. | 0. | 3. |
| SE | 3. | 2. | 0. | 0. | 0. | 0. | 5. |
| SSE | 1. | 4. | 0. | 0. | 0. | 0. | 5. |
| S | 2. | 2. | 0. | 0. | 0. | 0. | 4. |
| SSW | 0. | 3. | 0. | 0. | 0. | 0. | 3. |
| SW | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| WSW | 2. | 0. | 0. | 0. | 0. | 0. | 2. |
| W | 1. | 0. | 1. | 0. | 0 | 0. | 2. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| WNW | 3. | 8. | 3. | 0. | 0. | 0. | 14. |
| NW | 2. | 10. | 13. | 0. | 0. | 0. | 25. |
| NNW | 4. | 10. | 3. | 0. | 0. | 0. | 17. |
| TOTAL | 40. | 52. | 23. | 0. | 0. | 0. | 115. |
| CALM | 0. | | | | | | |

Table 2.6-4
(Sheet 4 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT JAN-MAR 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS D

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 128. | 109. | 40. | 0. | 0. | 0. | 277. |
| NNE | 62. | 23. | 2. | 0. | 0. | 0. | 87. |
| NE | 29. | 1. | 0. | 0. | 0. | 0. | 30. |
| ENE | 17. | 0. | 0. | 0. | 0. | 0. | 17. |
| E | 11. | 0. | 0. | 0. | 0. | 0. | 11. |
| ESE | 7. | 0. | 0. | 0. | 0. | 0. | 7. |
| SE | 11. | 0. | 0. | 0. | 0. | 0. | 11. |
| SSE | 13. | 12. | 0. | 0. | 0. | 0. | 25. |
| S | 17. | 23. | 2. | 0. | 0. | 0. | 42. |
| SSW | 5. | 3. | 5. | 0. | 0. | 0. | 13. |
| SW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| WSW | 9. | 0. | 0. | 0. | 0. | 0. | 9. |
| W | 6. | 9. | 2. | 0. | 0 | 0. | 17. |
| WNW | 11. | 31. | 18. | 1. | 0. | 0. | 61. |
| NW | 22. | 81. | 45. | 1. | 0. | 0. | 149. |
| NNW | 54. | 64. | 30. | 0. | 0. | 0. | 148. |
| TOTAL | 402. | 356. | 144. | 2. | 0. | 0. | 904. |
| CALM | 6. | | | | | | |

Table 2.6-4
(Sheet 5 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT JAN-MAR 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS E

| WIND DIRECTION | WIND SPEED (MPH) | | | | | |
|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 71. | 13. | 0. | 0. | 0. | 0. | 84. |
| NNE | 67. | 8. | 0. | 0. | 0. | 0. | 75. |
| NE | 49. | 3. | 0. | 0. | 0. | 0. | 52. |
| ENE | 14. | 0. | 0. | 0. | 0. | 0. | 14. |
| E | 20. | 0. | 0. | 0. | 0. | 0. | 20. |
| ESE | 7. | 0. | 0. | 0. | 0. | 0. | 7. |
| SE | 14. | 2. | 0. | 0. | 0. | 0. | 16. |
| SSE | 12. | 12. | 0. | 0. | 0. | 0. | 24. |
| S | 19. | 14. | 1. | 0. | 0. | 0. | 34. |
| SSW | 7. | 6. | 1. | 0. | 0. | 0. | 14. |
| SW | 5. | 2. | 0. | 0. | 0. | 0. | 7. |
| WSW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| W | 9. | 1. | 0. | 0. | 0 | 0. | 10. |
| WNW | 16. | 4. | 0. | 0. | 0. | 0. | 20. |
| NW | 13. | 6. | 1. | 0. | 0. | 0. | 20. |
| NNW | 37. | 5. | 0. | 0. | 0. | 0. | 42. |
| TOTAL | 360. | 76. | 3. | 0. | 0. | 0. | 439. |
| CALM | 8. | | | | | | |

Table 2.6-4
(Sheet 6 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT JAN-MAR 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS F

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 28. | 1. | 0. | 0. | 0. | 0. | 29. |
| NNE | 61. | 3. | 0. | 0. | 0. | 0. | 64. |
| NE | 19. | 2. | 0. | 0. | 0. | 0. | 21. |
| ENE | 3. | 0. | 0. | 0. | 0. | 0. | 3. |
| E | 10. | 0. | 0. | 0. | 0. | 0. | 10. |
| ESE | 4. | 0. | 0. | 0. | 0. | 0. | 4. |
| SE | 3. | 0. | 0. | 0. | 0. | 0. | 3. |
| SSE | 9. | 0. | 0. | 0. | 0. | 0. | 9. |
| S | 4. | 3. | 6. | 0. | 0. | 0. | 7. |
| SSW | 1. | 0. | 0. | 0. | 0. | 0. | 1. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SW | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| WSW | 4. | 0. | 0. | 0. | 0. | 0. | 4. |
| W | 1. | 0. | 0. | 0. | 0 | 0. | 1. |
| WNW | 2. | 1. | 0. | 0. | 0. | 0. | 3. |
| NW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| NNW | 8. | 0. | 0. | 0. | 0. | 0. | 8. |
| TOTAL | 158. | 10. | 0. | 0. | 0. | 0. | 168. |
| CALM | 1. | | | | | | |

Table 2.6-4
(Sheet 7 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT JAN-MAR 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS G

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 5. | 0. | 0. | 0. | 0. | 0. | 5. |
| NNE | 10. | 1. | 0. | 0. | 0. | 0. | 11. |
| NE | 3. | 2. | 0. | 0. | 0. | 0. | 5. |
| ENE | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| E | 2. | 0. | 0. | 0. | 0. | 0. | 2. |
| ESE | 2. | 0. | 0. | 0. | 0. | 0. | 2. |
| SE | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| SSE | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| S | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| SSW | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| SW | 2. | 0. | 0. | 0. | 0. | 0. | 2. |
| WSW | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| W | 3 | 0. | 0. | 1. | 0 | 0. | 3. |
| WNW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| NW | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| NNW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| TOTAL | 32. | 3. | 0. | 0. | 0. | 0. | 35. |
| CALM | 0. | | | | | | |

Table 2.6-4
(Sheet 8 of 28)

JOINT FREQUENCY DISTRIBUTION

INDIAN POINT APR-JUNE 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS A

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 7. | 69. | 31. | 2. | 0. | 0. | 109. |
| NNE | 2. | 4. | 10. | 0. | 0. | 0. | 16. |
| NE | 0. | 2. | 1. | 0. | 0. | 0. | 3. |
| ENE | 0. | 2. | 1. | 0. | 0. | 0. | 3. |
| E | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| ESE | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| SE | 2. | 4. | 0. | 0. | 0. | 0. | 6. |
| SSE | 7. | 30. | 2. | 0. | 0. | 0. | 39. |
| S | 7. | 43. | 12. | 0. | 0. | 0. | 62. |
| SSW | 0. | 10. | 6. | 0. | 0. | 0. | 16. |
| SW | 1. | 15. | 1. | 0. | 0. | 0. | 17. |
| WSW | 1. | 5. | 0. | 0. | 0. | 0. | 6. |
| W | 3. | 13. | 0. | 0. | 0 | 0. | 16. |
| WNW | 1. | 9. | 2. | 0. | 0. | 0. | 12. |
| NW | 2. | 20. | 16. | 0. | 0. | 0. | 38. |
| NNW | 4. | 39. | 11. | 0. | 0. | 0. | 54. |
| TOTAL | 38. | 265. | 93. | 2. | 0. | 0. | 398. |
| CALM | 0. | | | | | | |

Table 2.6-4
(Sheet 9 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT APR-JUNE 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS B

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 1. | 24. | 4. | 2. | 0. | 0. | 31. |
| NNE | 1. | 6. | 5. | 0. | 0. | 0. | 12. |
| NE | 1. | 1. | 2. | 0. | 0. | 0. | 4. |
| ENE | 0. | 2. | 0. | 0. | 0. | 0. | 2. |
| E | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| ESE | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| SE | 2. | 1. | 0. | 0. | 0. | 0. | 3. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SSE | 2. | 6. | 0. | 0. | 0. | 0. | 8. |
| S | 2. | 11. | 1. | 0. | 0. | 0. | 14. |
| SSW | 1. | 2. | 1. | 0. | 0. | 0. | 4. |
| SW | 3. | 1. | 0. | 0. | 0. | 0. | 4. |
| WSW | 0. | 1. | 0. | 0. | 0. | 0. | 1. |
| W | 3. | 1. | 0. | 0. | 0 | 0. | 4. |
| WNW | 1. | 2. | 2. | 0. | 0. | 0. | 5. |
| NW | 1. | 6. | 2. | 0. | 0. | 0. | 9. |
| NNW | 1. | 6. | 0. | 0. | 0. | 0. | 7. |
| TOTAL | 20. | 70. | 17. | 2. | 0. | 0. | 109. |

CALM 0.

Table 2.6-4
(Sheet 10 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT APR-JUNE 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS C

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 6. | 10. | 4. | 0. | 0. | 0. | 20. |
| NNE | 4. | 7. | 4. | 0. | 0. | 0. | 15. |
| NE | 0. | 2. | 0. | 0. | 0. | 0. | 2. |
| ENE | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| E | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| ESE | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| SE | 2. | 0. | 0. | 0. | 0. | 0. | 2. |
| SSE | 6. | 3. | 0. | 0. | 0. | 0. | 9. |
| S | 7. | 11. | 0. | 0. | 0. | 0. | 18. |
| SSW | 1. | 4. | 3. | 0. | 0. | 0. | 8. |
| SW | 2. | 1. | 1. | 0. | 0. | 0. | 4. |
| WSW | 0. | 1. | 0. | 0. | 0. | 0. | 1. |
| W | 3. | 4. | 0. | 0. | 0 | 0. | 7. |
| WNW | 0. | 3. | 0. | 0. | 0. | 0. | 3. |
| NW | 0. | 1. | 1. | 0. | 0. | 0. | 2. |
| NNW | 3. | 5. | 1. | 0. | 0. | 0. | 9. |
| TOTAL | 36. | 52. | 14. | 0. | 0. | 0. | 102. |

CALM 0.

Table 2.6-4
(Sheet 11 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT APR-JUNE 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS D

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 28. | 67. | 20. | 13. | 5. | 0. | 133. |
| NNE | 34. | 44. | 22. | 0. | 0. | 0. | 100. |
| NE | 45. | 24. | 2. | 0. | 0. | 0. | 71. |
| ENE | 32. | 8. | 0. | 0. | 0. | 0. | 40. |
| E | 18. | 0. | 0. | 0. | 0. | 0. | 18. |
| ESE | 14. | 2. | 0. | 0. | 0. | 0. | 16. |
| SE | 23. | 5. | 0. | 0. | 0. | 0. | 28. |
| SSE | 20. | 41. | 0. | 0. | 0. | 0. | 61. |
| S | 24. | 37. | 3. | 0. | 0. | 0. | 64. |
| SSW | 16. | 11. | 1. | 0. | 0. | 0. | 28. |
| SW | 6. | 3. | 0. | 0. | 0. | 0. | 9. |
| WSW | 7. | 6. | 0. | 0. | 0. | 0. | 13. |
| W | 3. | 4. | 0. | 0. | 0 | 0. | 7. |
| WNW | 2. | 18. | 2. | 0. | 0. | 0. | 22. |
| NW | 1. | 15. | 3. | 0. | 0. | 0. | 19. |
| NNW | 4. | 21. | 10. | 0. | 0. | 0. | 35. |
| TOTAL | 277. | 306. | 63. | 13. | 5. | 0. | 664. |
| CALM | 0. | | | | | | |

Table 2.6-4
(Sheet 12 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT APR-JUNE 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS E

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 37. | 41. | 7. | 0. | 0. | 0. | 85. |
| NNE | 44. | 32. | 7. | 0. | 0. | 0. | 83. |
| NE | 72. | 15. | 0. | 0. | 0. | 0. | 87. |
| ENE | 47. | 3. | 1. | 0. | 0. | 0. | 51. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| E | 15. | 0. | 0. | 0. | 0. | 0. | 15. |
| ESE | 12. | 0. | 0. | 0. | 0. | 0. | 12. |
| SE | 26. | 2. | 0. | 0. | 0. | 0. | 28. |
| SSE | 37. | 28. | 0. | 0. | 0. | 0. | 65. |
| S | 35. | 39. | 0. | 0. | 0. | 0. | 74. |
| SSW | 15. | 19. | 1. | 0. | 0. | 0. | 35. |
| SW | 6. | 3. | 0. | 0. | 0. | 0. | 9. |
| WSW | 4. | 2. | 0. | 0. | 0. | 0. | 6. |
| W | 7. | 7. | 1. | 1. | 0 | 0. | 15. |
| WNW | 5. | 7. | 0. | 0. | 0. | 0. | 12. |
| NW | 1. | 10. | 0. | 0. | 0. | 0. | 11. |
| NNW | 9. | 13. | 3. | 0. | 0. | 0. | 25. |
| TOTAL | 372. | 221. | 20. | 0. | 0. | 0. | 613. |

CALM 1.

Table 2.6-4
(Sheet 13 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT APR-JUNE1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS F

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 13. | 1. | 0. | 0. | 0. | 0. | 14. |
| NNE | 48. | 7. | 0. | 0. | 0. | 0. | 55. |
| NE | 59. | 16. | 0. | 0. | 0. | 0. | 75. |
| ENE | 25. | 0. | 0. | 0. | 0. | 0. | 25. |
| E | 18. | 0. | 0. | 0. | 0. | 0. | 18. |
| ESE | 5. | 0. | 0. | 0. | 0. | 0. | 5. |
| SE | 5. | 1. | 0. | 0. | 0. | 0. | 6. |
| SSE | 8. | 0. | 0. | 0. | 0. | 0. | 8. |
| S | 12. | 3. | 6. | 0. | 0. | 0. | 15. |
| SSW | 6. | 0. | 0. | 0. | 0. | 0. | 6. |
| SW | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| WSW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| W | 1. | 0. | 0. | 0. | 0 | 0. | 1. |
| WNW | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| NW | 3. | 0. | 0. | 0. | 0. | 0. | 3. |
| NNW | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| TOTAL | 206. | 28. | 0. | 0. | 0. | 0. | 234. |

CALM 0.

Table 2.6-4
(Sheet 14 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT APR-JUNE 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS G

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 3. | 1. | 0. | 0. | 0. | 0. | 4. |
| NNE | 13. | 0. | 0. | 0. | 0. | 0. | 13. |
| NE | 12. | 4. | 0. | 0. | 0. | 0. | 16. |
| ENE | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| E | 3. | 0. | 0. | 0. | 0. | 0. | 3. |
| ESE | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| SE | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| SSE | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| S | 2. | 0. | 0. | 0. | 0. | 0. | 2. |
| SSW | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| SW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| WSW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| W | 0. | 0. | 0. | 0. | 0 | 0. | 0. |
| WNW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| NW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| NNW | 2. | 0. | 0. | 0. | 0. | 0. | 2. |
| TOTAL | 38. | 5. | 0. | 0. | 0. | 0. | 43. |
| CALM | 0. | | | | | | |

Table 2.6-4
(Sheet 15 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT JULY-SEPT 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS A

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 4. | 67. | 6. | 0. | 0. | 0. | 77. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| NNE | 1. | 9. | 1. | 0. | 0. | 0. | 11. |
| NE | 1. | 4. | 2. | 0. | 0. | 0. | 7. |
| ENE | 2. | 1. | 0. | 0. | 0. | 0. | 3. |
| E | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| ESE | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| SE | 5. | 2. | 0. | 0. | 0. | 0. | 7. |
| SSE | 11. | 14. | 0. | 0. | 0. | 0. | 25. |
| S | 19. | 72. | 3. | 0. | 0. | 0. | 94. |
| SSW | 7. | 25. | 8. | 0. | 0. | 0. | 40. |
| SW | 3. | 13. | 0. | 0. | 0. | 0. | 16. |
| WSW | 1. | 7. | 0. | 0. | 0. | 0. | 8. |
| W | 6. | 16. | 0. | 0. | 0 | 0. | 22. |
| WNW | 2. | 5. | 0. | 0. | 0. | 0. | 7. |
| NW | 2. | 16. | 4. | 0. | 0. | 0. | 22. |
| NNW | 5. | 26. | 6. | 0. | 0. | 0. | 37. |
| TOTAL | 70. | 277. | 30. | 0. | 0. | 0. | 377. |

CALM 0.

Table 2.6-4
(Sheet 16 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT JULY-SEPT 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS B

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 4. | 18. | 1. | 0. | 0. | 0. | 23. |
| NNE | 3. | 9. | 1. | 0. | 0. | 0. | 13. |
| NE | 0. | 1. | 0. | 0. | 0. | 0. | 1. |
| ENE | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| E | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| ESE | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| SE | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| SSE | 1. | 1. | 0. | 0. | 0. | 0. | 2. |
| S | 8. | 18. | 1. | 0. | 0. | 0. | 27. |
| SSW | 2. | 4. | 0. | 0. | 0. | 0. | 6. |
| SW | 1. | 5. | 0. | 0. | 0. | 0. | 6. |
| WSW | 1. | 1. | 0. | 0. | 0. | 0. | 2. |
| W | 3. | 2. | 0. | 0. | 0 | 0. | 5. |
| WNW | 1. | 2. | 0. | 0. | 0. | 0. | 3. |
| NW | 2. | 0. | 0. | 0. | 0. | 0. | 2. |
| NNW | 1. | 0. | 0. | 0. | 0. | 0. | 1. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| TOTAL | 31. | 61. | 3. | 0. | 0. | 0. | 95. |

CALM 0.

Table 2.6-4
(Sheet 17 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT JULY-SEPT1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS C

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 3. | 21. | 0. | 0. | 0. | 0. | 24. |
| NNE | 2. | 2. | 0. | 0. | 0. | 0. | 4. |
| NE | 4. | 4. | 1. | 0. | 0. | 0. | 9. |
| ENE | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| E | 1. | 1. | 0. | 0. | 0. | 0. | 2. |
| ESE | 2. | 0. | 0. | 0. | 0. | 0. | 2. |
| SE | 2. | 0. | 0. | 0. | 0. | 0. | 2. |
| SSE | 3. | 3. | 0. | 0. | 0. | 0. | 6. |
| S | 9. | 15. | 0. | 0. | 0. | 0. | 24. |
| SSW | 3. | 4. | 1. | 0. | 0. | 0. | 8. |
| SW | 1. | 1. | 0. | 0. | 0. | 0. | 2. |
| WSW | 0. | 1. | 0. | 0. | 0. | 0. | 1. |
| W | 3. | 4. | 0. | 0. | 0 | 0. | 7. |
| WNW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| NW | 0. | 2. | 0. | 0. | 0. | 0. | 2. |
| NNW | 4. | 3. | 0. | 0. | 0. | 0. | 7. |
| TOTAL | 38. | 61. | 2. | 0. | 0. | 0. | 101. |

CALM 0.

Table 2.6-4
(Sheet 18 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT JULY-SEPT 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS D

WIND
DIRECTION WIND SPEED (MPH)

| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
|---|---|---|---|---|---|---|---|
| N | 11. | 77. | 7. | 0. | 0. | 0. | 95. |
| NNE | 21. | 36. | 2. | 0. | 0. | 0. | 59. |
| NE | 34. | 22. | 0. | 0. | 0. | 0. | 56. |
| ENE | 34. | 5. | 0. | 0. | 0. | 0. | 39. |
| E | 20. | 6. | 0. | 0. | 0. | 0. | 26. |
| ESE | 5. | 2. | 0. | 0. | 0. | 0. | 7. |
| SE | 22. | 0. | 0. | 0. | 0. | 0. | 22. |
| SSE | 13. | 4. | 0. | 0. | 0. | 0. | 17. |
| S | 43. | 86. | 5. | 0. | 0. | 0. | 134. |
| SSW | 15. | 39. | 4. | 0. | 0. | 0. | 58. |
| SW | 11. | 3. | 0. | 0. | 0. | 0. | 14. |
| WSW | 12. | 2. | 0. | 0. | 0. | 0. | 14. |
| W | 6. | 8. | 0. | 0. | 0 | 0. | 14. |
| WNW | 2. | 3. | 1. | 0. | 0. | 0. | 6. |
| NW | 2. | 8. | 1. | 0. | 0. | 0. | 11. |
| NNW | 5. | 13. | 1. | 0. | 0. | 0. | 19. |
| TOTAL | 256. | 314. | 21. | 0. | 0. | 0. | 591. |

CALM 0.

Table 2.6-4
(Sheet 19 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT JULY-SEPT 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS E

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 31. | 41. | 0. | 0. | 0. | 0. | 72. |
| NNE | 52. | 49. | 0. | 0. | 0. | 0. | 101. |
| NE | 56. | 38. | 0. | 0. | 0. | 0. | 94. |
| ENE | 26. | 3. | 0. | 0. | 0. | 0. | 29. |
| E | 23. | 2. | 0. | 0. | 0. | 0. | 25. |
| ESE | 19. | 0. | 0. | 0. | 0. | 0. | 19. |
| SE | 36. | 0. | 0. | 0. | 0. | 0. | 36. |
| SSE | 31. | 2. | 0. | 0. | 0. | 0. | 33. |
| S | 76. | 95. | 2. | 0. | 0. | 0. | 173. |
| SSW | 55. | 42. | 2. | 0. | 0. | 0. | 99. |
| SW | 18. | 3. | 1. | 0. | 0. | 0. | 22. |
| WSW | 9. | 3. | 0. | 0. | 0. | 0. | 12. |
| W | 11. | 4. | 0. | 0. | 0 | 0. | 15. |
| WNW | 10. | 4. | 0. | 0. | 0. | 0. | 14. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| NW | 19. | 6. | 0. | 0. | 0. | 0. | 25. |
| NNW | 14. | 18. | 0. | 0. | 0. | 0. | 32. |
| TOTAL | 486. | 310. | 5. | 0. | 0. | 0. | 801. |
| CALM | 14. | | | | | | |

Table 2.6-4
(Sheet 20 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT JULY-SEPT 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS F

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 21. | 2. | 0. | 0. | 0. | 0. | 23. |
| NNE | 32. | 6. | 0. | 0. | 0. | 0. | 38. |
| NE | 43. | 24. | 1. | 0. | 0. | 0. | 68. |
| ENE | 15. | 0. | 0. | 0. | 0. | 0. | 15. |
| E | 17. | 0. | 0. | 0. | 0. | 0. | 17. |
| ESE | 6. | 0. | 0. | 0. | 0. | 0. | 6. |
| SE | 8. | 0. | 0. | 0. | 0. | 0. | 8. |
| SSE | 12. | 0. | 0. | 0. | 0. | 0. | 12. |
| S | 6. | 1. | 0. | 0. | 0. | 0. | 7. |
| SSW | 4. | 0. | 0. | 0. | 0. | 0. | 4. |
| SW | 2. | 0. | 0. | 0. | 0. | 0. | 2. |
| WSW | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| W | 2. | 0. | 0. | 0. | 0 | 0. | 2. |
| WNW | 2. | 0. | 0. | 0. | 0. | 0. | 2. |
| NW | 5. | 0. | 0. | 0. | 0. | 0. | 5. |
| NNW | 2. | 0. | 0. | 0. | 0. | 0. | 2. |
| TOTAL | 178. | 33. | 1. | 0. | 0. | 0. | 212. |
| CALM | 4. | | | | | | |

Table 2.6-4
(Sheet 21 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT JULY-SEPT 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS G

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 2. | 0. | 0. | 0. | 0. | 0. | 2. |
| NNE | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| NE | 3. | 3. | 0. | 0. | 0. | 0. | 6. |
| ENE | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| E | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| ESE | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| SE | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| SSE | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| S | 2. | 0. | 0. | 0. | 0. | 0. | 2. |
| SSW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| SW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| WSW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| W | 0. | 0. | 0. | 0. | 0 | 0. | 0. |
| WNW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| NW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| NNW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| TOTAL | 10. | 3. | 0. | 0. | 0. | 0. | 13. |
| CALM | 0. | | | | | | |

Table 2.6-4
(Sheet 22 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT OCT-DEC 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS A

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 1. | 22. | 6. | 0. | 0. | 0. | 29. |
| NNE | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| NE | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| ENE | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| E | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| ESE | 0. | 1. | 0. | 0. | 0. | 0. | 1. |
| SE | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| SSE | 3. | 9. | 0. | 0. | 0. | 0. | 12. |
| S | 6. | 16. | 4. | 0. | 0. | 0. | 26. |
| SSW | 1. | 4. | 5. | 0. | 0. | 0. | 10. |
| SW | 0. | 8. | 0. | 0. | 0. | 0. | 8. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| WSW | 0. | 1. | 0. | 0. | 0. | 0. | 1. |
| W | 1. | 6. | 1. | 0. | 0 | 0. | 8. |
| WNW | 0. | 11. | 1. | 0. | 0. | 0. | 12. |
| NW | 0. | 16. | 6. | 0. | 0. | 0. | 22. |
| NNW | 1. | 12. | 2. | 0. | 0. | 0. | 15. |
| TOTAL | 13. | 106. | 25. | 0. | 0. | 0. | 144. |

CALM 0.

Table 2.6-4
(Sheet 23 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT OCT-DEC 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS B

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 0. | 16. | 6. | 0. | 0. | 0. | 22. |
| NNE | 0. | 1. | 1. | 0. | 0. | 0. | 2. |
| NE | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| ENE | 0. | 1. | 0. | 0. | 0. | 0. | 1. |
| E | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| ESE | 0. | 2. | 0. | 0. | 0. | 0. | 2. |
| SE | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| SSE | 1. | 2. | 0. | 0. | 0. | 0. | 3. |
| S | 4. | 10. | 1. | 0. | 0. | 0. | 15. |
| SSW | 2. | 2. | 1. | 0. | 0. | 0. | 5. |
| SW | 0. | 1. | 0. | 0. | 0. | 0. | 1. |
| WSW | 2. | 0. | 0. | 0. | 0. | 0. | 2. |
| W | 0. | 0. | 0. | 0. | 0 | 0. | 0. |
| WNW | 1. | 3. | 0. | 0. | 0. | 0. | 4. |
| NW | 1. | 4. | 5. | 1. | 0. | 0. | 11. |
| NNW | 2. | 8. | 5. | 0. | 0. | 0. | 15. |
| TOTAL | 14. | 50. | 19. | 1. | 0. | 0. | 84. |

CALM 0.

Table 2.6-4
(Sheet 24 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT OCT-DEC 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T

PASQUILL CLASS C

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 3. | 14. | 6. | 1. | 0. | 0. | 24. |
| NNE | 1. | 4. | 0. | 0. | 0. | 0. | 5. |
| NE | 0. | 1. | 0. | 0. | 0. | 0. | 1. |
| ENE | 1. | 1. | 0. | 0. | 0. | 0. | 2. |
| E | 0. | 1. | 0. | 0. | 0. | 0. | 1. |
| ESE | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| SE | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| SSE | 2. | 1. | 0. | 0. | 0. | 0. | 3. |
| S | 5. | 3. | 0. | 0. | 0. | 0. | 8. |
| SSW | 7. | 3. | 1. | 0. | 0. | 0. | 11. |
| SW | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| WSW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| W | 1. | 1. | 1. | 0. | 0 | 0. | 3. |
| WNW | 1. | 2. | 3. | 0. | 0. | 0. | 6. |
| NW | 2. | 2. | 3. | 0. | 0. | 0. | 7. |
| NNW | 4. | 7. | 5. | 0. | 0. | 0. | 16. |
| TOTAL | 28. | 40. | 19. | 1. | 0. | 0. | 88. |
| CALM | 0. | | | | | | |

Table 2.6-4
(Sheet 25 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT OCT-DEC1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS D

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 45. | 127. | 41. | 8. | 0. | 0. | 221. |
| NNE | 29. | 91. | 26. | 1. | 0. | 0. | 147. |
| NE | 19. | 32. | 2. | 0. | 0. | 0. | 53. |
| ENE | 16. | 13. | 0. | 0. | 0. | 0. | 29. |
| E | 8. | 2. | 0. | 0. | 0. | 0. | 10. |
| ESE | 9. | 0. | 0. | 0. | 0. | 0. | 9. |
| SE | 10. | 3. | 0. | 0. | 0. | 0. | 13. |
| SSE | 14. | 2. | 0. | 0. | 0. | 0. | 16. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| S | 33. | 48. | 0. | 0. | 0. | 0. | 81. |
| SSW | 28. | 13. | 1. | 0. | 0. | 0. | 42. |
| SW | 13. | 1. | 0. | 0. | 0. | 0. | 14. |
| WSW | 8. | 4. | 1. | 0. | 0. | 0. | 13. |
| W | 10. | 15. | 5. | 0. | 0 | 0. | 30. |
| WNW | 4. | 21. | 7. | 2. | 0. | 0. | 34. |
| NW | 7. | 46. | 28. | 2. | 0. | 0. | 83. |
| NNW | 14. | 47. | 28. | 4. | 0. | 0. | 93. |
| TOTAL | 267. | 465. | 139. | 17. | 0. | 0. | 888. |
| CALM | 0. | | | | | | |

Table 2.6-4
(Sheet 26 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT OCT-DEC1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS E

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 41. | 26. | 0. | 0. | 0. | 0. | 67. |
| NNE | 59. | 37. | 2. | 0. | 0. | 0. | 98. |
| NE | 58. | 28. | 0. | 0. | 0. | 0. | 86. |
| ENE | 17. | 4. | 1. | 0. | 0. | 0. | 22. |
| E | 17. | 1. | 0. | 0. | 0. | 0. | 18. |
| ESE | 13. | 1. | 0. | 0. | 0. | 0. | 14. |
| SE | 22. | 0. | 0. | 0. | 0. | 0. | 22. |
| SSE | 33. | 2. | 0. | 0. | 0. | 0. | 35. |
| S | 60. | 55. | 2. | 0. | 0. | 0. | 117. |
| SSW | 30. | 17. | 0. | 0. | 0. | 0. | 47. |
| SW | 23. | 10. | 0. | 0. | 0. | 0. | 33. |
| WSW | 22 | 4. | 1. | 0. | 0. | 0. | 27. |
| W | 18. | 32. | 1. | 0. | 0 | 0. | 51. |
| WNW | 16. | 19. | 0. | 0. | 0. | 0. | 35. |
| NW | 14. | 19. | 4. | 0. | 0. | 0. | 37. |
| NNW | 20. | 10. | 4. | 0. | 0. | 0. | 34. |
| TOTAL | 463. | 265. | 15. | 0. | 0. | 0. | 743. |
| CALM | 0. | | | | | | |

Table 2.6-4
(Sheet 27 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT OCT-DEC 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS F

| WIND DIRECTION | WIND SPEED (MPH) | | | | | |
|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 25. | 2. | 0. | 0. | 0. | 0. | 27. |
| NNE | 47. | 4. | 0. | 0. | 0. | 0. | 51. |
| NE | 46. | 30. | 0. | 0. | 0. | 0. | 76. |
| ENE | 13. | 2. | 0. | 0. | 0. | 0. | 15. |
| E | 9. | 0. | 0. | 0. | 0. | 0. | 9. |
| ESE | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| SE | 5. | 0. | 0. | 0. | 0. | 0. | 5. |
| SSE | 6. | 0. | 0. | 0. | 0. | 0. | 6. |
| S | 10. | 2. | 0. | 0. | 0. | 0. | 12. |
| SSW | 6. | 0. | 0. | 0. | 0. | 0. | 6. |
| SW | 3. | 0. | 0. | 0. | 0. | 0. | 3. |
| WSW | 6. | 0. | 0. | 0. | 0. | 0. | 6. |
| W | 3. | 0. | 0. | 0. | 0 | 0. | 3. |
| WNW | 2. | 0. | 0. | 0. | 0. | 0. | 2. |
| NW | 4. | 0. | 0. | 0. | 0. | 0. | 4. |
| NNW | 11. | 0. | 0. | 0. | 0. | 0. | 11. |
| TOTAL | 196. | 40. | 0. | 0. | 0. | 0. | 236. |
| CALM | 0. | | | | | | |

Table 2.6-4
(Sheet 28 of 28)

JOINT FREQUENCY DISTRIBUTION
INDIAN POINT OCT-DEC 1986
10 METER WIND SPEED & DIR. WITH 61-10 METER DELTA T
PASQUILL CLASS G

| WIND DIRECTION | WIND SPEED (MPH) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | >24 | TOTAL |
| N | 6. | 0. | 0. | 0. | 0. | 0. | 6. |
| NNE | 3. | 1. | 0. | 0. | 0. | 0. | 4. |
| NE | 4. | 5. | 0. | 0. | 0. | 0. | 9. |
| ENE | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| E | 0. | 0. | 0. | 0. | 0. | 0. | 0. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ESE | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| SE | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| SSE | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| S | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| SSW | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| SW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| WSW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| W | 0. | 0. | 0. | 0. | 0 | 0. | 0. |
| WNW | 1. | 0. | 0. | 0. | 0. | 0. | 1. |
| NW | 0. | 0. | 0. | 0. | 0. | 0. | 0. |
| NNW | 2. | 0. | 0. | 0. | 0. | 0. | 2. |
| | | | | | | | |
| TOTAL | 19. | 6. | 0. | 0. | 0. | 0. | 25. |
| | | | | | | | |
| CALM | 0. | | | | | | |

Table 2.6-5

(Sheet 1 of 14)
[Historical Information]

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION FOR PASQUILL STABILITY CATEGORY A

Indian Point B(3) Using a delta t correction factor of 0.605

Jan 1 1970 to Dec 31 1972 (Jan-July), Nov-Dec. 1970, Aug 1971, Sept-Oct 1972)

| WIND DIRECTION | | WIND SPEED (MPH) 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | Greater than 24 | MISS | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| 349-11 | N | .0001 | .0031 | .0039 | .0008 | .0001 | .0000 | .0000 | .0080 |
| 12-33 | NNE | .0000 | .0011 | .0007 | .0002 | .0000 | .0000 | .0000 | .0021 |
| 34-56 | NE | .0000 | .0003 | .0003 | .0000 | .0000 | .0000 | .0000 | .0007 |
| 57-78 | ENE | .0000 | .0005 | .0000 | .0001 | .0001 | .0000 | .0000 | .0007 |
| 79-101 | E | .0000 | .0000 | .0000 | .0001 | .0000 | .0000 | .0000 | .0001 |
| 102-123 | ESE | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 |
| 124-146 | SE | .0000 | .0002 | .0002 | .0010 | .0002 | .0000 | .0000 | .0017 |
| 147-168 | SSE | .0001 | .0011 | .0056 | .0037 | .0002 | .0000 | .0000 | .0107 |
| 169-191 | S | .0000 | .0026 | .0026 | .0010 | .0000 | .0000 | .0000 | .0063 |
| 192-213 | SSW | .0001 | .0019 | .0015 | .0001 | .0000 | .0000 | .0000 | .0037 |
| 214-236 | SW | .0000 | .0015 | .0009 | .0001 | .0000 | .0000 | .0000 | .0025 |
| 237-258 | WSW | .0002 | .0008 | .0008 | .0000 | .0000 | .0000 | .0000 | .0018 |
| 259-281 | W | .0002 | .0014 | .0016 | .0001 | .0001 | .0000 | .0001 | .0035 |
| 282-303 | WNW | .0001 | .0002 | .0015 | .0023 | .0009 | .0000 | .0008 | .0058 |
| 304-326 | NW | .0000 | .0009 | .0022 | .0026 | .0019 | .0001 | .0003 | .0081 |
| 327-348 | NNW | .0000 | .0018 | .0027 | .0021 | .0006 | .0000 | .0000 | .0072 |
| CALM | | .0000 | | | | | | | .0000 |
| MISS | | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 | | .0016 |
| TOTAL | | .0009 | .0176 | .0246 | .0143 | .0042 | .0001 | .0029 | .0646 |

Percentage of hours of temperature difference present in this stability category = 6.5 Numbers of hours in this stability category = 565

Table 2.6-5 (Sheet 2 of 14)

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION FOR PASQUILL STABILITY CATEGORY B

Indian Point B(3) Using a delta t correction factor of 0.605

JAN. 1 1970 1 DEC. 31 1972

WIND
DIRECTION WIND SPEED (MPH)

| | | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | Greater than 24 | MISS | TOTAl |
|---|---|---|---|---|---|---|---|---|---|
| 349-11 | N | .0002 | .0010 | .0014 | .0005 | .0001 | .0000 | .0000 | .0032 |
| 12-33 | NNE | .0001 | .0006 | .0006 | .0003 | .0000 | .0000 | .0000 | .0016 |
| 34-56 | NE | .0000 | .0005 | .0001 | .0000 | .0000 | .0000 | .0000 | .0006 |
| 57-78 | ENE | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 |
| 79-101 | E | .0000 | .0003 | .0001 | .0001 | .0000 | .0000 | .0000 | .0006 |
| 102-123 | ESE | .0000 | .0000 | .0001 | .0000 | .0000 | .0000 | .0000 | .0001 |
| 124-146 | SE | .0000 | .0002 | .0002 | .0001 | .0000 | .0000 | .0000 | .0006 |
| 147-168 | SSE | .0000 | .0008 | .0017 | .0014 | .0000 | .0000 | .0000 | .0039 |
| 169-191 | S | .0002 | .0017 | .0014 | .0002 | .0000 | .0000 | .0000 | .0035 |
| 192-213 | SSW | .0001 | .0010 | .0006 | .0000 | .0000 | .0000 | .0000 | .0017 |
| 214-236 | SW | .0002 | .0003 | .0005 | .0001 | .0000 | .0000 | .0000 | .0011 |
| 237-258 | WSW | .0002 | .0000 | .0003 | .0000 | .0000 | .0000 | .0001 | .0007 |
| 259-281 | W | .0001 | .0003 | .0005 | .0005 | .0000 | .0000 | .0001 | .0015 |
| 282-303 | WNW | .0001 | .0003 | .0003 | .0002 | .0000 | .0000 | .0002 | .0015 |
| 304-326 | NW | .0001 | .0002 | .0003 | .0008 | .0002 | .0001 | .0001 | .0018 |
| 327-348 | NNW | .0000 | .0006 | .0014 | .0005 | .0003 | .0001 | .0000 | .0029 |
| CALM | | .0000 | | | | | | | .0000 |
| MISS | | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 | | .0002 |
| TOTAL | | .0015 | .0080 | .0095 | .0047 | .0009 | .0002 | .0007 | .0255 |

Percentage of hours of temperature difference present in this stability category = 2.5 Numbers of hours in this s

Table 2.6-5 (Sheet 3 of 14)

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION FOR PASQUILL STABILITY CATEGORY C

Indian Point B(3) Using a delta t correction factor of 0.605

JAN. 1 1970 1 DEC. 31 1972

WIND DIRECTION WIND SPEED (MPH)

| | | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | Greater than 24 | MISS | TOTAl |
|---|---|---|---|---|---|---|---|---|---|
| 349-11 | N | .0005 | .0008 | .0010 | .0005 | .0000 | .0000 | .0001 | .0025 |
| 12-33 | NNE | .0001 | .0003 | .0008 | .0002 | .0000 | .0000 | .0000 | .0015 |
| 34-56 | NE | .0002 | .0003 | .0001 | .0000 | .0000 | .0000 | .0000 | .0007 |
| 57-78 | ENE | .0001 | .0000 | .0000 | .0000 | .0001 | .0000 | .0000 | .0002 |
| 79-101 | E | .0000 | .0000 | .0001 | .0000 | .0000 | .0000 | .0000 | .0001 |
| 102-123 | ESE | .0000 | .0002 | .0000 | .0001 | .0000 | .0000 | .0000 | .0003 |
| 124-146 | SE | .0000 | .0000 | .0002 | .0001 | .0000 | .0000 | .0000 | .0003 |
| 147-168 | SSE | .0000 | .0014 | .0013 | .0007 | .0001 | .0000 | .0000 | .0034 |
| 169-191 | S | .0000 | .0013 | .0010 | .0001 | .0000 | .0000 | .0000 | .0024 |
| 192-213 | SSW | .0000 | .0008 | .0003 | .0000 | .0000 | .0000 | .0000 | .0011 |
| 214-236 | SW | .0001 | .0002 | .0001 | .0000 | .0000 | .0000 | .0000 | .0005 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 237-258 | WSW | .0001 | .0002 | .0003 | .0000 | .0000 | .0000 | .0000 | .0007 |
| 259-281 | W | .0002 | .0000 | .0010 | .0002 | .0001 | .0000 | .0000 | .0016 |
| 282-303 | WNW | .0001 | .0000 | .0005 | .0005 | .0002 | .0002 | .0000 | .0015 |
| 304-326 | NW | .0003 | .0002 | .0005 | .0007 | .0006 | .0003 | .0000 | .0026 |
| 327-348 | NNW | .0001 | .0006 | .0007 | .0007 | .0002 | .0000 | .0000 | .0023 |
| CALM | | .0000 | | | | | | | .0000 |
| MISS | | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 | | .0001 |
| TOTAL | | .0019 | .0064 | .0080 | .0038 | .0014 | .0006 | .0002 | .0223 |

Percentage of hours of temperature difference present in this stability category = 2.2 Numbers of hours in this s

## Table 2.6-5 (Sheet 4 of 14)

## JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION FOR PASQUILL STABILITY CATEGORY D

Indian Point B(3) Using a delta t correction factor of 0.605

JAN. 1 1970 1 DEC. 31 1972

WIND DIRECTION — WIND SPEED (MPH)

| WIND DIRECTION | | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | Greater than 24 | MISS | TOTA |
|---|---|---|---|---|---|---|---|---|---|
| 349-11 | N | .0022 | .0152 | .0159 | .0068 | .0005 | .0001 | .0009 | .0414 |
| 12-33 | NNE | .0033 | .0163 | .0110 | .0029 | .0007 | .0001 | .0007 | .0350 |
| 34-56 | NE | .0027 | .0072 | .0019 | .0006 | .0002 | .0000 | .0006 | .0133 |
| 57-78 | ENE | .0023 | .0018 | .0005 | .0002 | .0000 | .0000 | .0005 | .0053 |
| 79-101 | E | .0026 | .0013 | .0009 | .0001 | .0000 | .0000 | .0001 | .0056 |
| 102-123 | ESE | .0022 | .0021 | .0014 | .0005 | .0000 | .0000 | .0002 | .0063 |
| 124-146 | SE | .0027 | .0056 | .0061 | .0009 | .0000 | .0000 | .0001 | .0154 |
| 147-168 | SSE | .0025 | .0130 | .0138 | .0054 | .0001 | .0000 | .0002 | .0351 |
| 169-191 | S | .0037 | .0136 | .0072 | .0021 | .0000 | .0000 | .0003 | .0269 |
| 192-213 | SSW | .0024 | .0055 | .0039 | .0013 | .0000 | .0000 | .0001 | .0131 |
| 214-236 | SW | .0026 | .0025 | .0009 | .0010 | .0001 | .0000 | .0003 | .0075 |
| 237-258 | WSW | .0018 | .0019 | .0009 | .0015 | .0000 | .0000 | .0001 | .0063 |
| 259-281 | W | .0011 | .0021 | .0037 | .0030 | .0009 | .0002 | .0007 | .0117 |
| 282-303 | WNW | .0018 | .0014 | .0053 | .0119 | .0071 | .0019 | .0003 | .0297 |
| 304-326 | NW | .0015 | .0017 | .0056 | .0103 | .0087 | .0033 | .0002 | .0313 |
| 327-348 | NNW | .0022 | .0054 | .0077 | .0087 | .0024 | .0003 | .0001 | .0267 |
| CALM | | .0000 | | | | | | | .0000 |
| MISS | | .0000 | .0000 | .0000 | .0000 | .0005 | .0001 | | .0015 |
| TOTAL | | .0377 | .0971 | .0865 | .0568 | .0211 | .0062 | .0065 | .3119 |

Percentage of hours of temperature difference present in this stability category = 31.2 Numbers of hours in this

Table 2.6-5 (Sheet 5 of 14)

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION FOR PASQUILL STABILITY CATEGORY E

Indian Point B(3) Using a delta t correction factor of 0.605

JAN. 1 1970 1 DEC. 31 1972

| WIND DIRECTION | | WIND SPEED (MPH) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | Greater than 24 | MISS | TOTAL |
| 349-11 | N | .0065 | .0143 | .0149 | .0046 | .0009 | .0000 | .0007 | .0418 |
| 12-33 | NNE | .0063 | .0281 | .0183 | .0035 | .0011 | .0001 | .0014 | .0594 |
| 34-56 | NE | .0059 | .0123 | .0043 | .0006 | .0005 | .0000 | .0014 | .0250 |
| 57-78 | ENE | .0031 | .0032 | .0008 | .0000 | .0000 | .0000 | .0002 | .0073 |
| 79-101 | E | .0025 | .0041 | .0018 | .0001 | .0001 | .0000 | .0001 | .0088 |
| 102-123 | ESE | .0029 | .0041 | .0021 | .0001 | .0000 | .0000 | .0002 | .0094 |
| 124-146 | SE | .0043 | .0062 | .0027 | .0003 | .0006 | .0000 | .0001 | .0143 |
| 147-168 | SSE | .0038 | .0114 | .0089 | .0023 | .0007 | .0002 | .0001 | .0274 |
| 169-191 | S | .0041 | .0162 | .0102 | .0014 | .0003 | .0003 | .0001 | .0327 |
| 192-213 | SSW | .0049 | .0101 | .0077 | .0008 | .0000 | .0000 | .0000 | .0234 |
| 214-236 | SW | .0042 | .0078 | .0038 | .0007 | .0001 | .0001 | .0001 | .0168 |
| 237-258 | WSW | .0030 | .0038 | .0029 | .0013 | .0007 | .0002 | .0001 | .0119 |
| 259-281 | W | .0023 | .0025 | .0055 | .0019 | .0015 | .0005 | .0007 | .0149 |
| 282-303 | WNW | .0022 | .0017 | .0072 | .0079 | .0059 | .0016 | .0007 | .0272 |
| 304-326 | NW | .0013 | .0030 | .0098 | .0120 | .0043 | .0010 | .0009 | .0323 |
| 327-348 | NNW | .0024 | .0071 | .0089 | .0070 | .0010 | .0000 | .0022 | .0286 |
| CALM | | .0000 | | | | | | | .0001 |
| MISS | | .0009 | .0009 | .0010 | .0008 | .0013 | .0000 | | .0062 |
| TOTAL | | .0606 | .1375 | .1107 | .0452 | .0191 | .0041 | .0103 | .3875 |

Percentage of hours of temperature difference present in this stability category = 38.7 Numbers of hours in this stability category = 3391

Table 2.6-5 (Sheet 6 of 14)

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION FOR PASQUILL STABILITY CATEGORY F

Indian Point B(3) Using a delta t correction factor of 0.605

JAN. 1 1970 1 DEC. 31 1972

| WIND DIRECTION | | WIND SPEED (MPH) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | Greater than 24 | MISS | TOTAl |
| 349-11 | N | .0043 | .0033 | .0007 | .0000 | .0000 | .0000 | .0000 | .0083 |
| 12-33 | NNE | .0053 | .0143 | .0051 | .0005 | .0000 | .0000 | .0001 | .0253 |
| 34-56 | NE | .0050 | .0094 | .0008 | .0000 | .0000 | .0000 | .0001 | .0153 |
| 57-78 | ENE | .0031 | .0014 | .0000 | .0000 | .0000 | .0000 | .0000 | .0045 |
| 79-101 | E | .0011 | .0006 | .0000 | .0000 | .0000 | .0000 | .0000 | .0017 |
| 102-123 | ESE | .0009 | .0008 | .0000 | .0000 | .0000 | .0000 | .0000 | .0017 |
| 124-146 | SE | .0016 | .0016 | .0001 | .0000 | .0000 | .0000 | .0000 | .0033 |
| 147-168 | SSE | .0029 | .0041 | .0005 | .0001 | .0000 | .0000 | .0000 | .0075 |
| 169-191 | S | .0022 | .0043 | .0007 | .0000 | .0000 | .0000 | .0000 | .0072 |
| 192-213 | SSW | .0031 | .0058 | .0006 | .0000 | .0000 | .0000 | .0001 | .0096 |
| 214-236 | SW | .0033 | .0041 | .0007 | .0000 | .0000 | .0000 | .0001 | .0082 |
| 237-258 | WSW | .0019 | .0013 | .0003 | .0000 | .0000 | .0000 | .0005 | .0040 |
| 259-281 | W | .0021 | .0009 | .0007 | .0000 | .0001 | .0000 | .0001 | .0039 |
| 282-303 | WNW | .0016 | .0005 | .0008 | .0001 | .0000 | .0000 | .0001 | .0031 |
| 304-326 | NW | .0017 | .0006 | .0007 | .0002 | .0000 | .0000 | .0000 | .0032 |
| 327-348 | NNW | .0024 | .0015 | .0006 | .0001 | .0000 | .0000 | .0000 | .0046 |
| CALM | | .0000 | | | | | | | .0000 |
| MISS | | .0002 | .0000 | .0000 | .0000 | .0000 | .0000 | | .0011 |
| TOTAL | | .0427 | .00544 | .0122 | .0010 | .0001 | .0000 | .0021 | .1125 |

Percentage of hours of temperature difference present in this stability category = 11.3 Numbers of hours in this

Table 2.6-5 (Sheet 7 of 14)

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND
DIRECTION FOR PASQUILL STABILITY CATEGORY G

Indian Point B(3) Using a delta t correction factor of 0.605

JAN. 1 1970 1 DEC. 31 1972

WIND DIRECTION — WIND SPEED (MPH)

| | | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | Greater than 24 | MISS | TOTA |
|---|---|---|---|---|---|---|---|---|---|
| 349-11 | N | .0010 | .0005 | .0001 | .0000 | .0000 | .0000 | .0000 | .0016 |
| 12-33 | NNE | .0015 | .0042 | .0001 | .0000 | .0000 | .0000 | .0000 | .0058 |
| 34-56 | NE | .0018 | .0034 | .0000 | .0000 | .0000 | .0000 | .0000 | .0053 |
| 57-78 | ENE | .0008 | .0001 | .0000 | .0000 | .0000 | .0000 | .0000 | .0009 |
| 79-101 | E | .0010 | .0002 | .0000 | .0000 | .0000 | .0000 | .0000 | .0013 |
| 102-123 | ESE | .0005 | .0002 | .0000 | .0000 | .0000 | .0000 | .0000 | .0007 |
| 124-146 | SE | .0014 | .0001 | .0000 | .0000 | .0000 | .0000 | .0000 | .0015 |
| 147-168 | SSE | .0007 | .0005 | .0000 | .0000 | .0000 | .0000 | .0000 | .0011 |
| 169-191 | S | .0009 | .0008 | .0000 | .0000 | .0000 | .0000 | .0000 | .0017 |
| 192-213 | SSW | .0013 | .0016 | .0001 | .0000 | .0000 | .0000 | .0001 | .0031 |
| 214-236 | SW | .0016 | .0005 | .0000 | .0000 | .0000 | .0000 | .0000 | .0021 |
| 237-258 | WSW | .0009 | .0002 | .0001 | .0000 | .0000 | .0000 | .0000 | .0013 |
| 259-281 | W | .0008 | .0003 | .0000 | .0000 | .0000 | .0000 | .0000 | .0011 |
| 282-303 | WNW | .0010 | .0002 | .0000 | .0000 | .0000 | .0000 | .0000 | .0013 |
| 304-326 | NW | .0011 | .0002 | .0000 | .0000 | .0000 | .0000 | .0000 | .0014 |
| 327-348 | NNW | .0010 | .0003 | .0000 | .0001 | .0000 | .0000 | .0000 | .0015 |
| CALM | | .0000 | | | | | | | .0000 |
| MISS | | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 | | .0001 |
| TOTAL | | .0174 | .0135 | .0005 | .0001 | .0000 | .0000 | .0002 | .0316 |

Percentage of hours of temperature difference present in this stability category = 3.2 Numbers of hours in this s

Table 2.6-5 (Sheet 8 of 14)

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION FOR PASQUILL STABILITY CATEGORY A

Indian Point B(3) Using a delta t correction factor of 0.605

JAN. 1 1970 1 DEC. 31 1972

| WIND DIRECTION | | WIND SPEED (MPH) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | Greater than 24 | MISS | TOTAl |
| 349-11 | N | .0010 | .0070 | .0080 | .0025 | .0002 | .0000 | .0001 | .0189 |
| 12-33 | NNE | .0005 | .0042 | .0027 | .0010 | .0000 | .0000 | .0001 | .0086 |
| 34-56 | NE | .0003 | .0019 | .0006 | .0001 | .0001 | .0000 | .0001 | .0032 |
| 57-78 | ENE | .0002 | .0005 | .0001 | .0002 | .0002 | .0000 | .0000 | .0013 |
| 79-101 | E | .0002 | .0005 | .0002 | .0002 | .0000 | .0000 | .0000 | .0011 |
| 102-123 | ESE | .0001 | .0002 | .0005 | .0002 | .0000 | .0000 | .0000 | .0010 |
| 124-146 | SE | .0005 | .0006 | .0014 | .0016 | .0002 | .0000 | .0000 | .0042 |
| 147-168 | SSE | .0002 | .0050 | .0103 | .0071 | .0003 | .0000 | .0000 | .0230 |
| 169-191 | S | .0010 | .0090 | .0066 | .0017 | .0000 | .0000 | .0000 | .0184 |
| 192-213 | SSW | .0003 | .0054 | .0029 | .0002 | .0000 | .0000 | .0001 | .0089 |
| 214-236 | SW | .0007 | .0024 | .0017 | .0003 | .0000 | .0000 | .0000 | .0051 |
| 237-258 | WSW | .0007 | .0013 | .0016 | .0002 | .0000 | .0000 | .0002 | .0040 |
| 259-281 | W | .0007 | .0021 | .0038 | .0016 | .0007 | .0001 | .0003 | .0093 |
| 282-303 | WNW | .0006 | .0010 | .0032 | .0047 | .0024 | .0007 | .0011 | .0137 |
| 304-326 | NW | .0008 | .0015 | .0037 | .0055 | .0038 | .0007 | .0005 | .0163 |
| 327-348 | NNW | .0007 | .0041 | .0056 | .0042 | .0013 | .0001 | .0000 | .0160 |
| CALM | | .0000 | | | | | | | .0000 |
| MISS | | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 | | .0022 |
| TOTAL | | .0086 | .0466 | .0528 | .0315 | .0093 | .0016 | .0048 | .1552 |

Percentage of hours of temperature difference present in this stability category = 15.5Numbers of hours in this s

Table 2.6-5 (Sheet 9 of 14)

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION FOR PASQUILL STABILITY CATEGORY B

Indian Point B(3) Using a delta t correction factor of 0.605

JAN. 1 1970 1 DEC. 31 1972

| WIND DIRECTION | | WIND SPEED (MPH) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | Greater than 24 | MISS | TOTAl |
| 349-11 | N | .0002 | .0007 | .0005 | .0001 | .0000 | .0000 | .0000 | .0015 |
| 12-33 | NNE | .0001 | .0005 | .0005 | .0000 | .0000 | .0000 | .0000 | .0010 |
| 34-56 | NE | .0005 | .0003 | .0000 | .0000 | .0000 | .0000 | .0000 | .0008 |
| 57-78 | ENE | .0001 | .0002 | .0000 | .0000 | .0000 | .0000 | .0001 | .0005 |
| 79-101 | E | .0002 | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 | .0002 |
| 102-123 | ESE | .0003 | .0005 | .0000 | .0001 | .0000 | .0000 | .0000 | .0009 |
| 124-146 | SE | .0000 | .0003 | .0006 | .0000 | .0000 | .0000 | .0000 | .0009 |
| 147-168 | SSE | .0002 | .0005 | .0010 | .0007 | .0001 | .0000 | .0000 | .0025 |
| 169-191 | S | .0005 | .0008 | .0006 | .0005 | .0000 | .0000 | .0000 | .0023 |
| 192-213 | SSW | .0000 | .0002 | .0006 | .0000 | .0000 | .0000 | .0000 | .0008 |
| 214-236 | SW | .0003 | .0001 | .0000 | .0000 | .0000 | .0000 | .0000 | .0005 |
| 237-258 | WSW | .0006 | .0002 | .0000 | .0001 | .0000 | .0000 | .0000 | .0009 |
| 259-281 | W | .0000 | .0000 | .0007 | .0001 | .0000 | .0000 | .0000 | .0008 |
| 282-303 | WNW | .0002 | .0000 | .0000 | .0005 | .0003 | .0000 | .0000 | .0010 |
| 304-326 | NW | .0001 | .0002 | .0003 | .0002 | .0003 | .0003 | .0000 | .0016 |
| 327-348 | NNW | .0001 | .0001 | .0006 | .0002 | .0000 | .0001 | .0000 | .0011 |
| CALM | | .0000 | | | | | | | .0000 |
| MISS | | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 | | .0000 |
| TOTAL | | .0035 | .0047 | .0053 | .0025 | .0008 | .0005 | .0001 | .0174 |

Percentage of hours of temperature difference present in this stability category = 1.7 Numbers of hours in this s

Table 2.6-5 (Sheet 10 of 14)

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND
DIRECTION FOR PASQUILL STABILITY CATEGORY C

Indian Point B(3) Using a delta t correction factor of 0.605

JAN. 1 1970 1 DEC. 31 1972

WIND
DIRECTION WIND SPEED (MPH)

| | | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | Greater than 24 | MISS | TOTA |
|---|---|---|---|---|---|---|---|---|---|
| 349-11 | N | .0000 | .0009 | .0009 | .0008 | .0000 | .0000 | .0000 | .0026 |
| 12-33 | NNE | .0001 | .0007 | .0008 | .0003 | .0001 | .0000 | .0000 | .0021 |
| 34-56 | NE | .0002 | .0005 | .0001 | .0001 | .0000 | .0000 | .0000 | .0009 |
| 57-78 | ENE | .0001 | .0000 | .0002 | .0000 | .0000 | .0000 | .0000 | .0003 |
| 79-101 | E | .0000 | .0001 | .0000 | .0001 | .0000 | .0000 | .0000 | .0002 |
| 102-123 | ESE | .0000 | .0001 | .0000 | .0000 | .0000 | .0000 | .0000 | .0001 |
| 124-146 | SE | .0002 | .0005 | .0007 | .0001 | .0000 | .0000 | .0000 | .0015 |
| 147-168 | SSE | .0003 | .0013 | .0018 | .0008 | .0000 | .0000 | .0000 | .0042 |
| 169-191 | S | .0001 | .0016 | .0006 | .0001 | .0000 | .0000 | .0000 | .0024 |
| 192-213 | SSW | .0001 | .0006 | .0003 | .0001 | .0000 | .0000 | .0000 | .0011 |
| 214-236 | SW | .0003 | .0005 | .0002 | .0003 | .0000 | .0000 | .0000 | .0014 |
| 237-258 | WSW | .0001 | .0000 | .0002 | .0003 | .0000 | .0000 | .0000 | .0007 |
| 259-281 | W | .0000 | .0002 | .0005 | .0008 | .0001 | .0000 | .0000 | .0016 |
| 282-303 | WNW | .0005 | .0002 | .0002 | .0013 | .0011 | .0005 | .0000 | .0038 |
| 304-326 | NW | .0000 | .0001 | .0001 | .0001 | .0009 | .0006 | .0000 | .0018 |
| 327-348 | NNW | .0003 | .0007 | .0005 | .0008 | .0006 | .0000 | .0000 | .0029 |
| CALM | | .0000 | | | | | | | .0000 |
| MISS | | .0000 | .0000 | .0000 | .0000 | .0002 | .0001 | | .0006 |
| TOTAL | | .0025 | .0079 | .0072 | .0062 | .0031 | .0011 | .0002 | .0282 |

Percentage of hours of temperature difference present in this stability category = 2.8 Numbers of hours in this s

Table 2.6-5 (Sheet 11 of 14)

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION FOR PASQUILL STABILITY CATEGORY D

Indian Point B(3) Using a delta t correction factor of 0.605

JAN. 1 1970 1 DEC. 31 1972

| WIND DIRECTION | | WIND SPEED (MPH) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | Greater than 24 | MISS | TOTAl |
| 349-11 | N | .0023 | .0149 | .0182 | .0066 | .0008 | .0001 | .0014 | .0442 |
| 12-33 | NNE | .0037 | .0166 | .0120 | .0035 | .0006 | .0001 | .0014 | .0378 |
| 34-56 | NE | .0030 | .0066 | .0026 | .0003 | .0003 | .0000 | .0006 | .0135 |
| 57-78 | ENE | .0022 | .0016 | .0001 | .0001 | .0000 | .0000 | .0006 | .0046 |
| 79-101 | E | .0024 | .0019 | .0010 | .0000 | .0000 | .0000 | .0002 | .0056 |
| 102-123 | ESE | .0023 | .0016 | .0013 | .0002 | .0000 | .0000 | .0003 | .0057 |
| 124-146 | SE | .0025 | .0055 | .0047 | .0006 | .0002 | .0000 | .0001 | .0136 |
| 147-168 | SSE | .0022 | .0114 | .0103 | .0032 | .0000 | .0000 | .0003 | .0274 |
| 169-191 | S | .0026 | .0101 | .0056 | .0013 | .0000 | .0000 | .0003 | .0199 |
| 192-213 | SSW | .0030 | .0035 | .0029 | .0011 | .0000 | .0000 | .0000 | .0105 |
| 214-236 | SW | .0021 | .0019 | .0009 | .0006 | .0001 | .0000 | .0003 | .0059 |
| 237-258 | WSW | .0011 | .0018 | .0008 | .0011 | .0000 | .0000 | .0000 | .0049 |
| 259-281 | W | .0013 | .0018 | .0022 | .0017 | .0008 | .0001 | .0006 | .0085 |
| 282-303 | WNW | .0015 | .0010 | .0050 | .0097 | .0063 | .0011 | .0002 | .0249 |
| 304-326 | NW | .0011 | .0019 | .0059 | .0117 | .0078 | .0026 | .0001 | .0312 |
| 327-348 | NNW | .0011 | .0057 | .0071 | .0079 | .0022 | .0002 | .0002 | .0245 |
| CALM | | .0000 | | | | | | | .0000 |
| MISS | | .0000 | .0001 | .0000 | .0001 | .0005 | .0000 | | .0011 |
| TOTAL | | .0343 | .0881 | .0806 | .0498 | .0195 | .0043 | .0072 | .2838 |

Percentage of hours of temperature difference present in this stability category = 28.4 Numbers of hours in this stability category = 2484

Table 2.6-5 (Sheet 12 of 14)

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION FOR PASQUILL STABILITY CATEGORY E

Indian Point B(3) Using a delta t correction factor of 0.605

JAN. 1 1970 1 DEC. 31 1972

| WIND DIRECTION | | WIND SPEED (MPH) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | Greater than 24 | MISS | TOTAL |
| 349-11 | N | .0046 | .0096 | .0073 | .0022 | .0006 | .0000 | .0002 | .0243 |
| 12-33 | NNE | .0035 | .0178 | .0117 | .0019 | .0009 | .0001 | .0006 | .0366 |
| 34-56 | NE | .0034 | .0070 | .0026 | .0006 | .0002 | .0000 | .0009 | .0147 |
| 57-78 | ENE | .0023 | .0026 | .0006 | .0000 | .0000 | .0000 | .0000 | .0055 |
| 79-101 | E | .0014 | .0035 | .0016 | .0001 | .0001 | .0000 | .0000 | .0067 |
| 102-123 | ESE | .0015 | .0034 | .0018 | .0001 | .0000 | .0000 | .0001 | .0070 |
| 124-146 | SE | .0035 | .0043 | .0021 | .0002 | .0003 | .0000 | .0001 | .0106 |
| 147-168 | SSE | .0025 | .0078 | .0066 | .0016 | .0005 | .0002 | .0000 | .0192 |
| 169-191 | S | .0026 | .0093 | .0064 | .0010 | .0003 | .0003 | .0001 | .0201 |
| 192-213 | SSW | .0031 | .0074 | .0063 | .0007 | .0000 | .0000 | .0000 | .0175 |
| 214-236 | SW | .0025 | .0045 | .0029 | .0007 | .0001 | .0001 | .0000 | .0107 |
| 237-258 | WSW | .0019 | .0029 | .0018 | .0009 | .0007 | .0002 | .0000 | .0085 |
| 259-281 | W | .0014 | .0018 | .0046 | .0014 | .0008 | .0005 | .0001 | .0105 |
| 282-303 | WNW | .0010 | .0009 | .0048 | .0058 | .0041 | .0014 | .0002 | .0183 |
| 304-326 | NW | .0008 | .0019 | .0069 | .0085 | .0021 | .0006 | .0005 | .0211 |
| 327-348 | NNW | .0019 | .0042 | .0057 | .0042 | .0005 | .0000 | .0013 | .0178 |
| CALM | | .0000 | | | | | | | .0000 |
| MISS | | .0005 | .0007 | .0010 | .0007 | .0010 | .0000 | | .0049 |
| TOTAL | | .0385 | .0897 | .0746 | .0306 | .0122 | .0034 | .0051 | .2542 |

Percentage of hours of temperature difference present in this stability category = 25.4 Numbers of hours in this

Table 2.6-5
(Sheet 13 of 14)

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION FOR PASQUILL STABILITY CATEGORY F

Indian Point B(3) Using a delta t correction factor of 0.605

JAN. 1 1970 1 DEC. 31 1972

| WIND DIRECTION | | WIND SPEED (MPH) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | Greater than 24 | MISS | TOTAL |
| 349-11 | N | .0040 | .0026 | .0026 | .0007 | .0000 | .0000 | .0000 | .0099 |
| 12-33 | NNE | .0040 | .0134 | .0075 | .0008 | .0002 | .0000 | .0000 | .0259 |
| 34-56 | NE | .0031 | .0082 | .0017 | .0000 | .0000 | .0000 | .0005 | .0135 |
| 57-78 | ENE | .0016 | .0013 | .0002 | .0000 | .0000 | .0000 | .0000 | .0031 |
| 79-101 | E | .0013 | .0003 | .0001 | .0000 | .0000 | .0000 | .0000 | .0017 |
| 102-123 | ESE | .0013 | .0007 | .0000 | .0000 | .0000 | .0000 | .0000 | .0019 |
| 124-146 | SE | .0009 | .0014 | .0002 | .0000 | .0000 | .0000 | .0000 | .0025 |
| 147-168 | SSE | .0022 | .0041 | .0015 | .0001 | .0002 | .0000 | .0000 | .0081 |
| 169-191 | S | .0022 | .0071 | .0029 | .0002 | .0000 | .0000 | .0000 | .0123 |
| 192-213 | SSW | .0021 | .0056 | .0014 | .0000 | .0000 | .0000 | .0000 | .0090 |
| 214-236 | SW | .0027 | .0049 | .0009 | .0000 | .0000 | .0000 | .0001 | .0087 |
| 237-258 | WSW | .0021 | .0013 | .0009 | .0000 | .0000 | .0000 | .0005 | .0047 |
| 259-281 | W | .0011 | .0010 | .0011 | .0001 | .0003 | .0000 | .0007 | .0045 |
| 282-303 | WNW | .0010 | .0008 | .0022 | .0009 | .0001 | .0001 | .0006 | .0057 |
| 304-326 | NW | .0011 | .0007 | .0022 | .0006 | .0009 | .0001 | .0005 | .0061 |
| 327-348 | NNW | .0013 | .0016 | .0024 | .0016 | .0001 | .0000 | .0008 | .0078 |
| CALM | | .0000 | | | | | | | .0001 |
| MISS | | .0007 | .0001 | .0000 | .0000 | .0000 | .0000 | | .0013 |
| TOTAL | | .0326 | .0552 | .0279 | .0050 | .0019 | .0002 | .0040 | .1268 |

Percentage of hours of temperature difference present in this stability category = 12.7 Numbers of hours in this

Table 2.6-5 (Sheet 14 of 14)

JOINT FREQUENCY DISTRIBUTION OF WIND SPEED AND DIRECTION FOR PASQUILL STABILITY CATEGORY G

Indian Point B(3) Using a delta t correction factor of 0.605

JAN. 1 1970 1 DEC. 31 1972

| WIND DIRECTION | | WIND SPEED (MPH) 01-03 | 04-07 | 08-12 | 13-18 | 19-24 | Greater than 24 | MISS | TOTA |
|---|---|---|---|---|---|---|---|---|---|
| 349-11 | N | .0027 | .0025 | .0003 | .0000 | .0000 | .0000 | .0000 | .0056 |
| 12-33 | NNE | .0047 | .0125 | .0014 | .0000 | .0000 | .0000 | .0001 | .0186 |
| 34-56 | NE | .0053 | .0089 | .0000 | .0000 | .0000 | .0000 | .0000 | .0142 |
| 57-78 | ENE | .0029 | .0008 | .0000 | .0000 | .0000 | .0000 | .0000 | .0037 |
| 79-101 | E | .0018 | .0007 | .0000 | .0000 | .0000 | .0000 | .0000 | .0025 |
| 102-123 | ESE | .0009 | .0009 | .0000 | .0000 | .0000 | .0000 | .0000 | .0018 |
| 124-146 | SE | .0024 | .0014 | .0000 | .0000 | .0000 | .0000 | .0000 | .0038 |
| 147-168 | SSE | .0023 | .0023 | .0002 | .0000 | .0000 | .0000 | .0000 | .0048 |
| 169-191 | S | .0021 | .0027 | .0005 | .0000 | .0000 | .0000 | .0000 | .0053 |
| 192-213 | SSW | .0033 | .0040 | .0003 | .0000 | .0000 | .0000 | .0002 | .0079 |
| 214-236 | SW | .0034 | .0026 | .0002 | .0000 | .0000 | .0000 | .0001 | .0064 |
| 237-258 | WSW | .0017 | .0008 | .0003 | .0000 | .0000 | .0000 | .0001 | .0030 |
| 259-281 | W | .0024 | .0006 | .0001 | .0000 | .0000 | .0000 | .0000 | .0031 |
| 282-303 | WNW | .0022 | .0003 | .0001 | .0000 | .0000 | .0000 | .0000 | .0026 |
| 304-326 | NW | .0021 | .0005 | .0000 | .0001 | .0000 | .0000 | .0000 | .0026 |
| 327-348 | NNW | .0026 | .0008 | .0001 | .0001 | .0000 | .0000 | .0000 | .0037 |
| CALM | | .0000 | | | | | | | .0000 |
| MISS | | .0000 | .0000 | .0000 | .0000 | .0000 | .0000 | | .0008 |
| TOTAL | | .0427 | .0423 | .0037 | .0002 | .0000 | .0000 | .0014 | .0903 |

Percentage of hours of temperature difference present in this stability category = 9.0 Numbers of hours in this s