

CONFIDENTIAL

INITIAL EVALUATION OF ADDITIONAL
DOWNVALLEY METEOROLOGICAL MONITORING
STATION AT NESCOPECK
SUSQUEHANNA STEAM ELECTRIC STATION
FOR PENNSYLVANIA POWER & LIGHT COMPANY

MARCH 1983

Dames & Moore

8308300624 830825
PDR ADCK 05000387
P PDR



Job No. 4894-078-09



1950

March 4, 1983

Pennsylvania Power & Light Company
Two North Ninth Street
Allentown, PA 18101

Attention: Mr. Tom Widner

Gentlemen:

Re: Initial Evaluation of Additional
Downvalley Meteorological Monitoring
Station at Nescopeck
Susquehanna Steam Electric Station

This letter presents a report of our initial 30-day evaluation of the additional meteorological monitoring station located downvalley of the Susquehanna Steam Electric Station (SSES) near Nescopeck. In addition, a summary of the previous downvalley analysis at Sites 1 and 2 is presented.

BACKGROUND

A meteorological monitoring network consisting of four wind measurement sites was established in the vicinity of the SSES to determine the validity of the Dames & Moore subjective atmospheric dispersion model and to determine if supplemental meteorological towers are needed at the SSES, and if so, the preferred locations. Dames & Moore's initial evaluation of these four sites for a 3-month period from 11/11/81 to 02/17/82 (documentation dated April 1, 1982) concluded that the two sites located downvalley of the SSES probably did not adequately represent the downvalley cases in our subjective model. We recommended that consideration be given to evaluating the downvalley cases further downwind near either Berwick or Nescopeck.

Subsequently, a report on the evaluation of the two upvalley sites was submitted on July 15, 1982. In addition, a third downvalley site location was selected by PP&L. This site (hereafter referred to as

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Site 5) is located approximately 3.5 miles southwest of the SSES at an elevation of about 580' MSL. This location lies in the "V" formed by the intersection of the two roads just west of Nescopeck. Site 5 became operational in late October 1982. An analysis of the 30-day period from 11/02/82 to 12/02/82 is presented herein.

DESCRIPTION OF SUBJECTIVE MODEL FOR DOWNVALLEY FLOW

A correction to the directional atmospheric transport of the plume centerline is made for wind speeds less than two meters/second (4.5 mph) and stable atmospheric conditions (Pasquill classes E, F, and G) to account for the influence of abrupt elevation changes on the local wind circulation patterns. It is assumed that the plume remains confined to the river valley when it encounters a steep rise in ground elevation.

For WNW, NW, NNW, N, NNE, and NE wind directions at the primary tower, the plume is assumed to be transported to within a specific distance (depending on the initial wind direction) of the southern valley wall and then transported downvalley in a direction toward 260 degrees (wind direction from 080 degrees). This causes the plume centerline to remain roughly parallel to the river valley wall at a distance of approximately 1000 meters.

For E, ESE, SE, and SSE wind directions at the primary tower, the plume is already within 1000 meters of the constraining northern valley wall and an initial ENE wind direction is assumed.

COMPUTER ANALYSIS PROCEDURES

Two types of computer analyses were performed. Wind frequency distributions were developed by wind sector and wind speed intervals for each supplemental tower site and the primary tower. Wind sector scatter diagrams were developed based on concurrent hourly data at each supplemental tower site versus the primary tower. These scatter

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diagrams were developed for all observations and for nighttime hours only (hours from 1900 to 0800, assumed to be representative of stable atmospheric conditions).

In addition, wind direction scatter diagrams were also developed for specified wind direction, wind speed, and time restrictions.

Scatter diagrams applicable to the downvalley case are as follows:

1. Wind direction at primary tower restricted to 320-060.
2. Wind direction at primary tower restricted to 320-060, wind speed at primary tower restricted to less than 5.0 mph, and hours restricted to nighttime.
3. Wind direction at primary tower restricted to 070-160.
4. Wind direction at primary tower restricted to 070-160, wind speed at primary tower restricted to less than 5.0 mph, and hours restricted to nighttime.
5. Wind direction at primary tower restricted to 230-310.

SUMMARY OF PREVIOUS RESULTS FOR DOWNVALLEY SITES 1 AND 2

The wind frequency distributions for Sites 1 and 2 compared favorably with the wind frequency distribution at the primary tower for the 11/11/81-02/17/82 study period. The predominant wind directions at all three locations were W and WSW and the minimum frequency of occurrence at all three locations occurred in the SE sector. However, the average wind speed at Site 2 was much higher than at either Site 1 or the primary tower.

Wind direction comparisons of concurrent observations at Sites 1 and 2 versus the primary tower also compared reasonably well for both the all observations case and for nighttime observations only. Little evidence of wind direction shifts in accordance with the predictions of the Dames & Moore subjective model was noted.

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An analysis of the scatter diagrams developed for specified wind directions indicated the following:

1. For winds from the E, ESE, SE, and SSE sectors at the primary tower, there was little evidence that the predicted shift to ENE flow occurs.
2. For winds from the WNW, NW, NNW, N, NNE, and NE sectors at the primary tower, there was only limited evidence that the predicted shift to a final downvalley flow from the E to ENE occurs (primarily for winds from 020 to 050 at the primary tower for Site 1 and for winds from 020 to 030 at the primary tower for Site 2).

Thus, it was apparent that the analysis of Sites 1 and 2 during the 11/11/81 to 02/17/82 study period did not generally support the Dames & Moore subjective model for downvalley locations. Further, it was concluded that the locations of Sites 1 and 2 probably did not adequately represent the downvalley cases (neither site was located directly in the river valley). An evaluation of the downvalley cases further downwind near either Berwick or Nescopeck was recommended.

RESULTS FOR SITE 5

Wind frequency distributions for the primary tower and Site 5 for the period 11/02/82-12/02/82 are presented in Tables 1 and 2, respectively. At the primary tower, the distribution was fairly uniform with a maximum frequency in the S to SW sectors and a secondary maximum in the ENE sector. On the other hand, the distribution at Site 5 indicated a pronounced valley flow with winds from the E and ENE approximately 32 percent of the time and from the SW and WSW another 26 percent of the time.

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Wind direction comparisons based on concurrent observations at Site 5 and the primary tower are shown in Table 3 for all observations and in Table 4 for nighttime observations only. Calm and variable occurrences are indicated separately in Tables 3 and 4. These tables also show the pronounced shift to valley flow noted above and indicate that the downvalley flow (E and ENE winds) is somewhat more pronounced for nighttime hours only. In addition, winds from the WNW, NW, and NNW at the primary tower appear to be shifted a sector or two to the west at Site 5.

In order to provide additional evaluation of the wind shifts predicted by the Dames & Moore subjective model, wind direction scatter diagrams for specified conditions (see Computer Analysis Procedures) were developed. These scatter diagrams are attached and indicate the following:

1. Downvalley case for winds from WNW, NW, NNW, N, NNE, and NE at Primary Tower - Plume bending to a final downvalley flow from the E to ENE occurs, but only for the NNE and NE wind directions at the primary tower. This shift occurs for all occurrences as well as when the hours were restricted to nighttime only (assumed to be representative of stable atmospheric conditions) with wind speeds less than 5.0 mph at the primary tower. For the latter case there were only a few occurrences for winds from NW-NNE at the primary tower.
2. Downvalley case for winds from E, ESE, SE, and SSE at Primary Tower - Wind direction is primarily E to ENE at Site 5 or generally as predicted by the Dames & Moore subjective model. However, the data does not support this shift for the SSE wind direction. This shift also occurs for both the all case and the case restricted to nighttime hours with wind speeds less than 5.0 mph at the primary tower. For the latter case, there were very few occurrences for winds from ESE-SSE at the primary tower.

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CONCLUSIONS

Two general conclusions can be drawn from the 30-day analysis at Site 5:

1. There is a pronounced valley flow in the river valley downwind of the primary tower.
2. There is generally downvalley flow (E to ENE wind direction) at Site 5 during winds from the NNE through SE at the primary tower regardless of wind speed or stability class.

Thus, the limited 30-day analysis indicates that the Dames & Moore subjective model for the downvalley case should only be applied for wind directions of NNE, NE, ENE, E, ESE, and SE at the primary tower. Additionally, the analysis indicates that the stability class restriction and wind speed restriction should be removed from the subjective model. This is similar to the finding for the upvalley case except that, for the downvalley case, there were not enough wind speeds above 9 mph in the sectors of interest at the primary tower to evaluate 9 mph as an upper limit.

If a supplemental tower is required downvalley of the SSES, it appears that Site 5 would be an ideal location. Nevertheless, it would be preferable to review a longer period of data before selecting a permanent supplemental tower site.

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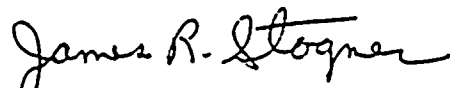
Please call if you have any questions or comments regarding this report.

Very truly yours,

DAMES & MOORE



Robert G. Allen
Partner



James R. Stogner
Senior Meteorologist

TABLE 1
WIND FREQUENCY DISTRIBUTION
PRIMARY TOWER

WIND POWER & LIGHT

PRIMARY TOWER

1951

DATA AND SOURCE FOR NO. 1 WIND TOWER
PERIOD (1/1/50 TO 12/31/50)
STATION CLASS ALL (AND DELTA TIME)
WINDS AT 10 METERS 1951

WIND FREQUENCY DISTRIBUTION
(FREQUENCY IN NUMBER OF OCCURRENCES)

WIND DIRECTION	UPPER CLASS INTERVALS OF WIND SPEED (MPH)											TOTAL	MEAN SPEED	
	1	2	3	4	5	6	7	8	9	10	11			12
NNE	2	7	16	4	5	1	0	0	0	0	0	0	35	2.96
NE	11	24	10	3	3	2	0	0	0	0	0	0	53	3.22
ENE	12	29	13	5	1	1	0	0	0	0	0	0	61	2.11
E	16	18	7	2	1	2	0	0	0	0	0	0	46	1.97
ESE	7	5	3	4	3	3	0	0	0	0	0	0	25	2.76
SE	2	8	2	3	4	2	1	0	0	0	0	0	22	3.11
SSE	4	4	2	5	2	1	2	0	0	0	0	0	20	3.15
S	3	11	10	6	10	10	11	5	0	1	1	2	70	4.82
SSW	5	6	6	16	9	8	3	1	1	3	0	4	62	4.81
SW	3	7	16	16	10	3	5	4	0	1	1	0	68	3.96
WSW	0	3	6	9	8	4	5	6	6	4	4	3	58	6.39
W	0	3	5	2	2	0	8	16	5	7	4	1	55	7.04
WNW	1	2	1	3	3	0	3	1	0	2	3	3	22	6.91
NW	1	0	0	1	2	4	4	4	2	1	1	6	26	8.08
NNW	2	1	1	0	3	1	3	0	2	1	2	0	16	5.94
N	2	4	4	3	2	7	1	2	2	5	1	1	34	5.66
VARIABLE													0	0.
CALM													0	0.
TOTAL	71	136	102	82	68	49	35	39	18	25	17	20	673	4.39

WIND FREQUENCY DISTRIBUTION
(FREQUENCY IN PERCENT OF TOTAL)

WIND DIRECTION	UPPER CLASS INTERVALS OF WIND SPEED (MPH)											TOTAL	MEAN SPEED	
	1	2	3	4	5	6	7	8	9	10	11			12
NNE	.30	1.04	2.38	.59	.74	.15	0.	0.	0.	0.	0.	0.	5.20	2.96
NE	1.63	3.57	1.49	.45	.45	.30	0.	0.	0.	0.	0.	0.	7.88	3.22
ENE	1.78	4.31	1.93	.74	.15	.15	0.	0.	0.	0.	0.	0.	9.66	2.11
E	2.38	2.67	1.04	.30	.15	.30	0.	0.	0.	0.	0.	0.	6.84	1.97
ESE	1.04	.74	.45	.59	.45	.45	0.	0.	0.	0.	0.	0.	3.71	2.76
SE	.30	1.19	.30	.45	.59	.30	.15	0.	0.	0.	0.	0.	3.27	3.11
SSE	.59	.59	.30	.74	.30	.15	.30	0.	0.	0.	0.	0.	2.97	3.15
S	.45	1.63	1.49	.89	1.49	1.49	1.63	.74	0.	.15	.15	.30	10.40	4.82
SSW	.74	.89	.89	2.38	1.34	1.19	.74	.15	.15	.30	0.	.30	9.71	4.81
SW	.45	1.34	2.38	2.38	1.19	.74	.89	0.	.15	.15	0.	0.	10.10	3.96
WSW	0.	.45	.89	1.34	1.19	.59	.74	.89	.89	.59	.30	0.	7.62	6.39
W	0.	.74	.74	0.	0.	0.	1.19	2.38	.74	1.63	.30	1.	9.17	7.04
WNW	.15	.30	.15	.15	.15	0.	.45	.15	0.	.30	.45	.15	3.27	6.91
NW	.15	0.	0.	.15	.30	.59	.59	.30	.15	.15	.15	.30	3.76	8.08
NNW	.30	.15	.15	0.	.15	.15	.30	0.	.30	.15	0.	0.	2.38	5.94
N	.30	.74	.74	.45	.30	1.19	.15	.30	.30	.74	.15	.15	5.94	5.66
VARIABLE													0.	0.
CALM													0	0.
TOTAL	10.55	20.21	15.15	12.18	10.10	7.71	6.38	5.79	2.67	3.71	2.53	2.97	100.00	4.39

U.S. DEPARTMENT OF COMMERCE, BUREAU OF MARINE SERVICE

WIND DATA FROM THE NATIONAL DATA CENTER, WASHINGTON, D.C.

TABLE 2
WIND FREQUENCY DISTRIBUTION
SITE 5

STATION NUMBER: 11001
 DATE: 1/1/68
 TIME PERIOD: 0000Z TO 2359Z
 STABILITY CLASS: 1
 WINDS AT 10 METER: 1000

2733.

WIND FREQUENCY DISTRIBUTION
(FREQUENCY IN NUMBER OF OCCURRENCES)

WIND DIRECTION	UPPER CLASS INTERVALS OF WIND SPEED (MPH)											TOTAL	MEAN SPEED	
	1	2	3	4	5	6	7	8	9	10	11			
NNE	0	2	4	1	1	1	2	0	0	0	0	0	11	3.00
NE	0	2	5	5	8	2	3	0	0	0	0	0	25	3.91
ENE	6	27	31	24	21	10	7	4	1	1	0	0	132	3.47
E	8	22	12	13	11	4	5	2	2	3	0	0	82	3.45
ESE	5	0	6	3	1	1	0	0	0	0	0	0	16	2.51
SE	0	4	5	4	1	0	0	0	0	0	0	0	14	2.69
SSE	0	4	0	2	2	2	3	0	0	0	0	0	13	4.08
S	1	3	7	5	9	5	2	3	1	2	0	5	46	5.53
SSW	1	3	10	9	10	5	3	2	3	1	0	3	50	4.87
SW	1	5	12	11	9	6	3	2	5	3	3	8	68	5.74
WSW	3	6	8	2	10	7	6	6	4	7	9	34	102	8.66
W	0	4	4	4	0	2	0	0	0	1	5	21	41	10.10
WNW	0	2	0	0	0	1	1	0	3	2	3	13	25	10.50
NW	0	0	0	0	0	1	1	2	0	0	3	2	9	9.29
NNW	0	1	1	2	1	2	2	1	0	3	1	0	14	6.16
N	0	3	3	1	2	2	1	0	2	0	0	0	14	4.34
VARIABLE CALM													0	0.
TOTAL	25	88	108	86	86	51	39	25	21	23	24	86	662	5.57

WIND FREQUENCY DISTRIBUTION
(FREQUENCY IN PERCENT OF TOTAL)

WIND DIRECTION	UPPER CLASS INTERVALS OF WIND SPEED (MPH)											TOTAL	MEAN SPEED	
	1	2	3	4	5	6	7	8	9	10	11			
NNE	0.	.30	.60	.15	.15	.15	.30	0.	0.	0.	0.	0.	1.66	3.62
NE	0.	.30	.76	.76	1.21	.30	.45	0.	0.	0.	0.	0.	3.78	3.91
ENE	.91	4.08	4.68	3.63	3.17	1.51	1.06	.60	.15	.15	0.	0.	19.94	3.47
E	1.21	3.32	1.81	1.96	1.66	.60	.76	.30	.30	.45	0.	0.	12.39	3.45
ESE	.76	0.	.91	.45	.15	.15	0.	0.	0.	0.	0.	0.	2.42	2.51
SE	0.	.60	.76	.60	.15	0.	0.	0.	0.	0.	0.	0.	2.11	2.69
SSE	0.	.60	0.	.30	.30	.30	.45	0.	0.	0.	0.	0.	1.96	4.08
S	.15	.45	1.06	.76	1.36	.76	.30	.91	.15	.30	0.	.76	6.95	5.53
SSW	.15	.45	1.51	1.36	1.51	.76	.45	.30	.45	.15	0.	.45	7.55	4.87
SW	.15	.76	1.81	1.66	1.36	.91	.45	.30	.76	.45	.45	1.21	10.27	5.74
WSW	.45	.91	1.21	.30	1.51	1.06	.91	.91	.60	1.06	1.36	5.14	15.41	8.66
W	0.	.60	.60	.60	0.	.30	0.	0.	0.	.15	.76	3.17	6.19	10.10
WNW	0.	.30	0.	0.	0.	.15	.15	0.	.45	.30	.45	1.96	3.78	10.50
NW	0.	0.	0.	0.	0.	.15	.15	.30	0.	0.	.45	.30	1.36	9.29
NNW	0.	.15	.15	.30	.15	.30	.30	.15	0.	.45	.15	0.	2.11	6.16
N	0.	.45	.45	.15	.30	.30	.15	0.	.60	0.	0.	0.	2.11	4.34
VARIABLE CALM													0.	0.
TOTAL	3.78	13.29	16.31	12.99	12.99	7.70	5.89	3.78	5.17	3.47	3.63	12.99	100.00	5.57

TOTAL NUMBER OF POSSIBLE OBSERVATIONS - 720

TOTAL NUMBER OF OBSERVATIONS WITH VALID SPEED, DIRECTION AND STABILITY - 662

TABLE 3
WIND DIRECTION COMPARISON
ALL OBSERVATIONS
SITE 5 VERSUS PRIMARY TOWER

WIND DIRECTION COMPARISON
SUSQUEHANNA STEAM ELECTRIC STATION
DATA PERIOD: AUGUST TO DECEMBER
FREQUENCY IN NUMBER OF OCCURRENCES
WINDS AT 10 METER LEVEL

PRIMARY TOWER	SITE 5																		
SECTOR	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	N	CALM	VART	TOTAL
NNE	3	6	15	4	0	0	0	0	0	0	0	1	0	0	1	3	0	0	33
NE	3	5	30	10	0	0	0	0	0	0	0	0	0	0	1	0	1	2	52
ENE	0	3	31	17	0	2	1	0	0	1	2	0	0	0	0	1	2	0	60
E	0	4	20	12	0	0	1	2	1	0	1	2	0	0	0	0	2	0	45
ESE	0	1	6	11	1	1	1	0	0	1	1	0	0	1	0	0	0	0	24
SE	0	0	7	6	1	3	0	0	0	0	1	0	0	0	0	1	0	3	22
SSE	0	0	1	5	5	2	0	2	1	0	2	0	0	0	0	0	1	1	20
S	2	0	2	5	3	3	7	23	14	4	1	2	0	0	0	1	1	2	70
SSW	0	0	1	1	2	2	2	12	20	14	3	1	0	0	2	0	2	0	62
SW	1	1	0	1	1	0	1	5	7	22	15	4	2	0	0	1	3	1	65
WSW	0	1	0	1	0	0	0	0	1	10	27	1	0	0	0	0	1	3	53
W	0	0	0	0	1	1	0	0	3	3	39	5	0	0	0	1	0	2	55
WNW	0	0	1	0	0	0	0	0	0	2	5	8	6	0	0	0	0	0	32
NW	0	0	0	0	0	0	0	0	0	0	1	15	7	2	0	0	0	1	26
NNW	0	0	0	1	1	0	0	0	1	0	0	0	7	3	1	1	0	0	15
N	1	2	5	0	0	0	0	0	0	1	0	0	3	3	9	5	0	0	29
CALM	1	2	13	8	1	0	0	2	2	2	4	2	0	0	0	0	4	6	47
VART	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	11	25	132	82	16	14	13	45	50	68	102	41	25	9	14	14	17	21	700
NUMBER OF INVALID OBSERVATIONS=																			20

TABLE 4
 WIND DIRECTION COMPARISON
 NIGHTTIME OBSERVATIONS
 SITE 5 VERSUS PRIMARY TOWER

WIND DIRECTION COMPARISON
 SUSQUEHANNA STEAM ELECTRIC STATION
 DATA PERIOD- NOV0282 TO DEC0282
 FREQUENCY IN NUMBER OF OCCURRENCES
 WINDS AT 10 METER LEVEL

PRIMARY TOWER	SITES																CALM	VARI	TOTAL
	SECTOR	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW			
NNE	3	5	7	3	0	0	0	0	0	0	0	1	0	0	0	3	0	0	22
NE	3	3	21	8	0	0	0	0	0	0	0	0	0	0	0	0	1	2	38
ENE	0	1	28	12	0	2	1	0	0	1	1	0	0	0	0	0	2	0	48
E	0	3	17	8	0	0	1	2	1	0	0	1	0	0	0	0	2	0	35
ESE	0	0	4	6	1	1	1	0	0	1	0	0	0	0	0	0	0	0	14
SE	0	0	4	3	1	1	0	0	0	0	1	0	0	0	0	0	0	1	11
SSE	0	0	0	2	4	1	0	1	1	0	0	0	0	0	0	0	1	1	11
S	2	0	2	3	3	0	2	11	3	2	1	0	0	0	0	0	0	1	30
SSW	0	0	1	1	2	1	2	4	5	5	0	0	0	0	0	0	1	0	22
SW	0	1	0	0	0	0	1	3	4	15	8	0	1	0	0	0	1	0	34
WSW	0	1	0	0	0	0	0	0	1	10	11	0	0	0	0	0	1	2	26
W	0	0	0	0	0	1	0	0	0	0	24	1	0	0	0	1	0	2	29
WNW	0	0	1	0	0	0	0	0	0	2	4	2	2	0	0	0	0	0	11
NW	0	0	0	0	0	0	0	0	0	0	1	5	2	2	0	0	0	1	11
NNW	0	0	0	1	1	0	0	0	1	0	0	0	7	1	0	1	0	0	12
N	1	2	2	0	0	0	0	0	0	0	0	0	0	3	2	1	0	0	11
CALM	1	2	12	8	1	0	0	1	2	2	4	1	0	0	0	0	4	3	41
VARI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	10	18	99	55	13	7	8	22	18	38	55	11	12	6	2	6	13	13	406

NUMBER OF INVALID OBSERVATIONS= 14

SCATTER DIAGRAMS

(Wind direction in tens of degrees)

REVISIONS BY DATE

FILE

CHECKED BY

Primary Tower

36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
2	3	4	6	10	36	30	15	6	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Description. WD at primary tower restricted in 320-060.

Results: 170 Occurrences.

Site 5

CHECKED BY _____ DATE _____

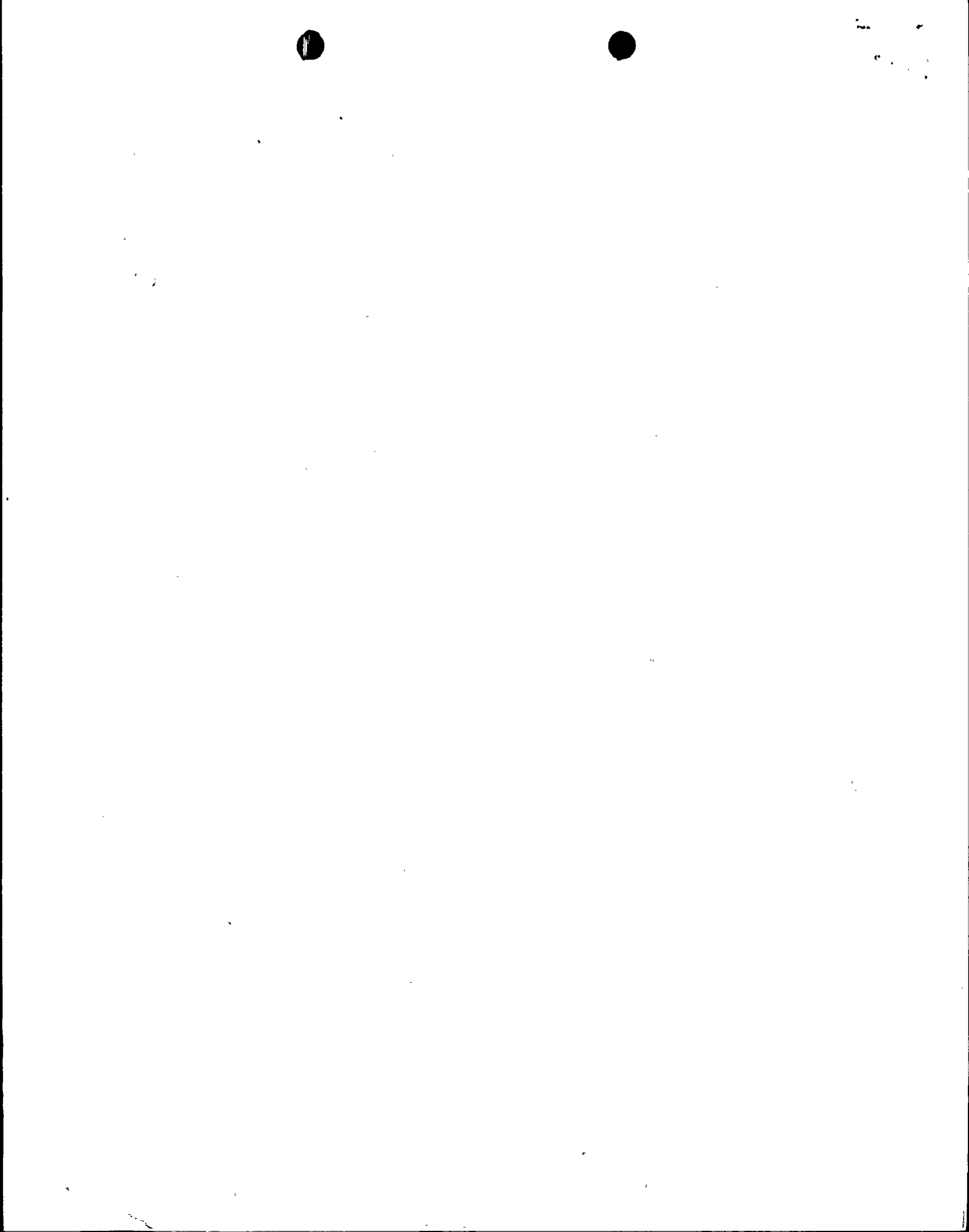
FILE _____

Primary Tower

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
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Description: WD at primary tower restricted to: 320-060;
 WE at primary tower restricted to less than 5.0 mph.
 Hours restricted to night-time (14-02).

Results: 89 Occurrences.

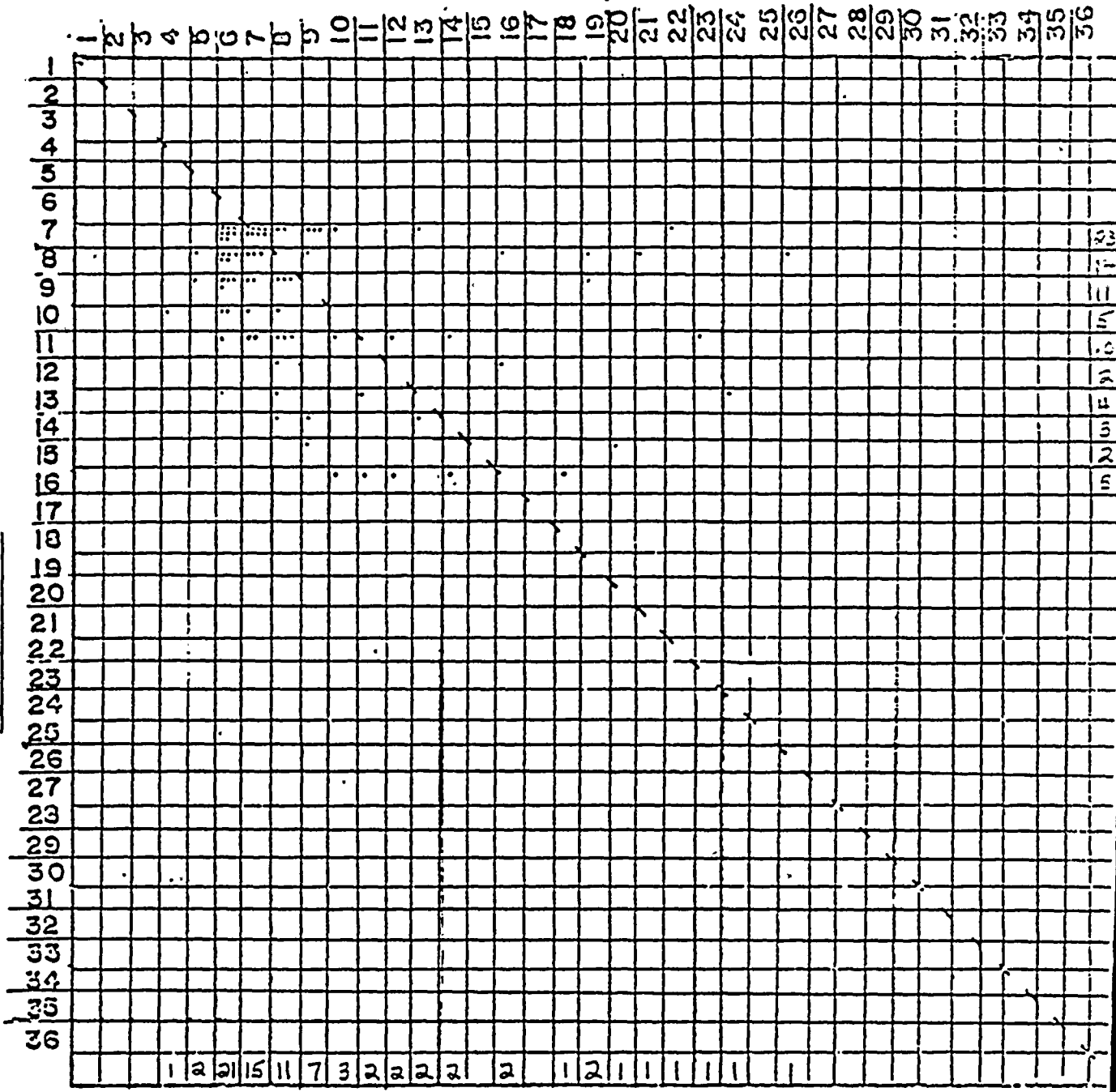


BY _____ DATE _____

FILE _____

CHECKED BY _____

Primary Tower



Description: WE at primary tower restricted to 070-160
 WS at primary tower restricted to less than 5.0 mph.
 Hours restricted to night-time (14-04).

Results: 79 Occurrences.

