

London Weather Centre Memorandum No. 7

STUDY OF THE INCIDENCE OF FOG ALONG THE THAMES FROM TOWER PIER TO  
THE ESTUARY FOR THE YEARS 1964-67

by

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LONDON AIR TRAFFIC CONTROL  
CENTRE, WEST DRAGON

At the end of 1963, a scheme was started by which the London Weather Centre (L.W.C.) gave the Port of London Authority (P.L.A.) fog warnings when the visibility was expected to fall below 1100 yards on the Thames between Tower Bridge and the Estuary. In return for, and in order to facilitate, these forecasts the P.L.A. supplied the L.W.C. with three hourly weather observations from selected points along the river. It was hoped that these warnings would enable the P.L.A. to advise ships still in the Estuary to wait for a later tide because of the likelihood of fog, rather than risk damage or undue congestion of the river by fogbound vessels.

The forecasting of fog over the Thames is not as straightforward as it may seem, for there are many different factors influencing its formation in this region. The first is that the Thames flows through several different climatic regions between Tower Bridge and the Estuary, ranging from Urban to Maritime, and the geographic features themselves are constantly changing as marshland is reclaimed for building purposes and mudflats change their shape due to erosion and sedimentation.

As can be seen from the map there are a considerable number of power stations along the river. They are attracted to the region because they use water from the Thames for cooling purposes, but the smoke and warm outflow put out by the stations does much to increase the incidence of fog, as does the dense smoke from the cement works along the river. It has been shown <sup>(1)</sup> that the effluent can cause the water temperature of the Thames in the Port of London to be as much as 10°C (18°F) higher than that at the Estuary.

The aim of this study is to obtain a statistical evaluation of the fog observed by the different stations over the four to five years during which observations have been made and to try and find any coherent movement of fog along the river as it forms and disperses. It was hoped that the results from these studies would prove an aid to forecasting in the future.

Most of the stations, which are marked on the map, started observations towards the end of 1963, so the period chosen for the statistical analysis was the four years from January 1964 to December 1967. Unfortunately the light vessels (stations U, S and T) and Southend Pier (P) did not start observations until later in 1964 so a different four year period was chosen for these places. The results of the analysis are shown in the tables at the end of the report. (Stations D, F, H, J, N and O had to be omitted from the tables as so many of their observations were missing that a statistical analysis for them was impossible).

Table A gives the percentage frequency of observation of various densities of fog, the purpose being to give a comparison of the fog experienced by the different stations. The results are expressed as a percentage of the total number of observations taken to allow for missing observations by some stations. The table shows the highest incidence was at stations R, U and L and the lowest at A, S and T. It is unfortunate that stations H, T and M did not report more frequently, as from comments by members of the P.L.A. and the readings available, it seems that these are situated in areas which are more prone to fog. The most surprising feature of this table is that Barrow Deep light vessel (U) had very much more fog in the four year period than the other two light vessels (S and T). This is unexpected, as most of the fog at these stations would probably be sea fog, and, over a period of four years, a similar frequency would be anticipated.

Table B shows the distribution of the occurrence of fog for each station and is very much as one might have expected, with, on the whole, most of the fog occurring in January and the least in July. The light vessels again stand out in this table, having a much higher percentage of their fog in April than the other stations.

In table C the relative amounts of fog at the different observation times for each season are tabulated. These figures indicate that the time when most fog occurs is between 0900 and 1200 hours in winter and between 0600 and 0900 hours for the rest of the year. This is again what might be expected, as, in general, fog tends to be thickest an hour or so after sunrise when the sun has had sufficient time to cause some turbulence, but no appreciable heating of the ground has occurred.

One must beware of making firm deductions from the tables, as four years is a very short period for figures of this sort, and the winter of 1963-64 was by far the worst from the point of view of fog. Results, therefore tend to be biased to the state of affairs at this time. (Future investigators into this subject may like to note that the summer of 1968 seems to have been particularly foggy).

To try and obtain an idea of any coherent movement of fog along the river and of any correlation between fog and wind direction, the two worst cases for each year were selected. For each observation time while the fog persisted, the visibility, wind direction and wind speed were plotted on maps of the Thames and a series of these maps built up. Copies of some of these series may be seen at the end of the report (Appendix A). However, no new information could be concluded from these maps. The wind direction appeared to have little connection with the fog formation, though it is interesting to note that all the cases of fog studied turned out to be instances of radiation fog. It is unfortunate that time did not permit a longer, perhaps statistical, study into this aspect of the subject.

In conclusion it would seem that of the stations analysed, R, U and L suffered most from fog, and A, S and T were the least affected. The most likely time for fog to occur is an hour or so after dawn during the months October to January. No correlation could be found between wind direction and fog though the predominance of radiation fog in the studied cases may account for this.

Further investigators into this subject might like to consider more display the question of correlation of wind direction and fog, and the movement of fog along the Thames. A study of movement of fog with tides would be particularly useful, although a previous investigator into this aspect of the subject had little success.

#### Reference

- (1) Lamb H. H. What can we find out about the trend of our climate?  
Weather, Royal Met. Soc. London, XVIII No. 7, July, 1963, P. 194.

Percentage Frequency of Observations of Various Densities of Fog Over a Four Year Period

Station	Less than						Period over which average is taken	
	1100 yds	1000 yds	899-700 yds	499-200 yds	199-50 yds	49-20 yds or less		
A	1.67	0.23	0.69	0.44	0.14	0.11	0.06	January 1964 to December 1967
E	2.01	0.31	0.66	0.12	0.37	0.13	0.13	January 1964 to December 1967
J			16.1% of the observations missing					January 1964 to December 1967
K	1.92	0.58	0.16	0.49	0.47	0.21	0.09	January 1964 to December 1967
L	2.24	0.43	0.43	0.67	0.45	0.19	0.09	January 1964 to December 1967
M		8.0% of the observations missing						January 1964 to December 1967
P	2.05	0.52	0.35	0.42	0.65	0.08	0.04	March 1964 to February 1968
R	2.57	0.51	0.95	0.42	0.46	0.21	0.04*	January 1964 to December 1967
S	1.69	0.31	0.24	0.39	0.51	0.16	0.08	July 1964 to June 1968
T	1.56	0.43	0.30	0.23	0.38	0.14	0.08	July 1964 to June 1968
U	2.41	0.57	0.60	0.33	0.50	0.22	0.18	August 1964 to July 1968

\* one reading

Monthly Distribution of Fog ( of Visibility 1100 yds. or Less ) Expressed as a Percentage of the Total Number of Observations of Fog in a Four Year Period

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
A	26.7	11.3	2.56	2.05	1.54	1.54	0	1.03	5.64	13.8	20.0	13.8
E	21.7	10.6	4.26	3.83	2.55	2.55	0	2.13	6.38	13.6	19.6	12.8
K	22.3	6.01	0.86	6.01	2.58	1.29	0.86	1.72	9.01	17.6	21.1	10.7
L	20.2	8.02	2.29	5.73	3.44	1.53	0.76	2.29	8.77	15.3	21.0	10.7
M	22.3	11.6	4.35	6.96	2.90	1.16	0.58	1.74	10.4	15.4	16.2	6.38
P	7.62	12.4	9.52	8.01	3.33	0	0.48*	4.76	8.57	12.9	18.1	14.3
R	27.7	10.0	1.67	2.33	3.00	1.33	0	1.00	6.33	18.3	16.7	11.7
S	14.2	8.63	7.62	16.2	6.09	2.54	2.03	1.52	6.09	9.64	13.2	12.2
T	15.5	8.84	5.52	14.4	9.94	6.63	2.76	2.76	2.76	9.39	11.6	9.39
U	16.3	7.09	8.16	14.5	8.87	4.96	1.42	3.19	4.61	11.0	9.22	10.3

For the period over which the averages are taken see table A

\* one reading

Thames Fog Investigation

Table C

Seasonal Percentage Frequency of the Total Incidence of Fog at Different Times for a Period of Four Years

Station	Summer											Autumn										
	00	03	06	09	12	15	18	21	00	03	06	09	12	15	18	21						
A	0	0.51*	1.54	0.51*	0	0	0	0	3.59	5.64	8.72	10.8	6.15	2.05	1.03	1.54						
B	0	0.43*	2.13	1.70	0	0	0.43	0	2.98	5.96	8.94	12.3	4.68	1.70	1.28	1.70						
K	0	0.43*	1.72	0.86	0.43*	0.43*	0	0	3.86	8.15	12.0	12.4	5.58	2.58	0.86	2.15						
L	0	0.38*	2.67	0.76	0	0	0.38*	0.38*	4.58	8.02	11.8	12.6	3.05	1.53	1.15	2.19						
M	0	0.58	2.03	0.58	0	0	0	0	6.09	7.54	9.86	10.2	4.06	1.45	1.16	1.74						
R	0	0.67	1.00	0.67	0	0	0	0	3.33	6.33	7.67	12.0	5.67	2.67	1.67	2.10						
S	0.51*	0	1.52	1.52	1.52	0.51*	0	0.51*	2.54	2.54	4.57	7.01	5.58	3.05	1.52	1.52						
T	1.66	0.55*	3.31	2.21	1.66	1.66	0.55*	0.55*	2.21	2.21	3.87	4.97	4.42	1.66	2.76	1.66						
U	0.35*	0.35*	0.35*	1.06	2.84	2.48	1.42	1.06	1.42	1.06	3.19	6.03	5.32	3.55	2.84	1.42						
P	0.48*	0.48*	0.48*	0.48*	1.43	0.48*	0.95	0.95	6.67	8.57	10.0	6.67	3.33	1.90	1.90							

For the period over which the averages are taken see table A

\* one reading

Seasonal Percentage Frequency of the Total Incidence of Fog at Different Times for a Period of Four Years

Station	<u>Winter</u>											<u>Spring</u>					
	00	03	06	09	12	15	18	21	00	03	06	09	12	15	18	21	
A	6.67	7.18	5.64	9.23	9.23	5.13	3.08	5.64	0	0.51*	1.53	2.56	0.51*	0.51*	0	0.51*	
E	4.68	5.96	3.83	10.2	7.66	5.96	2.55	4.26	1.28	0.85	1.70	4.26	1.28	0.85	0.43*	0	
K	3.43	4.29	5.58	8.58	5.58	5.58	2.58	3.43	1.72	1.29	2.58	3.00	0.43	0	0	0.43**	
L	3.82	5.34	4.96	6.49	7.63	4.96	2.29	3.44	1.91	1.15	4.96	1.19	0.38*	0.38*	0.38*	0.38*	
M	5.80	4.64	4.35	6.67	4.35	5.80	4.06	4.64	2.03	2.61	4.35	2.90	0.87	0	0.29*	1.16	
R	7.00	4.33	4.00	7.00	7.33	6.33	6.67	6.67	1.33	1.33	2.00	2.33	0	0	0	0	
S	1.52	4.06	4.06	7.11	6.09	5.08	4.06	3.05	2.03	3.55	5.58	5.58	4.06	4.06	2.03	3.05	
T	4.42	3.31	5.52	4.97	4.42	4.42	3.87	2.76	2.76	5.52	4.97	3.31	3.87	4.42	3.87	1.66	
U	2.48	3.55	3.55	6.38	6.38	5.67	2.84	2.84	2.84	3.55	4.26	4.26	4.61	4.96	3.90	3.19	
P	4.76	5.24	7.14	4.76	4.29	5.24	2.86	2.86	3.81	4.29	4.76	1.43	1.43	2.38	2.86		

For the period over which the averages are taken see table A

\* one reading

Additions to:

London Weather Centre Memorandum No. 7.

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TOWER PIER TO THE ESTUARY FOR THE YEARS 1964-67

ADD TO TABLE A:

STATION	less than 1100 yds.	1099 - 900 yds.	899 - 500 yds.	499 - 200 yds.	199 - 50 yds.	49 - 20 yds.	19 yds. or less.
N	3.11	0.49	0.86	0.85	0.79	0.10	0.02

Period over which average is taken 1964, 1966 and 1967  
(Aug. to Dec. 1965 missing)

ADD TO TABLE B:

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
N	27.94	12.87	2.94	2.57	5.15	2.21	0.37*	2.21	10.29	5.88	17.28	10.29

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