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## CASE X - ATMOSPHERIC FOG IN GREATER LONDON

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### PART 1 - INTRODUCTION

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You are responsible for public health in the Greater London area in 1952. On 5 December a thick layer of fog develops at a temperature close to 0°C. The fog persists without remission for several days and the daily newspapers carry stories about the fog. There is general agreement that this fog is unusually severe.

There is a heavy demand for hospital beds and on 8 December the Central London hospitals issue an Emergency Bed Warning that they have sufficient beds for fewer than 85% of applicants.

In addition, the Veterinary Public Health section of the Ministry of Health has reported that many cattle at the Smithfield show became ill during the fog and had to be slaughtered.

On 8 December the newspapers report that people are dying due to the fog, and that the fog contains dangerous chemical pollutants. Due to the community concern also expressed directly to politicians, the Ministry of Health appoints you to investigate all health aspects of the fog, to propose remedial measures and to prepare information for the community about the fog.

**Question 1** This is a monumental task to be achieved under conditions of pressure from the Minister of Health, who is responding to pressure from politicians, who are responding to pressure from voting constituents. Trying to remain cool, what immediate steps might you want to recommend?

Question 2 What kind of information would you want your staff to begin to collect?

Question 3 The use of routinely collected data (if appropriate and available) will result in quicker and less expensive results.

- What sources might provide data on mortality?
- What sources might provide data on morbidity?
- What sources might provide data on air pollution?
- What sources might provide demographic data?

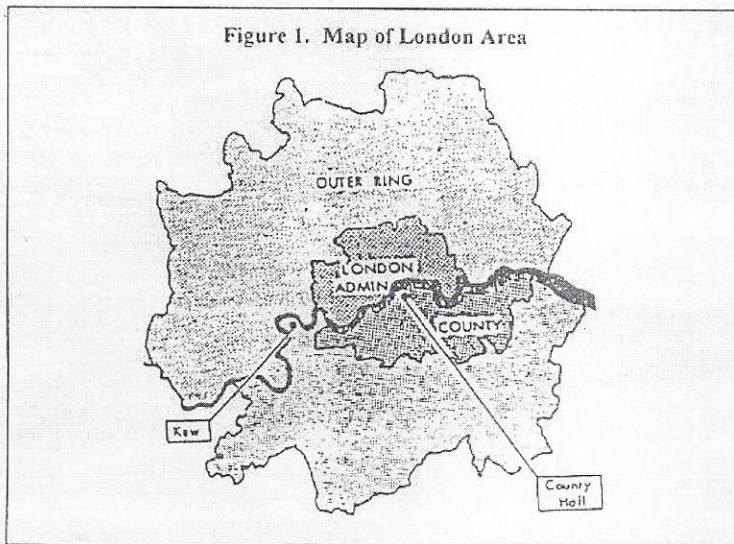
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**PART 2**

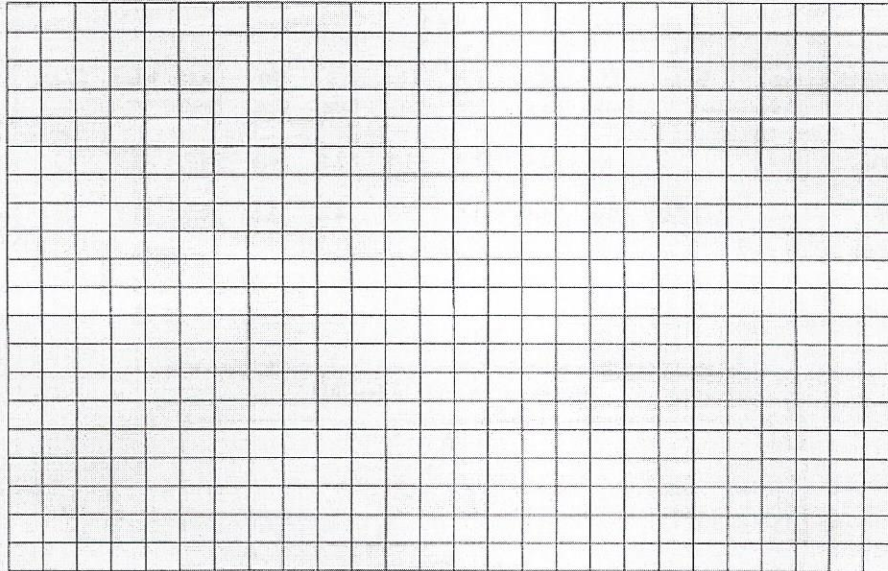
**Table 1. Number of deaths registered in the inner and outer part of Greater London and the 160 Great Towns outside London (Figure 1) in the weeks ending 8 November 1952 to 10 January 1953.**

Weeks ending	8 Nov.	15 Nov.	22 Nov.	29 Nov.	6 Dec.	13 Dec.	20 Dec.	27 Dec.	3 Jan.	10 Jan.
London Admin. County (LAC)	693	747	753	853	945	2482	1523	1029	1372	1216
Outer Ring (OR)	900	818	946	1049	1117	2219	1615	1205	1605	1418
Greater London (LAC + OR)	1593	1565	1699	1902	2062	4703	3138	2234	2977	2634
160 Great Towns	3310	3410	3603	4140	4585	4749	4541	4238	4865	4983

**Figure 1. Map of London Area**



Question 4 Using the data in Table 1, construct a graph to compare mortality trends in the London Administrative County (LAC), the Outer Ring (OR- See Figure 1), and the 160 Great Towns (not including London).



Question 5 What information does the graph provide?

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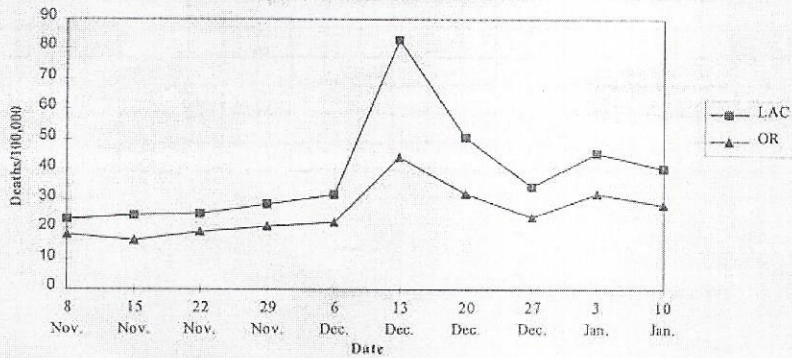
**PART 3**

Table 2 presents death rates per 100,000 population in LAC and OR during the same weeks. Figure 2 shows the same data in graphical form. This graph clearly indicates that the problems were greater in LAC than in the OR.

**Table 2**

Weeks ending	8 Nov.	15 Nov.	22 Nov.	29 Nov.	6 Dec.	13 Dec.	20 Dec.	27 Dec.	3 Jan.	10 Jan.
LAC	23.1	24.9	25.1	28.4	31.5	82.8	50.8	34.3	45.7	40.5
OR	18.0	16.4	18.9	21.0	22.3	44.4	32.3	24.1	32.1	28.4

**Figure 2 Death Rates in London Administrative County and the Outer Ring by weeks, 1 Nov.1952 - 10 Jan. 1953**



**Question 6** In this situation, registered deaths (routinely collected) were used, saving time and money, and providing a rapid ("quick and dirty") assessment of the situation. But, as usual, for speed, one pays a penalty. What are the limitations of death data?

**Question 7** Summarise what you know so far.

**Question 8** At this point, you have only been working with total numbers of deaths. What additional information should you have regarding the deaths?

**Table 3.** Age specific mortality data for deaths registered, London A.C., weeks from 8 November 1952 to 10 January 1953

Weeks ending	8 Nov.	15 Nov.	22 Nov.	29 Nov.	6 Dec.	13 Dec.	20 Dec.	27 Dec.	3 Jan.	10 Jan.
0-<4 weeks	19	25	13	22	16	28	19	12	22	21
4 weeks - <1 year	12	7	5	9	12	26	15	11	25	18
1-4 years	5	5	11	5	6	7	13	7	7	5
5-14 years	5	4	4	3	4	6	6	2	3	4
15-24 years	7	12	4	3	9	7	14	7	9	4
25-34 years	8	16	14	7	16	28	17	11	21	15
35-44 years	33	21	28	22	36	64	29	34	28	39
45-54 years	67	66	85	61	80	204	96	83	105	98
55-64 years	12	138	118	152	157	448	521	167	236	204
65-74 years	177	210	229	226	254	717	444	258	368	334
75+ years	237	243	242	343	355	949	619	437	548	474
All ages	693	747	753	853	945	2484	1523	1029	1372	1216

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**Question 2** What age groups were at greatest risk? (It would be helpful to visualise these data graphically if time allows).

**Table 4. Deaths per 100,000 population  
London A.C. weeks from 8 November 1952 to 10 January 1953**

Weeks ending	8 Nov.	15 Nov.	22 Nov.	29 Nov.	6 Dec.	13 Dec.	20 Dec.	27 Dec.	3 Jan.	10 Jan.
Age (years)										
0-1	55.0	65.2	36.7	63.2	57.1	110.0	69.3	46.9	95.8	79.5
1-4	2.3	2.3	5.0	2.3	2.7	3.2	5.9	3.2	3.2	2.3
5-14	1.3	1.0	1.0	0.8	.0	1.6	1.6	0.5	0.8	1.0
15-24	1.7	2.9	1.0	0.7	2.2	1.7	3.4	1.7	2.2	1.0
25-34	1.4	2.9	2.5	1.3	2.9	5.0	3.0	2.0	3.7	2.7
35-44	6.1	3.9	5.2	4.1	6.7	11.9	5.4	6.3	5.2	7.2
45-54	1.0	14.8	19.0	13.7	17.9	45.7	21.5	18.6	23.5	22.0
55-64	34.8	39.1	33.4	43.0	44.4	126.8	71.1	47.3	66.8	57.8
65-74	70.0	83.1	90.6	89.4	100.5	283.6	175.6	102.0	145.5	123.1
75+	197.6	202.6	201.8	286.0	296.0	791.2	516.0	364.3	456.9	395.2
All years	20.7	22.3	22.5	25.5	28.2	74.2	45.5	30.7	41.0	36.3

**Table 5. Cause-specific mortality data  
London A.C., weeks from 8 November 1952 to 10 January 1953**

Weeks ending	8 Nov.	15 Nov.	22 Nov.	29 Nov.	6 Dec.	13 Dec.	20 Dec.	27 Dec.	3 Jan.	10 Jan.
CAUSE										
Respiratory tuberculosis	10	20	18	19	14	77	37	21	24	22
Cancer of stomach	20	31	22	20	30	21	18	23	30	30
Cancer of lung	41	30	38	27	45	69	32	36	48	36
Other malignant and lymphatic neoplasms	112	114	110	113	116	167	118	91	133	109
Vascular lesions of CNS	49	84	73	98	102	128	119	91	131	105
Chronic rheumatic heart disease	18	10	17	20	18	57	27	15	22	28
Coronary disease	93	108	113	131	118	281	152	109	150	128
Myocardial degeneration	59	65	65	79	88	244	131	108	136	115
Other diseases of heart	28	28	30	42	49	126	80	40	50	44
Influenza	-	-	1	7	2	24	9	6	4	7
Pneumonia	35	29	31	28	45	168	125	91	104	87
Bronchitis	39	45	46	73	76	704	396	184	215	222
Other dis. of respiratory system	2	5	10	8	9	52	21	13	10	14
Motor vehicle accidents	6	8	6	1	8	4	10	4	5	7
Suicide	5	5	5	5	10	10	7	5	12	15
Other and ill-defined causes	176	165	168	182	215	352	241	192	298	247
Total (all causes)	693	474	753	853	945	2484	1523	1029	1372	1216



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Question 10 Table 5 presents the cause-specific mortality data. What specific diseases/conditions are responsible for the increase in mortality?

Question 11 At this point, the assumption in the press and among the general public is that the excess deaths are in some way related to the fog, but, you do not know this to be true, therefore you should consider all possibilities. Speculate on the other possible causes for this excess mortality.

Question 12 Considering the general assumption that the fog is related (and further suggested by the increase in respiratory deaths), how would you attempt to validate this assumption? What data do you need? Where might you obtain the data?

**PART 4**

The morning of 5 December and for four consecutive days, England experienced rare atmospheric conditions. The absence of any pressure gradient resulted in a persistent fog, an almost complete absence of wind currents, and a temperature inversion. The temperature inversion prevented dispersal of the fog and allowed the concentration of smoke and other atmospheric pollutants. Suspended matter, higher in the urban areas of London, provided nuclei on which particles of moisture were deposited, resulting in denser fog than in the rural areas around London.

Minimal temperature in central London hovered around freezing.

Burning of fossil fuel (coal) in open heart fires in homes and in industrial generation of electricity, along with automobile and lorry emissions contributed to the atmospheric pollution. Measurements for total suspended matter (TSM) and sulphur dioxide were routinely made in London during this time. In comparison, the mean December 1957 concentration for TSM was in the range of 0.12 to 0.44 mg/m<sup>3</sup> (milligrams per cubic metre) in both central and peripheral London. During 6-8 December 1952, daily averages from all monitoring points increased about 5-fold to 1.6 mg/m<sup>3</sup>. Peak values ranged between 3 and 10 times the normal values, and were highest in central London.

For sulphur dioxide, December 1951 concentrations ranged between 0.07 and 0.23 parts per million (ppm). During 6-8 December 1952 peak values were 1.34 ppm, about 3 to 12 times the normal value.

In addition, although not routinely measured, other contaminants were detected during this period, namely: sulphur trioxide, carbon monoxide, and carbon dioxide.

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**Table 6. Deaths in Greater London by date of occurrence, 1-15 December 1952  
with daily meteorological data for this period.**

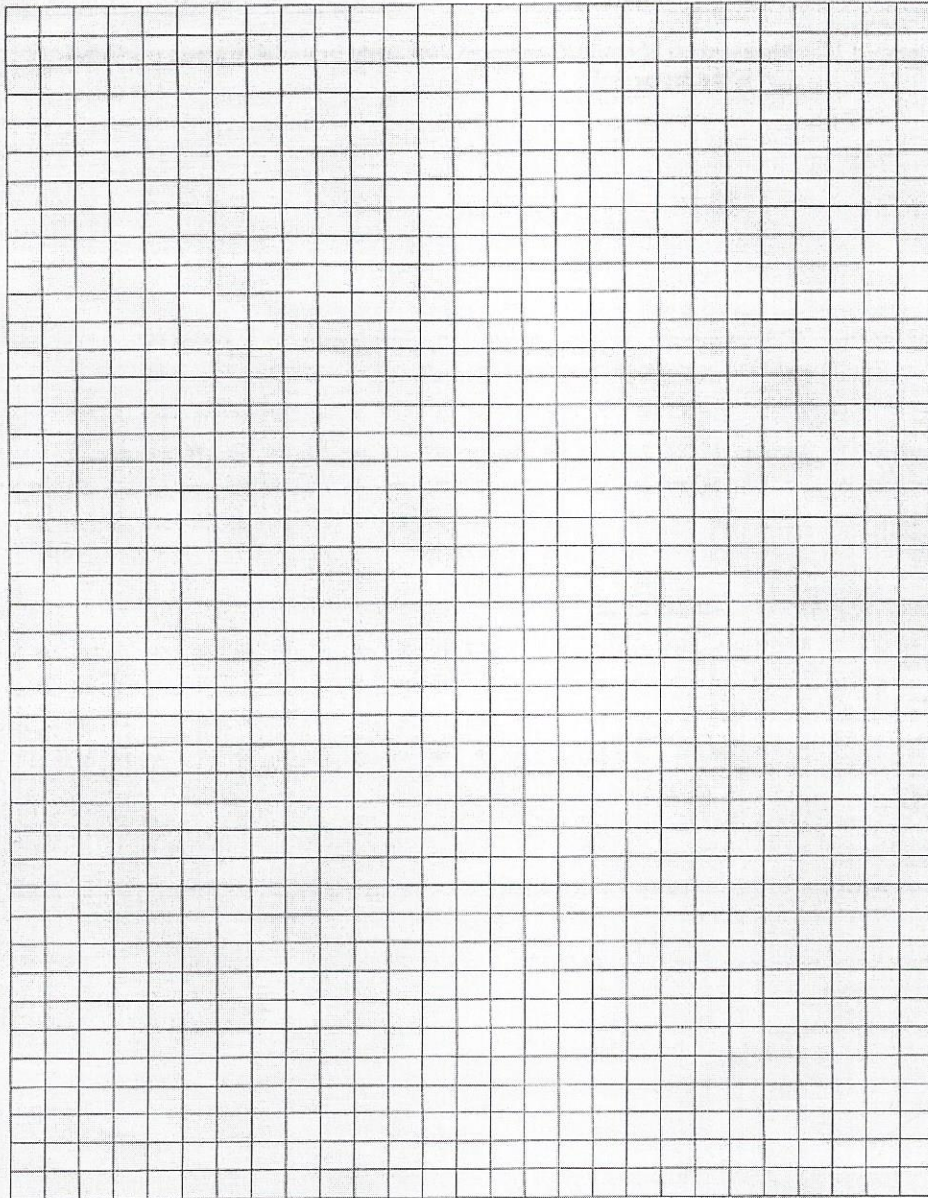
Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<b>Deaths</b>															
LAC	112	140	143	120	196	294	513	518	430	274	255	236	256	222	213
OR	147	161	178	168	210	287	381	392	362	269	273	248	245	227	212
Greater London (LAC+OR)	259	301	321	288	406	581	894	910	792	543	528	484	501	449	445
<b>Temperature</b>															
Daily mean (Kew)	36.9	34.2	39.0	36.5	29.5	28.9	28.9	31.5	36.0	43.3	45.1	40.1	37.2	35.2	32.0
Departure of Average of 80 years	-5.2	-7.7	-3.5	-5.4	-12.1	-12.8	-12.3	-10.0	-1.5	+2.7	+5.0	-0.1	-4.2	-6.0	-8.8
<b>Atmospheric pollution Smoke (mg/m<sup>3</sup>)</b>															
Mean (Kew)	0.34	0.34	0.19	0.42	1.47	1.75	0.87	1.19	0.47	0.17	0.19	0.24	0.32	0.29	0.18
Mean (County Hall)	0.30	0.49	0.61	0.49	2.64	3.45	4.46	4.46	1.22	1.22	0.32	0.29	0.50	0.32	0.32
<b>Sulphur Dioxide (ppm)</b>															
(County Hall)	0.09	0.16	0.22	0.14	0.75	0.86	1.34	1.34	0.47	0.47	0.22	0.23	0.26	0.16	0.16

**Question 13** Table 6 presents mortality data along with meteorological data for 1-5 December 1952. On the following page, construct a graphic presentation of these data to determine if there is an association.

**Question 14** Is the increase in mortality in London related to variations in temperature, atmospheric pollution (smoke) or sulphur dioxide (SO<sub>2</sub>) content?

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PART 5

**Question 15.** What sources of routinely collected data might be useful to assess morbidity during the fog period?

Table 7- Applications and admissions to hospitals of acute care made through Emergency Bed Bureaux during the period 1st-21st December, 1952

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Applications for beds	243	227	221	205	248	321	252	423	489	413	318	317	299	173	300	264	248	219	247	232	164
Admissions	203	197	194	176	207	253	191	299	390	329	270	275	266	158	269	223	215	192	213	211	150
Cases for whom beds were not found	40	30	27	29	41	68	61	124	99	84	40	42	33	15	31	41	33	27	35	21	14
Classification of Admissions (Central London area only)																					
1. respiratory disease	52	41	57	39	51	93	92	135	165	123	84	82	96	47	60	63	50	49	51	51	39
2. cardiac disease	13	15	12	19	22	45	39	43	40	33	27	30	19	6	13	6	12	15	17	15	17
3. cerebral haemorr.	10	5	5	5	9	8	6	7	10	6	9	7	6	5	8	9	4	7	6	10	7
4. other acute medical conditions	37	29	33	29	33	34	20	35	37	37	44	37	34	14	30	42	44	24	31	27	26
5. acute surgical cond.	31	30	19	25	29	15	17	38	33	32	17	40	29	25	38	33	25	28	25	18	18

**Question 16** In the present situation, data were available for applications and admissions to hospitals through the Emergency Bed Service Bureau. Table 7 presents these data. Do the data in Table 7 support the hypothesis of an air pollution effect?

**Table 8. New Claims to sickness benefit under the national insurance and (thousands) in the weeks ending 4 November in the weeks ending 4 November 1952 to January 1953**

Week ending	4 Nov.	11 Nov.	18 Nov.	25 Nov.	2 Dec.	9 Dec.	16 Dec.	23 Dec.	30 Dec.	6 Jan.
London and Middlesex	15.4	15.1	15.0	17.1	19.0	20.3	28.9	16.3	11.4	28.7
Remainder of S.E. Region	10.7	10.1	10.3	11.9	13.1	14.4	17.1	17.7	8.7	19.9
England and Wales excluding S.E. Region	88.1	85.8	88.3	97.7	107.9	112.4	102.6	90.0	74.0	139.0

**Question 17** In addition, morbidity information was available from the Ministry of Pensions and National Insurance. Table 8 summarises these data. Do the data in Table 8 support the hypothesis of an air pollution effect?

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Question 18 Is the fog responsible for the increased mortality and morbidity?

Question 19 What remedial measures would you suggest to prevent another "fog disease" episode due to SO<sub>2</sub> and smoke in the future?

Based on the report by the Ministry of Health (1954) *Mortality and morbidity during the London fog of December 1952*. London, HMSO, 1954 (Reports on Public Health and Medical Subjects, No. 95).