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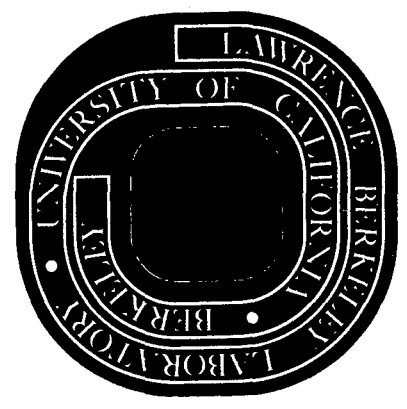
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FURTHER STUDIES ON THE ATMOSPHERIC LEAD AND BROMINE
CONCENTRATIONS IN THE SAN FRANCISCO EAST BAY REGION*

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August 1972

INTRODUCTION

In an earlier study of the atmospheric lead and bromine concentration in the Berkeley, California area¹ a series of filter papers collected weekly for the years 1963-1970 were analyzed using x-ray fluorescence analysis. Since then, filter papers were collected during 1971 and filter papers were obtained for the latter half of 1962. These have been analyzed and the results are presented along with results obtained from a number of other sampling stations in the East Bay area. Samples from two sites on the Lawrence Berkeley Laboratory (LBL) were available, as well as from three locations in the Livermore, California area--two on the site of the Lawrence Livermore Laboratory (LLL) and the third at the off-site location of the Livermore Veterans' Hospital. Another series of samples were taken near the highway in Emeryville, California.

EQUIPMENT

The same x-ray fluorescence equipment previously described¹ was used for this work. New calibration standards for lead and bromine were prepared and tested. An iron standard was also calibrated and used for the highway samples. Several selected filter papers from the previous work were reanalyzed and the two results agreed to within 3.0%.

RESULTS

Berkeley (Shattuck Avenue): Filter papers were available from April to December of 1962, and the latest collection of papers for January to December of 1971. Figure 1 is a plot of the Pb and Br concentrations for these two years. Table I lists the average daily Pb and Br concentrations ($\mu\text{g}/\text{m}^3$) and the ratio of Pb/Br for the years studied. The 1963 to 1970 results are listed for comparison purposes.

The Pb and Br concentrations are lower for 1971, but we feel this is due to the difference in weather in the area rather than to a change in traffic patterns or consumption of leaded gasoline in the Bay Area.

The lower results for 1962 are because the Jan.-Feb.-March results are not in the average. These three months are usually very high, so leaving these values out does not give a true average content for the year.

Lawrence Berkeley Laboratory (LBL): Filter papers for two locations were available. Weekly papers from August 1958 to December 1961 and August to December of 1970, taken at the Nuclear Chemistry Building (Bldg. 70) were analyzed. Similar samples from the Heavy Ion Accelerator (Bldg. 71) for the period August to December 1970 were also analyzed. Figure 2 gives the plots for these locations, and the averages are listed in Table I. The averages for LBL are lower by a factor of 5 from the Shattuck Avenue values. No simple conclusion can be drawn, however, even though the two locations are only 1/2 mile apart, because LBL has its own traffic pattern (which is less than Shattuck Avenue) and is 500 feet higher in elevation.

Lawrence Livermore Laboratory (LLL): We have filter paper samples from January to December 1970, for three locations in the Livermore Valley

area. Two sites on the Laboratory grounds and a third at the Livermore Veterans' Hospital (VA). One of the LLL locations is a heavily used area (watch tower), and the other is a remote section of the grounds (FCC). The two remote sites are low in Pb, whereas the heavily used area is higher in Pb. The Br values are not available because of equipment problems. Figure 3 is a plot of the lead concentrations for the three sites.

Emeryville Freeway: We decided to analyze the air in an area where there is very high automobile traffic. A location 100 yards off Interstate Highway 80 about one mile from the Oakland Bay Bridge toll gate was available. This location is at the edge of the bay. Whatman 41 paper was used because it is much lower in impurities than the HV70 used in all the other studies. Samples were taken every two hours from 0900 Monday, March 15 to 0900 Saturday March 20, 1971. The samples were collected on a Gelman sequential air sampler at a flow rate of 15 liters/min.

Figure 4 is a plot of the Fe, Pb, and Br concentrations and the wind speed for this period of time. The wind speed was measured by the Safety Services Department at a location on the LBL site. The two locations are about 2-1/2 miles apart and 600 feet difference in elevation.

Table II lists the values obtained for Pb, Br, and Fe. This location shows a variation of lead from 0.7 to 9.1 $\mu\text{g}/\text{m}^3$ but pretty much follows the wind speed pattern. An exception to this can be seen from 1500 March 18 to 0900 March 19. During this time the wind speed was higher than average and the Pb concentration was high. However, an examination of the weather data from the Oakland airport station shows that the winds were variable in direction.² Therefore, while there were winds blowing, they were back and forth

in the same location, and did not result in a sweeping of the pollution from the area.

The iron data appears to follow the same trends as the Pb and Br but is probably complicated by the presence of a steel mill a few blocks away.

ACKNOWLEDGMENTS

We thank the following members of the Safety Services Department: Wayne Pearce for the filter paper samples collected on the sequential sampler, Al Minter and Gary Garabedian for the many counts, and John Peck for the data on wind speeds and directions. Gordon Steers prepared the standards. We want to thank Hazards Control Department of LLL for supplying the Livermore filter papers.

FOOTNOTES AND REFERENCES

* This work performed under the auspices of the U. S. Atomic Energy Commission.

1. H. R. Bowman, J. G. Conway, and F. Asaro, Environmental Science and Technology 6, 558 (1972).
2. Local Climatological Data, U. S. Department of Commerce, National Oceanic and Atmospheric Administration, International Airport, Oakland, California.

Table I. Daily average of $\mu\text{g}/\text{m}^3$ for lead and bromine.

Year	Location	Lead	Bromine	Pb/Br
1962	(April-Dec.) Shattuck Ave.	1.9*	0.50*	3.8
1963	(Jan.-Dec.) Shattuck Ave.	2.8	0.75	3.7
1964	" "	2.8	0.75	3.7
1965	" "	3.0	0.83	3.6
1966	" "	3.0	0.85	3.5
1967	" "	3.1	0.90	3.4
1968	" "	3.2	0.90	3.6
1969	" "	3.0	0.84	3.6
1970	" "	2.9	0.82	3.5
1971	" "	2.1	0.64	3.3
1958	(Aug.-Dec.) Bldg. 70	0.84	0.16	5.3
1959	(Jan.-Dec.) Bldg. 70	0.66	0.17	3.9
1960	" "	0.66	0.12	5.5
1961	" "	0.59	0.09	6.6
1970	(Aug.-Dec.) "	0.57	0.18	3.2
1970	(Aug.-Dec.) Bldg. 71	0.61	0.19	3.2
1970	(Jan.-Dec.) Livermore F.C.C.	0.30		
1970	" Livermore Watch Tower	1.08		
1970	" Livermore V. A. Hospital	0.27		

* January, February, and March not included.

Table II. Daily average of $\mu\text{g}/\text{m}^3$ for iron, lead, and bromine.

Date	Iron	Lead	Bromine	Pb/Br
March 15, 1971 0900 to March 16, 1971 0900	4.4	4.4	1.5	2.8
March 16, 1971 0900 to March 17, 1971 0900	2.2	2.9	1.1	2.6
March 17, 1971 0900 to March 18, 1971 0900	2.3	2.5	0.7	3.7
March 18, 1971 0900 to March 19, 1971 0900	2.6	2.8	0.8	3.5
March 19, 1971 0900 to March 20, 1971 0900	2.7	5.7	1.8	3.1

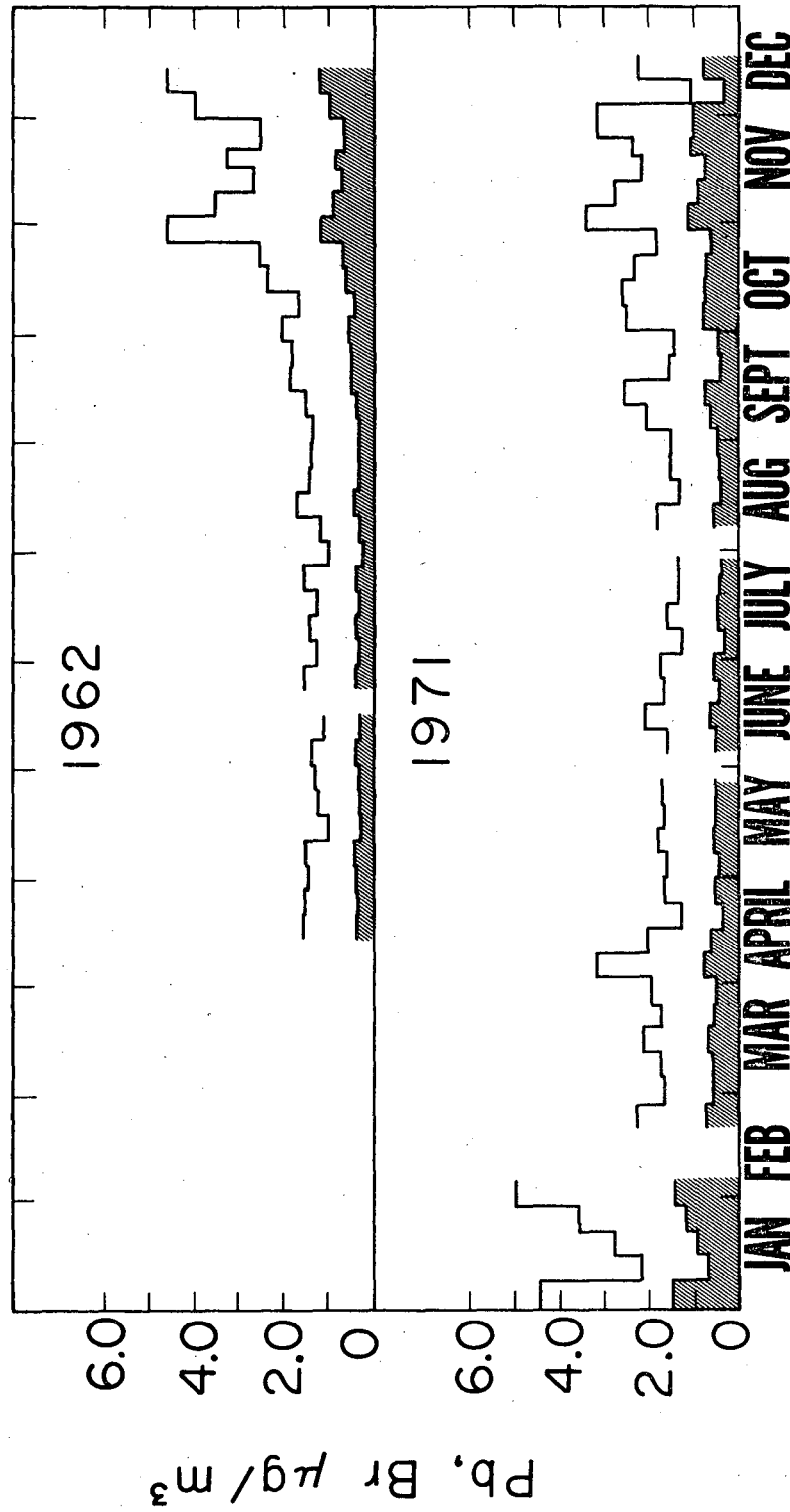
FIGURE CAPTIONS

Fig. 1. Atmospheric lead (upper solid line) and bromine (shaded area) concentrations in downtown Berkeley, (1962 and 1971).

Fig. 2. Atmospheric lead (upper solid line) and bromine (shaded area) concentrations at LBL Building 70 and Building 71.

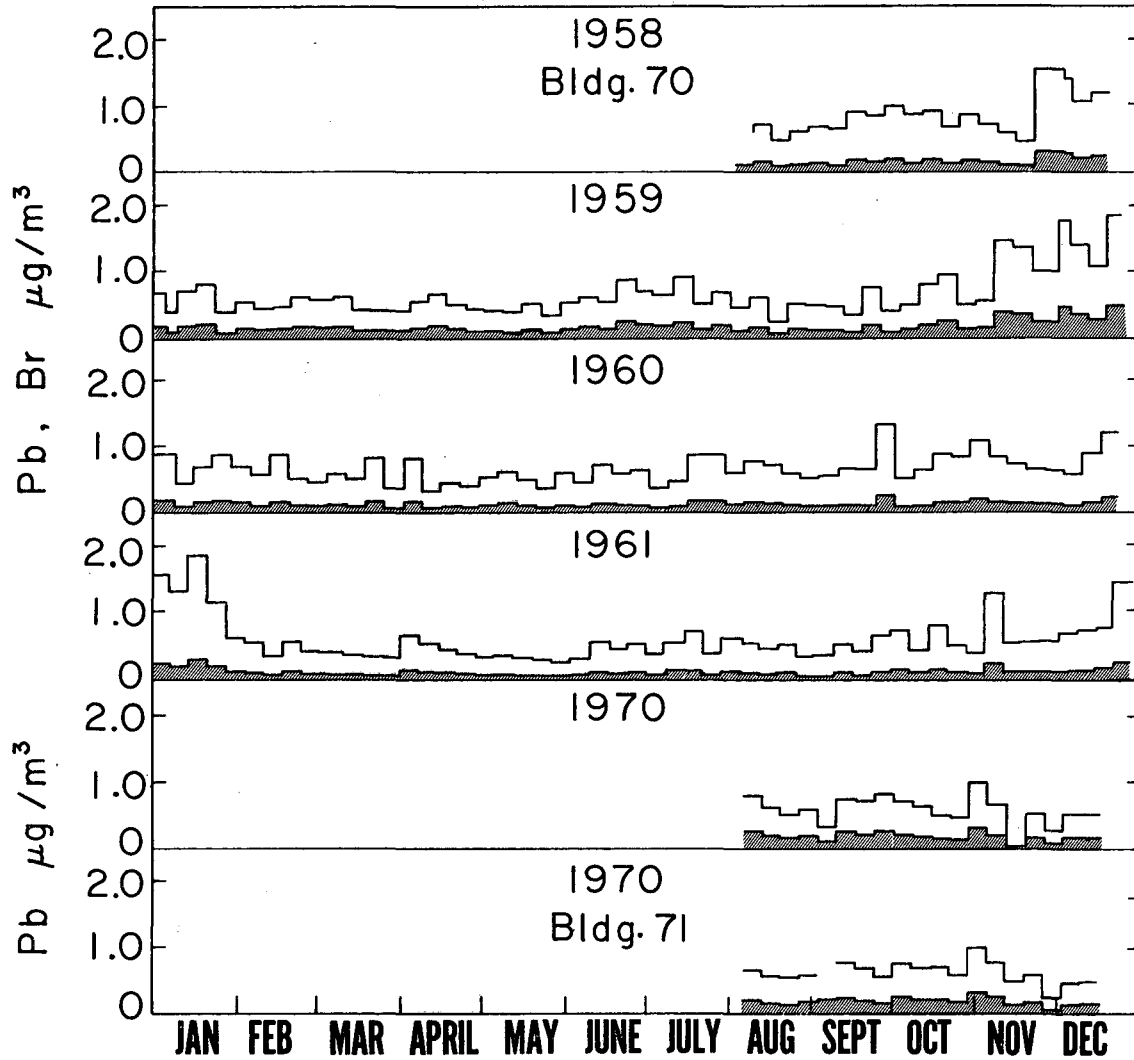
Fig. 3. Atmospheric lead concentrations at three sites in Livermore (1970).

Fig. 4. Atmospheric iron, lead, and bromine concentrations near a freeway and the wind speed at LBL (for the week of March 15, 1971).



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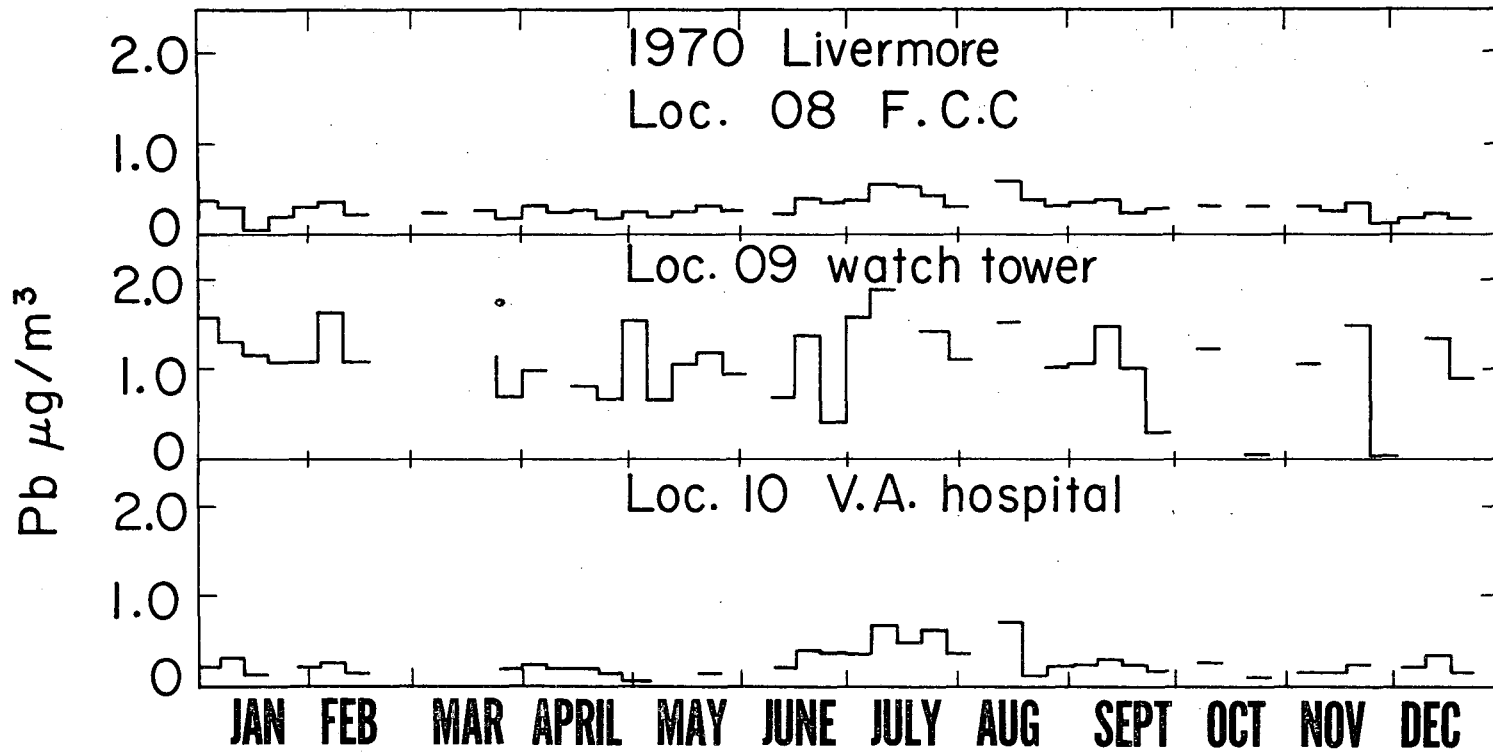
Fig. 1



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Fig. 2

Fig. 3



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March 15, 1971 Mon. March 16 Tue. March 17 Wed. March 18 Thur. March 19 Fri March 20 Sat.

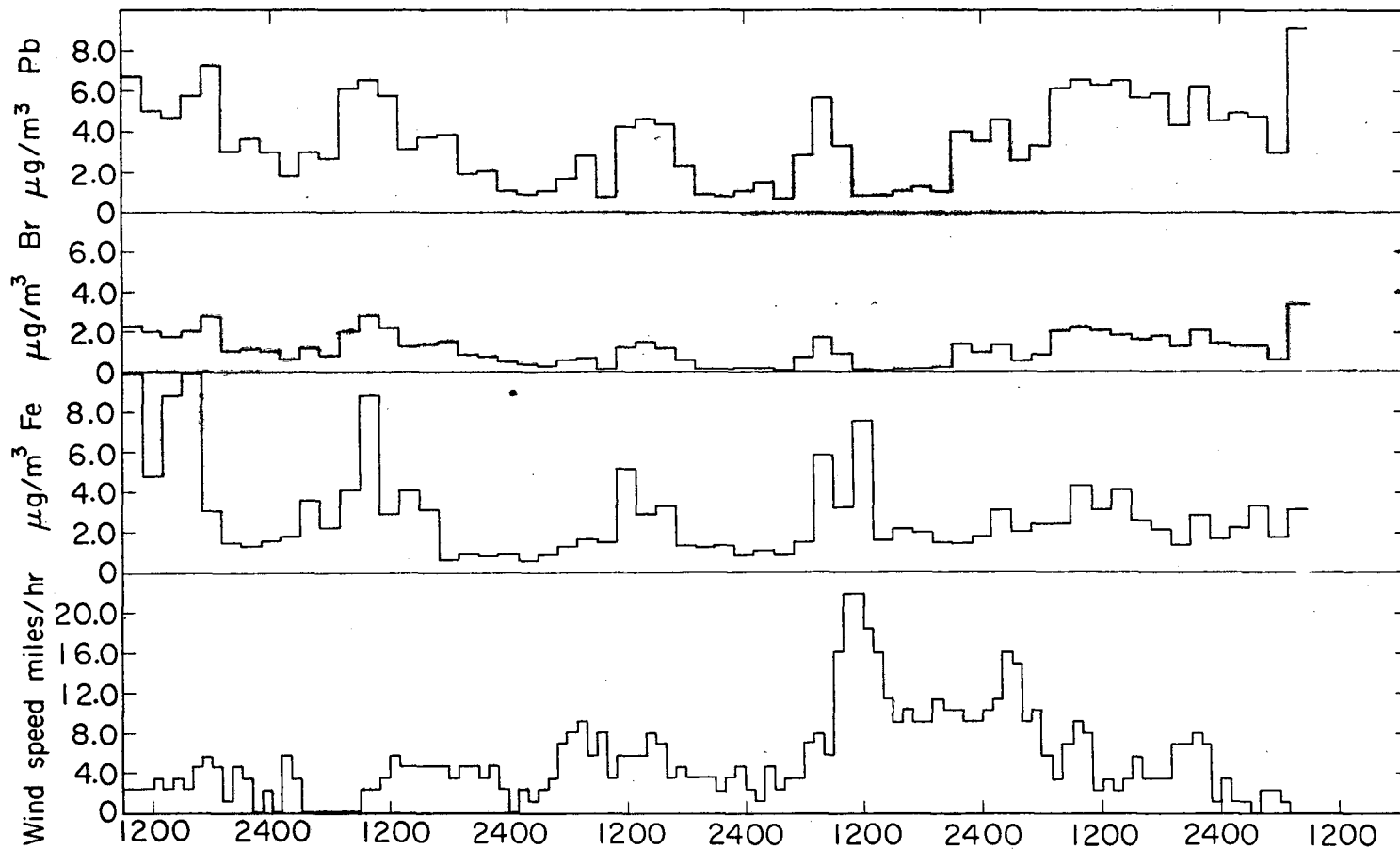


Fig. 4

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