KNOXVILLE SMOKE ABATEMENT IN RETROSPECT

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It has been shown (Robertson, etc., 1934) that over the entire area covered in the Knoxville smoke survey the soot-fall was higher in 1929 than in 1927 and still higher in 1930. It is probable that the relatively low soot-fall for 1927 was partly the result of favorable weather conditions for that year. These results are not to be interpreted to mean that the efforts to reduce smoke in Knoxville were ineffective. As will be shown, the results indicate that a decided reduction in soot-fall was made in the area in which the efforts of the smoke bureau were concentrated.

The Knoxville smoke survey covered an area of about 15 square miles, much of which was residential and not subject to the smoke ordinances. Unlike many surveys, this one was planned with no reference whatever to any particular source of contamination where anti-smoke measures might be expected to rapidly reduce the amount of contamination. For these reasons the soot-fall figures for Knoxville are small in comparison with those published for a number of other cities, and, with the exception of a few districts, there was no apparent change in the general smoke situation.

Visitors to Chicago observe that that city is not heavily dust laden, yet the dust-fall figures per month as published for Chicago (Bundesen, 1926, 1930) are higher than the yearly figures found for Knoxville. However, the per cent combustible for the Chicago "soot" is but little more than half that for Knoxville. Such comparisons are of doubtful significance. A closer approach to a just basis of comparison might be to choose from the Knoxville report only the stations in the downtown area where the soot-fall was heaviest and to make the comparison on the basis of combustible matter (which is far more objectionable than ash). The total solids settling from the atmosphere in Baltimore (Shrader, etc., 1929) are classified into three groups, depending upon the distance from the center of town. In the highest group the average is less than half the Chicago figures, although the Baltimore measurements were made at street levels. The average for three stations 10 miles from the center of town was 340 tons per square mile per year, the high value resulting doubtless from the fact that the jars were not elevated.

On the other hand the measured soot-fall for London for 1927 (Simpson, 1928) averaged only 297 tons per square mile per year. This, it will be observed, is higher than the 1927 figure for Knoxville, but less than the 1930 average. The London procedures were similar

TABLE 1

Soot-fall and combustible matter within a radius of one mile from Dale Avenue and Cowan Street

Station Number	Tons per Square Mile per Year		
	1927	1929	1930
1	344.0	290.0	308.0
7	677.0	805.0	559.0
9	285.0	202.0	211.0
10	118.0	165.0	157.0
11	202.0	239.0	214.0
17	272.0	248.0	244.0
18	193.0	223.0	222.0
19	268.0	270.0	217.0
Mean	295.0	305.0	267.0
Approx. Mean Wt. Combus.	129.0	140.0	117.0
Mean % Combus.	43.7	45.8	43.7

TABLE 2

Soot-fall and combustible matter outside a radius of one mile from Dale Avenue and Cowan Street

Station Number	Tons per Square Mile Per Year		
	1927	1929	1930
2	308.0	269.0	464.0
3	245.0	289.0	233.0
4	184.0	126.0	114.0
5	156.0	235.0	193.0
6	404.0	515.0	631.0
8	257.0	295.0	315.0
12	396.0	464.0	605.0
13	208.0	300.0	316.0
14	269.0	430.0	349.0
15	207.0	240.0	286.0
16	.....	207.0	205.0
20	202.0	258.0	281.0
21	195.0	202.0	365.0
22	177.0	205.0	286.0
23	180.0	193.0	170.0
24	296.0	363.0	363.0
Mean	246.0	287.0	324.0
Approx. Mean Wt. Combus.	105.0	119.0	128.0
Mean % Combus.	42.5	41.6	39.4

to those recommended by the Mellon Institute of Industrial Research.

Smoke Reductions in the Center of Town

In view of the fact that the smoke ordinances applied only to commercial concerns any improvemnts in the smoke situation would be expected to be greater in the main business section than in the rest of the city. The soot-fall for the eight stations within an area of one-mile radius from Dale Avenue and Cowan Street and covering the main business section for the three years studied is given in Table 1, and a summary of the results for the sixteen stations outside of the one-mile radius is given in Table 2.

Within the one-mile radius the total soot-fall in 1930 was more than 9% less than in 1927 and more than 12% less than in 1929. The

Fig. 1. A sample of smoke in the business section of town. Photograph used through the courtesy of Mr. Charles Krutch of the Knoxville *News-Sentinel*.

corresponding figures for the combustible are approximately 9% and 16%. On the other hand, an examination of the figures in Table 2 reveals the fact that outside the one-mile radius the total soot-fall was more than 16% greater in 1929 than in 1927 and that in 1930 there was an additional increase of nearly 13% over the average for 1929. The corresponding figures for the combustible are approximately 13% and 8%. It is to be noted that within the area where the total dust-fall was heaviest, the per cent combustible was also highest. In view of the reduction in total solids collected in 1930 the reduction in the per cent of combustible matter might have been expected to be greater than that found. In the case of Chicago, however, the quantity of combustible matter was actually greater in 1929 than in either of the

two previous years, whereas the quantity of total solids was less than in either of the two preceding years.

What the soot-fall within the one-mile radius would have been in 1929 and 1930 in the absence of smoke ordinances and the work of the smoke inspectors is, of course, conjectural. On the assumption that the same increase would have taken place as in the outside area, the figures for 1929 and 1930 (Table 1) correspond to reduction in total solids of more than 10% and 30%, respectively, over the 1927 figure.

By taking a one-mile radius centering at the courthouse, Station No. 6 is included and Nos. 9 and 10 are left out. The figures for total soot-fall for the three years are then 337, 370, and 342, respectively, within the one-mile radius and 230, 261, and 289, respectively, in the

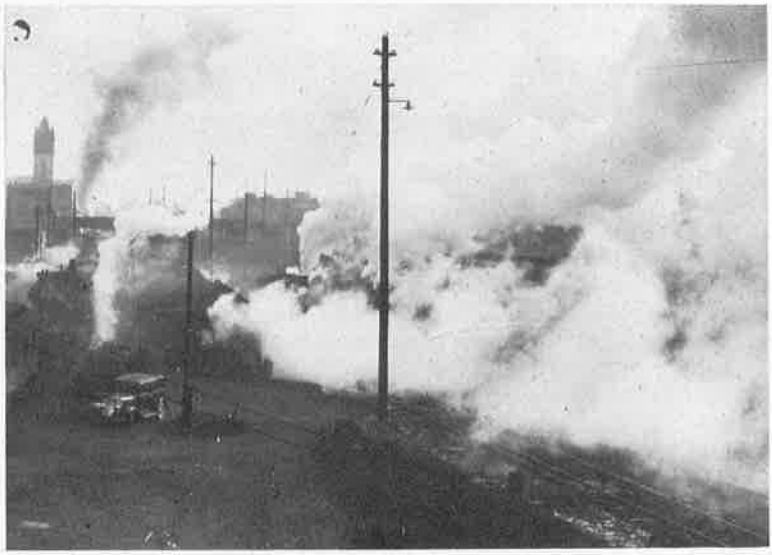

Fig. 2. A typical scene near the railway station. Photograph used through the courtesy of Mr. Charles Krutch of the Knoxville *News-Sentinel*.

outer area. The large increase in soot-fall at Station No. 6 partially conceals the general reductions in smoke brought about by the Smoke Abatement Bureau within the area. This particular station is located across the river at a point that did not lead to numerous complaints by citizens. Mr. Thomas Ashe, smoke engineer in 1930, has stated that the only means of correcting the situation at this point will be to install new boilers at the factory which was responsible for practically all of the smoke. If this station be omitted from Table 2 as abnormal, the averages for the outer area still show the characteristic increases, the figures being 234, 272, and 303, respectively. The relative increases from year to year are almost unaffected because the area as a whole

shows increases in soot-fall and because the number of stations is fairly large, being double that within the circle of a one-mile radius.

With the curtailment of appropriations for smoke abatement the smoke situation in Knoxville appears to have grown steadily worse. This opinion has been voiced many times recently through the press and the accompanying pictures (Figs. 1 and 2) attest just grounds for complaint. The present wave of public indignation may serve as the stimulus to take up again and with renewed determination the fight for smoke abatement. It cannot be considered an easy battle in a district that must depend primarily upon high-volatile coal for fuel, but the barriers are not insurmountable. Low temperature carbonization of coal which is now being studied as part of the program of the Tennessee Valley Authority may offer relief in the form of economical smokeless fuel. Central heating plants for the congested business areas appear to be entirely feasible. While there is room for invention and improvements in the design of burners for high-volatile coal, available down-draft designs and mechanical stokers have proved their merits in fuel economy and smoke reduction. In any case no city burdened with excessive smoke can afford to be without an active bureau of smoke abatement. With such a bureau under the direction of a well-trained engineer, ten years would convince the skeptic that smoke can be reduced and at the same time pay big dividends on the investment through fuel economy, cleanliness, and better health.

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