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Air Pollution—The Industrial Viewpoint

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st. I would like to say that industry oes recognize air pollution as a problem. that may not seem like a very profound state-t. but if we go back in history 10 or 15 years not sure, were I on this podium then, that ld make such a statement. Of course, Donora, the famous 1952 London smog, had occurred it was the general belief by people in indus-that these were unusual and isolated events. can't happen here" seemed to be the prevail-attitude. The American Petroleum Institute a Smoke and Fumes Committee, later to called the Air and Water Conservation Com-tee. Initially this Committee, was almost ex-sively concerned with the control of pollution m a refinery. It compiled many useful encyclo-dic-like volumes which offered detailed in-structions to the refinery operator on the control air and water pollution from his refinery. Other rade associations had similar committees. In-dividual plants may have had a person or a com-ittee whose task it was to see that a specific plant did not so badly pollute its immediate surroundings as to result in complaints from the local community or communities. That general air pollution was the result of the use by hundreds of millions of people of the products of industry never entered the thoughts of such industry air pollution people. Perhaps this was because every time air pollution became bad some official would appear on their doorstep demanding that the plant do something about its pollution of the air. We knew about fluoride pollution by smelters, the grit and grime of power plants, the smell of refineries, and the smoke of steel mills. This we thought and were told by air pollution control people was our problem. On this we concentrated.

Today, things have changed. We are becoming more knowledgeable (Table 1). We know, for in-

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TABLE 1
TOTAL U S AIR POLLUTION BY SOURCE—1966*

Source	Tons/Yr	% of Total
Industry	23,000,000	16.2
Power Plants	20,000,000	14.1
Motor Vehicles	86 000 000	60 6
Space Heating	8,000 000	5 6
Refuse Disposal	5,000 000	3 5
	142,000,000	

*The Sources of Air Pollution and Their Control, Public Health Service Publication No. 1548 (1966)

stance, that about 70% of the pollution is coming from the activities of you and me. Another 16% comes from industry, exclusive of power plants, and the remaining 14% comes from power plants. The American Petroleum Institute (API) now has a Committee on Air and Water Conservation which concerns itself almost exclusively with the problems which result from automobiles, power plants, and heating. A research effort amounting to about $2,000,000 per year has been mounted. Through the Coordinating Research Council (CRC), a joint effort of the API, the Automotive Manufacturers Association (AMA), and the National Center for Air Pollution Control (NCAPC) of the Department of Health, Education, and Welfare, another research effort amounting to $10,000,000 over the next three years is being mounted. The National Coal Association, in partnership with the Edison Electric Institute, has mounted a $2,500,000 research effort. The Manufacturing Chemists Association (MCA) has an Environmental Health Committee. Many of the major oil and automotive companies today are making large research expenditures on their own (mine spends over $4,000,000 per year) and have a full-time coordinator of air and water conservation. I am sure many other groups exist with which I am not familiar. I intend to slight no one, but rather do not mention them by name only out of ignorance and lack of time. The point is, however, that industry today is very aware of the nature of air pollution.

I have heard it said on several occasions, "Why does industry spend so much on air pollution research? Why don't they just use that money to control air pollution?" The quite simple answer to those questions is that industry is spending hundreds of millions of dollars to control its own air pollutants, but no one today is sure just how far it is necessary to control general air pollution, or how best to control it economically. Hence the research expenditures. It should be obvious to anyone that if humans are to continue to inhabit this earth we can't have absolutely clean air. The problem, therefore, is to determine at what level, between zero air pollution on the one hand and the present-day air pollution on the other, air pollution needs to be controlled and how to control it.

Many of you may have read alarmist articles in the popular press maintaining that our cities are becoming uninhabitable because of air pollution. We in industry just do not quite believe that things are all that bad. Our reasoning partly

TABLE II
CHICAGO SULFUR DIOXIDE LEVELS—ppm*

	Annual (Aver.)	Month (Max.)	Day (Max.)	Hour (Max.)
1962	.11	.24	.40	.89
1963	.15	.35	.79	1.36
1964	.17	.34	.68	1.09
1965	.13	.27	.55	1.14
Average	.14	.30	.61	1.12

*Regulation of Sulfur Oxide Emissions from Federal Facilities. U.S. Public Health Service, November 1966.

TABLE III
PHILADELPHIA SULFUR DIOXIDE LEVELS—ppm*

	Annual (Aver.)	Month (Max.)	Day (Max.)	Hour (Max.)
1962	.09	.13	.35	1.03
1963	.06	.15	.46	.85
1964	.08	.15	.43	.69
1965	.08	.13	.36	.94
Average	.08	.14	.40	.88

*Regulation of Sulfur Oxide Emissions from Federal Facilities. U.S. Public Health Service, November 1966.

resides in data published by the U.S. Public Health Service. Table II shows the SO_2 data for Chicago from 1962-1965. I personally see no overall worsening trend in these data. Table III gives comparable data for Philadelphia. Again, if a worsening trend is present, it is not obvious to me. Table IV shows SO_2 data for New York City from 1957-1965. Again, I can detect no consistent worsening trend over this nine-year interval. As a matter of fact the 26 million tons total of SO_2 emitted in the U.S. in 1966 is exactly the same as in 1945 due to sulfur reductions in gasoline, diesel fuel, and home heating oil, and the switch from coal to heating oil in private homes. Despite the alarmist predictions of doom, therefore, we in industry do not believe we are facing a crisis which demands precipitous action. We believe there is time to take a reasoned, rational course in air pollution control consistent with our technology and with ecomonics. Particularly do we think this is true since Dr. Austin Heller, Air Pollution Commissioner of New York City, was reported in *The New York Times* of November 29, 1967, as saying that the sulfur dioxide concentrations in New York City have decreased by as much as 50%.

There is much in the literature which purports

TABLE IV
NEW YORK SULFUR DIOXIDE LEVELS—ppm*

	Annual (Aver.)	Month (Max.)	Day (Max.)	Hour (Max.)
	.20	Not Available	.55	2.0
	.16		.58	1.3
	.17		.64	1.2
	.18		.91	1.4
	.16		.69	1.4
	.19		.71	1.9
	.20		.85	1.5
	.24		.71	1.9
	.21		.68	2.3
	.19		.70	1.7

gulation of Sulfur Oxide Emissions from Federal Facilities. ublic Health Service, November 1966.

ow the health effects of air pollution. I have this literature rather assiduously over the several years and must admit that I, as well any other capable people, remain far from inced, with the exception of one aspect. I am inced that the acute air pollution episode have an effect on health. Thus Donora, the se Valley, and London in 1952 and 1962 rather rly have established the fact that when a large ss of stagnant air sits over a city under an ersion layer for several days, excess deaths occur. The American Petroleum Institute ognized this fact several years ago and pro- ed a plan to avert such episodes. Surprisingly s plan was pooh-poohed openly as a stalling tic, and no serious consideration was given to at that time.[1] Even more surprisingly, this an today, with some very minor modifications, being or has been adopted by several cities, s if it were their own original idea. Now as far as the API is concerned, it really does not care whether or not it receives any credit for proposing such a plan. But it would like to believe that when it proposes something, others would accept the fact that these propositions are serious and examine them carefully.

When we begin to examine the data that have been put forth concerning the health effects of nonepisodic air pollution, we honestly state that we remain unconvinced. As an example, I would like to refer to a study of air pollution and urban morbidity reported by Sterling et al. in 1966.[2] In this study 29,922 hospital admissions were studied in relation to air pollution. One comparison was made between numbers of patients with certain diseases admitted to the hospital and SO_2 levels. Thus, they compared admission rates to the hospital for the one-third of the days with the lowest SO_2 averages, with admission rates to the hospital for the one-third of the days with the highest SO_2 averages. In looking over their table the authors were ". . . struck with the fact that the three high positive per cent differences in rates are for disease groupings of infectious diseases, acute uper respiratory infections, and bronchitis. None of the negative per cent differences reached anywhere near that level." I read that paper rather carefully and, at the suggestion of one of my engineering friends, I calculated the number of admissions for the one-third of the days with the middle SO_2 levels. Figures 1, 2 and 3 represent

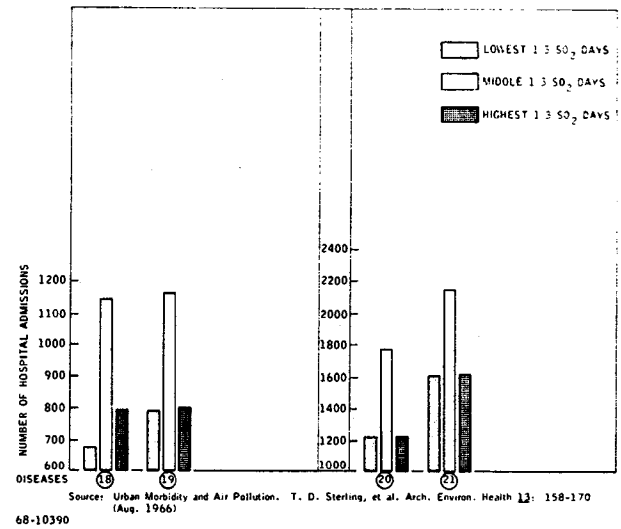


Fig. 1. Hospital admissions by three disease groupings for days with lowest, middle and highest one-third SO_2 averages.

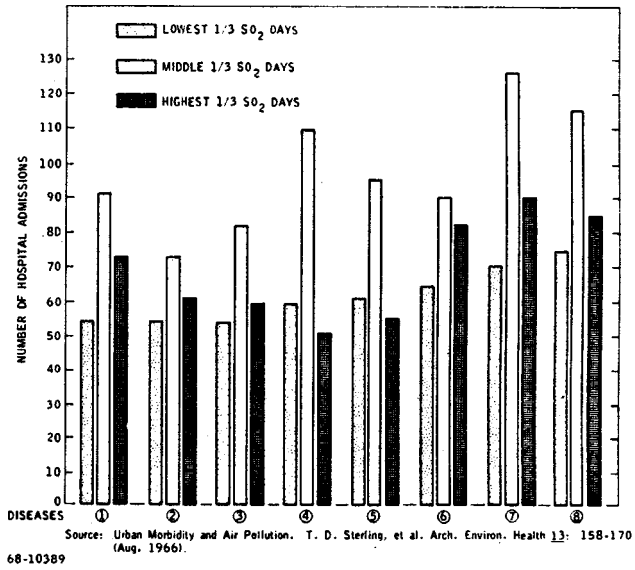


Fig. 2. Hospital admissions by eight disease groupings for days with lowest, middle and highest one-third SO_2 averages.

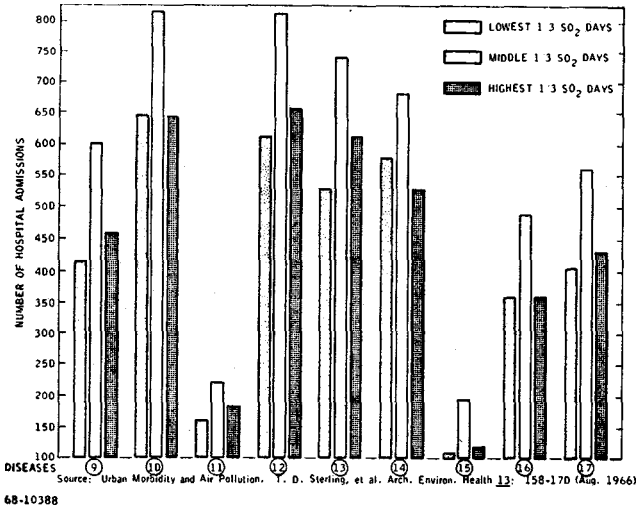


Fig. 3. Hospital admissions by nine disease groupings for days with lowest, middle and highest one-third SO_2 averages.

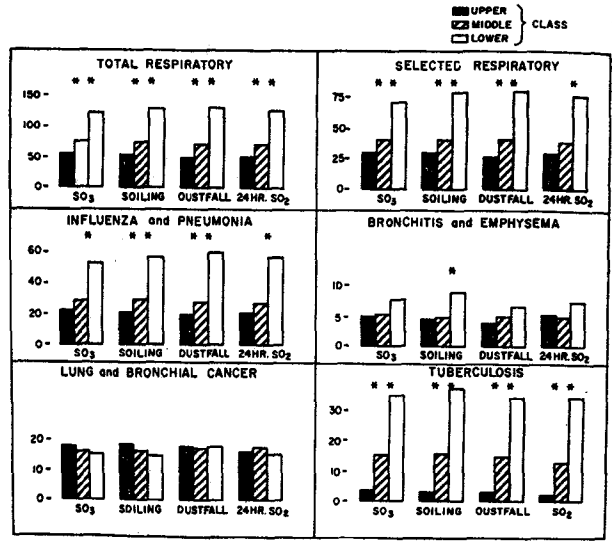


Fig. 4. Adjusted death rates/1000,000 for respiratory diseases by socio-economic class. (Source: Zeidberg, L. D. et al.: Arch Environ Health, 15:214-224, August 1967.)

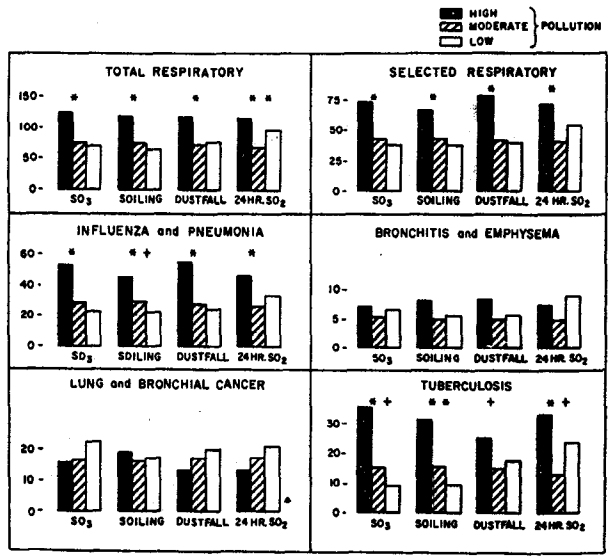


Fig. 5. Adjusted death rates/1000,000 for respiratory diseases among middle class population. (Source: Zeidberg, L. D. et al.: Arch Environ Health, 15:214-224, August, 1967.)

the number of hospital admissions for each of 21 disease categories discussed by the authors. Each of these charts show that for the middle one-third SO_2 days the number of admissions to hospital for every single one of the disease categories mentioned by Sterling et al.[2] exceeds the number of hospital admissions for either the lowest *or* the highest one-third SO_2 days. In some cases this excess is quite large and far greater than the differences between high and low SO_2 days. It is quite possible that health effects are produced by nonepisodic air pollution, but it is not clear from data of this type that this has been conclusively demonstrated, or that we can learn from such data, at what level such effects may occur and, therefore, to what level we need to control air pollution.

I would like to turn next to the famous Nashville studies; these have been reported.[3-5] Basically what these studies show is that mortality is severely affected by socio-economic status, but inconclusivly affected, if at all, by air pollution. Figure 4 shows the relationship between selected respiratory diseases and socio-economic status. The consistency of the pattern, with the exception of lung cancer is, to me, overwhelming. The lower the socio-economic status, the higher the mortality from disease. Conversely, the situation when socio-economic class is held constant and air pollution is varied is far less convincing (Fig. 5). Thus, in many cases the mortality from a disease went up when the air pollution was lowered. Look at the situation with 24-hour SO_2 levels and total respiratory disease mortality. In addition, although not significantly different, the mortality from bronchitis and emphysema, for all four measures of air pollution, was higher in the low pollution zone than in the moderate pollution zone. Figure 6 shows that comparable data also exist for cardiovascular disease. With the exception of arteriosclerotic heart disease, the inverse relationship between all types of cardiovascular disease and socio-economic status is quite consistent. When socio-economic status is held constant (Fig. 6) the relationship between cardiovascular disease and air pollution is far less

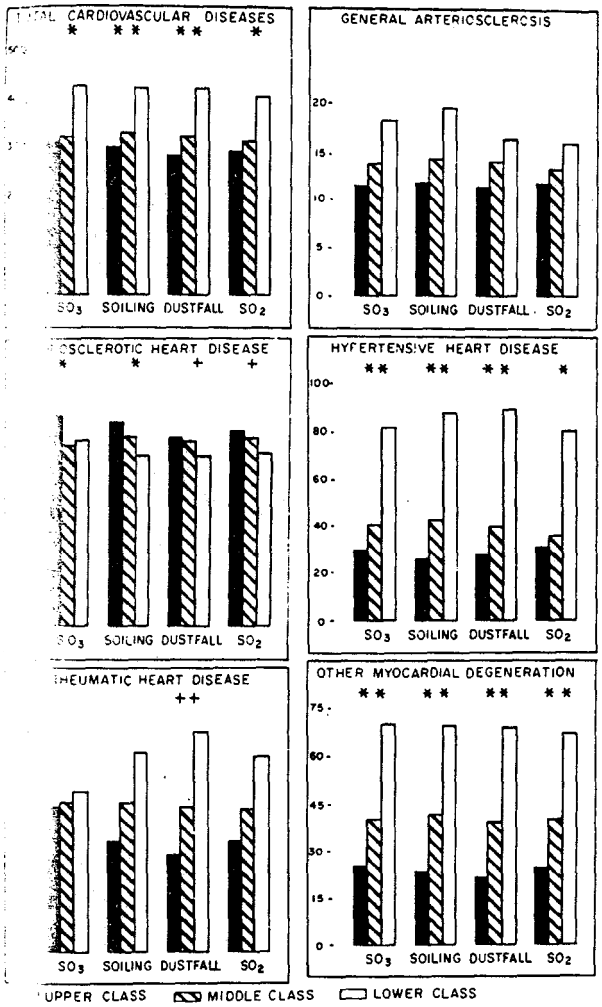


Fig. 6. Adjusted death rates/100,000 for cardiovascular diseases by socio-economic class. (Source: Zeidberg, L. D. et al.: Arch Environ Health, 15:225-236, August 1967.)

convincing because, in many cases as measures of air pollution decrease, cardiovascular diseases increase.

For cancer, the situation seems considerably more confused. For lung cancer, as shown in Figures 4 and 5, there seems to be no relationship between either socio-economic status or air pollution. This is probably due to the fact that smoking of cigarettes probably overpowers any other factor in the incidence of this disease. In fact, at a recent meeting of experts in epidemiology from all over the world held in New York City by the N. Y. Academy of Sciences, a statement was made that a growing body of data suggests that general air pollution is not a significant factor in the etiology of lung cancer. The statement went uncontested by the group. Figures 8 and 9 show the for socio-economic status show no consistent pattern but do show some interesting variations which might bear further investigation. The data for air pollution also are not particularly consistent. This is a conclusion also reached by the authors who presented these data.

By now, you are probably convinced that I am opposed to air pollution control. Nothing could be further from the truth. In fact, if my management were sitting beside me today you would have seen a smile pass over their faces because I am always prodding them to do more in the air pollution data for other cancers in Nashville in relation to socio-economic status and air pollution. The data control field. But I do *not* believe there is a crisis at hand, and I *do* believe that consistent steady progress in control is being made.

Figure 10 shows the sulfur oxide emissions on a per cent of 1965 emissions basis for the New

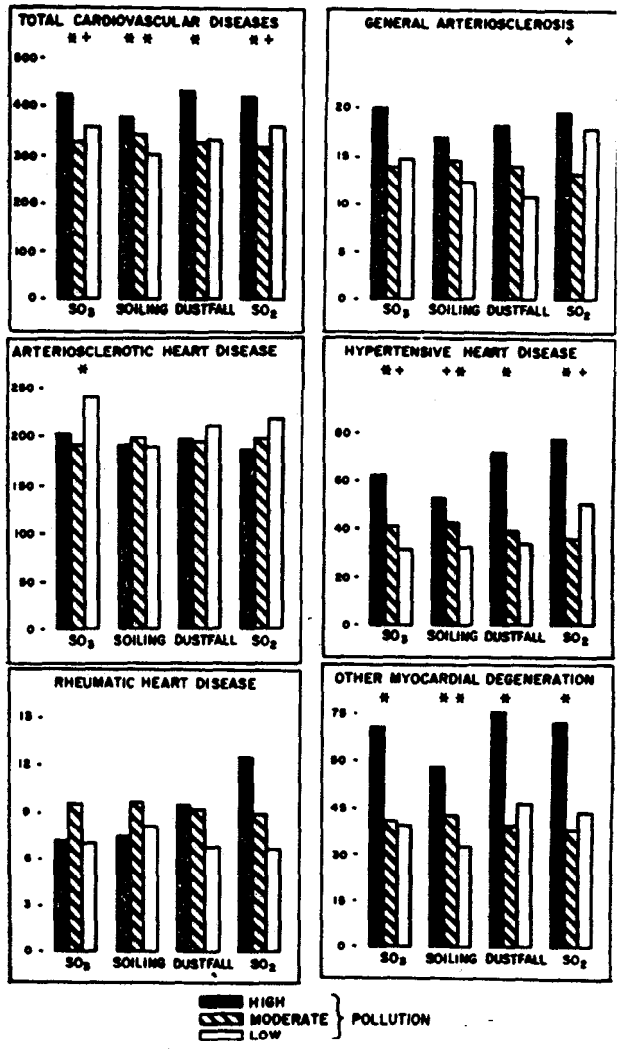


Fig. 7. Adjusted death rates/100,000 for cardiovascular diseases among middle class population. (Source: Zeidberg, L. D. et al.: Arch Environ Health, 15:225-236, August 1697.)

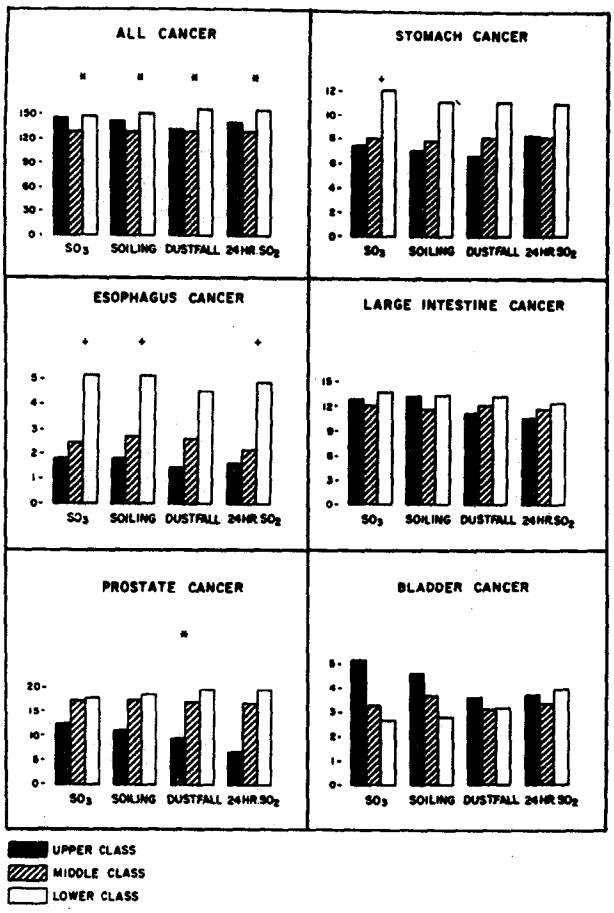


Fig. 8. Adjusted death rates/100,000 for cancer by socio-economic class. (Source: Hagstrom, R. M. et al.: Arch Environ Health, 15:237-248, August 1697.)

York City area. The dotted lines represent the over-all U.S. projections for sulfur oxides by the U.S. Public Health Service. New York has been used, since it represents one of the worst areas in the U.S. for sulfur dioxide pollution. I think this Figure shows that far greater progress is anticipated than the most optimistic predictions of the U.S. Public Health Service. This degree of progress is most heartening. Similar progress is being made in the automotive field.

If I were to attempt to summarize what my position, and presumably my industry's position, is on air pollution control, it would be somewhat as follows: If health effects are produced by air pollution, industry would go along with the concept that more vigorous efforts and higher expenditures for air pollution control are warranted. To date, however, based on evidence similar to that presented to you in this paper, industry is not convinced that air pollution, other than during an acute episode, has a significant deleterious effect on general health or on specific disease incidences. It has recognized the health effect of acute episodes and proposed a method of circumventing these episodes. This method, or modifications of it, is now being adopted by certain cities and regions and should ensure the elimination or minimizing of such episodes in the future. After all, even though we do not understand fully exactly what happened in Donora, there has never been a second episode in Donora.

Industry does believe that where effects other than health are involved, such as plant damage, eye irritation, odors, poor visibility, corrosion, etc., targets should be set which recognize the technologic ability to achieve them, the costs involved to achieve them, and the benefits to be desired. Thus, to reduce sulfur in heavy fuel oil to one per cent will cost huge sums in refinery capital investment. Further, to plan, design, construct, and put into operation the new refining facilities to accomplish this will require a lag time of three to four years. To require one per cent sulfur

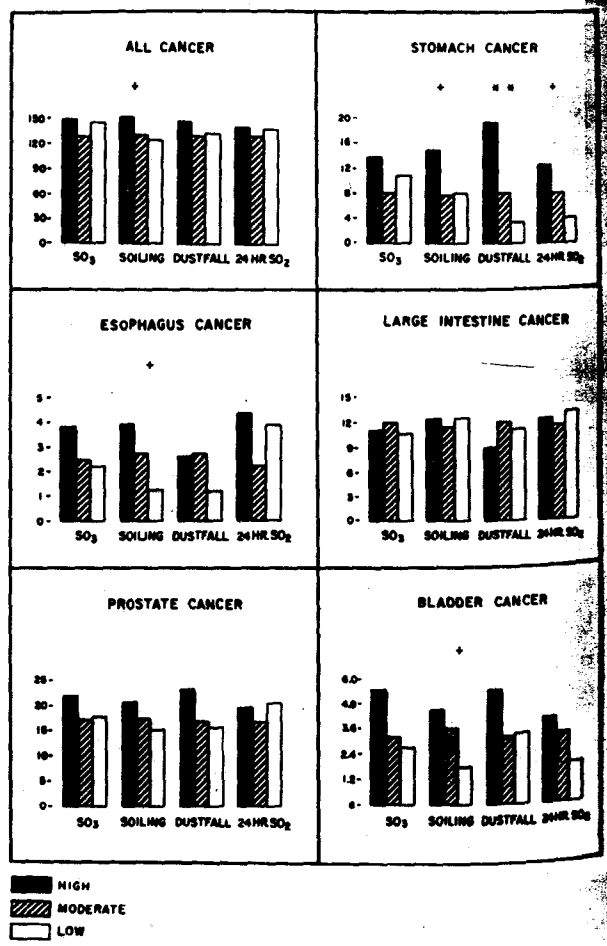
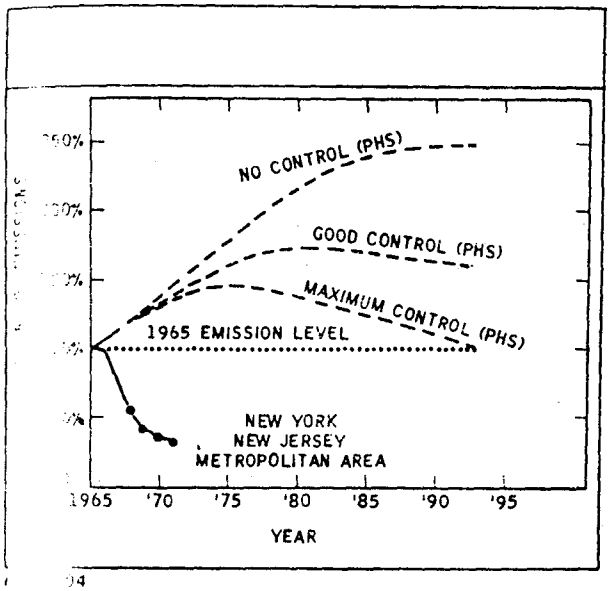


Fig. 9. Adjusted death rates/100,000 for cancer among middle class population. (Source: Hagstrom, R. M. et al.: Arch Environ Health, 15:237-248, August 1967.)



. Metropolican New York SO_2 emissions compared SPHS predictions.

next month would be impossible, except in limited areas. If the requirement were for 1971, this target could probably be met. In my parent company has just recently announced that it is investing over $100,000,000 in refinery to bring the New York area the low sulfur fuel it desires in 1970-1971. A few years this would not have been possible because technology was just not available. Making 0.3% sulfur oil in this plant is possible but it is much more expensive than to make one per cent. Further, coal could probably not meet the 0.3% sulfur limitation, and as yet no demonstrably satisfactory stack gas desulfurization process has developed beyond the pilot plant stage. Even if a satisfactory stack gas desulfurization process were available, it would take time to build such plants and put them into operation. Do we really need 0.3% sulfur fuel or its equivalent in stack gas desulfurization, or will the one per cent level be adequate? Industry believes we should control stepwise, measuring the benefits as we go along. Adequate cost-benefit analyses could then be made to see if the non-health benefits obtained are worth the costs that will be required.

If you estimate the cost of control devices on automobiles at $20.00 per car, then they will have cost the American public over $200,000,000 by the end of 1968, and an equivalent amount each year thereafter. Thus in ten years, when it is estimated that all cars driven will have such devices, the cost will have been over $2,000,000,000. Additional controls which will lower levels of exhaust emissions even more may cost four-five times this amount, the total estimates over ten years amounting at the present time to $8,000,000,000 to $10,000,000,000 more. The necessity for such additional devices should be evaluated as we go. If we do not really need them, should the public be asked to put them on their cars anyway? The public might prefer to spend these billions of dollars—if not really needed—in other ways—perhaps education or urban improvement.

Industry believes that realistic targets should be established which take into account these costs and technologic feasibility. As our technology advances, these costs may be further reduced and we may feel we can afford more controls. To establish goals or targets today that are excessively costly or technologically not feasible does not appear to be a sound objective. Since there does not appear to be any clear-cut crisis, as I have tried to show, it appears that a reasoned rational course in air pollution control should be adopted. Such a course would take cognizance of the state of technology available at the time, the economics of achieving the air quality we all desire, and the lead time necessary to achieve this. Such an approach will bring us closer and more quickly to our desired goals in air quality than will an irrational or emotional crash program. Let us continue to move, but move together toward reasonable goals.

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