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Particulate and Sulfur Oxide Emission Reductions Achieved Nationwide for Selected Industrial Source Categories, 1970 - 1974

U.S. ENVIRONMENTAL PROTECTION AGENCY
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SUMMARY OF PARTICULATE AND SULFUR OXIDE EMISSION REDUCTIONS ACHIEVED NATIONWIDE FOR SELECTED INDUSTRIAL CATEGORIES, 1970-1974

Prepared by the

U.S. ENVIRONMENTAL PROTECTION AGENCY

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I. INTRODUCTION AND PURPOSE

Under the Clean Air Act amendments of 1970, the States and EPA are charged with the responsibility of reducing the quantity of pollutants in the ambient air to levels adequate to protect public health and welfare. In 1971, EPA identified six pollutants which are deemed harmful to health and welfare in certain concentrations (total suspended particulates, sulfur oxides, nitrogen oxides, carbon monoxide, photo-chemical oxidents, and hydrocarbons) and established National Ambient Air Quality Standards (NAAQS) as levels to be attained and maintained.

The Clean Air Act amendments of 1970 required the states to develop State Implementation Plans (SIPs) by 1972 to assure that the federally established NAAQS are attained and maintained. In order to achieve the NAAQS, states set specific emission regulations in the SIP's restricting the amount of pollutants which any source may introduce into the atmosphere. These limitations on emissions are designed so that when sources comply, there will be a reduction in the ambient concentrations of those six pollutants to levels at least as low as the national ambient standards, taking into account the increase in emissions which occurs as a result of normal industrial growth. Two of these six pollutants, total suspended particulate matter and sulfur oxides, are the principal air pollutants emitted by stationary sources such as power plants and steel mills.

This report summarizes the results of four years of local, state, federal, and industry efforts to reduce the amount of particulates and sulfur oxides being emitted into the atmosphere by stationary sources and points out the remaining work to be done. Data developed for EPA to measure the reduction in emissions of sulfur oxides (SOx) and particulates are used to illustrate the progress achieved through 1974.[1]

Throughout this paper emissions are referred to as either "potential" or "actual". "Potential" emissions are defined as those which would have occurred without any controls. Included in potential emissions is the increase in levels of emissions which would have resulted from normal industrial growth between 1970 and 1974. "Actual" emissions, on the other hand, represent reduced levels of emissions which have in fact resulted from the introduction of pollution controls. Appendix A describes the procedures used to estimate the emissions.

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[1] Summary of Emission Reductions Achieved Nationwide by Selected Industrial Source Categories, Volumes I & II, Martin F. Massoglia, Research Triangle Institute, June 1975, U. S. Environmental Protection Agency Contract No. 68-02-1325, Task No. 21.

These estimates are useful in providing a surrogate measurement of progress toward the attainment of the NAAQS. They are also useful in assessing the impact of pollution control programs on the reduction of emission rates in specific, key industries and in identifying those industries where relatively less progress has been made toward meeting the full compliance levels. Although a national summary of this sort is valuable as an overall indicator of progress for specific industries and the nation, the nature of the results, that is, average emission rates and average compliance levels for an entire industry, do NOT lend themselves to direct application to a specific facility or a local geographic area.

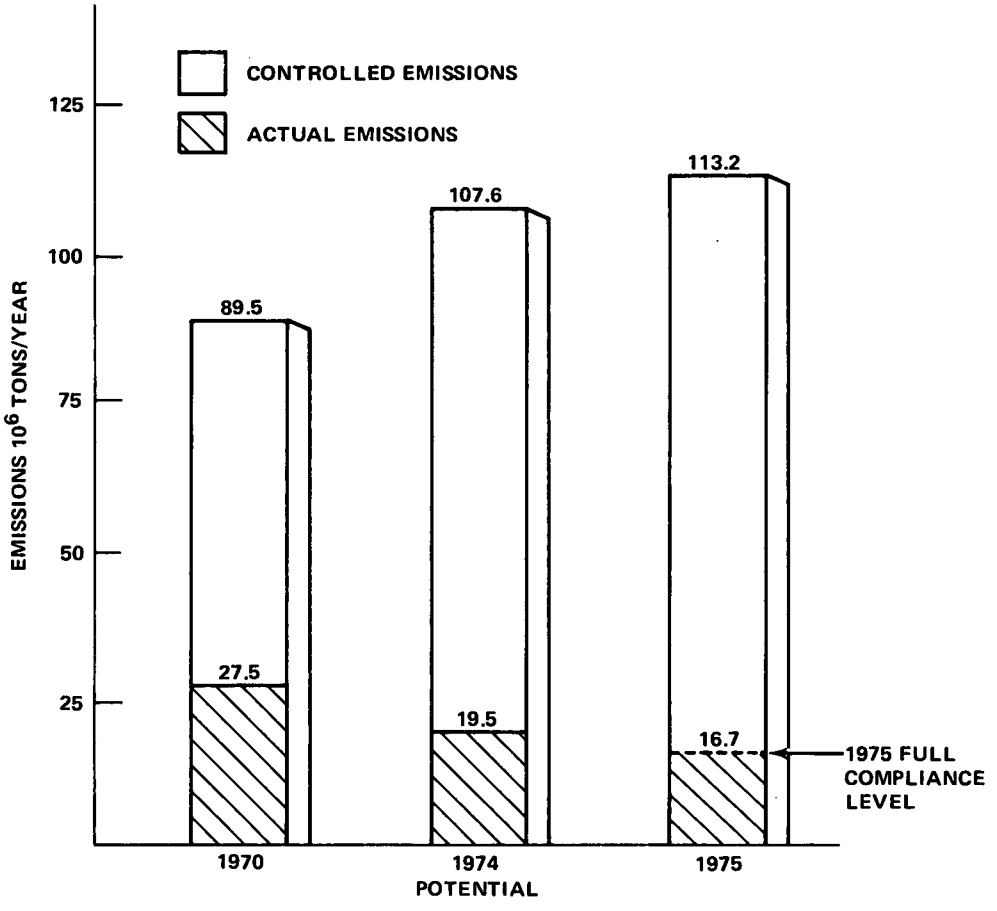
II. FINDINGS

The results are presented in three sections: Section A. Particulate Results for the Nation; Section B. Sulfur Oxide Results for the Nation; and Section C. Industry-by-Industry Results. Since some of the industries analyzed have significant emissions for only one of the two pollutants studied, an analysis of the less significant pollutant is omitted for those industries.

A. Particulate Results for the Nation

Potential and actual particulate emissions for the years 1970 and 1974 are shown in Figure 1 and listed in Table 1 along with potential and full compliance level emissions for 1975 attainment of the ambient air quality standards. The difference between potential and actual emissions is shown as controlled emissions.

FIGURE 1.



NATIONAL PARTICULATE EMISSIONS

Table 1

SUMMARY OF POTENTIAL AND ACTUAL EMISSION ESTIMATES
FOR TOTAL SUSPENDED PARTICULATES

Emissions 10^3 tons

Source Category	1970 Potential	1970 Actual	1974 Potential	1974 Actual	1975 Potential	1975 Full Compliance
Coal-Fired Steam Electric Power Plants	34,533	4,188	44,548	2,872	47,530	914
Oil-Fired Steam Electric Power Plants	54	54	84	84	94	94
Coal-Fired Industrial/ Commercial Boilers	4,501	2,545	3,959	1,231	3,959	401
Integrated Iron & Steel Mills & Coke Plants	15,259	2,800	17,787	2,710	18,532	521
Petroleum Refineries	253	136	304	150	318	150
Primary Smelters	1,637	190	2,040	210	2,170	149
Portland Cement Plants	10,643	906	11,924	394	12,291	69
Municipal Refuse Incinerators	184	105	219	90	230	18
Phosphate Fertilizer Plants	172	24	212	18	224	15
Ferroalloy Plants	366	225	389	101	395	31
Asphalt Concrete Plants	6,998	526	10,238	291	11,273	177
Coal Cleaning Plants	671	217	669	67	738	14
Kraft and Sulfite Pulp Mills	3,133	288	3,603	143	3,723	37
Gray Iron Foundries	1,320	156	1,500	119	1,549	79
Subtotal Selected Source Categories	79,724	12,360	97,476	8,530	103,046	2,669
All Sources	89,452	27,500	107,584	19,500	113,177	16,676

Between 1970 and 1974, potential emissions increased by 20% from 89.5 million tons per year to 107.6 million tons per year, a result of the industrial growth during the period. This growth of potential emissions made an absolute reduction in actual emissions more difficult. The 29% actual emissions reduction achieved (to 19.5 million tons per year in 1974 from 27.5 million tons per year in 1970) was possible only because abatement programs increased the overall degree of control from 69% in 1970 to 82% in 1974. By the end of 1974, some 26.1 million tons per year of particulates were being controlled that were not controlled in 1970.

The State Implementation Plans (SIPs) were designed to meet ambient air quality standards in 1975 by controlling the expected potential emission level in 1975 of 113.2 million tons per year by an overall 89% to an actual emission level of 16.7 million tons per year. Full compliance in 1975 would therefore result in the control of some 34.5 million tons per year of particulates not under control in 1970. Emission reductions achieved through 1974 represent 76% of the 1975 objective. Examination of Table 2 shows that for particulates, the industries which need the greatest amount of additional control to meet the 1975 full compliance level are coal-fired steam electric power plants and integrated iron and steel mills and coke plants. Each individual industry is discussed in Section C.

B. Sulfur Oxides Results for the Nation

Figure 2 shows and Table 3 lists actual and potential sulfur oxide emissions for the years 1970 and 1974, and also shows potential and full compliance level emissions under the SIP's for 1975 attainment of the ambient air quality standards. Sulfur oxide emissions result primarily from the combustion of fossil fuels. The magnitude of these emissions depends upon both the quantity and the sulfur content of the fuel burned. Since potential sulfur oxide emissions in this report are based on fuel usage and sulfur content values applicable in 1970, prior reductions achieved through fuel switching are not indicated in the figures presented throughout this report.

Between 1970 and 1974, potential sulfur oxide emissions increased by 13% (from 39.6 million tons per year to 44.3 million tons per year) as a result of the industrial growth and increased fuel usage during that period, therefore making an absolute reduction in actual emissions more difficult to achieve. Nevertheless, the overall degree of control of sulfur oxide emissions was increased from 13% in 1970 to 29% in 1974 resulting in an 8% reduction in actual emissions (to 31.4 million tons per year in 1974 from 34.3 million tons per year in 1970). By the end of 1974, some 7.6 million tons per year of sulfur oxides were being controlled that were not controlled in 1970.

Table 2

TOTAL SUSPENDED PARTICULATE

Source Category	% of Total Actual 1974 Emissions	Average % Control in 1974	% of 1975 Objective Achieved	Total Reduction Remaining 10^3 tons/yr	(%)
Coal-Fired Steam Electric Power Plants	15%	94%	70%	4,940	(30%)
Oil-Fired Steam Electric Power Plants	< 1%	*	*	*	(*)
Coal-Fired Industrial/ Commercial Boilers	6%	69%	61%	830	(39%)
Integrated Iron & Steel Mills & Coke Plants	14%	85%	47%	2,934	(53%)
Petroleum Refineries	< 1%	51%	72%	14	(28%)
Primary Smelters	1%	85%	66%	195	(34%)
Portland Cement Plants	2%	97%	72%	700	(28%)
Municipal Refuse Incin.	< 1%	59%	38%	83	(62%)
Phosphate Fertilizer Plants	< 1%	92%	75%	15	(25%)
Ferroalloy Plants	< 1%	74%	63%	86	(37%)
Asphalt Concrete Plants	1%	97%	75%	1,149	(25%)
Coal Cleaning Plants	< 1%	90%	56%	120	(44%)
Kraft and Sulfite Pulp Mills	1%	95%	67%	276	(33%)
Gray Iron Foundries	< 1%	92%	71%	89	(29%)
Total Selected Source Categories	44%	91%	65%	11,431	(35%)

*The national <u>average</u> emissions calculations indicate that no control is required even though specific situations may exist where state/local regulations are applicable and require some control.

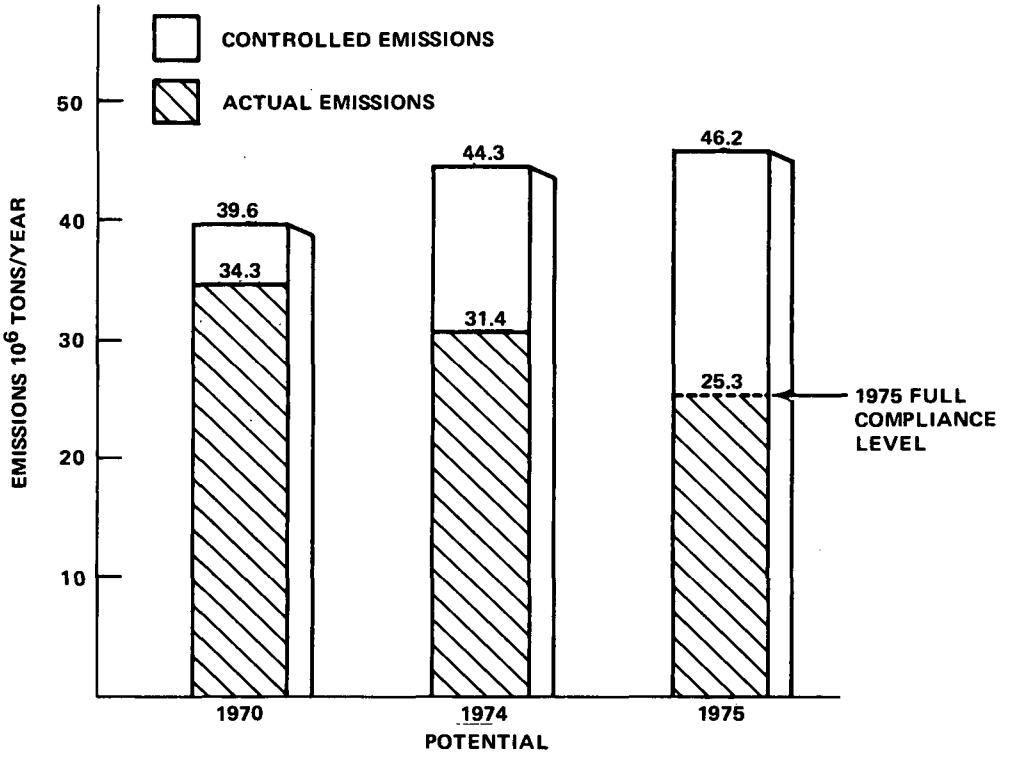
Table 3

SUMMARY OF POTENTIAL AND ACTUAL EMISSION ESTIMATES
FOR SULFUR OXIDES

Emissions 10^3 tons per year

Source Category	1970 Potential	1970 Actual	1974 Potential	1974 Actual	1975 Potential	1975 Full Compliance
Coal-Fired Steam Electric Power Plants	15,439	15,439	19,535	13,574	20,842	10,027
Oil-Fired Steam Electric Power Plants	1,618	1,618	2,519	1,479	2,806	1,487
Coal-Fired Industrial/ Commercial Boilers	5,529	5,529	5,130	3,835	5,130	2,788
Integrated Iron & Steel Mills & Coke Plants	197	180	182	128	179	26
Petroleum Refineries	4,487	3,890	5,392	2,547	5,646	1,463
Primary Smelters	4,845	3,580	5,346	2,912	5,547	1,005
Portland Cement Plants	733	732	821	821	846	846
Sulfuric Acid Plants	581	581	664	373	686	196
Subtotal Selected Source Categories	33,429	31,549	39,589	25,669	41,682	17,838
All Sources	39,586	34,300	44,275	31,400	46,168	25,300

FIGURE 2.



NATIONAL SULFUR OXIDE EMISSIONS

The SIP's were designed to achieve the primary ambient air quality standards for sulfur oxides in 1975 by controlling the expected potential emission level in 1975 of 46.2 million tons per year by 45% to a full compliance emission level of 25.3 million tons per year. Full compliance in 1975 would therefore result in the control of some 15.6 million tons per year of sulfur oxides not under control in 1970. Emission reductions achieved through 1974 represent 49% of the 1975 objective.

Examination of Table 4 shows that for sulfur oxides, the industries that need the greatest amount of additional control to meet the 1975 full compliance level are coal-fired steam electric power plants, primary smelters, petroleum refineries, and coal-fired industrial/commercial boilers. Each individual industry is discussed in the next section of this report.

Table 4

SULFUR OXIDES

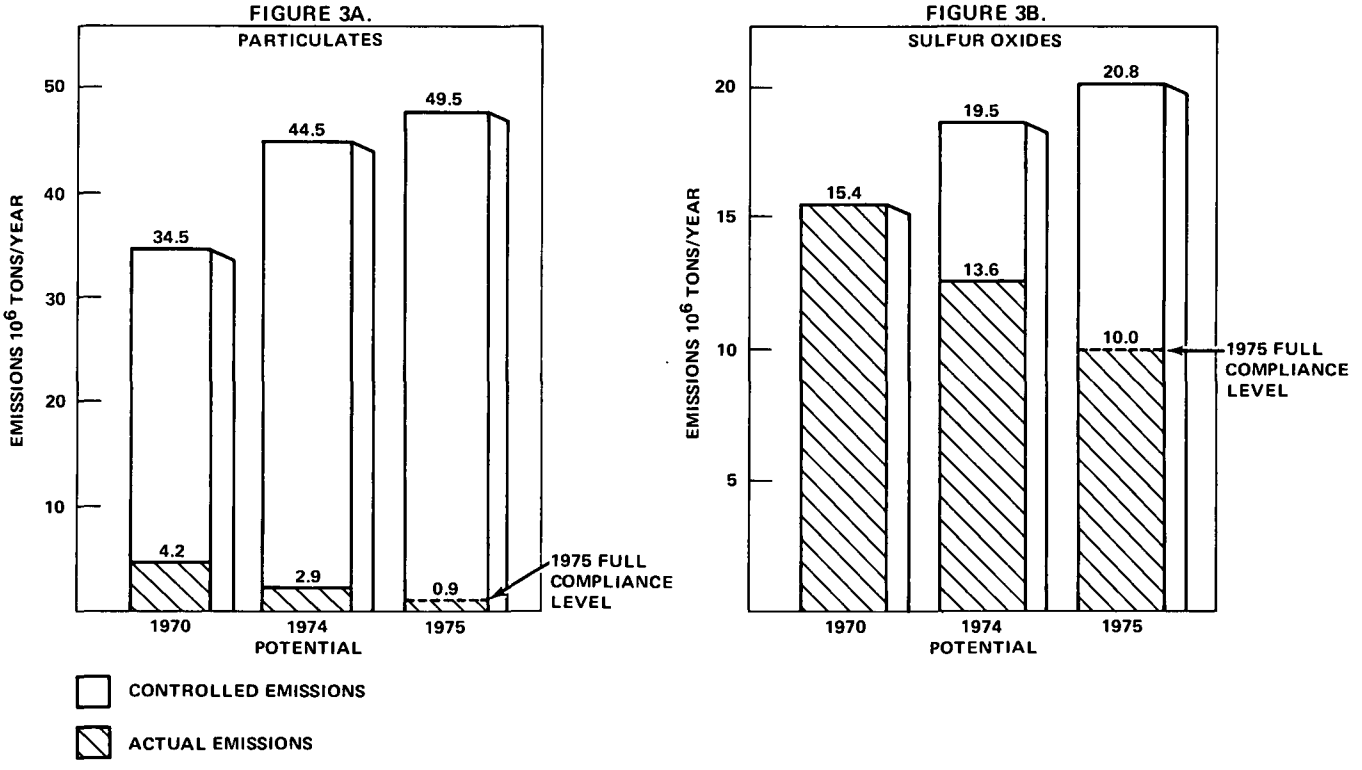
Source Category	% of Total Actual 1974 Emissions	Average % Control in 1974	% of 1975 Objective Achieved	Total Reduction Remaining 10^3 tons/yr (%)
Coal-Fired Steam Electric Power Plants	43%	30%	55%	4,854 (45%)
Oil-Fired Steam Electric Power Plants	5%	41%	79%	279 (21%)
Coal-Fired Industrial/ Commercial Boilers	12%	25%	62%	1,047 (38%)
Integrated Iron & Steel Mills & Coke Plants	< 1%	30%	40%	102 (60%)
Petroleum Refineries	8%	53%	63%	1,338 (37%)
Primary Smelters	9%	46%	36%	2,108 (64%)
Portland Cement Plants	3%	*	*	* (*)
Sulfuric Acid Plants	1%	44%	59%	199 (41%)
Total Selected Source Categories	82%	35%	55%	9,927 (45%)

*The national average emissions calculations indicate that no control is required even though specific situations may exist where state/local regulations are applicable and require some control.

C. Industry-by-Industry Results

1. Coal-fired Steam Electric Power Plants.

Examination of Tables 1 and 3 shows that coal-fired power plants are, as an industrial category, by far the largest potential and actual source of particulates and sulfur oxides in the country, accounting for 15% of all actual particulate emissions and 43% of all actual sulfur oxide emissions from stationary sources in 1974. Figures 3A and 3B illustrate actual and potential particulate and sulfur oxide emissions for the years 1970 and 1974, and also show potential and full compliance level emissions under the SIP's for 1975 attainment of the ambient air quality standards.



COAL-FIRED POWER PLANTS

Particulates - Between 1970 and 1974, as a result of the expansion of coal-fired electrical generation capacity, potential emissions of particulates increased by 29% (to 44.5 million tons per year in 1974 from 34.5 million tons per year in 1970). Existing environmental porgrams had achieved an overall degree of control of 88% by 1970. By 1974, the overall degree of control for particulates had increased to 94% and had resulted in a 31% reduction in actual emissions (to 2.9 million tons per year in 1974 from 4.2 million tons per year in 1970).

This means that 11.3 million tons per year of particulates were under control in 1974 that were not in 1970.

Full compliance with the SIP's in 1975 would require that the 1975 expected potential emissions for particulates be controlled by 98% to 0.9 million tons per year. Therefore, 16.3 million tons per year of particulates should be controlled in 1975 that were not in 1970. Through 1974, 69% of the 1975 required level for particulates has been achieved.

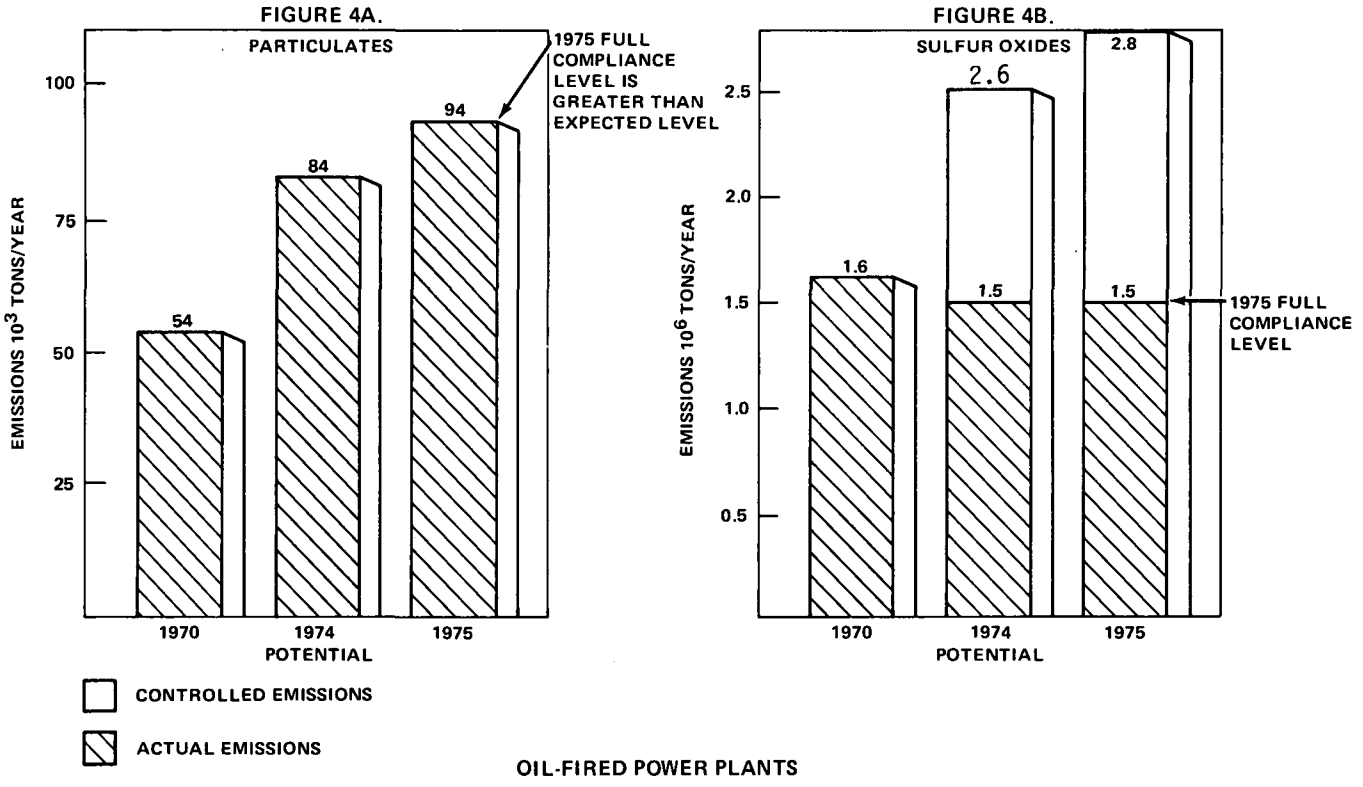
Sulfur Oxides - Between 1970 and 1974, as a result of expansion of coal-fired electrical generation capacity, potential emissions of sulfur oxides increased by 26% (to 19.5 million tons per year in 1974 from 15.4 million tons per year in 1970). As previously mentioned, potential sulfur oxide emissions in this report are based on fuel usage and sulfur content values applicable in 1970, and therefore do not indicate prior emission reductions achieved through fuel switching. Since there was little, if any, control of sulfur oxides achieved through the use of stack gas cleaning techniques prior to 1970, actual emissions were calculated to be uncontrolled and therefore the same as potential in 1970. By 1974, a 30% overall degree of control had been effected mainly through switching to lower sulfur fuels and by the use of flue gas desulfurization systems. Therefore, 6.0 million tons per year of sulfur oxides were being controlled in 1974 that were not under control in 1970.

The SIP's were designed to achieve the ambient air quality standards for sulfur oxides by controlling the 1975 expected potential emission level of 20.8 million tons per year by 52% to 10.0 million tons per year. Therefore, 10.8 million tons per year of sulfur oxides should be controlled in 1975 that were not controlled in 1970. Through 1974, 55% of the 1975 objective has been achieved.

2. Oil-fired Steam Electric Power Plants.

Examination of Tables 1 and 3 shows that oil-fired power plants accounted for about 1/2% of all actual particulate emissions and for 5% of all actual sulfur oxide emissions in 1974. Figures 4A and 4B illustrate potential and actual particulate and sulfur oxide emissions for 1970 and 1974, and also show potential and full compliance level emissions for 1975 attainment of the ambient air quality standards.

Particulates - Since 1970 potential emissions of particulates have increased by 56% (to 84 thousand tons per year in 1974 from 54 thousand tons per year in 1970), a result of the large increase in oil consumption during that period. In order to calculate actual particulate emissions for oil-fired power plants, SIP regulations were examined for those states accounting for over 70% of oil consumption



relating to electric generation. When the national average allowable emission rate was calculated, potential emissions for particulates were found to be less than the allowable rate for each year under consideration. This comparison indicates that, on the average, no control of particulates is required. Therefore actual emissions were assumed to be uncontrolled and the same as potential emission. This is illustrated in Figure 4A. Although potential particulate emissions from oil-fired power plants are below the full compliance level on a national basis, there maybe localized problems where more stringent local regulations require some particulate control.

Sulfur Oxides - Between 1970 and 1974, potential emissions of sulfur oxides have increased by 56% (to 2.6 million tons per year in 1974 from 1.6 million tons per year in 1970), a result of the 1970-1974 increase in oil consumption for electric generation. Potential emissions for 1970, 1974, and 1975 were calculated using 1970 fuel

sulfur content values and therefore do not indicate emission reductions achieved in prior years through switching to lower sulfur oils. Since prior emission reductions are not indicated and little if any stack gas cleaning was employed in 1970, actual emissions in 1970 were assumed to be uncontrolled and the same as potential. By 1974 the overall degree of control for sulfur oxides increased to 41% and resulted in a 139 thousand tons per year decrease in actual emissions, due mainly to additional switching to lower sulfur oils.

The SIP's were designed to control the expected 1975 potential sulfur oxide emission level of 2.8 million tons per year by 47% to 1.5 million tons per year. This would result in the control of some 1.3 million tons per year of sulfur oxides not under control in 1970. Through 1974, 79% of the 1975 objective has been achieved.

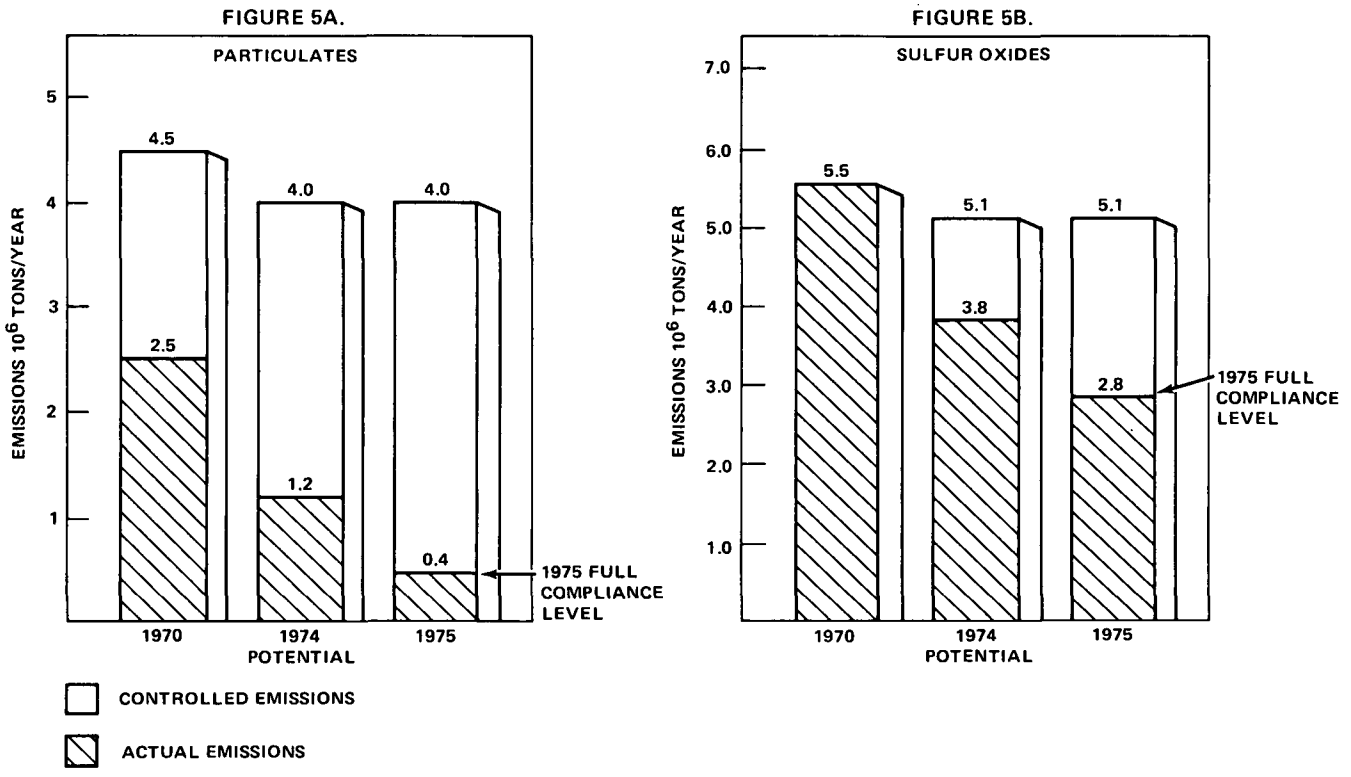
3. Coal-fired Industrial/Commercial Boilers.

Coal-fired industrial/commercial boilers are located at facilities in a number of industrial categories and plants. Emissions for the other industrial categories have not included emissions from coal-fired boilers which are covered here. In addition, emissions from coal-fired power plants which are covered in Section C.1. of this report are not included here. As a source category coal-fired industrial/commercial boilers accounted for 6% of all particulate and 12% of all actual sulfur oxide emissions in 1974.

Figures 5A and 5B illustrate actual and potential particulate and sulfur oxide emissions for 1970 and 1974, and potential and full compliance level emissions under the SIP's for 1975 attainment of the ambient air quality standards.

Particulates - Between 1970 and 1974 potential particulate emissions from coal-fired boilers decreased by 12% to 4.0 million tons per year because of a decline in coal consumption by all sources except utilities. Environmental controls installed prior to 1970 resulted in a 43% overall degree of control by 1970. By 1974, additional use of pollution control equipment increased the overall degree of control to 69% and resulted in a 52% reduction in actual emission (to 1.2 million tons per year in 1974 from 2.5 million tons per year in 1970). This means that 1.3 million tons per year of particulates from coal-fired industrial/ commercial boilers are being controlled that were not under control in 1970. A large part of the emission reduction achieved through 1974 is due to the decrease in potential emissions. This decrease is due primarily to switching from coal to oil by a number of plants and by the replacement of old coal boilers with oil fired units in others.

The SIP's were designed to control expected 1975 potential emissions for particulates (4.0 million tons per year) by 90% to the full compliance level of 0.4 million tons per year. This



COAL-FIRED INDUSTRIAL/COMMERCIAL BOILERS

should prevent 2.1 million tons per year of particulates not under control in 1970. Through 1974, 61% of the 1975 objective has been achieved.

Sulfur Oxides - Between 1970 and 1974 the potential for sulfur oxide emissions from coal-fired boilers also decreased by 7%, to 5.1 million tons per year, again attributable to a decline in coal consumption. As mentioned for other industries, prior emission reductions achieved through fuel switching are not indicated in this report since 1970 fuel sulfur content values were used to calculate potential emissions. Since there was no other control like stack gas cleaning applied to sulfur oxide emissions in 1970, actual sulfur oxide emissions were assumed to be uncontrolled and the same as potential.

By 1974, the overall degree of control increased to 25% primarily due to switches to lower sulfur coals. This resulted in a

31% reduction in actual sulfur oxide emissions (to 3.8 million tons per year in 1974 from 5.5 million tons per year in 1970). A large part of the actual emissions reduction is due to the decrease in coal consumption and is shown by the potential emission decrease. This actual and potential emission reduction means that 1.7 million tons per year of sulfur oxides are being controlled that were not under control in 1970.

The SIP's were designed to control the 1975 expected potential emission level (5.1 million tons per year) by 46% to the full compliance level of 2.8 million tons per year. Given the decrease in potential emissions, this control should prevent some 2.7 million tons per year of sulfur oxides not under control in 1970. Through 1974, 62% of the 1975 objective had been achieved.

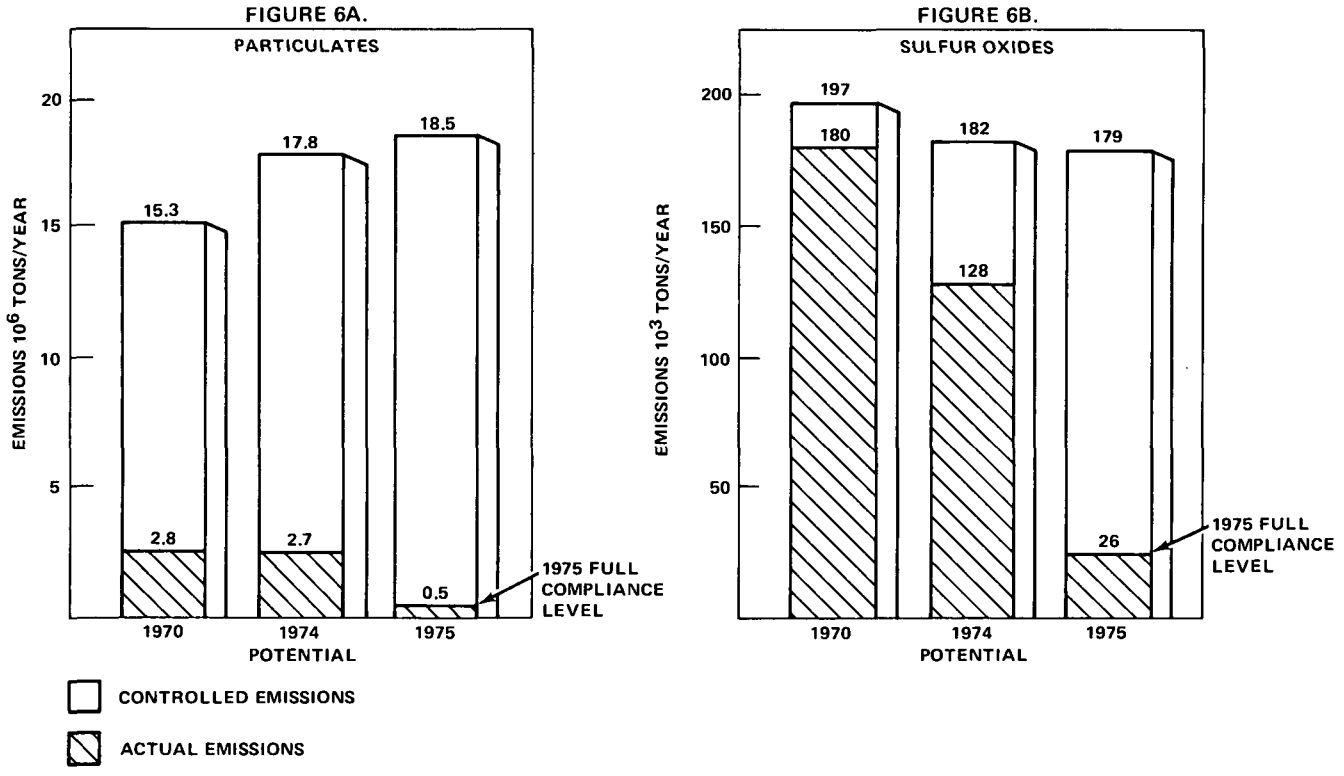
4. Integrated Iron and Steel Mills and Coke Plants.

Integrated iron and steel mills and coke plants accounted for 14% of all actual particulate emissions and less than 1% of all actual sulfur oxide emission in 1974. Figures 6A and 6B illustrate potential and actual particulate and sulfur oxide emissions for 1970 and 1974, and potential and full compliance level emissions for 1975 attainment of the ambient air quality standards.

Particulates - Between 1970 and 1974 potential emissions of particulates increased by 16% (to 17.8 million tons per year in 1974 from 15.3 million tons per year in 1970). Existing abatement programs had achieved an 82% overall degree of control through 1970. By 1974, the overall degree of control of particulates increased to 85% and resulted in a 3% reduction in actual emissions (to 2.7 million tons per year in 1974 from 2.8 million tons per year in 1970). This means that 2.6 million tons per year of particulates are under control that were not under control in 1970.

The SIP's were designed to control 1975 expected potential emissions of 18.5 million tons per year by 97% to the full compliance level of 0.5 million tons per year. Therefore, 5.6 million tons per year of particulates should be controlled in 1975 that were not in 1970. Through 1974, 47% of the required 1975 control has been achieved.

Sulfur Oxides - Between 1970 and 1974 potential emissions of sulfur oxides decreased by 8% (from 197 thousand tons per year in 1970 to 182 thousand tons per year in 1974). Much of the sulfur oxide emissions from steel mills results from the burning of coke oven gas that has not been substantially desulfurized and from coal-fired boilers. Sulfur oxide emissions from boilers are excluded here. Environmental controls installed prior to 1970 had achieved an overall degree of control of 9%. By the end of 1974, the overall degree of control of



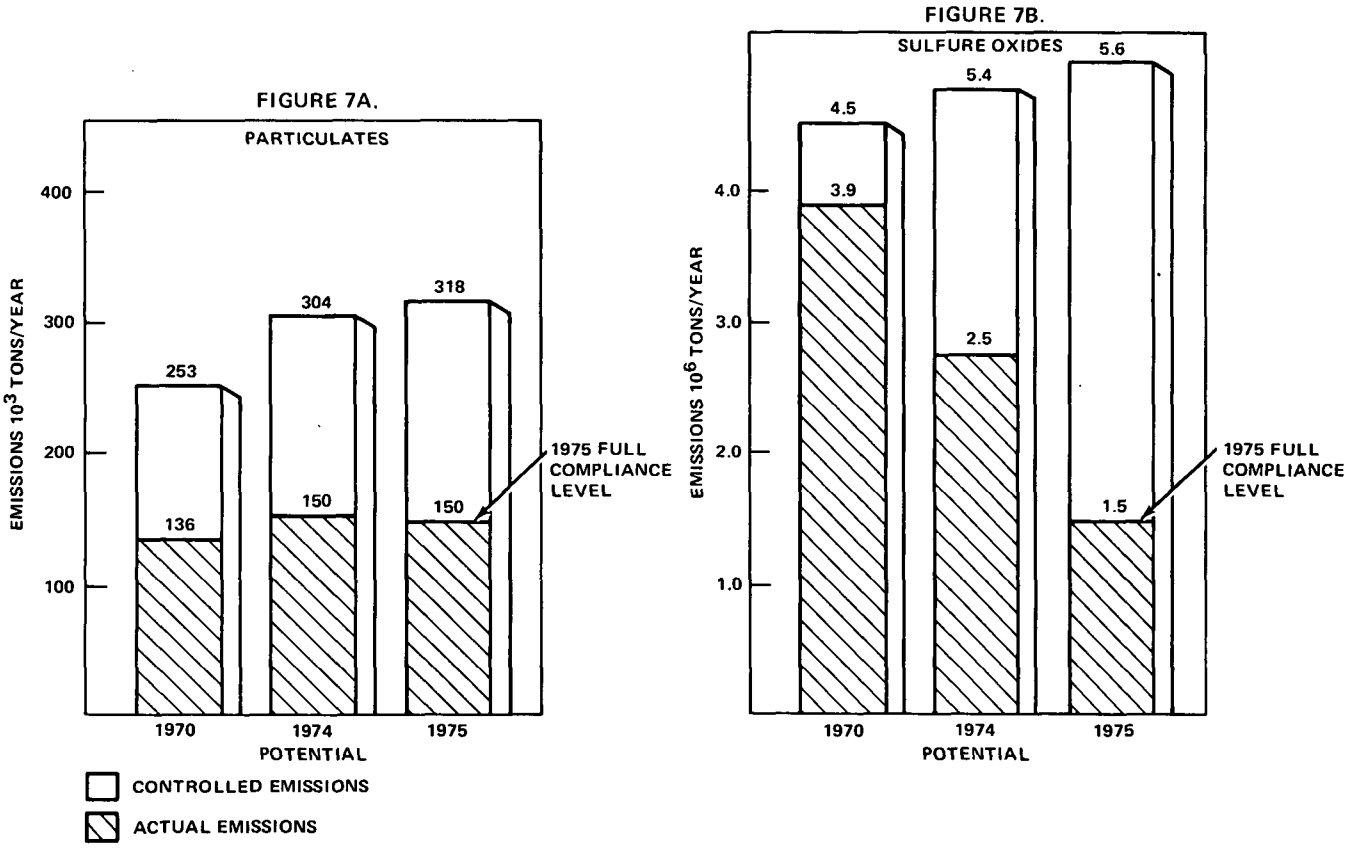
INTEGRATED IRON AND STEEL MILLS AND COKE PLANTS

sulfur oxides increased to 30% and resulted in a 29% reduction in actual emissions (to 128 thousand tons per year in 1974 from 180 thousand tons per year in 1970). This means that 69 thousand tons per year of sulfur oxides are under control that were not under control in 1970.

The SIP's were designed to meet the ambient air quality standards by controlling the 1975 expected potential emission level of 179 thousand tons per year by 85%. This means that 171 thousand tons per year should be under control in 1975 that were not in 1970. Through 1974, 40% of the 1975 objective has been achieved.

5. Petroleum Refineries.

Petroleum refineries accounted for less than 1% of all actual particulate and 8% of all actual sulfur oxides emissions in 1974. Figures 7A and 7B illustrate potential and actual particulate and sulfur oxide emissions from petroleum refineries for 1970 and 1974, and potential and full compliance level emissions for 1975 attainment of the ambient air quality standards.



PETROLEUM REFINERIES

Particulates - Potential emissions of particulates increased by 20% between 1970 and 1974 (to 304 thousand tons per year in 1974 from 253 thousands tons per year in 1970). Pollution control equipment installed prior to 1970 had achieved a 46% overall degree of control by 1970. By 1974, the overall degree of control increased to 51%, but actual emissions also increased by 10% (to 150 thousand tons per year in 1974 from 136 thousand tons per year in 1970). This increase in actual emissions indicates that, although some additional control has been installed, not enough has been added between 1970 and 1974 to reduce the actual emission rate to a level which would offset all the 20% growth in potential emissions. Since some additional control had been installed, 37 thousand tons of particulate were being controlled in 1974 that were not controlled in 1970.

The SIP's were designed to meet the ambient air quality standards in 1975 by controlling expected 1975 potential particulate emissions of 318 thousand tons per year by 53% to 150 thousand tons

per year. Accordingly, 51 thousand tons per year should be under control in 1975 that were not in 1970. Through 1974, 72% of the 1975 control has been achieved.

Sulfur Oxides - Between 1970 and 1974, potential sulfur oxide emissions increased by 20% (to 5.4 million tons per year in 1974 from 4.5 million tons per year in 1970). By 1970, existing environmental programs, including the use of Claus sulfur recovery plants achieved a 13% overall degree of control. By 1974, enough additional sulfur oxides control had been installed to effect a 53% overall degree of control. This means that 2.2 million tons per year of sulfur oxides were being controlled in 1974 that were not under control in 1970.

The SIP's were designed to meet the ambient air quality standards in 1975 by controlling expected 1975 potential sulfur oxide emissions of 5.6 million tons per year by 74% to 1.5 million tons per year. Full compliance in 1975 would therefore result in the control of some 3.6 million tons per year of sulfur oxides not under control in 1970. Through 1974, 63% of the 1975 objective has been achieved.

6. Primary Copper, Lead, Zinc, and Aluminum Smelters

Primary smelters accounted for 1% of all actual particulate and 9% of all actual sulfur oxide emissions in 1974. Figures 8A and 8B illustrate potential and actual particulate and sulfur oxide emissions for 1970 and 1974, and potential and full compliance level emissions for 1975 attainment of the ambient air quality standards.

Particulates - Potential emissions of particulates increased by 24% (to 2.04 million tons per year in 1974 from 1.64 million tons per year in 1970). Emission controls installed prior to 1970 resulted in an overall degree of control of 88% by 1970. By 1974, the overall degree of control had been increased to 90%; not enough to offset the 24% growth and prevent actual emissions from increasing by 10% (from 0.19 million tons per year in 1970 to 0.21 million tons per year in 1974). The added control means that 380 thousand tons per year of particulates are being controlled that were not controlled in 1970.

The SIP's were designed to meet the ambient air quality standards in 1975 by controlling expected 1975 potential particulate emissions of 2.17 million tons/year by 93% to 0.15 million tons per year. Therefore, 575 thousand tons per year of particulates should be controlled in 1975 that were not in 1970. Through 1974, 66% of the 1975 objective has been achieved.

Sulfur Oxides - Potential sulfur oxide emissions increased by 10% (to 5.3 million tons per year in 1974 and 4.8 million tons per year in

FIGURE 8A.

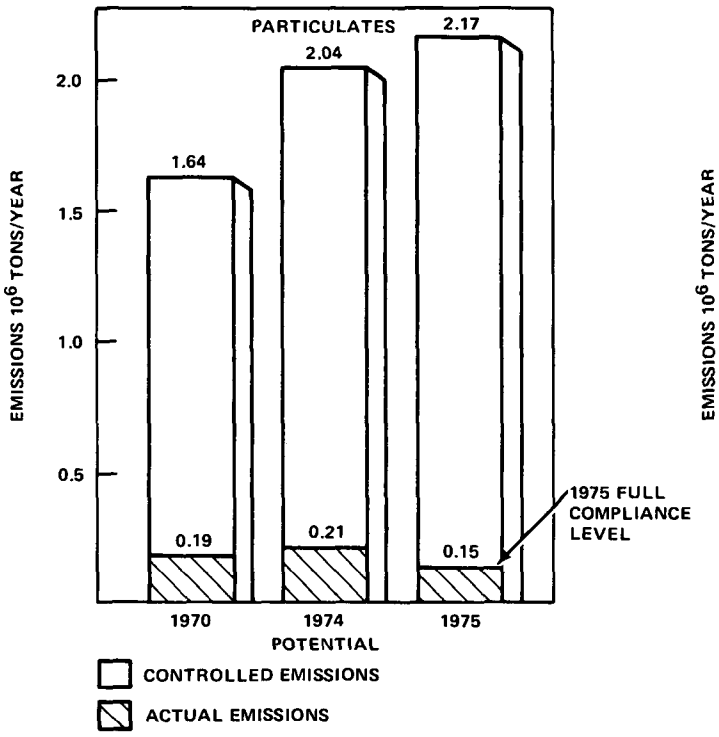
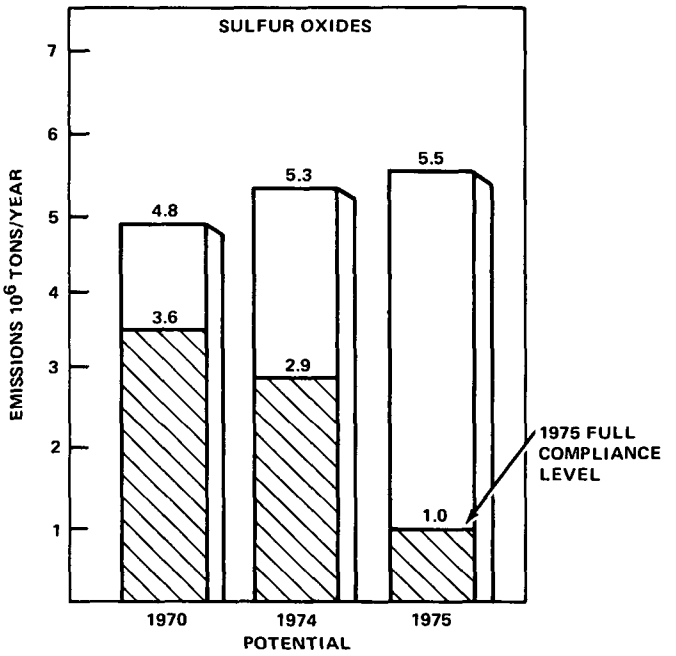


FIGURE 8B.



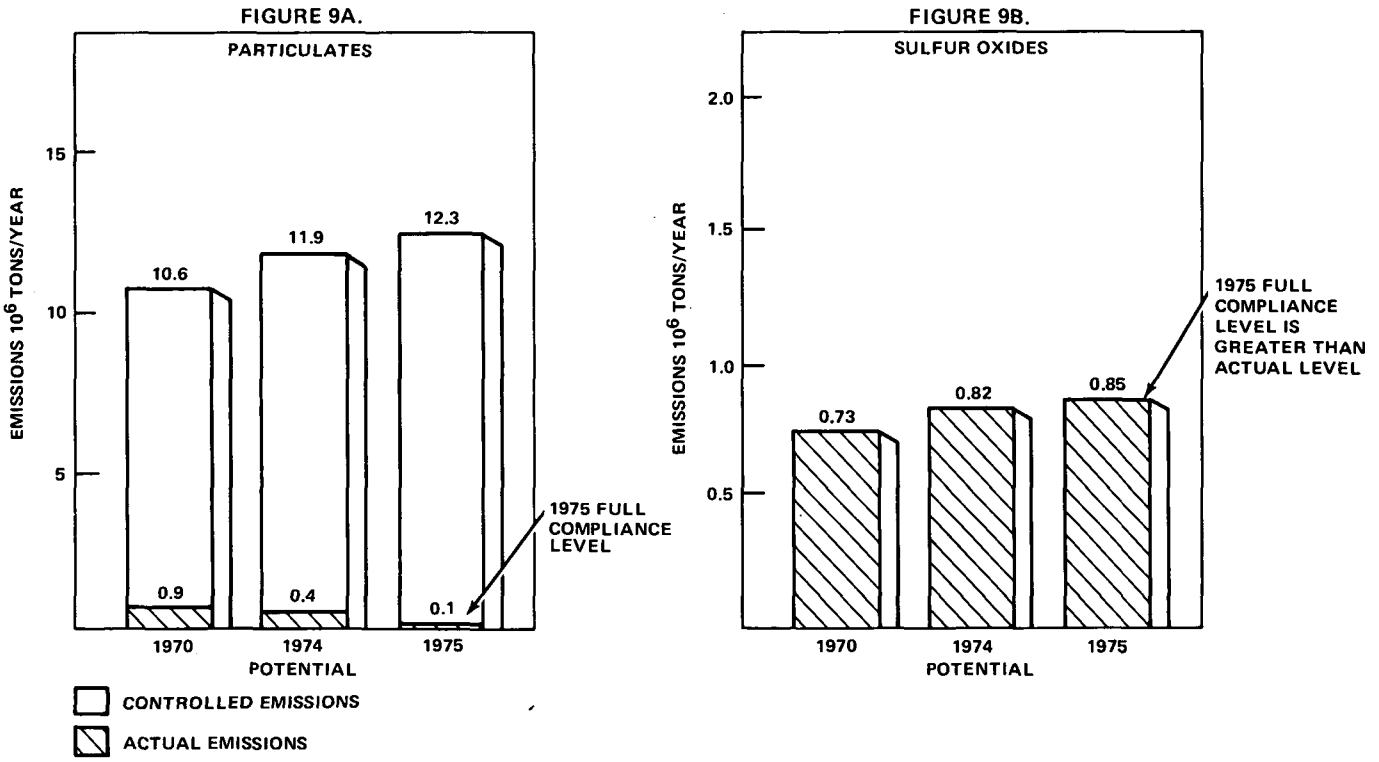
PRIMARY COPPER, LEAD, ZINC, AND ALUMINUM SMELTERS

1970). Existing environmental programs had achieved a 25% overall degree of control by 1970. Control programs increased the overall degree of control for sulfur oxides to 46% in 1974 resulting in a 19% reduction in actual emissions (to 2.9 million tons per year in 1974 from 3.6 million tons per year in 1970). This means that 1.2 million tons per year of sulfur oxides are being controlled that were not under control in 1970.

The SIP's were designed to meet the ambient air quality standards in 1975 by controling expected 1975 potential sulfur oxide emissions of 5.5 million tons/year by 82% to 1.0 million tons per year. Therefore, 3.3 million tons per year of sulfur oxides should be controlled in 1975 that were not controlled in 1970. Through 1974, 36% of the 1975 objective has been achieved.

7. Portland Cement Plants

Portland cement plants accounted for 2% of all actual particulate and 3% of all actual sulfur oxide emissions in 1974. Figures 9A and 9B illustrate potential and actual particulate and sulfur oxide emissions from portland cement plants for 1970 and 1974, and potential and full compliance level emissions for 1975 attainment of the ambient air quality standards.



PORTLAND CEMENT PLANTS

Particulates - Between 1970 and 1974 potential emissions of particulates from portland cement plants increased by 12% (from 10.6 million tons per year in 1970 to 11.9 million tons per year in 1974). Existing environmental programs achieved a 91% overall degree of control by 1970. By 1974, the overall degree of control increased to 97% resulting in a 56% decrease in actual emissions (to 394 thousand tons per year in 1974 from 906 thousand tons per year in 1970).

Therefore, 1.8 million tons per year of particulates were being controlled in 1974 that were not controlled in 1970.

The SIP's were designed to meet the ambient air quality standards by controlling expected 1975 potential emissions of 12.3 million tons per year by 99% to 69 thousand tons per year. Therefore, 2.5 million tons per year should be controlled in 1975 that were not controlled in 1970. Through 1974, 72% of the 1975 objective has been achieved.

Sulfur Oxides - Potential emissions of sulfur oxidesincreased by 12% between 1970 and 1974. Examination of State regulations showed that none of the states accounting for over 75% of the industry had regulations specific to portland cement plants for sulfur oxides and, therefore, requiring a reduction in emissions. Since no control is required, actual emissions were assumed to be uncontrolled and therefore the same as potential for all three years. Although sulfur oxide emissions from portland cement plants appear to require no control when averaged on a national basis, there may be some localized requirements for control where more stringent local regulations apply.

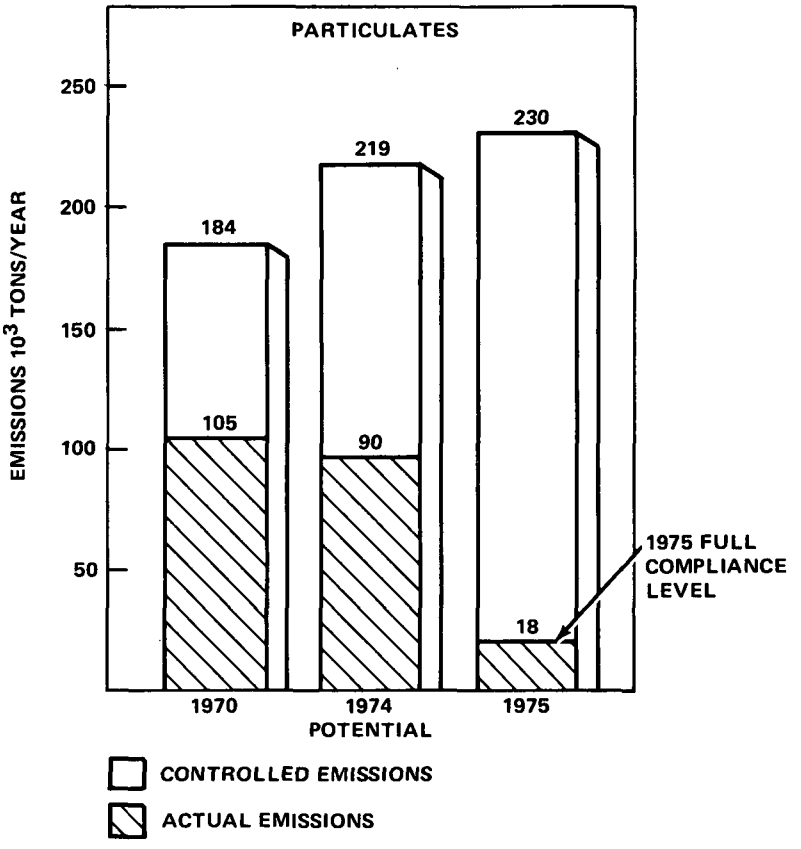
8. Municipal Refuse Incinerators

Municipal refuse incinerators accounted for less than 1% of all actual particulate emissions in 1974. Figure 10 illustrates potential and actual particulate emissions from municipal refuse incinerators for 1970 and 1974, and potential and full compliance level emissions for 1975 attainment of the ambient air quality standards.

Particulates - Potential emissions of particulates from municipal refuse incinerators increased by 19% between 1970 and 1974 (to 219 thousand tons per year in 1974 from 184 thousand tons per year in 1970). By 1970, a 43% overall degree of control had been achieved through existing environmental programs. By 1974, the overall degree of control increased to 59%, resulting in a 14% reduction in actual emissions (to 90 thousand tons per year in 1974 from 105 thousand tons per year in 1970). This means that 50 thousand tons per year of particulates are being controlled that were not under control in 1970.

The SIP's were designed to achieve the ambient air quality standards by controlling 1975 expected potential emissions of 230 thousand tons per year by 92% to 18 thousand tons per year. This means that 133 thousand tons per year of particulates should be controlled in 1975 that were not in 1970. Through 1974, 38% of the 1975 objective had been achieved.

FIGURE 10.



MUNICIPAL REFUSE INCINERATORS

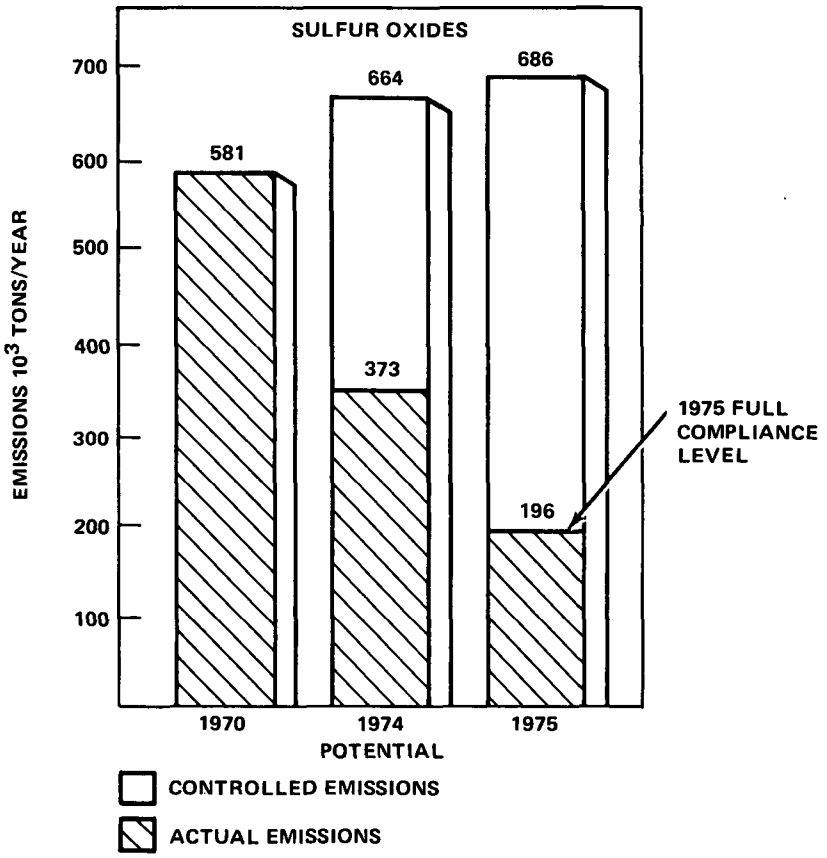
9. Sulfuric Acid Plants

Sulfuric acid plants accounted for 1% of all actual sulfur oxide emissions in 1974. Figure 11 illustrates potential and actual sulfur oxide emissions from sulfuric acid plants for 1970 and 1974, and potential and full compliance level emissions for 1975 attainment of the ambient air quality standards.

Sulfur Oxides - For the base year, 1970, actual emissions were assumed to be the same as potential emissions since sulfur oxide emission control in previous years was accomplished by improved process controls rather than by stack gas cleaning. Potential sulfur oxide emissions from sulfuric acid plants increased by 14% between 1970 and 1974 (to 664 thousand tons per year in 1974 from 581 thousand tons per year in 1970). By 1974, a 44% overall degree of control has been established resulting in a 36% reduction in actual emissions (to 373 thousand tons per year in 1974 from 581 thousand tons per year in 1970). This means that 291 thousand tons per year of sulfur oxides were being controlled in 1974 that were not under control in 1970.

The SIP's were designed to meet the ambient air quality standards in 1975 by controlling expected 1975 potential sulfur oxide emissions by 71% to 196 thousand tons per year. This means that 490

FIGURE 11.



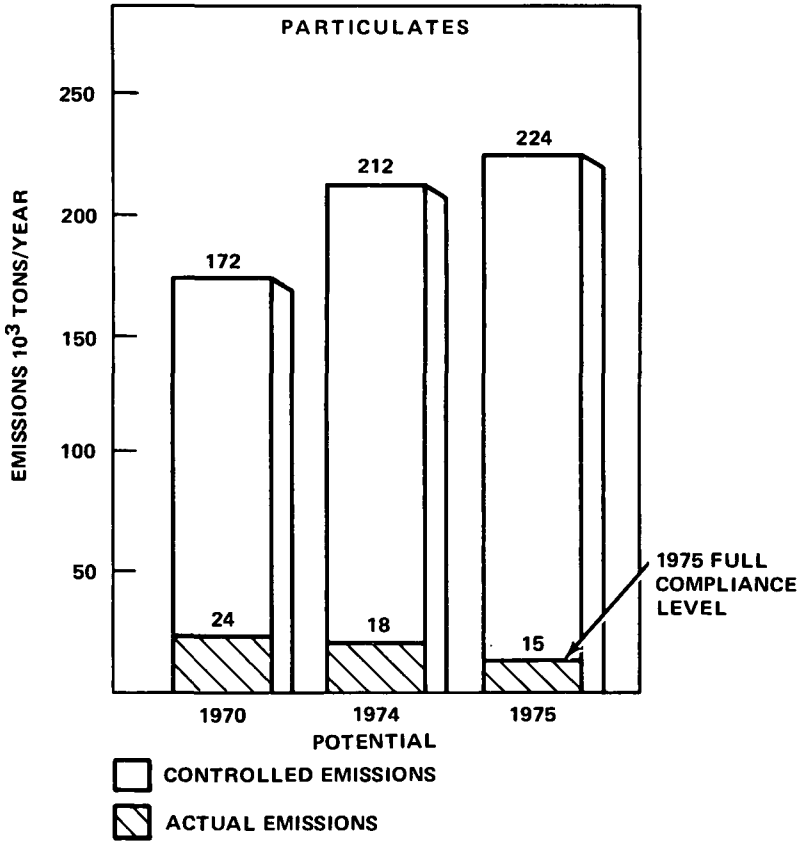
SULFURIC ACID PLANTS

thousand tons per year of sulfur oxides should be under control in 1975 that were not under control in 1970. Through 1974, 59% of the 1975 objective has been achieved.

10. Phosphate Fertilizer Plants

Phosphate fertilizer plants accounted for less than 1% of all actual particulate emissions in 1974. Figure 12 illustrates potential and actual particulate emissions from phosphate fertilizer plants for 1970 and 1974, and potential and full compliance level emission for 1975 attainment of the ambient air quality standards.

FIGURE 12.



PHOSPHATE FERTILIZER PLANTS

Particulates - Potential particulate emissions from phosphate fertilizer plants increased by 23% between 1970 and 1974 (to 212 thousand tons per year in 1974 from 172 thousand tons 1970). By 1970, an 86% overall degree of control had been established through existing environmental programs. By 1974, the overall degree of control increased to 92% resulting in a 25% decrease in actual emissions (to 18 thousand tons per year in 1974 from 24 thousand tons per year in 1970). This means that 46 thousand tons per year of particulates were being controlled in 1974 that were not under control in 1970.

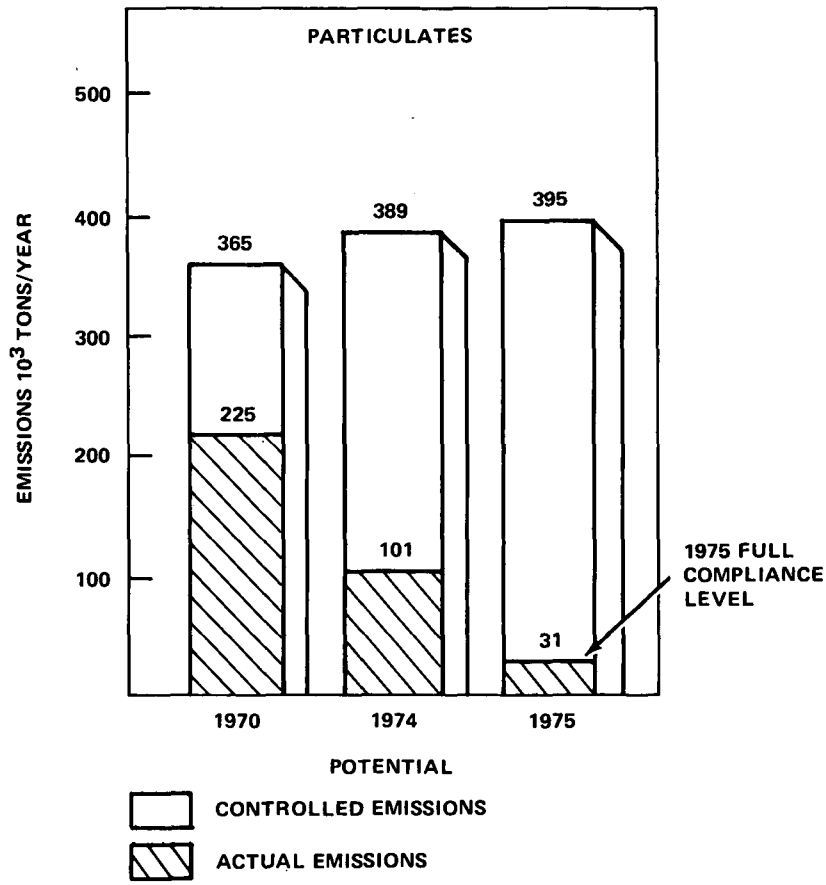
The SIP's were designed to meet the ambient air quality standards in 1975 by controlling expected 1975 potential particulate emissions of 224 thousand tons per year by 93% to 15 thousand tons per year. This means that 61 thousand tons per year of particulates should be under control in 1975 that were not in 1970. Through 1974, 75% of the required 1975 control has been achieved.

11. Ferroalloy Plants

Ferroalloy plants accounted for less than 1% of all actual particulate emissions in 1974. Figure 13 illustrates potential and actual particulate emissions from ferroalloy plants for 1970 and 1974, and potential and full compliance level emissions for 1975 attainment of the ambient air quality standards.

Particulates - Potential particulate emissions from ferroalloy plants increased by 6% between 1970 and 1974 (to 389 thousand tons per year in 1974 from 366 thousands tons per year in 1970). Existing environmental programs had achieved a 38% overall degree of control by 1970. By 1974, this overall control increased to 74% resulting in a 55% decrease in actual emissions (to 101 thousand tons per year in 1974 from 225 thousand tons per year in 1970). This means that 147

FIGURE 13.



FERROALLOY PLANTS

thousand tons per year were being controlled in 1974 that were not under control in 1970.

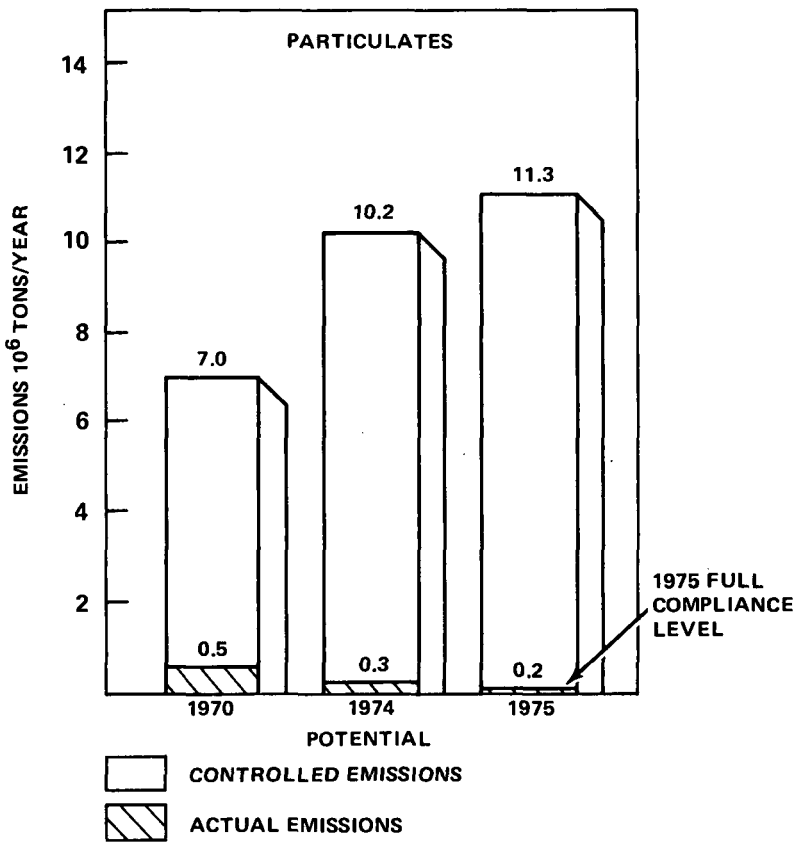
The SIP's were designed to meet the ambient air quality standards in 1975 by controlling expected 1975 potential emissions of 395 thousand tons per year by 92% to 31 thousand tons per year. This means that 233 thousand tons per year of particulates should be controlled in 1975 that were not in 1970. Through 1974, 63% of the required 1975 control has been achieved.

12. Asphalt Concrete Plants

Asphalt concrete plants accounted for 1% of all actual particulate emissions in 1974. Figure 14 illustrates potential and actual particulate emissions from asphalt concrete plants for 1970 and 1974, and potential and full compliance level emissions for 1975 attainment of the ambient air quality standards.

Particulates - Potential particulate emissions from asphalt concrete plants increased by 46% between 1970 and 1974 (to 10.2 million tons

FIGURE 14.



ASPHALT CONCRETE PLANTS

per year in 1974 from 7.0 million tons per year in 1970). Existing environmental programs achieved a 92% overall degree of control by 1970. By 1974, this overall control was increased to 97% resulting in a 45% decrease in actual emissions (to 291 thousand tons per year in 1974 from 526 thousand tons per year in 1970). This means that 3.5 million tons per year were being controlled in 1974 that were not under control in 1970.

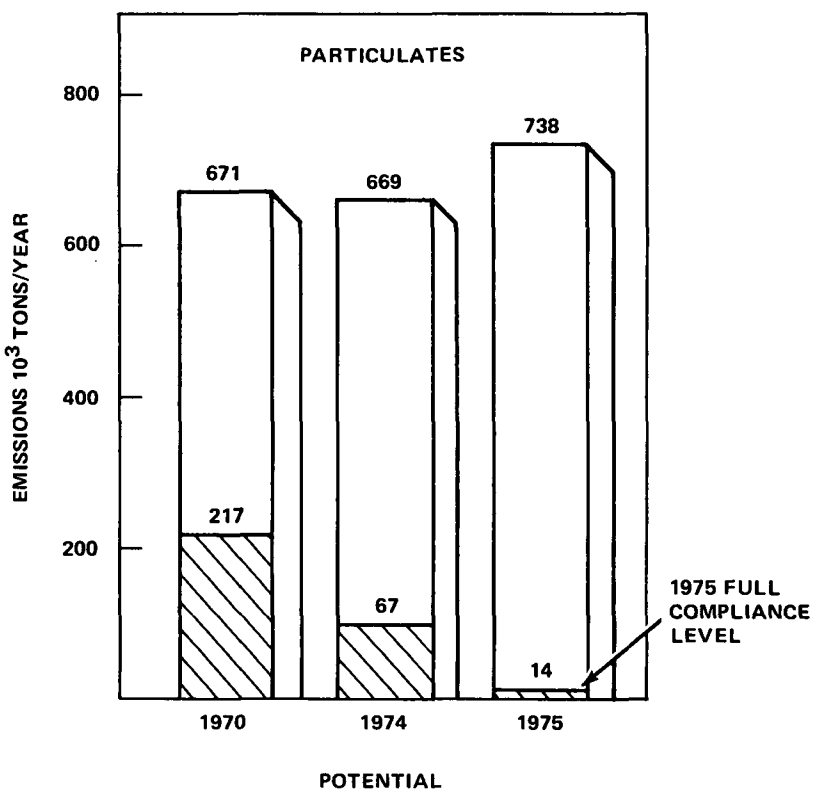
The SIP's were designed to meet the ambient air quality standards in 1975 by controlling expected 1975 potential emissions of 11.3 million tons per year by 98% to 177 thousand tons per year. This means that 4.6 million tons per year of particulate should be controlled in 1975 that were not in 1970. Through 1974, 75% of the required 1975 control has been achieved.

13. Coal Cleaning Plants

Coal cleaning plants accounted for less than 1% of all actual particulate emissions in 1974. Figure 15 illustrates potential and actual particulate emissions from coal cleaning plants for 1970 and 1974, and potential and full complaicne level emissions for 1975 attainment of the ambient air quality standards.

Particulates - Potential particulate emissions from coal cleaning plants decreased by less than 1% between 1970 and 1974 (to 669

FIGURE 15.



COAL CLEANING PLANTS

thousand tons per year in 1974 from 671 thousand tons per year in 1970). Existing environmental porgrams achieved a 68% overall degree of control by 1970. By 1974, this overall control increased to 90% resulting in a 69% decrease in actual emissions (to 67 thousand tons per year in 1974 from 217 thousand tons per year in 1970). This means that 150 thousand tons per year were being controlled in 1974 that were not under control in 1970.

The SIP's were designed to meet the ambient air quality standards in 1975 by controlling expected 1975 potential emissions of 738 thousand tons per year by 98% to 14 thousand tons per year. This means that 270 thousand tons per year of particulates should be controlled in 1975 that were not in 1970. Through 1974, 56% of the required 1975 control has been achieved.

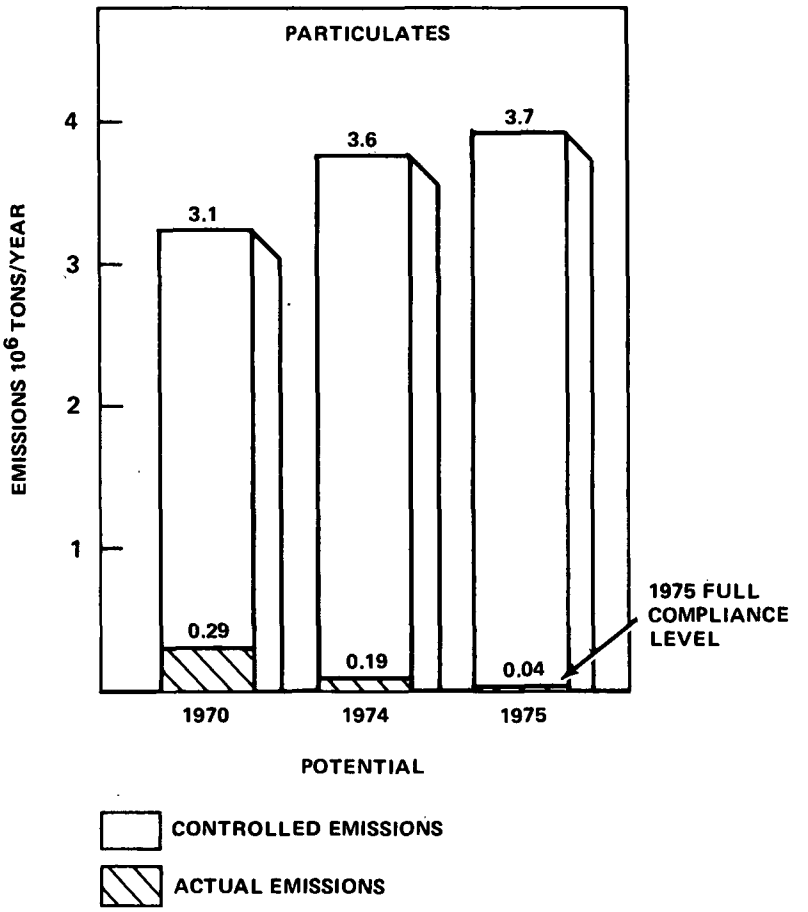
14. Kraft and Sulfite Pulp Mills

Kraft and sulfite pulp mills accounted for 1% of all actual particulate emissions in 1974. Figure 16 illustrates potential and actual particulate emissions from kraft and sulfite pulp mills for 1970 and 1974, and potential and full compliance level emissions for 1975 attainment of the ambient air quality standards.

Particulates - Potential particulate emissions from kraft and sulfite pulp mills increased by 15% between 1970 and 1974 (to 3.6 million tons per year in 1974 from 3.1 million tons per year in 1970). Existing environmental programs achieved a 91% overall degree of control by 1970. By 1974, this overall control increased to 95% resulting in a 33% decrease in actual emissions (to 193 thousand tons per year in 1974 from 288 thousand tons per year in 1970). This means that 565 thousand tons per year were being controlled in 1974 that were not under control 1970.

The SIP's were designed to meet the ambient air quality standards in 1975 by controlling expected 1975 potential emissions of 3.7 million tons per year by 99% to 37 thousand tons per year. This means that 841 thousand tons per year of particulates should be controlled in 1975 that were not in 1970. Through 1974, 67% of the required 1975 control has been achieved.

FIGURE 16.



KRAFT AND SULFITE PULP MILLS

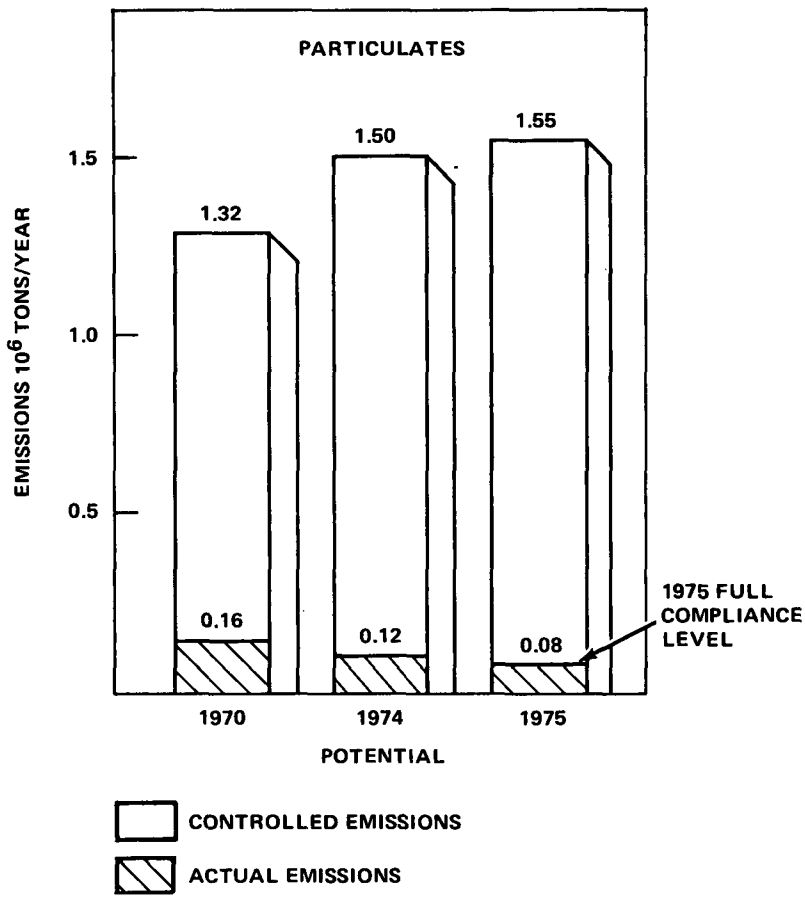
15. Gray Iron Foundries

Gray iron foundries accounted for less than 1% of all actual particulate emissions in 1974. Figure 17 illustrates potential and actual particulate emissions from gray iron foundries for 1970 and 1974, and potential and full compliance level emissions for 1975 attainment of the ambient air quality standards.

Particulates - Potential particulate emissions from gray iron foundries increased by 14% between 1970 and 1974 (to 1.5 million tons per year in 1974 from 1.3 million tons per year in 1970). Existing environmental programs achieved a 88% overall degree of control by 1970. By 1974, this overall control increased to 92% resulting in a 24% decrease in actual emissions (to 119 thousand tons per year in 1974 from 156 thousand tons per year in 1970). This means that 217 thousand tons per year were being controlled in 1974 that were not under control in 1970.

The SIP's were designed to meet the ambient air quality standards in 1975 by controlling expected 1975 potential emissions of 1.5 million tons per year by 95% to 79 thousand tons per year. This

FIGURE 17.



GRAY IRON FOUNDRIES

means that 306 thousand tons per year of particulates should be controlled in 1975 that were not in 1970. Through 1974, 71% of the required 1975 control has been achieved.

APPENDIX A

For each industrial category, the estimated potential emissions for 1970, 1974, and 1975, and estimated actual emissions for 1970 were utilized by EPA for analysis. Based on EPA's assessment of each industry's 1974 compliance status with SIP scheduled emission reductions, EPA calculated the actual emission rates for 1974. These figures provide a gauge for measuring the progress each industry has made since 1970. All emissions calculations were made using production figures, estimates of pollution control factors, and industry growth projections.

Analysis of the industry categories listed indicated that they fall into three general categories: those with a small number of plants (approximately 30 or less) within the United States, those with production capacity concentrated in small number of states, and those that are ubiquitous to the nation. The first category, typified by the primary smelter industry, is analyzed on a plant-by-plant basis using EPA national source inventories, industry background studies, trade associations data, and Department of Commerce data. The second category, exemplified by the petroleum industry and the integrated iron and steel industry, is analyzed by synthesizing the above factors on a national basis using data from states accounting for over 70 percent of the nationwide production. The third category, e.g., municipal incinerators, is analyzed using procedures developed specifically for the industry under study.

Provisions are included for the application of the more stringent requirements of Federal and State New Source Performance Standards (NSPS) to the 1974 and 1975 portion of annual production from new or modified sources. The base year was chosen as 1970 because the national air pollution program as presently constituted dates from the 1970 Clean Air Act amendments. The 1974 data appear because that is the last <u>full</u> year for which data are available. The full compliance target levels should not be considered as representative of existing emissions since they assume full compliance with the State regulations; rather they are target levels that will be met once full compliance with SIP emission requirements is achieved.

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(Please read Instructions on the reverse before completing)

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15. SUPPLEMENTARY NOTES

A report summarizing the progress of the air pollution abatement program

16. ABSTRACT

This report summarizes the results of four years of local, state, federal, and industry efforts to reduce the amount of particulates and sulfur oxides being emitted into the atmosphere by stationary sources of air pollution. Emission reductions for selected industrial categories are summarized and compared to the reduction goal planned for the time period. Results are presented in both graphic and tabular form and are discussed separately for each pollutant and each industry as well as for the nation as a whole.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Pollution Emissions Particles (Air pollution) Sulfur Oxides	Industrial Categories Potential Emissions Actual Emissions Full Compliance Level	13B 14D

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