AIR POLLUTION CONTROL LEGISLATION-

RESEARCH NEEDS

by

Mohd. Rashid Mohd. Yusoff

Department of Chemical Engineering,

Universiti Teknologi Malaysia

KUALA LUMPUR

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Mohd. Rashid Mohd. Yusoff

Department of Chemical Engineering

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ABSTRACT

This paper will outline the important role of research before any particular agency could adopt or impliment the air pollution control legislation or regulation.

In the industrialized countries, the air pollution standard criteria is based on the merit of pollution-health effect relationship, gathered from a profound research findings. Concurrently, the pollution control techniques are frequently updated to suit the needs of more stringent air quality act.

Our responsible agency must also streamline part of its activities in the same manner. The same agency ought to organize, conduct and make use of the local research findings before adopting and implementing any legislation. Only then, the agency can ensure that the regulation is feasible and easily be implimented in the most effective way.

INTRODUCTION

The Environmental Quality Act was enacted in 1974 with the objective to control and prevent pollution and to protect and at the same time to enhance the quality of the environment. Since then, a series of pollution control regulations have been gazetted under the Act which includes the Environmental Quality (Clean Air) Regulation 1978.

The Clean Air Regulation which came into force in October 1978 provides for the control of siting potentially polluting industries and the emission of smoke, particulate and other air impurities which include trace or toxic elements. The emission standards for SO_2 and NO_x from combustion sources are yet to be prescribed in the Act. Table 1 lists the various emission standards prescribed under the Clean Air Regulations. It is believed that many of the emission standards were adopted from other countries standards and the standards were not based on thorough local research findings. Eventhough, it is apt to do so initially, but this must not be allowed to happen for a long-term air pollution control legislation strategies. The very existence of the Environmental Quality Act (1974) thirteen years ago, has not initiated or spelt out any provision on financial aid from the central government to carry out short or long term fundamental research projects with regard to air pollution studies. Perhaps, these studies will give the legislator an up-to-date scientific informations on a particular pollutant that needs to be regulated.

As a comparison, the enactment of the Air Pollution Control Act of 1955 in the United States, has initiated the following actions:

1. Research on the effects of air pollution by the Public Health Service.

2. Provision for technical assistance to the states by the Federal Government.

3. Training of individual in the area of air pollution.

4. In-house and out-of-house research on air pollution control.

It is interesting to note that, the importance of research and development were fully recognized before the act in its very early stage. Heavy reliance of the provision was placed on :

- increased knowledge of the types and amounts of pollution being discharged.

- a better understanding of the meteorological and climatological factors that influence the dispersion of pollutants.

- more sophisticated knowledge of the physical and biological effects of air pollution.

- fuller awareness of the importance and a better understanding of the administrative, legal, social and economic factors involved in the control of air pollution.

It is the aim of this paper to discuss some of the important roles of research and development play in developing an effective air pollution control legislation in Malaysia. The paper hopes to discuss under these two broad topics:

1) Air Quality Criteria and Ambient Air Quality Standards.

2) Emission Standards for Stationary Sources.

1) AIR QUALITY CRITERIA AND AMBIENT AIR QUALITY STANDARD

Legislative Requirements.

The goal of the Clean Air Act is to protect the public health and welfare and enhance the quality of the Nation's air. Under the act, the Federal Government is responsible for establishing, on a nationwide basis ambient air quality standards that are stringent enough to protect the public health with an adequate margin of safety.

The first step in establishing an ambient air quality standards is a finding by the responsible agency (i.e. Dept. of Environment) that a particular pollutant causes or contributes to air pollution which may reasonably be anticipated to endanger the public health and welfare. In this case the agency ought to issue a kind of air quality criteria document which will form the scientific basis for the ambient air quality standard. This document should contain the latest scientific knowledge useful in indicating the kind and extent of all identifiable effects on public health and welfare.

Establishing the latest scientific knowledge based on the experienced experts on the qualitative and quantitave relationship between various level of exposure to pollutants and the short and long term effects on health and welfare requires a tremendous amount of money, time and research efforts. Many of the developing countries are not willing to commit themselves in this aspect partly because the air quality criteria is already well established in the more developed countries. As an example of air quality criteria for sulfur dioxide found in the United States is given in Table 2. The air quality criteria later will act as a basis in establishing the ambient air quality standards. The US National Ambient Air Quality Standards and its standard setting process are given in Table 3 and Figure 1 respectively. As shown in Figure 1, the scientific research informations serve as the fore-most and the most important input in the development of the ambient air quality standards setting process itself. Besides, the US Environmental Protection Agency (USEPA) also has its own Science Advisory Board (SAB) which acts as an independant body consisting of scientists and engineers with substantial scientific and technical expertise. Its function is to provide critical review of scientific matters before the Agency. This is to ensure that the regulation has been given its due considerations in all dimensions.

Considerations in Establishing Air Quality Standards.

To date, there is no National Ambient Air Quality Standards for this country. So far the Department of Environment (DOE) has always refer to guidelines for certain pollutants standards which are solely based on the US standards (Table 3). Even though this may be a good start, but a proper methodology and systematic approach should be considered from now in developing our future ambient air quality standards. A simple and practical approach suggested by the author is given schematically in Figure 2. This approach is certainly not the only rational way in which ambient air quality standards can be achieved in this country, although it seems to be the most scientifically and technically sound. The proposed methodology can be summarized as follows:

<u>Established Scientific Informations</u> - is the latest scientific knowledge available with respect to the pollution health-effect relationship. Some of these pollutants may be considered; particulate matter, SO_2, NO_x, Volatile organic hydrocarbon, photochemical oxidants, lead etc. These informations are well documented elsewhere and only literature survey is needed to compile them systematically.

<u>Identification and Application</u> - is to identify whether these informations are relevant to our local situation. Preliminary survey on the existence of some of these pollutants is warranted.

<u>Monitoring & Studies</u> - this is the most important stage after the identification process. A consistent and systematic monitoring program should now be carried out to get the most reliable and presentative data which include the baseline data. Bulk of the research work will lie in this stage.

<u>Interpretation or Conclusion</u> - is the interpretation of results obtained from the monitoring stage. These results are again compared with the established scientific information and if necessary with other supplementary research findings. A critical scientific review is needed to interpret these findings. Inadequate judgement will require more studies to be conducted. After all the considerations and comparative studies are thoroughly made, air quality standards are then proposed for public and scientific community to review and comment before the final promulgation stage.

At this point, one could see clearly that concerted research efforts are required to set up the Malaysia National Ambient Air Quality Standards. There may be other alternative methods which can still be used to achieve the same goal. But for whatever method is suggested, the proposed standards should reflect the reality in our local scene.

2) EMISSION STANDARDS FOR STATIONARY SOURCES

Definition.

An emission standard is a limit on the amount of pollutant which can be emitted from a source and is intended to bring the concentration of the pollutant in the ambient air within acceptable ambient air quality standards. Ambient air quality standards are maximum desired levels of pollution in the outdoor air established by responsible agency as legal regulation. In this respect, the level of pollution in a given region will reflect the effectiveness of the air pollution control legislation imposed (through emission standard) on pollution sources. Therefore, a sound and effective emission standards should be drawn to prevent air pollution in short and long-term air pollution control strategies.

Clean Air Regulation 1978.

In the Clean Air Regulation (1978), the emission standards for point sources vary from a common to a very specific ones. As an example of common emission standards is given in regulation 25 which states:

> "In any trade, industry, process, fuel burning equipment or industrial plant (other than plant or equipment used for the heating of metals) in the operation of which dust or other solid particles are emitted, the concentration at any point of any smoke, soot, dust ash (including flyash) cinders, cement, lime, alumina, grit or other solid particles before admixture with air, smoke or other gases does not exceed Standard A : Ø.6, Standard B : Ø.5, Standard C : Ø.4 gramme in each normal cubic meter of effluent gases".

A common emission standard like the one above may give more advantages for the small plants and disadvantages for the big plants. The regulation above allows approximately 8Ø% control for small sources, 9Ø% control for medium size processes and as much as 99.9% for very large plants. Ideally, each type of industry should has its own emission standard instead of setting one rate for all of them. This is due to the fact that the degree of difficulty of control is not the same for each type of source.

Therefore, Malaysia has to design and review from time to time a meaningful and effective air pollution control legislation program for existing and new pollution sources. A good example of air pollution control legislation program is to develop what is known as New Standards of Performance for Stationary sources (NSPS). This approach has been developed by the USEPA not long ago. The main focus of the regulation is on new and primarily on large new sources of particulate matter, SO_2 and NO_x emissions. The objective of the NSPS is to prevent new air pollution problems in the short-run and result in long term improvement in the air quality as existing plants are replaced with new ones. A summary of NSPS for fossil fuel fired steam and electric steam generator is given in Table 4. In NSPS, the emission control for all affected facilities were based on Best Demonstrated Technology (BDT) approach. Therefore, NSPS is designed to ensure that the new stationary sources are designed, built, equipped, operated and maintained to maximize emission control in the most effective manner. Certainly, a tremendous amount of research works were required to develop this particular program and this can clearly be seen in the procedure for the development of the standard of performance itself as in Figure 3.

CLOSING REMARKS

Similarly, our responsible agency will have to streamline part of its activities on this line. A number of research projects can be carried out to properly organize our air pollution control legislation strategy.

The agency should establish, initiate and accelerate a national research and development program for the prevention and control of air pollution. As part of this program the agency shall: 1) conduct, and promote the coordination and acceleration of research, investigations, experiments, demonstrations, surveys and studies relating to the causes, effects, extent, prevention and control of air pollution. 2) establish technical advisory committees composed of recognized experts in various aspects of air pollution to assist in the examination and evaluation of research progress and proposals and to avoid duplication of research and 3) most importantly, to make grants or provide financial aids (may be through Federal Government) to other public or non-profit private agencies, institutions, organizations and to individuals for research purposes.

In this light, it is hope that our existing clean air resources will be preserved and protected consistently with the economic growth of our country.

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Table I

EMISSION STANDARDS FOR AIR IMPURITIES

Source: Environmental Quality (Clean Air) Regulations 1978
PU (A) 280 Pgs. 745 - 747

Substance Emitted	Source of Emission	Standards		
1. Solid particles concentration in the heating of metals		Standard A: 0.3 gm/Nm^3 Standard B: 0.25 gm/Nm^3 Standard C: 0.2 gm/Nm^3		
2. Solid particles concentration in other operations		Standard A: 0.6 gm/Nm^3 Standard B: 0.5 gm/Nm^3 Standard C: 0.4 gm/Nm^3		
3. Metals and metallic compounds.		Std. A gm/Nm^3	Std. B gm/Nm^3	Std. C gm/Nm^3
Mercury		0.02	0.01	0.01
Cadmium		0.025	0.015	0.015
Lead		0.04	0.025	0.025
Antimony		0.04	0.025	0.025
Arsenic		0.04	0.025	0.025
Zinc		0.15	0.1	0.1
Copper		0.15	0.1	0.1

Substance Emitted	Source of Emission	Standards
4. (a) Acid Gases	Manufacture of sulphuric acid	1. Equivalent of: Standard A: 7.5 Standard B: 6.0 Standard C: 3.5 gramme of sulphur trioxide /Nm^3 of effluent gas. 2. Effluent gas free from persistent mist.
(b) Sulphuric acid mist or sulphur trioxide or both	Any source other than combustion process and plant for manufacture of sulphuric acid as in (a) above.	1. Equivalent of: Standard A: 0.3 Standard B: 0.25 Standard C: 0.2 gramme of sulphur trioxide/ Nm^3 of effluent gas. 2. Effluent gas free from persistent mist.
(c) Chlorine gas	Any source	Standard A: 0.3 Standard B: 0.25 Standard C: 0.2 gramme of hydrogen chloride/Nm^3
(d) Hydrogen chloride	Any source	Standard A: 0.6 Standard B: 0.5 Standard C: 0.4 gramme of hydrogen chloride/Nm^3
(e) Fluorine, hydroflouric acid, or inorganic fluorine compound	Manufacture of aluminium from alumina	Equivalent of: Standard C: 0.02 gramme of hydrofluoric acid/Nm^3 of effluent gas.
(f) Fluorine, hydroflouric acid, or inorganic fluorine compound	Any source other than manufacture of aluminium from alumina as in (e) above	Equivalent of: Standard A: 0.15 Standard B: 0.125 Standard C: 0.100 gramme of hydrofluoric acid/Nm^3 of effluent gas

Substance Emitted	Source of Emission	Standards		
(g) Hydrogen sulphide	Any source	Standard A: 6.25 Standard B: 5.00 Standard C: 5.00 parts per million volume for volume		
(h) Oxides of nitrogen	Manufacture of nitric acid	Equivalent of: Standard A: 4.60 Standard B: 4.60 Standard C: 1.7 and effluent gas substantially colourless gm. of sulphur trioxide/Nm^3		
(i) Oxides of nitrogen	Any source other than Combustion processes and manufacture or nitric	Equivalent of: Standard A: 3.0 Standard B: 2.5 Standard C: 2.0 gramme of sulphur trioxide/Nm^3.		
5. Dust and solid particles		Std. A gm/Nm^3	Std. B gm/Nm^3	Std. C gm/Nm^3
	ASPHALT CONCRETE PLANT			
	Stationary plant	0.5	0.4	0.3
	Mobile Plant	0.7	0.7	0.4
	PORTLAND CEMENT PLANT			
	Kiln	0.4	0.2	0.2
	Clinker, cooler finish grinding and others	0.4	0.2	0.1
6. Asbestos and Free silica		0.4	0.2	0.12

TABLE 2

United States Ambient Air Quality Criteria for Sulfur Dioxide

Concentration of sulfur dioxide in air (ppm)	Exposure	Human symptoms and effects on vegetation
400	—	Lung edema; bronchial inflammation
20	—	Eye irritation; coughing in healthy adults
15	1 hr	Decreased mucociliary activity
10	10 min	Bronchospasm
10	2 hr	Visible foliar injury to vegetation in arid regions
8	—	Throat irritation in healthy adults
5	10 min	Increased airway resistance in healthy adults at rest
1	10 min	Increased airway resistance in asthmatics at rest and in healthy adults at exercise
1	5 min	Visible injury to sensitive vegetation in humid regions
0.5	10 min	Increased airway resistance in asthmatics at exercise
0.5	—	Odor threshold
0.5	1 hr	Visible injury to sensitive vegetation in humid regions
0.5	3 hr	United States National Secondary Ambient Air Quality Standard promulgated in 1973[b]
0.2	3 hr	Visible injury to sensitive vegetation in humid regions
0.19	24 hr[a]	Aggravation of chronic respiratory disease in adults
0.14	24 hr	United States National Primary Ambient Air Quality Standard promulgated in 1971[b]
0.07	Annual[a]	Aggravation of chronic respiratory disease in children
0.03	Annual	United States National Primary Ambient Air Quality Standard promulgated in 1971[b]

[a] In the presence of high concentrations of particulate matter.

[b] Expected to be superseded by revised standards.

Sources: Air Quality Criteria for Particulate Matter and Sulfur Oxides, final draft, United States Environmental Protection Agency, Research Triangle Park, N.C., December 1981; Review of the National Ambient Air Quality Standards for Sulfur Oxides: Assessment of Scientific and Technical Information, Draft OAQPS Staff Paper, United States Environmental Protection Agency, Research Triangle Park, N.C., April 1982.

TABLE 3: NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Primary Standards	Averaging Time	Secondary Standards
Carbon monoxide	10 mg/m^3 40 mg/m^3	8-hour[a] 1-hour[a]	Same as primary
Hydrocarbons (Non-methane)	160 $\mu g/m^3$	3-hour[a] (6 to 9 a.m.)	Same as primary
Lead	1.5 $\mu g/m^3$	Quarterly average	Same as primary
Nitrogen oxides	100 $\mu g/m^3$	Annual (arithmetic mean)	Same as primary
Particulate Matter (TSP)	75 $\mu g/m^3$ 260 $\mu g/m^3$	Annual (geometric mean) 24-hour[a]	60 $\mu g/m^3$ [b] 150 $\mu g/m^3$
Ozone	235 $\mu g/m^3$	1-hour[c]	Same as primary
Sulfur oxides	80 $\mu g/m^3$ 365 $\mu g/m^3$ ---	Annual (arithmetic mean) 24-hour[a] 3-hour[a]	--- --- 1300 $\mu g/m^3$

[a]Not to be exceeded more than once per year.

[b]Guide to achieving the 24-hour standard.

[c]The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 235 $\mu g/m^3$ is equal to or less than 1.

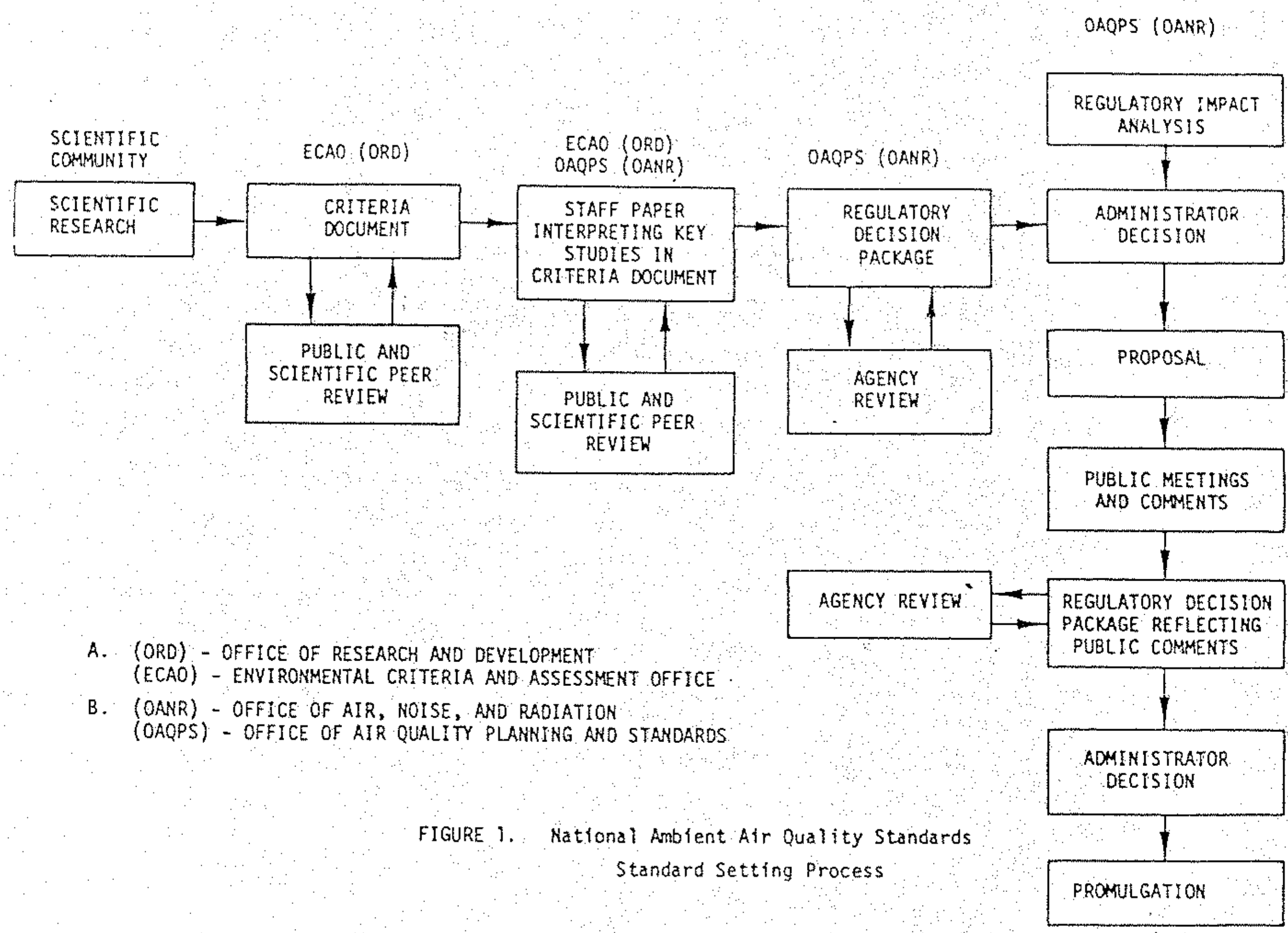


FIGURE 1. National Ambient Air Quality Standards Standard Setting Process

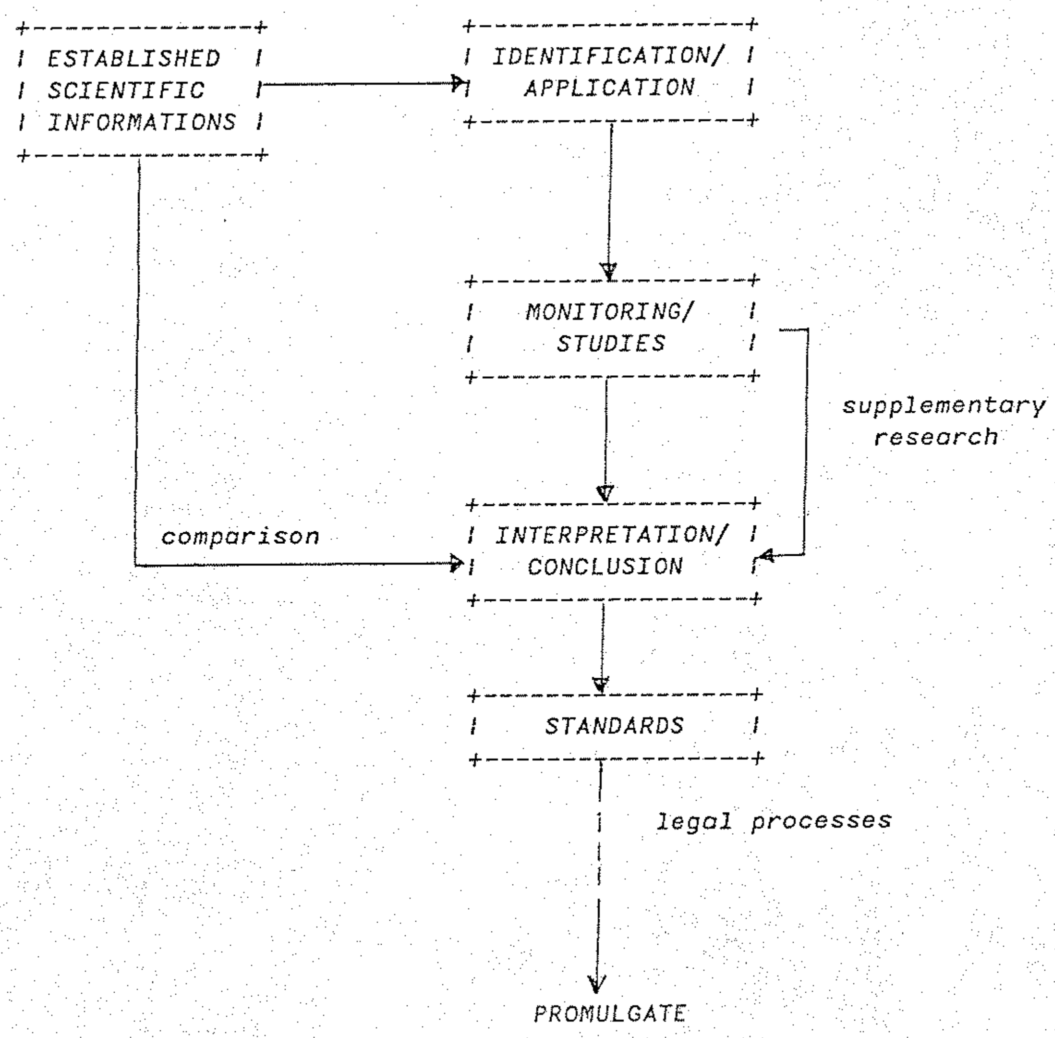


Figure 2 : The Proposed Methodology

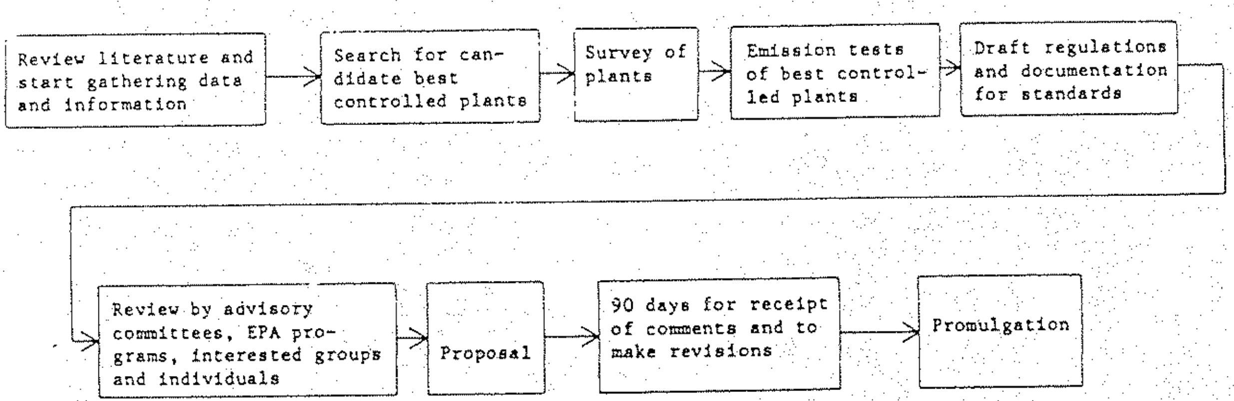
TABLE 4

A Summary of New Source Performance Standards Promulgated through February 1983.

Source category	Affected facility	Pollutant	Emission level	Monitoring requirement
Subpart D: Fossil fuel fired steam generators for which construction is commenced after August 17, 1971				
Proposed/effective 8/17/71 (36 FR 15704) *Promulgated*	Coal, coal/wood residue fired boilers >250 million Btu/h	Particulate Opacity SO_2 NO_x	0.10 lb/10^6 Btu 20%; 27% 6 min/h[a] 1.2 lb/10^6 Btu 0.70 lb/10^6 Btu	No requirement Continuous Continuous[b] Continuous[b]
12/23/71 (36 FR 24876) *Revised* 7/26/72 (37 FR 14877)	Oil, oil/wood residue fired boilers >250 million Btu/h	Particulate Opacity SO_2 NO_x	0.10 lb/10^6 Btu 20%; 27% 6 min/h 0.80 lb/10^6 Btu 0.30 lb/10^6 Btu	No requirement Continuous Continuous[b] Continuous[b]
10/15/73 (38 FR 28564) 6/14/74 (39 FR 20790) 1/16/75 (40 FR 2803)	Gas, gas/wood residue fired boilers >250 million Btu/h	Particulate Opacity NO_x	0.10 lb/10^6 Btu 20%; 27% 6 min/h 0.20 lb/10^6 Btu	No requirement Continuous[b] Continuous[b]
10/6/75 (40 FR 46250) 12/22/75 (40 FR 59204) 11/22/76 (41 FR 51397) 1/31/77 (42 FR 5936) 7/25/77 (42 FR 37936)	Mixed fossil fuel fired boilers >250 million Btu/h	Particulate Opacity SO_2 NO_x (except lignite or 25% coal refuse)	0.10 lb/10^6 Btu 20%; 27% 6 min/h Prorated Prorated	No requirement Continuous Continuous[b] Continuous[b]
8/15/77 (42 FR 41122) 8/17/77 (42 FR 41122) 12/5/77 (42 FR 61537) 3/3/78 (43 FR 8800) 3/7/78 (43 FR 9276) 1/17/79 (44 FR 3491) 6/11/79 (44 FR 33580) 12/28/79 (44 FR 76786) 2/6/80 (45 FR 8211) 5/29/80 (45 FR 36077) 7/14/80 (45 FR 47146) 11/13/81 (46 FR 55975) 11/24/81 (46 FR 57497) 1/15/82 (47 FR 2314) *BID* EPA 450/3-79-021 EPA 450/2-76-030a&b	Lignite, lignite/wood residue >250 million Btu/h	Particulate Opacity SO_2 NO_x (as of 12/22/76)	0.10 lb/10^6 Btu 20%; 27% 6 min/h 1.2 lb/10^6 Btu 0.60 lb/10^6 Btu 0.80 lb/10^6 Btu for ND, SD, MT lignite burned in cyclone-fired unit	No requirement Continuous Continuous[b] Continuous[b]

Source category	Affected facility	Pollutant	Emission level	Potential combustion concentration	Reduction of potential combustion concentration, %	Monitoring requirement
Subpart Da: Electric utility steam generating units for which construction is commenced after September 18, 1978	Boilers >73 MW >250 million Btu/h) firing solid and solid derived fuel	Particulate	13 ng/J (0.03 lb/million Btu)	3000 ng/J (7.0 lb/million Btu)	99	No requirement
		Opacity	20%; 27% 6 min/h			Continuous
		SO_2	520 ng/J (1.20 lb/million Btu)	See 60.48a(b)	90	Continuous
			or <260 ng/J (0.60 lb/million Btu)	See 60.48a(b)	70	Continuous

[a] Exceptions, see 60.42(b).
[b] Exceptions, see standards.



Procedure for Development of Standards of Performance

Figure 3