ADVANTAGES AND DISADVANTAGES OF AIR QUALITY STANDARDS

P. D. Kalabokas
Research Centre for Atmospheric Physics and Climatology, Academy of Athens, Greece

M.N. Christolis and **N.C. Markatos**
National Technical University of Athens, Chemical Engineering Dept., Computational Fluid Dynamics Unit, Greece.

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Summary

There are major air pollution philosophies on which almost all air pollution regulations are based, either directly or indirectly. These are the emission standard and the air quality standard philosophies. The basic idea of the emission standard philosophy is that there is some maximum possible degree of emission control, and when this maximum degree of control could be determined for each class, and every member of that class is required to limit emissions to this maximum degree possible, then the pollutant emission rate will be the lowest possible. The cost-effectiveness of the emission standard philosophy is quite poor but its simplicity and the enforceability is excellent. In contrast to the emission standard philosophy, which can be characterized as the "cleanest possible air" philosophy, as discussed above, the air quality standard philosophy can be characterized as the "zero-damage" philosophy. The air quality standard philosophy is based on the assumption that the true situation for most major air pollutants is the threshold value situation. The cost-effectiveness of the air quality standard philosophy is good but not excellent. The flexibility of the air quality standard philosophy, as well as, the evolutionary ability is fair.

1. Air pollution control philosophies

The major theoretical target of air pollution abatement efforts is to achieve a completely unpolluted environment at no cost. Due to the fact that this target cannot be possibly fulfilled, the realistic goal is to have an appropriately clean environment, obtained at a reasonable cost, with the latter being appropriately distributed among industry, car owners, homeowners, and other pollutant sources. An air pollution control philosophy is a fundamental set of ideas about how one determines what constitutes an appropriately clean environment, an appropriate cost and an appropriate distribution of that cost.

A perfect air pollution philosophy and its implementing regulations should be cost-effective, simple, enforceable, flexible and evolutionary. A cost effective philosophy gains the maximum possible benefits (reduced damages or discomforts) for the sources expended on pollution control. A simple philosophy and its implementing regulations are understandable to all involved in the pollution control effort and do not require legal interpretation of every word of the laws and regulations. An enforceable philosophy clarifies the responsibilities of all parties involved, in a way that courts of law will enforce. A flexible philosophy can deal with special difficulties, such as control equipment breakdown and delays in control equipment delivery. An evolutionary philosophy should enable the utilization of new information on the effects of pollution and of new developments in control technology without major overhauls of our legal structure or major revisions of existing industrial plants. The two major air pollution philosophies on which almost all air pollution regulations are based directly or indirectly on are the emission standard and the air quality standard philosophies.

2. General Characteristics of the Emission Standard Philosophy

The basic idea of the emission standard philosophy is that there is some maximum possible (or practical) degree of emission control. This degree varies among various classes of emission sources like automobile traffic or industries. If the maximum degree of control could be determined for each class, and every member of that class is required to limit emissions to this maximum degree possible, then the pollutant emission rate will be the lowest possible. Because emission rate and air quality are closely related, it follows that if this philosophy is carried out rigorously we will have the cleanest possible air. Thus, this might be called the “cleanest possible air” philosophy.

The first large-scale application of this philosophy was the Alkali Acts in England in 1863. In the original form of the Leblanc process for manufacturing soda ash, the hydrochloric acid byproduct was emitted from the chimney of the factory as a vapor or mist. This emission destroyed the vegetation downwind and led to the introduction of pollution restriction legislation. According to the new legislation a new organization was formed “The Alkali Inspectorate” whose duty was to inspect regularly all alkali plants and find the best techniques for minimizing the emission of harmful air pollutants. Once a technique had been shown to be effective in one plant, the inspectors forced all the other plants to adopt it. Thus, the emission limitations were steadily made more stringent as the control technology was improving and each member of the class was obliged to meet the same emission standard as the cleanest member of the group. This application is called the best technology type of emission standard because all members of a group are required to use the best technology currently available for controlling emissions and to keep the control equipment in good operating condition. In this type of regulation there is generally no specified emission rate or emission test. The operator who installs and operates properly the “best technology” is deemed to be complying with the regulation. The best technology approach is still widely used in cases where the determination of the emission rate is difficult like, for example, in large gasoline storage tanks.

The prohibition against open burning of garbage and agricultural wastes is a kind of emission standard, because open burning generates more pollutants per unit of waste than landfill, closed incineration, recycling or composting. Visible emissions from stacks, particularly from coal-burning furnaces, are indicative of emissions of suspended atmospheric particles. Regulations limiting these emissions are a form of emission standard like the Ringelman test for visible emissions.

Fuel sulfur content and gasoline olefin content maxima, as well as gasoline oxygen content minima, are also emission standards, because most of the sulfur in fuels enters the atmosphere as sulfur dioxide, because olefins are more effective in causing photochemical smog than equivalent amounts of other hydrocarbons, and because automobiles using oxygen-containing gasolines emit less carbon monoxide than those using other gasoline types.

All the above kinds of emission standards are based on the same general idea: there is some degree of emission control that is practical to impose upon all members of a well-defined class of emission sources, and that degree of control is required of all members of that class.

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Biographical Sketches

Dr. Pavlos Kalabokas obtained his first degree in Physics from the University of Athens, Greece, in 1983, followed by the Masters and Ph.D degrees in Air Pollution Chemistry from the University of Paris VII, France, during 1983-87. The topic of his research was "sampling and analysis of carbonyl compounds in the atmosphere of Paris, France".

He was a visiting scientist to the German Research Center KFA-Julich, Institute of Chemistry of Polluted Atmospheres, during 1987-1988, and to the German Research Center KFA-Julich, Institute of Applied Physical Chemistry, during 1989-1990. During 1991-1993 he was Research Associate at the Laboratory of Meteorology of the University of Athens working on the vertical measurements of tropospheric and stratospheric ozone over Athens. During 1994-1997 he was Research Associate at the Environmental Research Laboratory of the Greek National Center of Scientific Research "Demokritos" working on the analysis of air pollution data in Athens using atmospheric models.

Since 1997 Dr. Kalabokas has been an elected Researcher at the Research Center for Atmospheric Physics and Climatology, Academy of Athens, studying urban air pollution in Athens; rural ozone levels around Athens; atmospheric pollution around refineries; and air quality in the area of the proposed new airport of Athens (the NTU Athens project).

To date Dr. Kalabokas has published over 65 papers on the above research topics. His other scientific activities include review of papers for international scientific journals on environmental pollution, and review of research projects in the European Union. He is a member of the Greek Committee on Environmental Pollution problems.

Dr. Michael Christolis is a Civil Engineer specializing in environmental science and technology. Currently he is working as a research collaborator at the National Technical University of Athens (NTUA), Greece, on the mathematical modeling of environmental problems. He has so far accumulated twenty years of experience in air quality monitoring, pollutant dispersion modeling, assessment of the impacts of industrial accidents, design of emergency systems, and implementation of the Seveso Directive in Greece.

During 1983-1988 he was the Head of the Laboratory for the Air Quality Monitoring Network for the City of Athens. In 1988 he joined the Computational Fluid Dynamics Unit (CFDU) of the Chemical Engineering Department of the NTUA, working on research projects on the computational modeling of various applications focusing on environmental issues and problems.

Professor Nicholas C. Markatos obtained his Diploma in Chemical Engineering from the National Technical University of Athens, Greece, in 1967, followed by M.Sc, DIC and Ph.D degrees from the Imperial College of Science, Technology & Medicine, University of London, UK, during 1970 to 1974.

In 1983 Professor Markatos was appointed Director of the Centre for Mathematical Modeling and Process Analysis at the school of Mathematics and Scientific Computing of the University of Greenwich, London, England. At that time he was also a visiting lecturer to the Computational Fluid Dynamics Unit of Imperial College as well as working for CHAM Ltd, (Concentration Heat and Momentum, Limited), London, England. At CHAM he worked first as leader of the Aerospace Group (1976) and then, from 1977 until 1984, as Manager of the Applications Team working on various Fluid Mechanical, Thermodynamic and Transport problems.

Since 1974 he has served as technical consultant to many Research Centres, state institutions and industries.

In June 1980 he was awarded the "Certificate of Recognition" by the Inventions Council of NASA.

In 1985 Professor Markatos was elected Professor of Chemical Engineering at the National Technical University of Athens, and in 1990 he was elected Head of the Chemical Engineering Department. In 1991 he was elected Rector of that University.

Professor Markatos' main scientific interest is in the mathematical modeling of Transport Phenomena, Fluid Mechanics, Thermodynamics and Physical Processes like Fluid Flow (Laminar and especially Turbulent), Heat and Mass Transfer, Environmental Flows, Combustion, etc.

He is referee of scientific papers, reviewer of new books, as well as member of the Editorial Board of several international Scientific Journals.

He has published over 100 original scientific papers in international journals and participated and organized many international conferences, seminars and meetings all over the world. Author of two books, he has also published many articles in the popular press on Engineering Higher Education.