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The Elements of Regulatory Control

Regulatory control is governmental imposition of limits on emission from sources. In addition to quantitative limits on emissions from chimneys, vents, and stacks, regulations may limit the quantity or quality of fuel or raw material permitted to be used; the design or size of the equipment or process in which it may be used; the height of chimneys, vents, or stacks; the location of sites from which emissions are or are not permitted; or the times when emissions are or are not permitted. Regulations usually also specify acceptable methods of testing or measurement.

One instance of an international air pollution control regulation was the cessation of atmospheric testing of nuclear weapons by the United States, the USSR, and other powers signatory to the cessation agreement. Another was the Trail Smelter Arbitration [1] in which Canada agreed to a regulatory protocol affecting the smelter to prevent flow of its stack emissions into the United States. Another example is the Montreal Protocol to Protect stratospheric ozone, developed by the United Nations, that has greatly reduced and which may eventually eliminate the release of chlorofluorocarbons (CFCs) and other ozone-depleting chemicals.

National air pollution control regulations in some instances are preemptive in that they do not allow subsidiary jurisdictions (states, provinces, counties, towns, boroughs, cities, or villages) to adopt different regulations. In other instances, they are not preemptive in that they allow subsidiary jurisdictions to adopt regulations that are not less stringent than the national regulations. In the United States, the regulations for mobile sources are an example of the latter (there is a provision of a waiver to allow more stringent automobile regulations in California); those for stationary sources are an example of the former.

In many countries, provinces or states have enacted air pollution control regulations. Unless or until superseded by national enactment, these regulations are the ones currently in force. In some cases, municipal air pollution control regulatory enactments are the ones currently in force and will remain so until superseded by state, provincial, or national laws or regulations.

A regulation may apply to all installations, to new installations only, or to existing installations only. Frequently, new installations are required to meet more restrictive limits than existing installations. Regulations which exempt from their application installations made before a specified date are called *grandfather clauses,* in that they apply to newer installations but not to older ones. Regulatory enactments sometimes contain time schedules for achieving progressively more restrictive levels of control. To make regulatory control effective, the regulatory agency must have the right to enter premises for inspection and testing, to require the owner to monitor and report noncompliance, and, where necessary, to do the testing.

I. CONTROL OF NEW STATIONARY SOURCES

In theory, if starting at any date, all new sources of air pollution are adequately limited, all sources installed prior to that date eventually will disappear, leaving only those adequately controlled. The weakness of relying solely on new installation control to achieve community air pollution control is that installations deteriorate in control performance with age and use and that the number of new installations may increase to the extent that what was considered adequate limitation at the time of earlier installations may not prove adequate in the light of the cumulative impact of these increased numbers. Although in theory old sources will disappear, in practice they take such a long time to disappear that it may be difficult to achieve satisfactory air quality solely by new installation control.

One way to achieve new installation control is to build and test prototype installations and allow the use of only replicates of an approved prototype. This is the method used in the United States for the control of emissions from new automobiles (Table 27.2).

Another path is followed where installations are not replicates of a prototype but rather are each unique, e.g., cement plants. Here two approaches are possible. In one, the owner assumes full responsibility for compliance with regulatory emission limits. If at testing the installation does not comply, it is the owner's responsibility to rebuild or modify it until it does comply. In the alternative approach, the owner makes such changes to the design of the proposed installation as the regulatory agency requires after inspection of the plans and specifications. The installation is then deemed in compliance if, when completed, it conforms to the approved plans and specifications. Most regulatory agencies require both testing and plan approval. In this case, the testing is definitive and the plan filing is intended to prevent less sophisticated owners from investing in installations they would later have to rebuild or modify.

In following the approved replicate route, the regulatory agency has the responsibility to sample randomly and test replicates to ensure conformance with the prototype. In following the owner responsibility route, the agency has the responsibility for locating owners, particularly those who are not aware of the regulatory requirements applicable to them, and then of testing their installations. Locating owners is a formidable task requiring good communication between governmental agencies concerned with air pollution control and those which perform inspections of buildings, factories, and commercial establishments for other purposes. Testing installations for emissions is also a formidable task and is discussed in detail in Chapter 36. Plan examination requires a staff of well-qualified plan examiners.

Because of the foregoing requirements, a sophisticated organization is needed to do an effective job of new installation control. Prototype testing is best handled at the national level; installation testing and plan examinations at the state, provincial, or regional level. Location of owners is a local operation with respect to residential and commercial structures but may be a state or provincial operation for industrial sources.

II. CONTROL OF EXISTING STATIONARY SOURCES

Existing installations may be controlled on a retrospective, a present, or a prospective basis. The retrospective basis relies on the receipt of complaints from the public and their subsequent investigation and control. It follows the theory that "the squeaking wheel gets the grease". Complaint investigation and control can become the sole function of a small air pollution control organization to the detriment of its overall air pollution control effectiveness. Activities of this type may improve an agency's short-term image by appeasing the more vocal elements of the public, but this may be accomplished at the expense of the agency's ability to achieve long-range goals.

On a present basis, an agency's staff can be used to investigate and bring under control selected source categories, selected geographic areas, or both. The selection is done, not on the basis of the number or intensity of complaints, but rather on an analysis of air quality data, emission inventory data, or both. An agency's field activity may be directed to the enforcement of existing regulatory limits or to the development of data from which new regulatory limits may be set and later enforced.

On a prospective basis, an agency can project its source composition and location and their emissions into the future and by the use of mathematical models and statistical techniques to determine what control steps have to be taken now to establish future air quality levels. Since the future involves a mix of existing and new sources, decisions must be made about the control levels required for both categories and whether these levels should be the same or different.

Regulatory control on a complaint basis requires the least sophisticated staffing and is well within the capability of a local agency. Operation on present basis requires more planning expertise and a larger organization and therefore is better adapted to a regional agency. To operate on a prospective basis, an agency needs a still higher level of planning expertise, such as may be available only at the state or provincial level. To be most effective, an air pollution agency must operate on all three bases, retrospective, present, and prospective, because an agency must address complaints, attend to special source or area situations, and conduct long-range planning.

III. CONTROL OF MOBILE SOURCES

Mobile sources include railroad locomotives, marine vessels, aircraft, and automotive vehicles. Over the past 100 years, we have gained much experience in regulating smoke and odor emission from locomotives and marine craft. Methods of combustion equipment improvement, firefighter training, and smoke inspection for these purposes are well documented. This type of control is best at the local level.

Regulation of aircraft engine emissions has been made a national responsibility by law in the United States. The Administrator of the Environmental Protection Agency is responsible for establishing emission limits of aircraft engines, and the Secretary of Transportation is required to prescribe regulations to ensure compliance with these limits.

In the United States, regulation of emissions from new automotive vehicles has followed the prototype-replicate route. The argument for routine annual automobile inspection is that cars should be regularly inspected for safety (brakes, lights, steering, and tires) and that the additional time and cost required to check the car's emission control system during the same inspection will be minimal. Such an inspection certainly pinpoints cars whose emission control system has been removed, altered, damaged, or deteriorated and force such defects to be remedied. The question has been whether the improvement in air quality that results from correcting these defects is worth the cost to the public of maintaining the inspection system. Another way of putting the question is whether the same money would be better invested in making the prototype test requirements more rigid with respect to the durability of the emission control system (with the extra cost added to the cost of the new car) than in setting up and operating an inspection system for automotive emissions from used cars. A final question in this regard is whether the factor of safety included in the new car emission standards is sufficient to allow a percentage of all cars on the road to exceed the emission standards without jeopardizing the attainment of the air quality standard.

To date, inspection and maintenance has been a successful part of the overall strategy to improve air quality. Advances in diagnostics and improved emission reduction technologies have also been important.

IV. AIR QUALITY CONTROL REGIONS

Workers in the field of water resources are accustomed to thinking in terms of watersheds and watershed management. It was these people who introduced the term *airshed* to describe the geographic area requiring unified management for achieving air pollution control. The term airshed was not well received for regulatory purposes because its physical connotation is wrong. It was followed by the term *air basin*, which was closer to the mark but still had the wrong physical connotation, since unified air pollution control management is needed in flat land devoid of valleys and basins. The term that finally evolved was *air quality control region*, meaning the geographic area including the sources significant to production of air pollution in an urbanized area and the receptors significantly affected thereby. If long averaging time isopleths (i.e. lines of equal pollution concentration) of a pollutant such as suspended particulate matter are drawn on the map of an area, there will be an isopleth that is at essentially the same concentration as the background concentration. The area within this isopleth meets the description of an air quality control region.

For administrative purposes, it is desirable that the boundaries of an air quality control region be the same as those of major political jurisdictions. Therefore, when the first air quality control regions were officially designated in the United States by publication of their boundaries in the *Federal Register*, the boundaries given were those of the counties all or part of which were within the background concentration isopleth.

When about 100 such regions were designated in the United States, it was apparent that only a small portion of the land area of the country was in officially designated regions. For uniformity of administration of national air pollution legislation, it became desirable to include all the land area of the nation in designated air quality control regions. The Clean Air Amendments of 1970 therefore gave the states the option of having each state considered an air quality control region or of breaking the state into smaller air quality control regions mutually agreeable to the state and the US Environmental Protection Agency. The regions thus created need bear no relation to concentration isopleths, but rather represent contiguous counties which form convenient administrative units. Therefore, for purposes of air pollution control, the United States is now a mosaic of multicounty units, all called air quality control regions, some of which were formed by drawing background concentration isopleths and others of which were formed for administrative convenience.

Some of the former group are interstate, in that they include counties in more than one state. All of the latter are intrastate.

None of the interstate air quality control regions operates as a unified air pollution control agency. Their control functions are all exercised by their separate intrastate components.

V. TALL STACKS AND INTERMITTENT AND SUPPLEMENTARY CONTROL SYSTEMS

For years, it was an item of faith that the higher the stack from which pollution was emitted, the better the pollution would be dispersed and the lower the ground-level concentrations resulting form it. As a result, many tall stacks were built. Subsequently, this practice came under attack on the basis that discharge from tall stacks is more likely to result in long-range transport with the associated problems of interregional and international transport, fumigation, and acidic deposition. In retrospect, tall stacks seem to be an example of doing the wrong thing for the right reasons. It is argued that, to prevent these problems, pollutants must be removed from the effluent gases so that, even if plumes are transported for long distances, they will not cause harm when their constituents eventually reach ground level, and that, if such cleanup of the emission takes place, the need for such tall stacks disappears. Despite these arguments, the taller the stack, the better the closer-in receptors surrounding the source are protected from its effluents.

The ability of a tall stack to inject its plume into the upper air and disperse its pollutants widely depends on prevalent meteorological conditions. Some conditions aid dispersion; others retard it. Since these conditions are both measurable and predictable, intermittent and supplementary control systems (ICS/SCS) have been developed to utilize these measurements and predictions to determine how much pollution can be released from a stack before ground-level limits are exceeded. If such systems are used primarily to protect close-in receptors by decreasing emissions when local meteorological dispersion conditions are poor, they tend to allow relatively unrestricted release when the upper-air meteorology transports the plume for a long distance from the source. This leads to the same objections to ICS/SCS as were noted to the use of tall stacks without a high level of pollutant removal before emission. Therefore, here again it is argued that if a high level of cleanup is used, the need to project the effluent into the upper air is reduced and the benefits of operating an ICS/SCS (which is costly) in lieu of installing more efficient pollutant removal equipment disappear. The US 1990 Clean Air Act Amendment [2] does not allow ICS/SCS to be substituted for pollutant removal from the effluent from fossil fuel-fired steam-powered plants. However, ICS/SCS may still be useful for other applications.

REFERENCES

1. Dean, R. S., and Swain, R. E., Report submitted to the Trail Smelter Arbitral Tribunal, *US Department of the Interior, Bureau of Mines Bulletin 453*. US Government Printing Office, Washington, DC, 1944.
2. Public Law No. 101–549, US 101st Congress, *Clean Air Act Amendments of 1990*, November 1990.

SUGGESTED READING

Eisenbud, M., *Environment, Technology and Health—Human Ecology in Historical Perspective*. New York University Press, New York, 1978.

Friedlaender, A. F. (ed.), *Approaches to Controlling Air Pollution*. MIT Press, Cambridge, MA, 1978.

Gangoiti, G., Sancho, J., Ibarra, G., Alonso, L., García, J. A., Navazo, M., Durana, N., and Ilardia, J. L. Rise of moist plumes from tall stacks in turbulent and stratified atmosphere. *Atmos. Environ.*, **31**(2), 253–269 (1997).

Hauchman, F. S., The role of risk assessment in Title III of the 1990 Clean Air Act Amendments, in *Proceedings of the Conference on Air Toxics Issues in the 1990s: Policies, Strategies, and Compliance*, pp. 73–80. Air and Waste Management Association, Pittsburgh, PA, 1991.

Powell, R. J., and Wharton, L. M., *J. Air Pollut. Cont. Assoc.* **32**, 62 (1982).

Stern, A. C., *J. Air Pollut. Control. Assoc.* **32**, 44 (1982).

US Environmental Protection Agency Civil Enforcement: CAA National Enforcement Programs, 2007, http://www.epa.gov/compliance/civil/caa/caaenfprog.html.

QUESTIONS

1. What are the geographic boundaries of the air quality region (or its equivalent in countries other than the United States) in which you reside?
2. Are there regulatory limits in the jurisdiction where you reside which are different from your state, provincial, or national air quality or emission limits? If so, what are they?
3. Discuss the application of the prototype testing–replicate approval approach to stationary air pollution sources.
4. One form of air pollution control regulation limits the pollution concentration at the owner's "fence line." Find an example of this type of regulation and discuss its pros and cons.
5. How are pollutant emissions to the air from used automobiles classified where you reside? Discuss the merits and the extent of such regulation.
6. Limitation of visible emission was the original form of control of air pollution a century ago. Has this concept outlived its usefulness? Discuss this question.
7. Discuss the use of data telemetered to the office of the air pollution control agency from automatic instruments measuring ambient air quality and automatic instruments measuring pollutant emissions to the atmosphere as air pollution control regulatory means.
8. The ICS/SCS control system has been used for control of emissions from nonferrous smelters. Discuss at least one such active system in terms of its success or failure.
9. Discuss the reasons why the interstate air pollution control region concept has failed in the United States.