CHAPTER 11: STATIONARY-SOURCES LOCAL AIR POLLUTION

I. Introduction

A. There are approximately 27,000 major stationary sources of air pollution in the U. S.

B. In this section, we will look at the evolution of efforts to control these pollutant sources, focusing on the cost effectiveness of the alternative policy tools that have been used.

II. Phase I: Pre-1970

A. Prior to 1970, there was little in the way of federal laws dealing with these sources of air pollution.

B. The laws that were passed during this period were focused on

1. Providing funds for research into the problem

2. State grants for personnel training and technical assistance.

C. At the same time, the states were reluctant to move on the issue because it would put them at a competitive disadvantage in keeping and attracting industry.

D. The Air Pollution Control Act of 1955

1. This was the first attempt to deal with the air pollution problem at the federal level.

2. The law mainly subsidized research into air pollution problems.

E. Three addition pieces of legislation of importance:

1. The Clean Air Act of 1963 (the original clean air act)

   a. Created a mechanism for permanent federal support of environmental research.

   b. Allowed for federal assistance for the development of state control agencies.

   c. Introduced federal involvement in transboundary pollution problems.

2. The 1965 Motor Vehicle Air Pollution Control Act

   Allowed HEW (Health, Education and Welfare) to set emission standards for new motor vehicles.

3. The 1967 Air Quality Act

   a. Required states to establish air quality control regions (AQCR's)
b. Required states to establish ambient air-quality standards for the “criteria” pollutants.

F. The transition piece of legislation between this and the next period was the National Environmental Policy Act of 1969 (signed 1/1/70) (NEPA)

1. Prior to NEPA, environmental responsibilities were divided among 20 federal departments and agencies.

2. The agencies claimed to have no mandate to consider environmental problems.

3. NEPA
   a. Created the Council of Environmental Quality (a temporary precursor of EPA) to "provide a consistent and expert source of review of national policies, environmental problems and trends, both long-term and short-term. Such a council would act entirely independently of the executive, mission oriented agencies."

   b. Introduced the notion of the environmental impact statement.

This legislation represented the first tentative efforts of the federal government into the realm of direct involvement in pollution control.

III. Phase II: 1970-1990

This second phase of pollution control efforts emerged from a frustration on the part of the federal government in terms of the lack of progress by states.

This phase is characterized by very direct intervention on the part of the federal government, with extensive use of command and control forms of pollution control.

Four major developments occurred during this period, including two pieces of legislation,

A. The Clean Air Act Amendments of 1970

1. This act put the federal government in the position of a major player in pollution control for the first time.

2. The U. S. Environmental Protection Agency (EPA) was established to oversee and implement pollution control strategies.

3. The primary focus of the 1970 Clean Air Act was on criteria pollutants.
   a. **DEFINITION:** Criteria Pollutants are ones that are (1) relatively common substances, (2) found in almost all parts of the country, and (3) presumed dangerous only in high concentration.

   It is also called conventional pollutants, in contrast to hazardous pollutants, ones that pose a localized risk of severe harm to human health.
b. The name comes from the language of the act, requiring that the EPA develop "criteria documents" to be used in setting acceptable standards for these pollutants.

c. The criteria pollutants include:
   i. Sulfur dioxide
   ii. Total suspended particulates
   iii. Carbon Monoxide
   iv. Nitrogen Oxides
   v. Ozone
   vi. Lead

d. The Command and Control Policy Framework
   i. The primary approach to air pollution has been to use emissions standards (i.e., the command and control policy - CAC).
   
   ii. Recall from the previous section that this approach is not efficient.

   iii. For each criteria pollutant, the EPA has established ambient air quality standards.

   * These standards are legally binding everywhere, but for practical purposes are only monitored at specific locations.

   iv. The standards may specify a

   * short term (e.g. three hour average) concentration level, typically can be exceeded no more than once a year, and
   * A long-term standard (e.g., annual concentration levels).

   v. Two standards are used:

   * The primary standard is designed to protect human life and is used for all pollutants.

   * The secondary standard is designed to protect other aspects of human welfare.

       - Aesthetics

15-3
◊ TSP and Sulfur dioxide impair visibility

– Physical objects

◊ Ozone corrodes rubber and paint

◊ Sulfur Dioxide and TSP also corrode metal

– Vegetation

◊ Nitrogen Oxides are toxic to plant life.

If there is a secondary standard, it is the legally dominant standard.

e. The ambient standards are required to be set by statute *without any consideration given to the costs of meeting them.*

f. While EPA established the standards, the states are primarily responsible for enacting the laws.

i. States must establish a "State Implementation Plan" (SIP) to be approved by the EPA.

ii. The SIP divides the state into so called "air quality control regions."

iii. The SIPs then spells out for each control region procedures and timetables for

• Meeting local standards and

• For the abatement of the effects on other regions

4. A Secondary focus was placed on Hazardous Pollutants

a. *DEFINITION:* *Hazardous pollutants* are ones that pose a localized risk of severe harm to human health. They are distinguished from criteria pollutants both by the degree of harm they pose and by the fact that emissions usually occur only at a few key locations.

b. The EPA follows a separate control policy for this category.

i. First the EPA identifies the substance as being within this categorization.

ii. Once the substance is listed, the EPA has to move within 180 days to either regulate the substance or remove it from the list.
c. Typically, it is acknowledged that there is no safe level for airborne carcinogens, so that they should be banned entirely according to some readings of the Clean Air Act.

However, this would be prohibitively expensive.

d. **Question:** What would you expect to be the EPA's approach in this case?

A: The EPA has moved slowly to list pollutants.

e. By 1980, only 7 pollutants were on the list

i. asbestos

ii. beryllium

iii. mercury

iv. vinyl chloride

v. benzene

vi. radionuclides

vii. inorganic arsenic

f. Despite the 180 day deadline, only four were regulated by 1980.

i. Asbestos

ii. beryllium

iii. mercury

iv. vinyl chloride

g. Subsequent court action led to addition standards by 1984.

h. By 1989, only 7 of the 86 pollutants were controlled.

i. The EPA has incorporated benefit/cost analysis and risk assessment into its decision making process, unlike in the case of criteria pollutants.

j. It has created a list of substances on an "intention to list" list, in order to buy time.

**B. The 1977 Amendments to the Clean Air Act**

15-5
1. By 1975, it was apparent that many regions would not meet the statutory deadlines.

2. In 1977, congress passed the 1977 Amendments to the Clean Air Act.
   a. The carrot: extending the deadline for attainment to
      i. 1982 for all primary standards
      ii. 1987 for ozone and carbon monoxide.
   b. The stick: designating all areas not expected to reach the original deadlines as "nonattainment regions." These regions were subjected to stringent controls.
      i. These regions had to have precise plans for attainment, with the EPA now having the power to:
         - Halt construction on new or modified pollution sources.
         - Deny federal sewage and transportation grants to the offending state.
      ii. Non-attainments regions were forced to have a permit program for large new construction and major modifications: technology-based effluent standards (TBES) are introduced.
         - Permits could not be issued if it jeopardized attainment.
         - New sources had to control emissions to the "lowest achievable emissions rate" (LAER).

   **DEFINITION: LAER is the lowest emissions rate included in any SIP plan whether or not any source is currently achieving that rate.**

   Note: LAER is set by the state.

   - Existing Sources in non-attainment regions had to install RACT’s - reasonably available control technologies.

3. Another major development during this period was the establishment of the Prevention of Significant Deterioration Policy (PSD).
   a. Standards merely set upper bounds, they do not lead to improvements everywhere or prevent deterioration of existing attainment regions.
   b. The PSD program specifies the maximum increase in pollution from a specified baseline, with the increase depending upon a region's classification:
i. Class I: Consisted primarily of national parks and wilderness areas. Almost no allowable increment

ii. Class II: Moderate increments allowed.

iii. Class III: Largest increments allowed, unless increments led to violation of ambient standards.

c. Permits were required for new pollution sources within a region.

i. The new sources must employ the best available control technology (BACT).

ii. BACT's were determined by the state on a case-by-case basis

iii. No technology-based effluent standards for existing sources.

4. EPA also established national uniform emissions standards for new sources, known as the New Source Performance Standards (NSPS).

a. These were instituted as a floor to BACT and LAER standards.

b. The idea is that the EPA should control the standards for new sources, and the states control standards for existing sources. NSPS specifies the floor for new sources.

c. Empirically if the EPA has decided a NSPS, it is usually considered as LAER in nonattainment areas and BACT in PSD areas.

5. New-source bias: stricter standards for new sources. Justification:

a. economic: more costly to incorporate new control equipments to existing plants than to new plants.

b. political: owners of existing plants have more political power than those of new plants.

i. This policy helps deter competition.

c. administrative: there are more existing plants than new plants: cost saving.

6. **Question: What are going to be problems with the above policies?**

a. It takes time to establish all of the standards, including LAERs and BACTs.

b. It also takes money

Enforcement is required.
c. In 1977, the federal government established that non-compliance penalties be based upon the economic value of delay to the source.

d. The standards do not take into account differences in meteorological conditions. Therefore, they must be stringent enough to work under the most adverse conditions.

C. Evaluating the Command and Control Approach

1. Efficiency of the Command and Control Approach

   Efficiency requires that the ambient standards be set at an efficient level. There are four aspects of current procedures which suggest that this is not done.

   a. The Threshold concept.

      i. The Clean Air Act prohibits the balancing of costs and benefits of pollution.

      ii. Instead it uses the "health criterion threshold": the "...standard has to be set with a margin of safety high enough so that no adverse health effects would be suffered by any member of the population as long as the air quality met the standard."

      iii. **Question:** What is wrong with this standard, besides the fact that it ignores costs and benefit trade-offs?

         • It presumes that such a threshold exists.

         • In all likelihood, this threshold is zero or near zero.

   b. The Level of the Standard

      i. Cost/benefit analysis is precluded.

      ii. The resulting standard is likely to be inefficient.

      iii. That is not to say that controls are unjustified, just that they may be inefficiently set.

   c. Uniformity: the standards usually take no account of

      i. The number of people exposed.

      ii. The sensitivity of the local ecology

      iii. The cost of emissions control in various areas

      iv. The Timing of emissions flows
- The timing of emissions can be as important as the locational considerations.
- Stagnant air can make normally acceptable pollution level problematic.
- Since benefits depend upon meteorological conditions, so should emissions standards.

2. The Cost-Effectiveness of the CAC Approach
   a. In general, it is hard to say how bad the CAC approach is.
   b. Several studies, however, suggest that the problem may be severe.
   c. These studies typically compare the CAC approach to the least cost method of achieving the same objective.
   d. In general, the costs are 2 to 22 times higher under CAC than under the least cost method.

   Table 16.2

   e. The CAC approach did relatively well only where the pollution problem was so bad (e.g., LA in the Hahn and Noll article) that everyone had to control as much as possible.

   In these cases there was no room for flexibility.

D. Emissions Trading Program
   1. The Clean Air Act focused on the specification of emissions standards imposed upon specific emissions sources (e.g., stacks, vents, storage tanks).
   2. The Emissions Trading Program was developed, not as the result of a single law, but through a series of rulings and statutes from late 1975 through present.
   3. The trading program tries to inject a degree of flexibility into the system.
   4. Components:
      a. The Emissions Reduction Credit.
         i. This is the currency of the system
         ii. Sources controlling emissions to a point higher than the degree necessary to fulfill its obligations can apply for a certification of excess control.
iii. They then receive a reduction credit which can be "banked." (or used in one of the following policies).

iv. In order to receive the credit, the source must prove that the reduction is:
   - a surplus
   - enforceable
   - permanent: not that the trade must be permanent. Only that the emission reductions giving rise to the ERC is permanent.
   - quantifiable

b. The Offset Policy: for new/expanding sources in nonattainment regions
   i. This policy attempts to resolve the conflict between economic growth and ambient standards in nonattainment regions.
   
   ii. The policy allows a new or expanding source to commence operation in a nonattainment area provided they acquire sufficient emissions reduction credits from existing sources.

   Typically they must acquire 20% more credit than the added emission of the new facility

   iii. In essence, the new sources are financing the additional emissions control by existing sources.

   iv. The new sources must still meet the LAER requirement by itself and for all existing sources owned and operated by the applicant.

c. The Bubble Policy: for existing firms, mainly intrafirm
   i. The bubble policy allows existing sources to use emissions reduction credits to satisfy their SIP responsibility.
   
   ii. The sum of emission reduction credits plus actual emissions reductions must equal assigned emissions reductions.

   iii. The name comes from the image of treating all sites as being within a bubble and the goal being to reduce the total pollution within the bubble.

d. Netting: for modification of existing sources, intrafirm
   i. Netting allows sources undergoing modification or expansion to escape the burden of new source review so long as the net
increase in plant-wide emissions is insignificant (including emissions reductions credits).

ii. Typically new source review occurs when the increased emissions resulting from modernization or expansion exceeded a specified threshold.

iii. Netting allows the company to

• avoid the review process
• The need to acquire permits, as well as meeting the associated permit requirements, such as
  – the need to install BACT or LAER control technologies.

iv. However, netting cannot be used to avoid NSPS standards.

e. Banking

i. Banking allows the firm to store emission reduction credits for future use.

ii. Emission credit reductions are the currency of this bank.

iii. States are responsible for designing their own banking systems.

5. The Effectiveness of the reform

a. Example - Narraganset Electric Company

i. The company had two generators

ii. Originally, both plants had to burn 1% sulfur oil in order to meet the standard.

iii. The trading program allows them to run one plant with high sulfur coal (2.2%), while running the second plant using natural gas or not at all.

iv. This saved an estimated $3 million, reduced imported oil by 600,000 barrels/year and reduced sulfur emissions by 30%.

b. Achievements:

i. Worked well mainly for uniformly mixed pollutants

ii. Mainly involved large polluting sources close to each other
Table 15-8 of Field.

c. **Question:** What can go wrong with this system?

i. **Potential Imperfect Competition**
   - If monopolies or oligopolies arise in the market for permits, inefficiencies can result.
   - Initial allocation of permits becomes important for efficiency.
   - While this is a potential problem, the data suggest that it is not currently a significant problem and is far outweighed by the benefits of the problem.

ii. **Property Rights and Permit Banking**
   - Emissions reduction credits are not always vested in the supplier.
   - In San Francisco and LA, communities have resisted vesting ownership of credits with the original sources.
     - The credits are viewed as a public resource to be used for other purposes.
     - San Francisco allows these credits to be confiscated if more stringent standards are set later.

**Question:** What impact will this have on the trading program and its efficacy?

It will eliminate the firm's incentive to reduce emissions and obtain marketable permits.

E. **Progress to Date**

1. There has been some significant progress in the control of the criteria pollutants, particularly
   a. Lead
   b. Particular matter
   c. Carbon monoxide
2. However, significant problems persist in terms of
   a. Ozone
   b. The number of non-attainment regions

3. It is difficult to determine the reason for these changes
   a. The Clean Air Act Amendments may have contributed to the changes.
   b. However, there is evidence to suggest the change in pollution control was more rapid prior to 1970 than in the years after 1970.

IV. Phase III: 1990 - Present - The 1990 Clean Air Act
   A. There is additional recognition of the region diversity of needs in terms of pollution control (Severe, Moderate, Serious, etc. divisions).
   B. Transferable emission permit plan for controlling SO$_2$ emissions from power plants.

   1. EPA issues quantity of emission permits to designated power plants
      a. Each permit allows 1 ton of SO$_2$.

      a. covers 110 electric utility (large coal-burning) plants in 21 eastern and Midwestern states.
      b. number of permits of each plant
         =average BTUs of fuel used 1985-1987 (in million) * 2.5 pounds of SO$_2$ per million BTUs.
      c. about 5.5 million permits were allocated initially
      d. EPA also has 3.5 million “reserve” permits

   3. Phase II: program to be expanded to cover power plants throughout the country.
      a. Formula change: 1.2 pounds of SO$_2$, instead of 2.5
      b. Overall cap of 8.95 million permits given out by the EPA.