

**AMENDING CHINA'S AIR POLLUTION PREVENTION AND CONTROL LAW:
RECOMMENDATIONS FROM THE INTERNATIONAL EXPERIENCE**

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Supported by:
The Energy Foundation, China Sustainable Energy Program

July 2009

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PREFACE

In November 2008, China's Ministry of Environmental Protection (MEP) invited a number of U.S. air pollution experts to a workshop in Beijing to discuss the proposed amendment of China's *Atmospheric Pollution Prevention and Control Law* ("Air Pollution Law") and lessons that might be learned from the U.S. air pollution regulatory system, the 1970 U.S. Clean Air Act and the Clean Air Act's subsequent amendments. China's Air Pollution Law has not been amended since 2000, and many provisions of the Air Pollution Law need to be amended to respond to the demands presented by a China that has changed dramatically in the span of less than ten years.

Following the November workshop, a team led by the Natural Resources Defense Council, the Regulatory Assistance Project, and the Energy Foundation's China Sustainable Energy Program prepared a set of written recommendations for the Air Pollution Law revision. The team was composed of some of the leading experts in air pollution regulation in the U.S., including former federal and state environmental officials, energy utility regulators, participants in the original drafting of the U.S. Clean Air Act and its amendments, and top experts in environmental law. These recommendations were delivered to MEP and other stakeholders in December 2008.

Based on subsequent conversations with Chinese government officials and research institute leaders, it became apparent that a more in-depth analysis of international experience in air pollution regulation was necessary to enable Chinese legislative drafters to better understand the history and context surrounding air regulation in the U.S. and other jurisdictions, and to learn about successful practices that China might utilize, *and* also failures that China should be careful to avoid. The international experience, all parties agreed, contained important experience that could benefit China, and understanding the best practices and past mistakes of the developed countries would ideally allow China to "leapfrog" to an advanced stage much more quickly. Chinese officials and experts all noted, however, that an authoritative resource of air regulatory practices in the U.S. and elsewhere, at a level of detail that would allow Chinese drafters to properly assess how to adapt international practices to Chinese circumstances, did not yet exist.

This volume attempts to provide such a resource in the Chinese language for the first time. The fourteen chapters herein cover key topics raised at the November 2008 Beijing workshop as the most important issues for the amendment of the Air Pollution Law. The content of these chapters benefits from the more than 45 years of combined China experience of the three sponsoring organizations—the Natural Resources Defense Council, the Regulatory Assistance Project, and the Energy Foundation, China Sustainable Energy Project—as well as the participation of some of the leading experts on air pollution regulation in the U.S. The biographies for the research team members are listed after this preface.

We hope this report will serve as a useful source of information for the current revision of the Air Pollution Law, but also remain an unparalleled resource in the future for Chinese legislators, air pollution regulators, and researchers who want to understand how international experience in

air regulation—both good and bad—can contribute to the strengthening of China’s framework for air pollution control and environmental protection in general.

Natural Resources Defense Council
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Beijing, China
July 2009

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David Moskowitz is a director and co-founder of The Regulatory Assistance Project. He has worked with the Energy Foundation, the Asian Development Bank, the World Bank and other institutions in China on energy and power sector issues since 1999, and recently began leading the ClimateWorks Foundation's Best Practice Network efforts on the power sector in China. Moskowitz served as a Commissioner of the Maine Public Utilities Commission from 1984 through 1989, after having served as a Commission Staff Attorney for six years. Mr. Moskowitz authored Maine's rules regarding the development of cogeneration and small power production. Prior to joining the Maine PUC, he was employed by Commonwealth Edison, Inc., an Illinois utility. Moskowitz has published numerous technical and policy articles on incentive regulation, least-cost planning and renewable energy. He is a frequent speaker at national seminars and has provided expert testimony on these topics. He received his B.S.E. in Engineering from Purdue University and his J.D. from Loyola University.

David P. Novello is an environmental lawyer and mediator with his own practice in Washington, D.C. He represents corporate and trade association clients on environmental issues, with a particular focus on air quality matters. Until 1992, Mr. Novello was a senior attorney with the U.S. EPA Office of General Counsel, where he worked on a variety of Clean Air Act, hazardous waste, and international environmental issues. Mr. Novello has taught courses on the Clean Air Act at Georgetown University Law Center and the University of Maryland School of Law. He has written many publications on environmental matters (including two guides for the Air & Waste Management Association), and is co-editor of both editions of the American Bar Association's *Clean Air Act Handbook*. For many years he has been active in the American Bar Association Section of Environment, Energy, and Resources, where he has served in leadership positions on the air quality committee, the climate change and sustainable development committee, and the alternative dispute resolution committee. Mr. Novello graduated *magna cum laude* from Dartmouth College in 1979 and received his J.D. in 1984 from Columbia Law School, where he was a Stone Scholar.

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Department of Justice in the Environment and Natural Resources Division, Law and Policy Section. She also worked as a legal intern for former Senator James M. Jeffords (I-VT). Ms. Olson practices all aspects of clean air law. She has been involved in landmark clean air litigation, advised clients on complex EPA regulations, and helped companies navigate the legislative process, particularly with regard to pending climate change legislation.

Rebecca Schultz is a research and policy analyst at the Regulatory Assistance Project. Previously, at the Center for American Progress in Washington, D.C., she specialized in climate change policy with respect to the developing world and led the energy poverty chapter of the Center's energy portfolio. She focused on efforts to support sub-Saharan African countries engage the global carbon markets and improve U.S. development assistance by addressing both the adaptation and mitigation challenges of climate change. Prior to joining the Center, Schultz studied the Muslim history of northwestern China at Swarthmore College and spent several years living and working in the region. She has done extensive field research on the expressions of Islamic faith and culture in China and worked with indigenous rural development organizations in that part of the world.

Michael Walsh is a mechanical engineer who has spent his entire career working on motor vehicle pollution control issues at the local, national and international levels. During the 1980s he was an adviser to the U.S. Senate Environment and Public Works Committee during development of the 1990 Clean Air Act amendments. He currently co-chairs the U.S. Environmental Protection Agency's Mobile Source Advisory Subcommittee and is actively involved in projects in Brazil, Hong Kong, Moscow and China. He is also a member of the National Research Council Committee on the Future of Personal Transport Vehicles in China. He is the principal technical consultant to the Asian Development Bank regarding a regional technical assistance project, Reducing Vehicle Emissions in Asia, and served as a peer review expert to the EU Commission during its recent deliberations regarding near zero sulphur fuels. He was selected as the first recipient of the U.S. EPA's Lifetime Individual Achievement Award for "outstanding achievement, demonstrated leadership and a lasting commitment to promoting clean air."

Alex L. Wang is a Senior Attorney for NRDC based in Beijing and the director of NRDC's China Environmental Law Project. In this capacity, he works with China's government agencies, legal community, and environmental groups to improve environmental enforcement and strengthen the role of the public in environmental protection. He helped to establish NRDC's Beijing office in 2006. He was a Fulbright Fellow to China from 2004-05. Prior to that, he was an attorney at the law firm of Simpson Thacher & Bartlett LLP in New York City, where he worked on mergers & acquisitions, securities matters, and *pro bono* Endangered Species Act litigation. He is a member of the Advisory Council for the Asia Society's Center on U.S.-China Relations and was selected to the National Committee on U.S.-China Relations Public Intellectuals Program 2008-10. Mr. Wang received a B.S. in Biology with honors from Duke University in 1993 and a J.D. degree with honors from New York University School of Law in 2000.

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Contributing Organizations

The Natural Resources Defense Council (NRDC) is one of the most effective nonprofit environmental organizations in the United States. Established in 1970, NRDC uses law, science, and the support of 1.2 million members and online activists to protect the planet and ensure a safe and healthy environment for all living things. NRDC's staff of more than 350 lawyers, scientists, and policy experts work out of offices in New York, Washington, Chicago, Los Angeles, San Francisco, and Beijing. For nearly 15 years, NRDC has been working in China with local partners to support leading domestic efforts on energy conservation and environmental protection. NRDC's work in China builds on its long-standing expertise in the United States and elsewhere in the areas of energy, health, market transformation, and environmental enforcement.

The Regulatory Assistance Project (RAP) is a non-profit organization, formed in 1992 by experienced utility regulators, that provides research, analysis, and educational assistance to public officials on electric utility regulation. RAP workshops cover a wide range of topics including electric utility restructuring, power sector reform, renewable resource development, the development of efficient markets, performance-based regulation, demand-side management, and green pricing. RAP also provides regulators with technical assistance, training, and policy research and development. RAP has worked with public utility regulators and energy officials in 45 states, Washington D.C., Brazil, India, Namibia, China, Egypt, and a number of other countries. RAP has been active in China since 1999.

Energy Foundation, China Sustainable Energy Program (CSEP) supports China's policy efforts to increase energy efficiency and renewable energy. The program emphasizes both national policy and regional implementation, awarding grants and taking direct initiatives in eight areas: low-carbon development paths, transportation, renewable energy, electric utilities, buildings, industry, environmental management and sustainable cities. CSEP helps Chinese agencies, experts, and entrepreneurs solve energy challenges for themselves; at the request of Chinese leaders, including its Senior Policy Advisory Council (ministers) and Dialogue Partners (ministry directors-general), the program supports capacity building and technology policy transfer through linking Chinese experts with "best practices" expertise from around the world. When it determines there is an unmet need in the field, the program may convene workshops, commission papers, or take other direct initiatives, in addition to its primary role as a grant-

maker. Since inception, CSEP has invested \$60 million, including over 400 grants. CSEP has over 60 policy development and implementation projects underway in 19 provinces.

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CHAPTER ONE

AMENDING CHINA'S AIR POLLUTION PREVENTION AND CONTROL LAW: RECOMMENDATIONS FROM THE INTERNATIONAL EXPERIENCE

Natural Resources Defense Council;¹ Regulatory Assistance Project;² The Energy Foundation, China Sustainable Energy Program;³ Richard Ayres; Chris James; David Novello; Art Williams; Michael Walsh; Jessica Olson

EXECUTIVE SUMMARY

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Since China last amended its *Atmospheric Pollution Prevention and Control Law* in 2000, much has changed. China has continued to experience an unprecedented pace of economic growth that has brought with it a broad range of new air pollution challenges. It has brought about ever greater contributions to air pollution from China's energy, industrial and transportation sectors, and there has been a growing recognition in China of the need to address air pollution at the regional level. Awareness globally and in China of the dangers posed by climate change has increased exponentially since that time. China's national policies regarding information transparency and public participation in the environmental decision-making process have seen significant expansions during this past decade. Environmental protection in general has received significant attention at the highest levels of government. In response, China has experimented with a wide range of regulatory and enforcement tools, including permits, Total Emissions Control (TEC), air pollution planning, higher fines, and greater transparency. Major national-level events, like the Beijing Olympics, have provided China with the opportunity to experiment with a series of aggressive air pollution efforts.

In response to previous engagements with China on air pollution law and regulation (see Preface for background), the authors of this report have prepared an in-depth analysis of international air regulation experience related to thirteen key issues in air pollution. These issues were identified at a November 2008 workshop on air pollution regulation with China's Ministry of Environmental Protection (MEP) and other government agencies as particularly relevant to the amendment of China's Air Pollution Law. Each chapter contains detailed discussion of how these issues are handled in the United States, or in certain cases other jurisdictions, such as the European Union.

¹ Alex Wang, Barbara Finamore, Gao Jie, Alvin Lin.

² David Moskowitz, Rebecca Schultz, Richard Cowart, Rick Weston.

³ Hu Min

The specific issues covered in the report are:

1. National ambient air quality standards.
2. Combining air quality standards with Total Emissions Control (TEC).
3. State implementation plan (SIPs) process.
4. Nonattainment areas.
5. Air pollution permits.
6. Air quality regions and regional offices.
7. Technology standards.
8. Motor vehicle pollution control.
9. Integrating energy and environmental policy.
10. Multi-pollutant control policies.
11. Information gathering & transparency.
12. Environmental enforcement.
13. Climate change.

National Ambient Air Quality Standards (NAAQS) (Chapter Two) are discussed first in this report as a reflection of their foundational importance in the air pollution regulation system. All of the other techniques discussed within this volume are in service of the achievement of the NAAQS. Also, elevating the consideration of health impacts in establishment of NAAQS, beyond the direct health benefits offered, can help to clarify for the public and other bureaus the reasons that more effective environmental protection is needed. This chapter also emphasizes the need for clear consequences (such as requirements for offsets before establishing new enterprises in nonattainment areas, or more stringent emissions standards) for violations air quality standards. Chapter Three on **Combining Air Quality Standards with Total Emissions Control (TEC)** examines from a more theoretical perspective the use of air quality-driven approaches and emissions-driven approaches in the United States, and how the two types of approaches complement and reinforce each other. Emissions-driven approaches can be a powerful tool for achieving air quality standards. This is particularly relevant to China as it considers how to coordinate air quality standards, emissions standards, and annual or five-year Total Emissions Control targets. Chapter Four on the **State Implementation Plan (SIPs) Process** describes the workings of state-based planning processes to achieve ambient air quality standards in the U.S. Chapter Five on **Nonattainment Areas** sets forth the consequences under U.S. law for areas that fail to meet ambient air quality standards. These include stricter emissions standards and greater pollution offset requirements for new projects in nonattainment areas. The U.S. experience in dealing with areas not in attainment with air quality standards should be familiar to China and can offer useful lessons in driving better environmental compliance, particularly as China considers such approaches as regional project approval limitations (). Chapter Six on **Air Pollution Permits** provides a detailed description of how air pollution permits work in the U.S. This chapter sets forth the key elements of U.S. permits, including emissions and operating standards, monitoring, recordkeeping and reporting requirements, and other elements. Permits are the primary mechanism for facility-level regulation in the U.S. Chapter Seven offers particular focus on **Air Quality Regions and Regional Offices** and techniques utilized in the U.S. to handle regional air quality problems. Chapter Eight addresses several types of **Technology Standards**, including technology-based emissions standards and energy efficiency standards, which have been very effective in lowering

emissions and achieving ambient air quality standards in the U.S. and the E.U. Chapter Nine evaluates steps for handling one of the fastest growing areas of air pollution - ***Motor Vehicle Pollution Control***, including through coordinated fuel and emissions standards and a broadening of the types of pollution sources regulated. Chapters Ten and Eleven cover a variety of approaches to integrating environmental concerns into China's energy industry, with a particular focus on the use of ***Multi-Pollutant Control Policies*** to send signals to industry on the future path of air pollution regulation and drive more efficient pollution reduction strategies. Chapter Twelve (***Information Gathering & Transparency***) focuses on the use of informational techniques to strengthen environmental enforcement. Techniques include strong governmental information gathering authority, public disclosure of emissions and environmental impact assessment reports, and greater transparency and participation in government decision-making processes. China has made significant advances in this area, and can draw further on U.S. experience to expand the impact of China's own informational approaches. Chapter Thirteen focuses on ***Environmental Enforcement***, perhaps one of the most vexing challenges facing China's environmental protection. This chapter discusses the approaches in the U.S. to dealing with some of the most difficult issues in environmental enforcement. These issues, which are major challenges in China as well, include the role of techniques to deter data falsification and obstruction of inspections, higher fines that remove from enterprises the economic benefit of violations of environmental law, environmental protection bureau authorities to order injunctive relief (e.g., stoppage of illegal pollution) and the use of the courts to strengthen environmental protection. The final chapter (Chapter Fourteen) on ***Climate Policy*** sets forth detailed information on the approaches the U.S. is currently implementing or considering. Climate change is one of the greatest challenges of our time and better understanding of how other major economies are addressing the issue will hopefully remove sticking points that have prevented earlier, successful agreement on climate

A brief summary of the recommendations for each issue is provided in this chapter. Recognizing that Chinese drafters and decision-makers need to be able to evaluate the details of how international best practices work in order to properly adapt them for use in China, a detailed explanation of specific air regulatory practices is set forth in the chapters that follow.

1. National Ambient Air Quality Standards

Uniform, national ambient air quality standards and a comprehensive framework of requirements to bring about compliance with such standards have played a critical role in the success of the U.S. in reducing its air pollution. China has established a system of national atmospheric environmental quality standards, but has faced challenges in achieving implementation. Moreover, China's recent efforts to focus on the environmental health impacts of pollution are not reflected in the current Air Pollution Law, with certain pollutants left out of the scope of regulation and monitoring, and only limited mention of health considerations in the law's text.

Based on our analysis of U.S. practice, we make the following specific recommendations for China's Air Pollution Law amendment:

- **Health-based Ambient Standards.** Make China's national ambient environmental quality standards explicitly health-based; i.e., based strictly on scientific information on the effects of pollutants on public health and environmental quality. Ensure that the major

pollutants that impact on human health are within the scope of regulation. Require monitoring and reporting of all of these major pollutants.

- **Prioritize Achievement of Ambient Standards.** Elevate and clarify the importance of ambient standards in the law to ensure that they receive as much focus as total emissions control (TEC) targets.
- **Clear Consequences for Non-compliance.** Establish clear consequences, such as the use of regional project approval limitations (), with stronger central authority in order to improve enforcement.
- **Public Participation.** Provide for an appropriate scope of public participation in the standard setting process to strengthen the scientific basis and public acceptance of ambient air quality standards.

2. Combining air quality standards with Total Emissions Control (TEC)

China, like the U.S., has established air quality-driven and emissions-driven regulatory programs. However, with the focus on Total Emissions Control in recent years, some experts have raised the issue of how China should prioritize these two types of programs. Some have expressed concern that inadequate focus is being placed on air quality-driven programs.

We recommend that:

- China maintain a strong focus on meeting ambient air quality standards, even as it pushes forward to implement emissions-driven programs.
- MEP be given stronger authority to supervise and enforce against failure to meet ambient standards and TEC targets, including influence over government officials' evaluations, regional project approval limitations () and other tools. Information disclosure can also be a powerful tool for driving achievement of TEC targets and ambient air quality standards, and utilization of this important tool should be aggressively expanded.

3. State Implementation Plan Process

The use of planning for the purpose of achieving air quality targets is a fundamental element of the U.S. air pollution regulatory regime. As China considers expansion of the use of planning processes to achieve its air pollution goals, the several decades of experience in the U.S. (both positive and negative) will be of use in China. Based on our review of the U.S. and Chinese air pollution regulatory systems, we make the following specific recommendations to strengthen air quality planning in China's Air Pollution Law amendment:

- **Air Quality Planning.** Development of regional, provincial and/or municipal planning systems akin to SIPs for the purpose of attaining ambient standards. Greater planning specifically focused on how jurisdictions can meet air quality targets is essential to improved air quality.
- **Central Enforcement Authority.** For plans to be meaningful and effective there must be consequences for failure to meet plan targets. China's system already has effective tools

to address failure to meet official targets and these should be adapted and aggressively expanded for use in the air quality context. Specifically, we recommend giving the State Council or its administrative bureau in charge of environmental protection the authority to take over air quality programs if provinces or cities fail to perform as required, enforce against intransigent factories, give evaluations to officials on their environmental performance, and other authority.

- **Direct Central Authority Over Large Emission Sources.** Large sources of emissions with regional impacts, such as the transportation sector, large electric generators and industrial facilities, should be regulated by the State Council or its administrative bureau in charge of environmental protection. This notion is similar to what China is already implementing with its “State Controlled Key Pollution Sources System” (国家控制重点污染源管理系统), but central authority should be expanded and strengthened. This has proven to be effective in the U.S.
- **Central TEC Authority.** TEC is a powerful tool for driving implementation of air pollution reduction. The State Council or its administrative bureau in charge of environmental protection should have greater authority over TEC designations to help meet regional air pollution targets. In cases where provinces have failed to meet TEC targets, the central government should have authority to take over local level allocations. Even if seldom utilized, this leverage can be a powerful tool for improving enforcement. China already exercises central supervision through MEP’s Environmental Supervision and Inspection Bureau (国家环保部环境监察局) and the Ministry of Supervision (国家监察委员会). This authority can be expanded to enhance TEC implementation.
- **Strengthening Monitoring and Reporting.** Accurate and timely monitoring and reporting are critical to the effective implementation of air pollution plans. Funding and human resources, as well as penalties for cheating on monitoring and reporting must be increased substantially.

4. Nonattainment Areas

Based on these findings from the U.S. experience, we make the following specific recommendations for China’s Air Pollution Law amendment with regard to the nonattainment of ambient air quality standards:

- **Consequences for Nonattainment.** The Air Pollution Law amendment should clearly state consequences for the failure to meet ambient air quality and Total Emissions Control targets. Elements of U.S. nonattainment practice can be melded with China’s regional project approval limitations (区域项目审批限制) system to make the system more effective in the Chinese context.
- **Stricter Requirements for More Polluted Areas.** Areas that are nonattainment should have stricter oversight and specific rules for getting into compliance from the central government. More heavily polluted areas can receive a longer time to attain standards, but strict schedules with interim targets must be put in place.
- **Technology-based Standards.** Centrally determined technology-based emissions standards for enterprises (see Chapter Eight for more detail about such standards) in

nonattainment areas can help to reduce pollution significantly. These should be coupled with energy efficiency standards to encourage process and operations innovations beyond end-of-pipe solutions.

- **Offsets.** Offsets of existing pollution should be required before new polluting enterprises can be constructed in a nonattainment area. “Overcontrol” offsets (i.e., obtaining greater reductions at plants still in operation) should be preferred, as cheating is easier when claims for “shutdown” offsets are made. The U.S. has had to deal with significant cheating in the offsets area and many of the measures taken to combat cheating may be considered for implementation in China.

5. Air Pollution Permits

China has many years of experience with pollution permitting, but until the 2008 amendment of the Water Pollution Prevention and Control Law had not instituted a national pollution permitting scheme. There is now significant interest in establishing a national *air* pollution source permitting scheme. Air permits utilized in China at present do not contain a number of requirements that would improve compliance and enforcement. U.S. air permits include elements, such as operational, monitoring, reporting and record-keeping requirements that could be utilized in China to significantly improve the effectiveness of China’s air pollution permitting scheme. Based on our evaluation of the Clean Air Act’s Title V operating permit program, we set forth the following specific recommendations for consideration in the amendment to the Air Pollution Law:

- **Require permits to specify all applicable environmental requirements.** Mandate that all applicable air pollution control requirements pertaining to a given enterprise be specified in the permit to improve ease of enforcement/compliance and help the enterprise itself to understand the range of environmental requirements to which it is subject. This should include emissions standards, including process and operation guidelines.
- **Monitoring, reporting, and record-keeping.** In particular, permits should include detailed monitoring, reporting, and record-keeping provisions. Effective monitoring is critical to determining compliance with emission standards. In addition, periodic reports and records of emissions often indicate problems in operations and emissions, and thus can alert emitters to correct those problems and also can provide enforcement officials with an easier avenue for enforcement.
- **Public access to permits.** The public should have access to permits and related records. This can provide enforcement officials with valuable supervision assistance. Creating a public interest litigation provision to allow citizens to enforce against permit violations also provides assistance to enforcement officials.
- **Public participation.** Permits should undergo a public comment process prior to approval. This can alert officials to any problems in advance and increase public awareness and acceptance of enterprises.

6. Air Quality Regions and Regional Offices

There are many important roles and functions for enhanced regional mechanisms within China's environmental management system. The national law should provide sufficient and clear authority for all anticipated roles and functions of regional bodies. This includes ensuring that existing and future regional offices are adequately staffed, funded and trained; that pilot projects be used to test roles and functions; and that officials at the provincial and local levels are fully integrated into regional mechanisms in all appropriate and necessary ways.

To ensure sufficient authority in the Air Pollution Law to achieve the benefits and perform the roles and functions of regional mechanisms described in this chapter, it is recommended that authorizing language be added to the Air Pollution Law as follows:

- **Authorizing Robust, Well-resourced Regional Offices.** MEP should be allowed to identify and divide the country into environmental management regions of appropriate size using criteria determined by MEP such as airshed, historic, socio-economic, scientific, and other geographical factors that scientifically and practically relate to the goals of regional environmental management. MEP should be authorized to establish one principal office in each region and other lesser offices as may be necessary.
- **Establish Air Quality Management Regions.** MEP should be authorized to designate regional areas comprised of several provinces, which may or may not be the same as the aforementioned management zones, to address specific air pollution issues that need to be managed by the national government. MEP would develop the criteria to determine which regions should be established and the basis for establishing the regions.
- **Designation of Specific Air Quality Management Regions.** The following regions should be designated in the law as Air Quality Management Regions: (1) the Beijing, Tianjin, Tangshan region, (2) the Yangtze River Delta region, (3) the Pearl River Delta region, and (4) any other logical regions and airsheds. MEP should be authorized to establish a primary regional office in each of these regions with the same duties as indicated above.
- **Provincial Authority to Petition for Air Quality Management Regions.** Provinces should be authorized to petition MEP to establish a regional Air Quality Management Regions based on criteria established by MEP. MEP would be authorized to approve, deny or amend such request as appropriate.
- **Local cooperation with MEP regional offices.** Local and Provincial EPBs should be required to submit to regional MEP offices any relevant environmental or related information requested by MEP.

7. Technology Standards

Various countries have had experience utilizing technology-based emissions standards and energy efficiency standards. China is experimenting now with sophisticated energy efficiency standards for specific industries which consider cogeneration and waste heat recovery, but has

not utilized the types of technology-based emissions standards utilized in the U.S. The two approaches in combination can provide a superior mechanism for reducing pollution.

- **Technology-based emissions standards.** The U.S. has utilized various technology-based emissions standards to drive significant reductions in pollutant emissions. China should consider development of such technology-based emissions standards, coupled with strong enforcement provisions to ensure that equipment is not installed and left unused. Technology-based standards should be expressed as a level of performance (such as grams of pollutant per unit of product manufactured) rather than simply requiring that a particular control technology be employed. This will help to spur the development of improved air pollution control technology (as well as cleaner technology for the manufacturing process itself), and will also allow the emitter to reduce pollutant emissions in the most efficient and cost-effective manner possible.
- **Energy efficiency standards.** One shortcoming of technology-based emissions standards is their emphasis on end-of-pipe pollution reduction. Jurisdictions, including the EU and now China, have experimented with output-based, energy efficiency standards that drive enterprises to reevaluate production processes and lead to more efficient production. China's energy consumption standards for 22 industries provide a strong policy foundation that should be built upon by environmental regulators.
- **Combining the approaches.** By jointly mandating high-efficiency technology and advanced pollution control technology, environmental regulators could take advantage of synergies in management, enforcement and compliance.

8. Motor Vehicle Pollution Control

Pollution from transportation is one of the greatest air pollution challenges China faces today. We recommend two particular proposals, among other things, for the air pollution law amendment based upon our review of U.S. experience in motor vehicle pollution control that we believe have the ability to make dramatic improvements in China's air pollution control:

- **Fuel quality.** Poor fuel quality, such as fuel high in sulfur content, can hinder the ability of emissions control technologies to function properly. It has long been recognized in the U.S. that fuel quality and emissions control standards must be coordinated. We propose that authority over fuel quality and emissions standards be given to the Ministry of Environmental Protection. Alternatively, a coordination mechanism should be established to ensure that fuel quality standards keep up with China's rapidly improving auto emissions standards. Beijing's Environmental Protection Bureau, for example, was given greater authority over fuel quality in the lead up to the 2008 Summer Olympic Games.
- **Non-road Engines.** The range of mobile sources regulated by U.S. EPA and states such as California is mind-boggling. We recommend that the air pollution law amendment make special provisions for the regulation of non-road engines that can be a significant source of air pollution.
- **Smart Growth.** City plans should undergo EIA to ensure they have incorporated smart growth principles and fully considered the development of public transportation.

9. Integrating Energy and Environmental Policy

China's current institutional structure discourages the integrated consideration and making of energy and environmental policies. Energy agencies focus narrowly on energy issues and assume the Ministry of Environmental Protection and associated environmental agencies will deal with environmental issues. Meanwhile, MEP focuses on the many severe and pressing environmental problems and assumes that it has no need or responsibility to be engaged in the development of energy policy.

We suggest several amendments to the Air Pollution Law to address these institutional problems. The Law should:

1. Give the environmental agency the responsibility and capacity to assess the environmental consequences of proposed energy-related decisions and to provide their assessment to all appropriate energy agencies;
2. Give the energy agencies the obligation to consult with the environmental agency in the ordinary course of their decision making; and
3. Establish a division of the Ministry of Environmental Protection, within the Department of Policies, Laws and Regulations, to develop expertise in energy and environmental linkages, evaluate the environmental impacts of proposed and current energy policies, develop opportunities for cooperative policy reforms, and expand inter-agency relations.

In addition, we note below four specific policy reforms with immediate relevance for China that have the potential to serve both energy and environmental priorities, while reducing emissions from electric generators and industrial facilities.

1. Multi-pollutant strategies for air quality management in the power sector;
2. Best available technology standards for reduced industrial pollution;
3. Output-based performance standards for electricity generation; and
4. Environmental dispatch of electric generators using continuous emissions monitoring systems (CEMS).

10. Multi-Pollutant Control Policies

There are currently a variety of pollutants commonly regulated in the developed world that are currently unregulated or not comprehensively regulated in China. This has historical reasons related to China's stage of development and available capacity and resources. However, the fact of the matter is that the negative impacts of these pollutants on human health and the environment are well known and as China continues to develop at a rapid clip it will certainly in the near- to mid-term seek to strengthen regulation of these pollutants. If advanced planning is not put into how this process will develop in China, the costs to industry and to Chinese society will be much higher than they need to be. A multi-pollutant approach that encourages long-term, holistic planning is a way to avoid these problems and excess costs. Based upon our review of experience in the U.S. and elsewhere we make a specific recommendation that the Air Pollution Law amendment include language to require:

- A multi-pollutant approach on air regulation focused on total emissions control for SO₂, NO_x, particulate matter, and mercury, and emission intensity for CO₂.

11. Information Gathering & Transparency

Disclosure of accurate, timely environmental information is a fundamental prerequisite of an effective environmental regulatory regime. Moreover, informational techniques can help to reduce public misunderstandings of risk and can help to increase public supervision and lessen the burden on environmental enforcement officials. China has already recognized this and is moving forward to utilize information transparency as a tool to improve its environmental protection regime. We believe, however, that critical elements of open information disclosure are currently missing from China's environmental protection regime. Based on our experience with the U.S. framework, we make a number of specific recommendations for consideration in the amendment of China's Air Pollution Law that we believe will have a marked effect on environmental protection in China:

- **Government authority to gather information.** Strengthen authority of lower levels of government and MEP authority to gather information from emitters about emissions data and pollution control equipment. Dramatically increase penalties for false reporting, tampering with monitoring and pollution control equipment and obstruction of inspections to send a signal that China will not tolerate false information and cheating.
- **Public disclosure of emissions.** Pollutant emissions should be disclosed to the government and the public. Disclosure of emissions data has been proven to lead to reductions in emissions.
- **Public disclosure of environmental impact assessment reports.** Complete environmental impact assessment reports should be disclosed to the government and the public. This has been proven in other countries to enhance government and public supervision both before and after construction or implementation of projects and plans. Moreover, jurisdictions all over the world have managed this sort of public disclosure in a way that protects business secrets. China's current practice of only disclosing an abridged version of the EIA report is not within the mainstream of international practice and is less effective for environmental protection and the avoidance of projects that are high in pollution energy use and resource consumption ().
- **Transparency in policymaking makes for better policy.** Adopt measures to make the policymaking process more transparent (e.g., hold public hearings, solicit public comment, and require MEP to respond to public comment).

12. Environmental Enforcement

China's Air Pollution Law currently lacks strong enough mechanisms to guarantee information accuracy, deter environmental violations, and fully utilize the public to help supervise enterprises and local government implementation. Based on our review, we recommend several key proposals for the amendment to China's Air Pollution Law that we believe can help to solve one of China's most vexing challenges-the weak enforcement of its environmental laws and regulations:

- **Penalties for Falsifying Emissions Information.** The accuracy of emissions and monitoring information are the foundation of an effective air regulatory system. We recommend criminal penalties (including jail time and fines) for “responsible corporate officers” who file false emissions reports, omit or conceal facts, or fail to file reports.
- **Fines Per Day.** It is well known that fine levels in China are too low to deter enterprises from violating the air pollution law. Establishing fines that accrue per day of violation is a simple way to increase the deterrent value of fines and increase the incentive for enterprises to rapidly cure their violations.
- **Economic Benefit and Supplemental Environmental Projects.** Enterprises should not profit from their environmental violations, so fines should be set to remove any economic gains that enterprises obtain from their violations of the law. Supplemental Environmental Projects, which are projects violators must implement to make environmental improvements, are another mechanism for imposing consequences on violators that can also at the same time bring about environmental improvements.
- **Strengthen EPB Authority to Order Injunctive Relief ().** The authority of the environmental agency to order stoppage of illegal pollution or to take actions to comply with the law (backed by the availability of judicial enforcement) is a critical one in the U.S. Strengthening EPB authority in China to order injunctive relief and compliance with the law is critical. Authority to appeal to the provincial level courts or to higher levels of EPBs, for example, may help to address this EPB authority problem. Certain enforcement powers, such as the ability to halt operations of enterprises in serious and continual violation of laws, should be shifted from the government at large to the environmental protection bureaus.
- **Citizen Suits.** Citizen lawsuits to enforce environmental laws can be structured to work well with government enforcement actions and to minimize frivolous lawsuits. These can be a powerful tool for pushing government offices and enterprises to follow the law.

13. Climate Change

China is well aware of and has publicly acknowledged the harm that it will suffer due to climate change impacts. While important actions have already been taken to mitigate emissions that lead to climate change, much more still needs to be done in China, the U.S. and the rest of the world.

In amending the Air Pollution Law, China has a window of opportunity to establish a legal framework that can anticipate and establish a sound framework for addressing climate change. To take advantage of this opportunity, the Air Pollution Law should explicitly seek to:

- Integrate climate change and air quality management;
- Enhance coordination between energy and environmental policy and regulation;
- Build capacity and firmly establish the Ministry of Environmental Protection’s leadership role in monitoring, verification and reporting of greenhouse gases, especially CO₂; and
- Ensure that a cap and trade platform designed for SO₂ and/or NO_x trading is also compatible with CO₂.

CHAPTER TWO

NATIONAL AMBIENT AIR QUALITY STANDARDS

Richard Ayres

1. SUMMARY OF RECOMMENDATIONS

Uniform, national ambient air quality standards and a comprehensive framework of requirements to bring about compliance with such standards have played a critical role in the success of the U.S. in reducing its air pollution. China has established a system of national atmospheric environmental quality standards, but has faced challenges in achieving implementation. Moreover, China's recent efforts to focus on the environmental health impacts of pollution are not reflected in the current Air Pollution Law, with certain pollutants left out of the scope of regulation and monitoring, and only limited mention of health considerations in the law's text.

This chapter addresses recommendations from the U.S. experience on establishing a robust system of health-based national ambient air quality standards and preliminary ideas for improving implementation. Subsequent chapters deal with specific mechanisms to improve implementation and improve air quality, such as State Implementation Plans (Chapter Four), consequences for nonattainment (Chapter Five), permits (Chapter Six), regional planning (Chapter Seven), technology-based standards (Chapter Eight) and so on. In particular, we make the following specific recommendations for China's Air Pollution Law amendment:

- **Health-based Ambient Standards.** Make China's national ambient environmental quality standards explicitly health-based; i.e., based strictly on scientific information on the effects of pollutants on public health and environmental quality. Ensure that the major pollutants that impact on human health are within the scope of regulation. Require monitoring and reporting of all of these major pollutants.
- **Prioritize Achievement of Ambient Standards.** Elevate and clarify the importance of ambient standards in the law to ensure that they receive as much focus as total emissions control (TEC) targets.
- **Clear Consequences for Non-compliance.** Establish clear consequences, such as the use of regional project approval limitations (), with stronger central authority in order to improve enforcement. The early failure to give U.S. EPA sufficient authority to carry out enforcement led to years of insufficient compliance and implementation. This is a mistake that China can avoid.
- **Public Participation.** Provide for an appropriate scope of public participation in the standard setting process to strengthen the scientific basis and public acceptance of ambient air quality standards.

2. INTRODUCTION

In the United States, the 1970 Clean Air Act (CAA) established a comprehensive air regulatory system that had at its foundation two important elements: (i) National Ambient Air Quality Standards (NAAQS) for a variety of pollutants, and (ii) State Implementation Plans (SIPs) (covered in Chapter Four), which are complex plans developed by the states to set forth the steps for meeting the NAAQS.

2.1. Ambient Air Quality Standards and Human Health Protection as the Foundation

NAAQS therefore serve in some ways as the foundation for the US air regulatory system. An important aspect of the setting of NAAQS levels is the legal requirement that NAAQS must protect the public health “with an adequate margin of safety.” In this sense, NAAQS are *health-based*. This is somewhat different than the current Chinese air pollution law, which includes the “safeguarding of human health” as a general aim of air regulation, but does not explicitly require that ambient air quality standards be set at levels sufficient to achieve specific human health goals. Establishing explicitly “health-based” ambient standards in the Chinese air pollution law can have several benefits.

- Health-based standards are a *human-centered* approach to air regulation consistent with a general policy in China to design laws and policies that are *human-centered*.
- Such standards can send a clear signal to the public of the health-based purpose for strong air regulation. This provides a clear policy rationale for allocation of resources to air pollution regulation and counterbalances pressure from regulated industries to weaken emissions controls.
- Health-based standards can drive the regulation of certain pollutants harmful to human health that are currently not under regulation in China, such as PM_{2.5} and 8-hour ozone.

National health-based ambient standards also provide air quality planners with a clear cut target for their work and clarify the importance the country places on regulating key pollutants that harm human health and the environment. Such emphasis can be an important step in implementing China’s “National Action Plan on Environment and Health (2007-2015),” which explicitly calls for revision of laws and regulations to place a greater emphasis on environmental health.

2.2. Harmonize Ambient Air Quality Standards with Other Important Chinese Regulatory Tools, such as Total Emissions Control

China currently also has five-year total emissions control (TEC) targets for sulfur dioxide and interim annual TEC targets as well. These TEC targets are important and have given China useful experience in the implementation and achievement of pollution reduction targets. However, we suggest that the air law amendment clarify the relationship between TEC and ambient air quality standards, making clear that TEC is just one tool toward the ultimate achievement of ambient air quality standards and that achievement of TEC goals is necessary, but not sufficient. (See Chapter Three for a discussion on combining air quality-driven programs

with emissions-driven programs.) We suggest that the air law be amended to emphasize and firmly establish the importance China places on achievement of *all* of the national ambient standards, so that meeting standards for pollutants not included in the TEC system is not neglected. Eventually, the implementation lessons from the TEC system should be brought to bear on all key pollutants that have a negative impact on human health.

2.3. Establish Clear Consequences for Failure to Meet Ambient Air Quality Standards

An important element of the U.S. NAAQS program is the clear consequences for jurisdictions that do not meet NAAQS levels. In the U.S., continued nonattainment can lead to federal government sanctions against states or localities, such as limitations in highway funding and increasingly stringent requirements for new factories that can affect a locality's economic growth. These tools, even when not utilized in practice, provide the EPA with leverage and authority that can be used to drive better implementation at the local levels. The form of the consequences for non-compliance in China will likely be different than those chosen for the U.S. Indeed, China has focused on establishment of bureaucratic evaluation criteria and the use of regional project approval limitations () on environmental impact assessments. We strongly encourage the further development of such tools. As we will reiterate time and time again in this report, U.S. experience has shown that *strengthening central level authority over environmental enforcement* has been a key to pollution reduction in many instances, and that allocation of too much enforcement authority to the local levels in the U.S. has been a recipe for enforcement failure. Whatever form such consequences for nonattainment take in China, it is critical that clear consequences for non-compliance are set forth.

It is also important to note that economic costs are not considered in the establishment of NAAQS. Costs and economic impact are instead considered at the phase of setting emissions standards on pollution sources.

In this chapter, we also set forth the U.S. process for establishing NAAQS levels and promulgating regulations. The process is focused on gathering and publicizing extensive amounts of scientific background materials and involving public comment on proposals. The "Criteria Documents," which collect all relevant scientific, medical and technical information related to a pollutant, a "Staff Paper," which is the EPA's staff recommendation and the recommendations of the government's Clean Air Scientific Advisory Committee are all public documents that China might find beneficial as it establishes further ambient standards, such as PM2.5 and 8-hour ozone (as have been announced).

Note that the U.S. has only established NAAQS for seven pollutants (although preliminary steps in the process of NAAQS development have been undertaken for certain greenhouse gases). The U.S. has chosen to address other pollutants, such as hazardous pollutants, that can harm human health and the environment through technology-based emissions standards (addressed in Chapter Eight of this report).

3. U.S. EXPERIENCE WITH NATIONAL AMBIENT AIR QUALITY STANDARDS

This chapter describes the U.S. system of National Ambient Air Quality Standards. NAAQS are federal standards applicable everywhere in the U.S. that specify a concentration of each pollutant found widely in the outdoor air that is consistent with protecting public health and the environment with a margin of safety. NAAQS do not apply directly to any emitter. Instead, they are a measure of the success of the states and metropolitan areas in reducing pollution to tolerable levels in the air. The costs or attainability of NAAQS are not considered when they are adopted. Instead, cost is considered at the implementation stage, when specific emission limitations are applied to particular emitters.

3.1. Benefits of NAAQS

NAAQS have several functions:

First, NAAQS provide a clear-cut goal for air quality planners. Each state or major metropolitan area (see discussion of Air Quality Management Areas in Chapter Three) must prepare a State Implementation Plan (SIP) that includes enforceable emission control measures sufficient to improve air quality to the NAAQS in nonattainment areas, or maintain good air quality (sometimes called “maintenance SIPs”). See Chapter Six for a detailed discussion of SIPs.

Second, NAAQS inform the public of how much improvement must be made in air quality in their locality to provide citizens with healthy air to breathe. This enables citizens to become rational participants in policy development. It also counterbalances the pressure from the regulated industries to weaken emission controls.

Third, NAAQS provide uniform air quality standards nationwide. This national uniformity is important since people everywhere are affected by pollutants in the same way. Uniform national air quality requirements serve an important equity function in society because they eliminate “pollution havens” where emissions are not controlled.

Fourth, NAAQS establish a baseline target for environmental quality that is not compromised by cost considerations. The decision to require NAAQS to be based only on public health and environmental quality was a decision about how, not whether, economics would be considered in the U.S. program. NAAQS tell the public and the government what air quality is necessary to protect public health and the environment, without reference to cost. But NAAQS are not directly applicable to emitters. When it comes to determining what emission limitations will apply to specific emitters—either vehicles, or industrial plants, or people’s homes—the CAA requires consideration of cost as well as improvement in air quality. This structure creates clear targets for protecting public health and the environment, while allowing for appropriate consideration of impacts on economic development.

While NAAQS are not enforceable directly on emitters, states and localities suffer consequences if they do not attain NAAQS by the specified deadline. The failure to attain NAAQS can require a state or locality to adopt additional emission limitations and limitations on traffic. Continued nonattainment can also open a state or locality to sanctions from the federal government in the

form of limitations in highway funding and increasingly stringent requirements for new factories that can affect a locality's economic growth. These consequences for failure to attain NAAQS are important to the effectiveness of the U.S. air pollution regulatory regime. See Chapter Seven for additional details.

3.2. History and Background of NAAQS

Prior to 1970, U.S. law did not require federally-adopted NAAQS. During the 1960s the Department of Health, Education and Welfare (HEW), as it was then called, employed a staff of public health scientists and administrators who supported some of the first significant research into the effects of air pollution on public health and the environment. HEW's role was advisory to the states that realized they had a pollution problem. In 1967, Congress adopted a revision of the federal Clean Air Act that instructed HEW to develop compilations of scientific findings on the impact of various pollutants on public health and welfare, which were called "criteria documents."

In 1970, Congress drastically increased the role of the federal government in air pollution control. For the first time, the federal government was instructed to develop NAAQS—national standards to protect health and environmental quality. The 1970 Clean Air Act Amendments were based primarily on the concept of federally established NAAQS, with State Implementation Plans (SIPs) as the means to improve air quality to the levels required by the NAAQS. While subsequent legislation has increased the role of the federal government substantially, the federal-state partnership established in 1970 remains an important part of the U.S. air pollution control program. As Congress had expected, the NAAQS have become a powerful driver for the entire U.S. air pollution control program. The federal-state partnership has proven significantly less able to improve air quality than was expected in 1970. The reasons, which will be familiar to China's Ministry of Environmental Protection, are discussed in detail in Chapter Six, on the SIP program.

The U.S. Environmental Protection Agency (EPA) has promulgated NAAQS for seven pollutants: sulfur dioxide, particulate matter, fine particulate matter ($PM_{2.5}$), nitrogen oxides, carbon monoxide, ozone, and lead. Some of these pollutants are emitted directly, while others (notably ozone and $PM_{2.5}$) are formed in the atmosphere by chemical reactions among precursor emissions. Programs to attain NAAQS for pollutants formed in the atmosphere must reduce one or more of the precursor emissions. In the U.S., the primary strategy for attaining the ozone NAAQS in most places is to reduce emissions of NO_x . Strategies for attaining the $PM_{2.5}$ NAAQS concentrate on reducing emissions of both sulfur dioxide and NO_x .

For each of the pollutants, EPA establishes "primary" and "secondary" NAAQS. Primary NAAQS establish concentrations of pollutants in the outdoor (ambient) air to protect the public health with "an adequate margin of safety." Secondary standards are designed to protect natural and manmade environmental values. The U.S. government has so far failed to implement the secondary NAAQS as intended, though there would be substantial air quality and environmental benefits if secondary NAAQS were properly implemented.

NAAQS are notable in particular for the fact that the EPA must base primary NAAQS strictly on health evidence, without any consideration of the cost of attaining the NAAQS. This point has been debated hotly ever since 1970, and industry has tried repeatedly and unsuccessfully to require EPA to consider cost in establishing a NAAQS, or to convince Congress to change the law. As noted at the beginning of this chapter, health-based NAAQS have important political benefits for air quality planners. Because health-based NAAQS provide the public with a clear way to tell how well the country is progressing towards healthful air quality, they also allow citizens an opportunity to assess how well their government is doing on the pollution issue. This can create pressure on the government that can counter the pressure applied by affected industries, allowing the government better to carry out sound emission control policies.

NAAQS are not directly enforceable on any emitter. No individual or industrial plant may be prosecuted if an area fails to attain the NAAQS. But each state is required to develop a SIP that includes binding emission limitations for industrial and other sources of pollution, transportation planning, and other measures sufficient to attain the NAAQS. The SIP must require that all new industrial sources of emissions in the nonattainment area achieve the “lowest achievable emission rate” (LAER) (a standard for facility-level, technology-based emissions standards), and find offsetting emission reductions from other emitters within the nonattainment area. In areas where NAAQS are already achieved, the SIP must include measures to prevent “significant deterioration” of air quality, and require all new emitters to install “Best Available Control Technology” (BACT) (a standard for facility-level, technology-based emissions standards that may be equal to or less stringent than LAER, depending on cost considerations). These emission limitations and other measures are directly enforceable against emitters, governmental entities, and individuals who are subject to them. When developing their SIPs, states may also take into account the improvement of air quality that will result from implementation of federal government programs that directly regulate emissions from motor vehicles, electric power plants, and other industrial sources of emissions, which are also enforceable. These points are discussed at greater length in Chapter Six.

Once established, NAAQS must be reviewed at five-year intervals to determine whether new medical or scientific information requires them to be made more or less stringent. However, in practice, because the process of revision (described below) is elaborate and time-consuming, it often takes longer than five years to review and revise NAAQS.

3.3. Legal Framework for NAAQS

The CAA requires EPA to promulgate a list of air pollutants that are emitted by “numerous or diverse” sources, and which “may reasonably be anticipated to endanger public health or welfare” (“welfare” includes effects on the natural and built environment, visibility, or economic values that depend on the quality of the air) at concentrations found in the ambient air. In order to list a pollutant, the Administrator of EPA (“Administrator”) must determine that (1) the substance is an air pollutant; (2) it is emitted by numerous or diverse sources; and, (3) the pollutant’s presence in the atmosphere “may reasonably be anticipated to endanger public health or welfare.” This duty may be enforced through a lawsuit in a federal court.

NAAQS are intended to regulate only pollutants that are “generally present in the ambient air in all areas of the nation” and are “detectable through monitoring devices and systems.” Pollutants that endanger public health only in areas immediately surrounding the source are typically dealt with separately through state law. If they are particularly toxic, localized emissions may be regulated under the federal “hazardous pollutant” program; or they may be controlled through federal “new source performance standards.” Both these programs require application of pollution control technology without respect to the concentrations in the ambient air. See Chapter Eight below.

Once a pollutant is listed, EPA must publish within twelve months a compilation of the scientific and medical studies about the health and/or environmental effects of the pollutant. For historical reasons, this compilation is called a “Criteria Document.”⁴ The Criteria Document is supposed to “accurately reflect the latest scientific knowledge useful in indicating the kind and extent of all identifiable effects on public health or welfare” from its presence in the ambient air. This document is available to the public.

At the same time it publishes the Criteria Document, EPA must also formally propose primary and secondary NAAQS. The proposed NAAQS must be based on the information in the Criteria Document. NAAQS are expressed in terms of concentrations of a pollutant in the outdoor (ambient) air, usually in terms of a mass of pollutant per volume of air (e.g., in micrograms/cubic meter of air or parts per million of air). These concentration levels are measured over a specific period of time (e.g., the NAAQS for carbon monoxide specifies one hour and eight hour averaging times). A NAAQS is not necessarily exceeded if there is one measure in excess of the specified concentration. NAAQS usually define an “exceedance” in statistical terms, in order to provide a more robust understanding of the true air quality in an area.

The following table lists the U.S. NAAQS with comparisons to standards in China and the European Union and guidelines from the World Health Organization.

⁴ The concept of air quality “criteria” was introduced into the CAA in 1963, which directed the Secretary of Health, Education and Welfare to “compile and publish criteria” on the latest scientific knowledge of the effects of air pollution. For this reason substances listed as pollutants are described as “criteria pollutants,” and the EPA scientific evaluation document is called a “Criteria Document.”

3.4. Air Pollution Health Standards Comparison

Pollutant	Averaging Time	China ¹			USA ²	WHO ³	EU ⁴
		Level I	Level II	Level III			
PM10	Day	50	150	250	150	50	50 [◇]
	Year	40	100	150	—	20	40 [◇]
PM2.5	Day	—	—	—	35	25	
	Year	—	—	—	15	10	25 ⁵
Sulfur Dioxide	Hour	150	500	700	—	500	350 [◇]
	Day	50	150	250	364	20	125 [◇]
	Year	20	60	100	78	—	—
Nitrogen Dioxide	Hour	120	240	240	—	200	200 [†]
	Day	80	120	120	—	—	—
	Year	40	80	80	100	40	40 [†]
Carbon Monoxide	1-hour	10	10	20	40	—	—
	8-hour	—	—	—	10	—	10 [◇]
	Day	4	4	6	—	—	—
Ozone	1-hour	160	200	200	220	—	—
	8-hour	—	—	—	147	100	120 [†]
Lead	Rolling 3-mo average	—	—	—	0.15	—	—
	Quarterly average	1.5	1.5	1.5	1.5	—	—
	Year	1.0	1.0	1.0	—	—	0.5 ⁶

With the exception of carbon monoxide, all units are $\mu\text{g}/\text{m}^3$. Figures for CO are given in mg/m^3 .

Notes:

- The figures for Chinese air pollution standards come from [GB3095-1996](#) (1996) and [GB3095-1996](#) (2001). Level I standards apply to “nature reserves, resorts, and other areas in need of special protection.” Level II standards apply to “residential areas, mixed commercial and residential areas, culture areas, normal industrial areas designated by the urban zoning plan, as well as rural areas.” Level III standards apply to “industrial areas.”
- [EPA National Ambient Air Quality Standards](#) (NAAQS) (<http://www.epa.gov/air/criteria.html#1>).
- WHO air quality guidelines, last updated in 2005, can be found at http://www.who.int/phe/health_topics/outdoorair_aqg/en. According to the WHO, the “air quality guidelines (AQGs) are intended for worldwide use but have been developed to support actions to achieve air quality that protects public health in different contexts.”
- The EU’s health standards for air quality can be found at <http://ec.europa.eu/environment/air/quality/standards.htm>. Several pollutant limits have not yet entered into force. A number entered into force in 2005, but several are due to be effective in 2010 and beyond.
[◇] Limit value enters into force January 1, 2005
[†] Target or limit value enters into force January 1, 2010
- For PM2.5 in the EU: Target value enters into force January 1, 2010
Limit value enters into force January 1, 2015
- For lead in the EU: Limit value enters into force January 1, 2005 (or January 1, 2010 in the immediate vicinity of specific, notified industrial sources; and a 1.0 $\mu\text{g}/\text{m}^3$ limit value applies from January 1, 2005 to December 31, 2009)

3.4.1. Primary NAAQS

The CAA states that the primary NAAQS must protect the public health “with an adequate margin of safety.” This phrase embodies an approach to managing risk that is central to the entire air pollution program. While the NAAQS need not be so stringent as to protect the most

sensitive person in the population, or to protect those who are confined to a hospital, the standards must protect “sensitive groups” in the population. In 1970, Congress explained that purpose of the margin of safety was to protect “sensitive groups” such as “bronchial asthmatics and emphysematics who in the normal course of daily activity are exposed to the ambient environment.”⁵ EPA stated the policy less succinctly in a 1994 rule as follows:

Not only to prevent pollution levels that have been demonstrated to be harmful, but also to prevent lower pollutant levels that [the Administrator] finds pose an unacceptable risk of harm, even if that risk is not precisely identified as to nature or degree. In selecting a margin of safety, the EPA has considered such factors as the nature and severity of health effects involved, the size of sensitive population(s) at risk, and kind and degree of the uncertainties to be addressed.⁶

The federal courts have upheld the CAA margin of safety requirement and rejected the argument that EPA had exceeded its authority by adopting NAAQS more stringent than necessary to protect the public health.

EPA has struggled over the years with an inherent contradiction in the underlying assumptions of the primary NAAQS requirement, given what we know about air pollution. In 1970, the authors of the CAA no doubt believed that there would be a concentration of each pollutant in the ambient air that would be harmless – that would have no health effects whatever. Years of scientific investigation have led to a different conclusion: that for most air pollutants, there is probably no level of exposure which can be considered truly harmless. Thus for most air pollutants, there is no level of exposure, except no exposure whatever, low enough to “protect public health with an adequate margin of safety.”

In practice, EPA has interpreted the CAA language as being addressed to the uncertainty of scientific studies. NAAQS have been set below the lowest concentrations which EPA concludes have been shown unequivocally, through epidemiological or experimental studies, to cause harm to the health of humans. Effects that are shown by a relatively few studies, or contradictory studies, are considered in establishing a margin of safety that is used to establish a NAAQS at a level below the level already shown to have health effects.

EPA’s approach has been upheld by the D.C. Circuit which has stated that EPA need not identify a “perfectly safe” concentration of pollution. The “inability to guarantee the accuracy or increase the precision of the PM_{2.5} NAAQS in no way undermines the standards’ validity.”⁷

3.4.2. Secondary NAAQS

Secondary NAAQS are meant to protect the natural and man-made environment from the effects of air pollution. The CAA says that secondary NAAQS are to be set at concentrations “requisite

⁵ The concept was first articulated by the U.S. Senate in the report of the committee that wrote the 1970 Amendments to the Clean Air Act. S.REP. NO. 91-1196, at 9-10 (1970).

⁶ 59 Fed. Reg. 58,598-59 (1994).

⁷ *American Trucking Ass’n v. EPA*, 283 F.3d 355 (DC Cir. 2001).

to protect the public welfare” from “any known or anticipated adverse effects.” “Public welfare” is defined in the CAA as including –

effects on solids, water, crops, vegetation, manmade materials, animals, wildlife, weather, visibility, and climate, damage to and deterioration of property, and hazards to transportation, as well as effects on economic values and on personal comfort and well-being.⁸

The sweeping language and legislative history of the secondary NAAQS would suggest that they should be an important part of the CAA regulatory program. Until recently, however, the secondary NAAQS have played a minor role compared to primary NAAQS. Secondary NAAQS have been set at the same concentrations as primary NAAQS for PM, ozone, NO_x, and lead. Among conventional pollutants, only SO₂ has a separate secondary NAAQS.

But the secondary NAAQS may become more important in dealing with greenhouse gases. The use of the word “climate” in the definition of “welfare” played a significant part in the 2007 decision of the Supreme Court of the United States, in the case *Massachusetts v. EPA*, holding that EPA has the power under the CAA to regulate greenhouse gases as air pollutants. The Court ordered EPA to make a finding whether greenhouse gases endangered public health, a precursor to promulgating a NAAQS and other regulatory actions to curtail emissions of greenhouse gases. The Bush Administration ignored the Supreme Court, issuing an “advanced notice of proposed rulemaking” in July 2008 that repeated the arguments rejected by the Supreme Court and refused even to discuss the potential effects of global warming on human health.

However, the Obama Administration has reversed the Bush policy. In early 2009, EPA issued a proposed “endangerment” finding that could trigger regulations to reduce greenhouse gas emissions under several provisions of the CAA. As of the writing of this report, EPA was taking comment on this proposal. EPA has also announced publicly that it plans to adopt a greenhouse gas standard applicable to new motor vehicles that would require substantial reductions in both vehicle emissions of CO₂ and use of HFCs in vehicle air conditioning systems. As of the time of this writing, we expect that the EPA will in the near future propose CO₂ emission limitations for new fossil fuel-fired electric generating plants that likely would effectively ban construction of any new conventional coal-fired plants in the near future.

Such standards do not require new Congressional legislation. Under the CAA, as interpreted by the U.S. Supreme Court, EPA already has authority to make endangerment findings and act to regulate sources of greenhouse gas emissions. EPA could adopt NAAQS for greenhouse gases based on an endangerment finding, although the agency is not expected to use the NAAQS/SIP mechanism to address global warming gases. Global warming is uniquely a global problem, and there would be no way a single state (or even country) could demonstrate that what it could do would assure attainment of a NAAQS (e.g., an atmospheric CO₂ limit of perhaps 350 ppm) that would be sufficient to protect public health with a margin of safety as required by the U.S. CAA.

⁸ CAA Section 302(h).

3.5. Process for Adopting or Revising a NAAQS

Whenever EPA considers a new or revised NAAQS the agency goes through a long and rigorous administrative process to understand the state of scientific and medical knowledge about the pollutant. This process consists of three phases: (1) a scientific assessment phase; (2) a regulation development phase; and (3) an implementation phase. It is a complex process involving many people and interests, and it is not unusual for the process to take more than the five years allowed by the CAA for revisions of NAAQS. Most of the documents created in this process are available to the public for review and comment.

3.5.1. *Scientific Assessment Phase*

During the first phase EPA gathers and assesses medical, scientific and technical data and provides an opportunity for public and expert review of the documents put together by EPA staff. EPA staff proposes a revised, or new, draft Criteria Document. Because of the increasing amount of information available on the health and welfare effects of pollutants, Criteria Documents have become multi-volume compendiums of the scientific, medical, and technical information about each pollutant.

The review process for the Criteria Document begins with a comprehensive search of the scientific and medical literature of the health and welfare effects of the pollutant in question. EPA publishes a notice in the Federal Register⁹ announcing the commencement of the review and inviting submission of relevant scientific and technical papers for consideration in the preparation of the Criteria Document. When new information appears to justify revision of a Criteria Document, teams of experts from both inside and outside of EPA prepare a “workshop draft” of a revised (or new) Criteria Document. “Peer review workshops” are then convened to review each chapter or subject of the workshop draft Criteria Document. For example, if the Criteria Document were for PM_{2.5}, one peer review workshop might involve experts on the effects of inhaled PM_{2.5} on the respiratory system, while another might include experts on the effects of PM_{2.5} on soils and stream chemistry. The workshop draft is also made available for comment to the public and various interest groups. The authors of each chapter then review the comments received from the peer reviewers and the public, and revise the workshop draft Criteria Document accordingly. EPA staff then integrate the chapters into a single draft of the Criteria Document and prepare an executive summary.

As the Criteria Document evolves, successive drafts are also reviewed by the public and the Clean Air Scientific Advisory Committee (CASAC), an arm of EPA’s Scientific Advisory Board (SAB). CASAC meetings are usually attended by representatives of concerned industries, non-

⁹ The Federal Register is a daily publication of the U.S. government available to the general public. Whenever an Executive Branch agency, such as EPA, considers adopting a new policy, it must publish the proposed new rule, with an explanation of the need for the proposed rule, the legal authority for the proposed rule, and alternatives the agency has considered. The agency is required by law to allow a specified time—usually 30-90 days—for affected interests, other government agencies, non-governmental organizations, and members of the general public to comment on the proposal. The Federal Register typically publishes more than 20,000 pages of triple-columned, tightly spaced type of such proposals, final rules, and notices each year.

governmental environmental organizations, and other interested parties. The public has an opportunity to present written comments to the CASAC and to make brief oral presentations. CASAC public meetings often last several days.

Based on its meetings and the presentations given there, CASAC prepares detailed scientific and technical comments on each chapter of the draft Criteria Document to EPA. EPA staff incorporate this scientific and technical advice and recommendations and suggestions made by public witnesses before CASAC. At times public and CASAC comments have been so extensive that EPA and CASAC agree that a revised draft of the Criteria Document should be prepared for review at a future CASAC meeting.

EPA has found that it is useful also to prepare a separate document that addresses both the scientific, medical, and technical findings of the Criteria Document, and the legal and policy judgments the Administrator must make in establishing the NAAQS. This document is commonly referred to as the “Staff Paper.” It is also made available to the public, and it provides an opportunity to the public to comment on the proposed staff recommendations and the approach being taken by the Administrator before the decision is presented to the Administrator. In April 2007, the Bush Administration issued a memorandum stating that the Staff Paper would no longer be prepared, but would be replaced by a separate “risk/exposure assessment” and a “policy assessment” to be published in the Federal Register as an “advanced notice of proposed rulemaking.”

The Staff Paper is prepared by EPA’s Office of Air Quality Standards and Planning (OAQPS), which is located in North Carolina, rather than Washington, D.C. The Staff Paper evaluates the implications of the information in the Criteria Document for setting a NAAQS. The Staff Paper recommends the specifics of a proposed NAAQS, such as the form the NAAQS should take (e.g., “the third highest reading in a year”); type of indicator to be used to measure attainment; the averaging time or times that should be used to determine attainment; the concentrations for the primary and secondary NAAQS, and other such issues.

The revised drafts of both the Staff Paper and the Criteria Document are submitted once again to CASAC and the public for further review. CASAC meets again to review the revised drafts, again with public participation. When CASAC completes its review, it formally submits its advice and recommendations to the Administrator in the form of a “closure letter.” EPA staff then prepare the final Criteria Document and Staff Paper, taking CASAC’s recommendations into account.

3.5.2. Regulation Development Phase

After the assessment phase is completed, EPA staff prepare a regulatory “decision package” for the Administrator. These include the staff’s recommendations on the concentration, form, averaging times, and indicators for primary and secondary NAAQS. This decision package considers the Criteria Document, Staff Paper, and the advice of CASAC, and presents alternative policies (with the rationale for each) for the Administrator’s consideration. The Administrator must consider the Criteria Document, Staff Paper, and CASAC recommendations, as well as the recommendations of his or her staff. If the Administrator decides that a new (or revised)

NAAQS is called for, he or she must determine the appropriate concentration for the new NAAQS, as well as the appropriate “margin of safety” for the NAAQS.

Before publishing a proposed rule, EPA must prepare an analysis for the White House Office of Management and Budget (OMB), an agency that prepares the federal budget and reviews federal expenditures. While EPA cannot take cost into account in establishing a NAAQS, the agency must nonetheless provide OMB with its best estimate of the costs and benefits that will flow from the proposed standards. Under a Presidential Executive Order, OMB has the authority to require EPA to reconsider a NAAQS before making a formal proposal. The exercise of this authority is typically constrained in Democratic administrations. But Republican Presidents have often used OMB to force EPA to make concessions to regulated industries against the agency’s better judgment.

When the Administrator has decided, based on the Criteria Document and staff papers, the approach the agency will take, EPA issues a “proposed rule” in the Federal Register. The proposed rule usually includes not only the proposed NAAQS concentration and form, but also typically specifies the kind of air quality monitoring EPA expects the states to undertake to determine the concentration of the pollutant in outdoor air. In this proposal, the Administrator must explain at length the scientific basis for the proposal; the policy choices that have been made in establishing the concentration level, averaging time, and other aspects of the NAAQS; and the legal authority for the proposal. Once again, the agency formally invites public comment on the proposed rule for a specified period (usually 90 days for a NAAQS). Written comments are placed in an electronic “docket” at EPA, so that any commenter may read and comment on the observations of others. When an interested party comes in to see any EPA staff person, the visit is recorded and placed in the electronic docket as well.

When EPA proposes to adopt a new NAAQS or revise a current NAAQS, the agency usually develops other proposed rules or guidance to assist States in developing State Implementation Plans (SIPs) that will be needed to reduce emissions sufficiently for states to attain and maintain the NAAQS. These may include reference methods for measuring concentrations of the pollutant in the ambient air, monitoring requirements for major sources of the pollutant, and requirements for surveillance of sources to assure compliance with the emission limitations.

3.5.3. Final Promulgation and Judicial Review of a New or Revised NAAQS

At the end of the comment period on the proposed rule, EPA may have received hundreds of written comments from potentially affected industries, public interest non-governmental organizations, state and local governments, trade associations, medical and scientific experts, and members of the general public. The agency reviews each comment before preparing a final rule for promulgation. Based on these comments, the agency may make further adjustments before final promulgation of the rule.

EPA then prepares a second document for the Federal Register. In this document, the agency responds to all the comments that were made in response to the publication of the proposed rule. It then describes the reasons it has adopted the final NAAQS. This second Federal Register document includes the exact regulatory language of the rule. When this document is published,

the NAAQS becomes legally effective. Promulgation of the NAAQS subjects states and localities to a legal requirement to develop SIPs that include emission limitations and other measures sufficient to attain the NAAQS (the SIP process is described in Chapter Four, below).

Once a NAAQS has been promulgated as a final rule by EPA, it may be challenged by interested parties in the federal courts. Such challenges are typically brought by industries that feel they will have to pay for the emission reductions required to attain a NAAQS, or by non-governmental environmental organizations who believe that the NAAQS continues to allow concentrations of pollutants that may be harmful to public health or welfare.

Under the CAA, a lawsuit against a NAAQS may only be brought in one court—the United States Court of Appeals for the District of Columbia (“DC Circuit”). Because such a suit is considered an appeal (from EPA’s decision), the challenger may not question the Administrator’s judgment with respect to questions of fact. Only two questions may be raised: (1) Did the Administrator erroneously interpret the law? Or, (2) Did the Administrator abuse his or her discretion? These legal standards have typically been interpreted liberally in EPA’s favor.¹⁰

¹⁰ Since the 1980s U.S. Courts have operated under the “Chevron” doctrine, by which the courts will defer to the agency on matters of interpreting the CAA if the particular CAA provision in question is “ambiguous.” Since it is often possible to say that a statutory provision is ambiguous, the courts often defer to the agency even as to interpretation of the CAA language.

CHAPTER THREE

COMBINING AIR QUALITY STANDARDS WITH TOTAL EMISSIONS CONTROL (TEC)

Richard Ayres

1. SUMMARY OF RECOMMENDATIONS

China, like the U.S., has established air quality-driven and emissions-driven regulatory programs. However, with the focus on Total Emissions Control in recent years, some experts have raised the issue of how China should prioritize these two types of programs. Some have expressed concern that inadequate focus is being placed on air quality-driven programs. Our review of the U.S. experience has generated the following findings with regard to the use of air quality-driven and emissions-driven regulatory approaches:

- The U.S. experience has demonstrated that *air quality-driven programs*, such as the NAAQS/SIP program described in Chapters Two and Four, and *emissions-driven programs*, such as the U.S. acid rain program, have proven entirely compatible—and indeed complementary.
- Air quality-driven programs are useful because they provide goals for the entire air pollution control effort, benchmarks for progress, and a means of informing the public about progress towards health-protective air quality. Indeed, the high level of public interest in ambient air quality and “blue sky days” in China demonstrates the importance of maintaining a strong focus on air quality.
- Emissions-driven programs, like TEC and the U.S. acid rain program, are easier to implement and provide fewer opportunities for the regulated industries to delay or obstruct. Monitoring and enforcement are always important, but they are particularly so if a cap and trade system such as the U.S. acid rain program is to work.

We recommend that:

- China maintain a strong focus on meeting ambient air quality standards, even as it pushes forward to implement emissions-driven programs. Technology-based emissions standards (in conjunction with energy efficiency standards – see Chapter Eight) can be a powerful, implementable tool to support both air quality- and emissions-driven programs, as well as a workable approach to regulating a broader range of pollutants.
- MEP should be given stronger authority to supervise and enforce against failure to meet ambient standards and TEC targets, including influence over government officials’ evaluations, regional project approval limitations () and other tools. Information disclosure can also be a powerful tool for driving achievement of TEC targets and ambient air quality standards (see Chapter Twelve), and utilization of this important tool should be aggressively expanded.

2. INTRODUCTION

China has in recent years developed an innovative approach to air pollution control known as Total Emissions Control (TEC). One issue of concern has been the relationship between China's ambient air quality standards, TEC and facility-level emission standards. Based on the American experience, we believe that China's program will be most effective if all three components are robust, active mechanisms within the air regulatory system.

The U.S. Clean Air Act (CAA) includes two fundamental approaches to protecting public health and the environment. First, many of the objectives of air pollution control are established in air quality-driven programs such as the NAAQS/SIP program. Second, the CAA includes a number of emissions-driven programs that are very effective tools for achieving air quality objectives. These include technology-based New Source Performance Standards, motor vehicle emission control standards, and industry-wide and cap and trade programs. These emission-driven programs, like the TEC, are not derived primarily from a calculation of what is needed to attain air quality objectives. Nevertheless, they contribute greatly to efforts to attain air quality goals.

Each of these approaches has distinct benefits. Establishing air quality standards provides a benchmark and a measure of success for air quality planning officials. It also provides the public with a way to understand what progress is being made towards healthful air quality. Emissions-driven programs, on the other hand, are easier and less expensive to establish, and often considerably easier to administer and enforce. A regional or national emissions cap is particularly attractive as a means to cut emissions from existing emitters. To make such a cap work, however, requires much more sophisticated emission monitoring and reporting requirements, together with strict enforcement measures.

3. AIR QUALITY-DRIVEN PROGRAMS IN THE U.S.

The U.S. Clean Air Act includes two major air quality-based programs, one for polluted areas (i.e., areas where air quality is worse than National Ambient Air Quality Standards (NAAQS)), and one for areas where air quality is better than health-based NAAQS. In the metropolitan areas where the air is polluted, attaining the NAAQS is the objective of all CAA programs. To attain the NAAQS, states and polluted metropolitan areas must adopt State Implementation Plans (SIPs). SIPs are collections of measures to reduce emissions designed to lower concentrations of pollutants sufficiently to attain the NAAQS in the area. See Chapter Two regarding the NAAQS.

Because SIPs are air quality-driven programs, they begin with measuring the actual quality of the air in the area, usually at several places where the highest concentrations of pollutants are expected. If the measurements show that concentrations of any of the regulated pollutants in the air exceed the NAAQS, the state or locality must prepare a SIP. The measured air quality information is fed into a computer-based air quality model, which uses data about wind speeds and directions, topography, atmospheric inversion layers, and the pollution concentrations measured by the monitors to model the air quality in the area. Using this model, state and local air quality management officials evaluate various air pollution control strategies to determine what combination of measures is needed to lower the excessive pollution concentrations to the levels required by the NAAQS. In other words, the NAAQS/SIP process starts with the NAAQS

and works back deductively, through sophisticated models, to identify the emission reductions necessary to attain the air quality goals.

In any area where NAAQS are not attained, the state or local agency must have a system to manage proposed new industrial facilities to assure that new emitters may be accommodated consistent with the goal of attaining NAAQS. For this reason, a new emitter may not be built in a nonattainment area without a review by the state to determine whether the emitter will (1) be equipped with the most modern pollution control technology (technology that will achieve the “Lowest Achievable Emission Rate” (LAER)), and (2) more than offset any emissions remaining after installation of the LAER pollution control technology. LAER is determined by the state agency on a case-by-case basis.¹¹ Emission “offsets” are reductions made by other emitters in the area (paid for by the new emitter) beyond what the other emitter is required to do by the SIP. See Chapter Five for more details about the rules governing nonattainment areas.

The second air quality-driven program in the U.S. is designed to preserve high quality air wherever it exists (e.g., in the Mountain West). This “prevention of significant deterioration” (PSD) program has two goals: first, to protect the high quality air of certain federally-protected lands such as National Parks (e.g., Grand Canyon) and Wilderness Areas (where the “hand of man” is not evident); and second, to manage the air resources in other “clean air” areas to preserve the air quality and maximize the potential for economic growth. As in the NAAQS program, states are required to prepare SIPs to prevent significant deterioration. Like the NAAQS program, the PSD program allows air quality managers to control emissions from industrial emitters in order to protect air quality. Any new emitters who wish to locate in such areas must (1) install “best available control technology” (BACT)¹² and (2) demonstrate that it will not cause deterioration of air quality beyond limits established in the CAA.

4. EMISSIONS-DRIVEN PROGRAMS IN THE U.S.

The U.S. CAA also includes emission-driven programs that are not directly related to air quality measurement and modeling, although they are critical to the attainment of the NAAQS because they reduce emissions. The idea behind the emissions-driven programs is that, in light of the scientific findings that there is no safe level of air pollution, the government should be able to require new or modified sources of pollution to install available and affordable pollution control technology or other measures without demonstrating an air quality need. Unlike the NAAQS/SIP program, in the emission-driven programs the federal government directly establishes limits on emissions for all new emitters in a given category, which applies nationally, without regard to measured air quality. These programs are administered for the most part by the federal government, although the federal government may delegate the administration of some of them to state agencies under certain circumstances.

¹¹ EPA maintains a “RACT/BACT/LAER Clearinghouse” that includes all of the LAER determinations made by all of the state agencies (with federal oversight and approval). State agencies use it to inform themselves of the state of the art in technology before making their own LAER determination in a specific case. The RACT/BACT/LAER Clearinghouse database is available at <http://cfpub.epa.gov/RBLC/htm/bl02.cfm>.

¹² Like LAER determinations, BACT determinations are made on a case-by-case basis by the state agency.

The national emissions-driven programs include: (1) emission limitations for emissions of NO_x, CO and HC from new motor vehicles; (2) controls on the content of various components of gasoline (such as a ban on adding lead); (3) New Source Performance Standards (NSPS) that apply to any new major industrial sources of emissions; (4) federal Maximum Available Control Technology standards for toxic air pollutants; and (5) the federal acid rain control program.

The emissions-driven programs assist in attaining air quality objectives. They are relatively easy to administer because they can be applied without the expensive and time-consuming air quality measurements and modeling exercise. In already-polluted areas, they contribute to the states' efforts to attain the NAAQS. In areas with air quality better than required by the NAAQS, such as in the American Southwest, emissions-driven programs preserve the incomparable views and experiences. In addition, they require efficient use of high quality air resources, to preserve them to support future economic growth.

Emissions-driven programs that apply to new industrial units also eliminate competition based on air pollution requirements among localities competing for new industrial development. Without uniform federal standards for new industrial units, metropolitan governments might engage in a "race to the bottom," offering entities relaxed pollution control requirements as an inducement to locate in the area.

Federal emissions-driven programs also act like a floor underneath state and local air pollution authorities. When states and localities design their SIPs, they may assume the emission reductions that will occur as a result of the federal NSPS and other federal programs. If, to take an oversimplified example, an area found that it needed to reduce concentrations of PM_{2.5} by 50 percent in order to attain the PM_{2.5} NAAQS, it might be able to assume that federal emissions-driven programs would achieve a 35 percent reduction over the planning period. If so, the state or locality could assure attainment of the NAAQS through SIP measures that will achieve a 15 percent reduction in ambient pollutant concentrations.

4.1. New Source Performance Standards

One example of an emissions-driven program that may be especially relevant to China is the New Source Performance Standards. The CAA directs EPA to establish "standards of performance" (emission standards) for new and modified industrial emission sources. These standards must require new units to be equipped with the best system of emission control available, taking into account cost and certain other factors. NSPS have been adopted for dozens of types of major emitting facilities, including electric power generators, metal production plants, oil refineries, cement manufacturing, industrial boilers, etc. Unlike the emission limitations adopted in SIPs, the NSPS are the same for any new or modified unit, regardless of location. Any new or modified emission source must meet these emission standards, even if it is not necessary to attain NAAQS in the area.

NSPS are different from the TEC in one important respect. While requiring the installation of state-of-the-art pollution control technology, NSPS do not establish a cap on total emissions. Thus NSPS do not limit the number of new sources that may be built, or the total amount of emissions from such sources.

4.2. MACT standards for Hazardous Air Pollutants

“Hazardous,” or toxic, air pollutants are not regulated in the U.S. by NAAQS or other air quality standards. The reason is that NAAQS are designed to regulate pollutants that are ubiquitous in the outdoor air. Toxic emissions are assumed to be essentially localized problems resulting from factories that use or manufacture chemicals, petroleum, or other sources of toxic emissions. Under U.S. law, toxic air pollutants are therefore regulated by emissions-driven technology standards that by law must require the “maximum available control technology” (MACT). These standards, which are discussed at greater length below in Chapter Eight, are established by the federal government and apply nationally. Because they apply to toxic air emissions, the law does not provide for balancing emission reduction against cost as with the NSPS. Instead, MACT standards for new plants that emit toxics must reduce pollutants as well as the best single similar facility in existence in the U.S. or elsewhere. MACT standards for existing emitters must be equal to the average of the emission reduction performance of the 12 percent best performing emitters in the same category. Like NSPS, MACT standards limit emissions from individual emitting facilities, but do not limit the number of such facilities that may be built.

4.3. The Acid Rain Control Program

At this time, the only U.S. CAA program that caps the total amount of emissions from any industrial sector is the “acid rain” program contained in Title IV of the CAA.¹³ This program applies to all large electric generating units, new and existing. It includes a cap on emissions from all such units of 8.9 million tons of SO₂ annually.

This cap is not based on measurements of sulfur dioxide in the ambient air. The cap limit was based on findings by the U.S. National Academy of Sciences that the excessive accumulation of sulfur and nitrogen compounds in forests, streams, and soils across much of the U.S. was degrading biological systems, interfering with visibility, and causing damage to the man-made environment. In the 1980s, the National Academy concluded that a reduction of 50 percent in acid deposition would slow the processes of acidification sufficiently to protect the environment. Thus the purpose of the program was to reduce the deposition of sulfur and nitrogen compounds on the outdoor environment to an extent that was thought sufficient to slow the accumulation to a tolerable amount. Today, many scientists in the U.S. would argue that the cap on sulfur dioxide should be tightened by 75 percent or more in order to further reduce acid deposition and reduce human exposure to fine particulate pollution.

To assure that the cap will be met, the CAA creates an emissions trading system with strong enforcement mechanisms. Under this system, the federal government gives away “allowances” for 8.9 million tons of SO₂ emissions each year. These allowances are distributed free to fossil fuel-fired electric generating stations based on a complex formula contained in the CAA. Each allowance gives the holder the right to emit one ton of sulfur dioxide. These allowances are tradable—that is, if a company emits less sulfur dioxide than the number of allowances it has received from the federal government, it may sell its excess allowances to anyone at whatever price is agreed upon. Likewise a company that emits more sulfur dioxide than the amount of

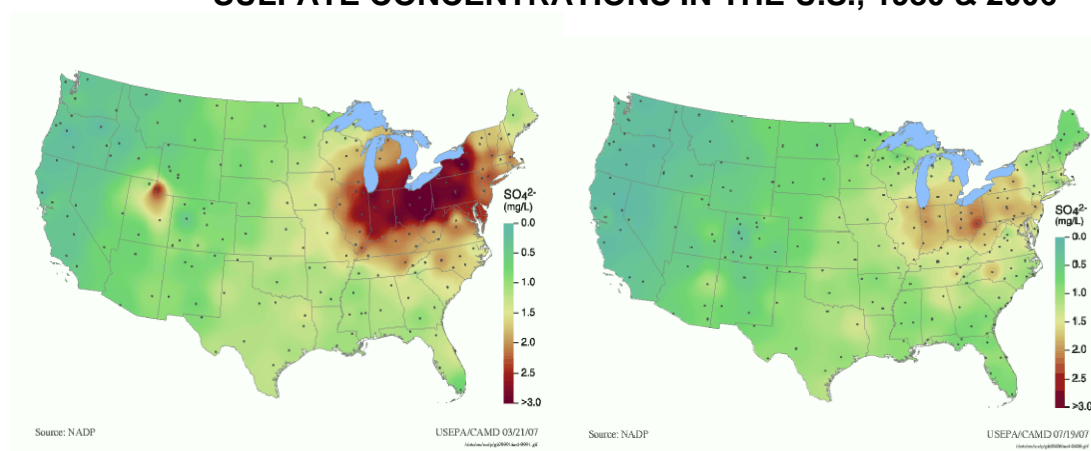
¹³ This program is discussed at greater length in Chapters Seven and Fourteen.

allowances it receives from the government may buy allowances from other electric generating companies, or from brokers or other “middle men” who have purchased allowances from companies that have more than they need.

Compliance with this system is on an annual basis. At the end of each year, the owner or operator of the generating plant must certify the emissions from the plant for the year, and transfer to EPA a number of allowances equal to the total emissions from the generating plant for the entire year. If the emissions exceed the allowances, the operator must pay a fine of \$2,000 per excess ton of sulfur dioxide emissions. In addition, the generator must “repay” the shortage of allowances by providing twice the allowance shortfall in the following year.

As shown in the chart below, the acid rain program has been very successful in reducing concentrations of sulfates in the air of the East and Midwest, just as was intended.

SULFATE CONCENTRATIONS IN THE U.S., 1980 & 2006



There are two reasons the acid rain program is successful. First, the program reconciles two seemingly irreconcilable needs. On the one hand, it permits the government to set a hard-and-fast limit on the total national emissions of sulfur dioxide. On the other hand, it allows emitters great flexibility in how much they emit, while providing a strong financial incentive for them to find ways to minimize total emissions from their fossil fuel-fired units. Sale of allowances to others may provide sufficient revenue to pay part or all of the cost of installing and operating sulfur dioxide “scrubbers,” for example.

The second reason the acid rain program works is because it includes a very rigorous monitoring and enforcement component. Without these, the system would not have achieved the emission reductions that it has. Any emitter subject to the cap is required to use continuous emission monitors (CEMs) for sulfur dioxide. The data generated by the CEMs must be reported to the air pollution control agency. The operators of the generating plant must be required to maintain the emission monitoring equipment at all times, subject to civil or criminal penalties for failing to operate and report the results from the monitors (see Chapter Thirteen on enforcement). At the end of the year, senior officials must certify the emissions from the generating unit. They are subject to strong criminal penalties if they falsely certify. Because the U.S. system contains these elements, compliance with the program appears virtually total. As a result, the program

has achieved substantial emission reductions even as power demand has increased since the program was initiated, at a total cost a small fraction of what the U.S. government and the electric utility industry predicted when the legislation was under consideration in 1990.

As described above, the acid rain program was adopted to address an important environmental problem caused by deposition of pollutants, rather than directly to protect human health by reducing concentrations of pollutants in the ambient air. But the Congressional legislative history shows that Congress understood that the acid rain program would also be helpful in attaining NAAQS by reducing the regionally-transported emissions of sulfur dioxide and NO_x from large power plants, which contribute to excessive concentrations of PM_{2.5} and tropospheric ozone. As with NSPS, states may take into account the reductions in concentrations of pollutants such as ozone and PM_{2.5} resulting from the acid rain and other programs when they design their SIPs. Like NSPS, and TEC, the acid rain program supports efforts to attain the NAAQS, even though it is an independent pollution control program, separate from the air quality-driven NAAQS/SIP program.

5. EVALUATION: ARE AIR QUALITY-DRIVEN AND EMISSIONS-DRIVEN REGULATIONS COMPATIBLE?

The American experience suggests that emissions-driven programs can be highly complementary to air quality-driven programs such as the NAAQS/SIP program. Each type of program has its own strengths. Air quality-driven programs, such as NAAQS, provide a measure of the air quality necessary to provide healthful air quality to all citizens, and a useful benchmark of how much progress is being made. But American air pollution officials have found that emissions-based regulations are considerably easier to adopt and enforce, because they do not require the difficult step of demonstrating that emissions from a particular factory or area cause excessive concentrations of pollutants in the ambient air.

By contrast, emissions-based programs provide fewer opportunities for obstructing the regulatory process. A technology approach like NSPS requires the regulatory agency to determine only what is technologically possible and affordable. Also, because NSPS applies only at the time the owner or operator is making a major commitment of capital (when the unit is either new or being modernized) it engenders less opposition from factory owners. Emissions-based regulation is less successful controlling emissions from existing factory units. As factory owners are quick to point out, every installation on an existing industrial unit presents unique problems and costs. When a uniform technology standard is applied, the high costs of some installations makes the program much more expensive and less efficient in terms of pollution reduced per amount of money spent.

The cap and trade approach provides an answer to this problem when applied to existing emission sources. Because it allows those with high compliance costs to purchase allowances from those who have lower emission control costs, the cap and trade approach eliminates much of the economic inefficiency in the emission standards approach when applied to existing emitters. Because it provides flexibility, and because the idea of a market is familiar to factory owners, a cap and trade approach seems to engender less opposition from the regulated industry. When the U.S. acid rain program was adopted, the regulated industry largely accepted the cap.

Instead of opposing the cap, they spent most of their energy lobbying government leaders to allocate more allowances to their particular company or region.¹⁴

In short, both air quality-driven and emissions-driven regulatory structures have strengths and weaknesses. In the U.S., we have found that the most effective system includes both approaches, because together they tend to preserve the strengths of both and cancel out the weaknesses of each.

¹⁴ In the current U.S. debate on global warming legislation, there is a heated debate over whether CO2 allowances should be given out free to emitting industries, or whether the industries should have to enter an auction to purchase allowances. This issue is a serious one, though it was not debated when the acid rain program was adopted in 1990.

CHAPTER FOUR

STATE IMPLEMENTATION PLAN PROCESS

Chris James
Richard Ayres

1. SUMMARY OF RECOMMENDATIONS

The use of planning for the purpose of achieving air quality targets is a fundamental element of the U.S. air pollution regulatory regime. As China considers expansion of the use of planning processes to achieve its air pollution goals, the several decades of experience in the U.S. (both positive and negative) will be of use in China. Based on our review of the U.S. and Chinese air pollution regulatory systems, we make the following specific recommendations to strengthen air quality planning in China's Air Pollution Law amendment:

- **Air Quality Planning.** Development of regional, provincial and/or municipal planning systems akin to SIPs for the purpose of attaining ambient standards. Greater planning specifically focused on how jurisdictions can meet air quality targets is essential to improved air quality. This can be made to fit well with China's already well-developed system of government planning. Stronger planning at the regional level can avoid some of the challenges the U.S. has had in regional planning.
- **Central Enforcement Authority.** For plans to be meaningful and effective, there must be consequences for failure to meet plan targets. China's system already has effective tools to address failure to meet official targets and these should be adapted and aggressively expanded for use in the air quality context. Specifically, we recommend giving the State Council or its administrative bureau in charge of environmental protection the authority to take over air quality programs if provinces or cities fail to perform as required, enforce against intransigent factories, give evaluations to officials on their environmental performance, and other authority.
- **Direct Central Authority Over Large Emission Sources.** Large sources of emissions with regional impacts, such as the transportation sector, large electric generators and industrial facilities, should be regulated by the State Council or its administrative bureau in charge of environmental protection. This notion is similar to what China is already implementing with its "State Controlled Key Pollution Sources System" (国家控制重点污染源管理系统), but central authority should be expanded and strengthened. This has proven to be effective in the U.S.
- **Central TEC Authority.** TEC is a powerful tool for driving implementation of air pollution reduction. The State Council or its administrative bureau in charge of environmental protection should have greater authority over TEC designations to help meet regional air pollution targets. In cases where provinces have failed to meet TEC targets, the central government should have authority to take over local level allocations. Even if seldom utilized, this leverage can be a powerful tool for improving enforcement.

China already exercises central supervision through MEP's Environmental Supervision and Inspection Bureau () and the Ministry of Supervision . This authority can be expanded to enhance TEC implementation.

- **Strengthening Monitoring and Reporting.** Accurate and timely monitoring and reporting are critical to the effective implementation of air pollution plans. Funding and human resources, as well as penalties for cheating on monitoring and reporting must be increased substantially.

2. INTRODUCTION

China is considering how the use of broader planning processes for air pollution control can improve its air quality. The United States has had several decades of experience with utilizing state-based air quality planning processes to produce detailed, technical plans to achieve the air quality standards established pursuant to the Clean Air Act. The experience in the U.S. has shown that such planning can have tremendous benefits for air quality. However, the decentralized nature of such planning has also led to implementation problems that must be addressed by giving the central-level environmental bureau more authority over policymaking, enforcement and implementation.

This chapter will set forth in detail the air quality planning process used by federal and state air quality agencies in the United States in the hopes that China may learn from the successes and failures of the U.S. experience. A State Implementation Plan is the term used to describe a collection of regulations, policies and procedures that a state uses to reduce and control pollution within its jurisdiction to meet federal air quality standards and regional air pollution limits. Developing a SIP is only one of several state responsibilities, each of which relates to and has influence upon the others.¹⁵ Regulations developed by air quality planners must be enforced to be effective at reducing pollution. The regulatory effectiveness is in turn measured by air quality monitors. Pollution levels recorded by monitors inform air quality planners and influence what future regulations and reductions are required to meet and maintain compliance with air quality standards. This is a continuous process.

Decades of experience show that SIPs can help to promote long-term planning and offer collaborative opportunities to develop regionally consistent approaches to reduce air pollution. Moreover, SIPs may become the platform that the U.S. uses to implement measures to reduce greenhouse gas emissions. However, it is important to recognize that the evolution of the air quality management system that exists today in the United States has been the product of forty years of domestic political circumstances—America's *special characteristics* (), if you will—circumstances very different from those in China today. The state implementation planning process, as its name suggests, bestows much responsibility on the states. This is especially the case for large industrial sources of emissions, which are among the largest emitters and frequently responsible for pollution that is transported and damages air quality in other

¹⁵ Other state-level responsibilities include developing SIPs for areas that are already in attainment of national ambient air quality standards. This is a process called “prevention of significant deterioration” (PSD) and seeks to prevent the deterioration of areas with good air quality.

states. Dispersed authority across 50 states has created a relatively fragmented system in which states exhibit varying degrees of commitment despite common environmental goals.

The varying levels of commitment to improving air quality have driven the creation of a number of more centralized air quality management authorities. The U.S. experience has shown that stronger central enforcement authorities have improved implementation of the Clean Air Act and improved air quality, and resolved some of the problems associated with the more decentralized system established by the CAA's NAAQS/SIPs program.

Central-local relations are a hotly debated topic in China as well, and China's relatively decentralized environmental enforcement system—with primary responsibility for most environmental enforcement residing at the local levels—has led to enforcement problems (). China will need to strike a balance between concentrated and dispersed authority in establishing its air quality management planning system. The U.S. model of dispersed authority may not provide the best example for China to follow. A more effective model would involve strong central institutions that provide clear, explicit direction to the provinces and local authorities on the full range of air regulation activities, including implementation, monitoring, and enforcement, such that central directions achieve verifiable results in the provinces.

3. STATE PLANNING IN U.S. CLEAN AIR ACT¹⁶

The U.S. Clean Air Act (CAA) has often been described as a federal-state partnership. Prior to 1970, air pollution in the U.S. was seen as a primarily local problem affecting a few cities that were particularly dependent on one polluting industry (e.g., Pittsburgh and steel) or particularly prone to trapping pollution from motor vehicles (e.g., Los Angeles). Though the U.S. developed federal air legislation in the 1950s and 60s, these early laws were well-intentioned but lacking in real enforceable requirements. As awareness grew that air pollution had become a national problem, Congress finally “took a stick to the states” (as one famous law journal article described it). In 1970, Congress adopted the first strong federal air pollution law, which established a federal-state partnership that endures today. Under that law, the federal government established the goals of the effort (the National Ambient Air Quality Standards), and stepped in to regulate directly motor vehicle emissions and *new* industrial emitters.

States were given the task of establishing emission limitations for *existing* industrial emitters, and adopting measures to control and reduce traffic in metropolitan areas. To make sure that states and localities adopted and enforced the emission limitations required to attain the NAAQS, Congress required the states to demonstrate to EPA the efficacy of their SIPs and their authority to enforce their SIPs, to make available to the public the emission information from regulated entities, and to meet a number of other requirements. EPA was required to review and approve or disapprove SIPs, and to substitute a Federal Implementation Plan (FIP) if a SIP was deficient.

The CAA's reliance on state and local governments was in part a function of the history of air pollution in the U.S., and also a recognition that it was the states that first addressed pollution issues. Indeed, California and New York, among others, were far ahead of the federal

¹⁶ For more on regional air quality management in the U.S., see Chapter Seven.

government when the 1970 Clean Air Act Amendments were adopted. In part the federal-state partnership is a result of the limitations of federal resources. And in part it responds to a deep-seated American preference for regulation by officials closer to home than those in Washington, D.C. This preference is embodied in the U.S. Constitution, which reserves to the states all powers not expressly delegated to the federal government.

In truth, the states have not been completely effective at achieving the goals set out in the CAA. State governments are often unable to resist the pressure of industries that are large employers in their states. Most states do not have the resources—in terms of personnel, funding, or political backing—needed to force large emitters to clean up. A few states, notably California and the New England states, have been able to adopt strong clean air programs, but these are not states with a great deal of polluting heavy industry.

One problem the states have faced is that many of the largest air pollution problems are regional or national in nature, and therefore not easily addressed at the level of a state or metropolitan area. Congress recognized this problem to some extent when it directed EPA to regulate emissions from motor vehicles. Congress also empowered the EPA to establish uniform national performance standards for “new sources” of pollution. But the CAA does not authorize federal emission limitations for emitters that existed before the federal new source performance standards were adopted for most classes of large industrial emitters. Control of emissions from these emitters, who are responsible for the lion’s share of industrial air pollution, remains in the hands of the states.

Many of these emitters—for example, coal-fired electric power plants built before 1979—are among the largest sources of pollution in the country. Many of them are also responsible for pollution that travels hundreds of miles, polluting states far from the emitter itself. As explained below, the CAA offers no obvious mechanism for states suffering harm to require emission reductions in states where pollution originates. See Chapter Seven for a detailed discussion of federal and state efforts to deal with regional pollution. One such program, for example, is the Clean Air Interstate Rule (CAIR), adopted by EPA to assist states that find they cannot attain the federal NAAQS and provide healthful air quality to their citizens because of pollution blown in from other states.

The U.S. Clean Air Act is consistent with the fundamental U.S. Constitutional doctrine that all powers not explicitly delegated by the states to the federal government remain with the states, but China does not have such a constitutional structure. Consequently, although its practice and resources have resulted in relative decentralization, China has the flexibility to implement more central control.

There are, however, other underlying commonalities between the two countries. Both national governments rule over vast territory, with local conditions that vary greatly in terms of industry, culture, and wealth. And in both countries, national policy is modified by officials at lower levels of government. So in spite of the different governmental structures, the difficulties experienced in the U.S. decentralized SIP program, and the federal government’s attempts to encourage more uniform and energetic pollution controls, the American experience may be of interest to Chinese policy makers.

4. THE STATE IMPLEMENTATION PLAN PROCESS

4.1. Clean Air Act requires the EPA to establish air quality standards.

The Clean Air Act governs air quality management and planning in the United States. Congress directed that EPA be responsible for establishing National Ambient Air Quality Standards, which become the goals for the entire state program, and for promulgating regulations that include the CAA requirements for State Implementation Plans. States are designated the authority to implement programs, as long as the state programs are as stringent as required by EPA.¹⁷

4.2. States are required to monitor NAAQS pollutants.

State and local agencies are required to establish a network of air quality instruments to monitor pollutant concentrations. The network is subject to quality assurance and quality control criteria that dictate siting locations for monitors, frequency of sampling and how data are to be analyzed, maintained and reported. Each monitor and its location is required to be approved by EPA.

Under the Clean Air Act, Congress appropriates funds to EPA to distribute to states to cover the costs to purchase air quality instruments, install, maintain and operate the monitoring network, and analyze the data collected. Each state submits a grant application to EPA that describes the proposed network and the budget required to cover capital and operating costs. The grants are administered and overseen by the ten EPA regional offices.¹⁸

4.3. EPA classifies areas as attainment or nonattainment.

EPA established air quality management areas (AQMA) across the United States. AQMA are typically associated with urban geographic boundaries, such as the area contained within the city's limits plus adjacent counties. In many instances, AQMA cross state boundaries, which require interstate coordination in SIP planning.¹⁹ EPA classifies AQMAs based upon the measured pollutant concentrations relative to the NAAQS. AQMA that have air quality better than a NAAQS are classified as *attainment*. AQMA with air quality more polluted than the NAAQS are classified as *nonattainment*. Classifications are determined on a pollutant-by-pollutant basis, so an AQMA may be classified as nonattainment for one or more pollutants, but attainment for others. AQMA without monitors or insufficient data are classified as unclassifiable (this typically occurs in rural or sparsely populated areas). More recently, EPA has taken advantage of improved air quality models and analytical techniques to predict pollutant concentrations in areas without monitors. Such techniques were used for the recent classification of PM_{2.5} areas.

¹⁷ The Clean Air Act designates both state and local agencies the authority to develop air quality plans to meet the NAAQS. For clarity in this document, the terms "state" and "states" are used and apply equally to both state and local air quality agencies.

¹⁸ More information on NAAQS is provided in Chapter Two.

¹⁹ The word "state" in SIP does not prevent a metropolitan area from having a SIP even though it is in more than one state. The Washington, D.C. SIP, for example, covers areas in Maryland and Virginia, in addition to the District of Columbia.

NAAQS for two pollutants—ozone and fine particulates—have been particularly difficult to attain. For ground-level ozone, the CAA assigns four nonattainment classifications depending upon the severity of measured pollutant concentrations in each AQMA: *severe*, *serious*, *moderate* and *marginal*. Fine particulate (PM_{2.5}) have two classifications for nonattainment relative to the PM_{2.5} NAAQS: *serious* and *moderate*. Moderate refers to regions with projected attainment dates within five years; serious areas are those scheduled to reach attainment beyond five years. The nonattainment areas classified as more polluted are allowed more time to attain the NAAQS, and are required to implement more stringent pollution control measures.

4.4. EPA makes formal designation and notifies state Governor(s).

Once EPA establishes the classification for a NAAQS in an AQMA, the EPA Administrator sends a formal letter of designation to that state's Governor. The letter to the Governor occurs each time that EPA either establishes a new NAAQS or when the NAAQS is revised, or about once every five years for each pollutant.²⁰ The designation letter also establishes the boundaries of attainment and nonattainment areas. This part of the process can be subject to state and federal political influence. Governors have occasionally negotiated with EPA that nonattainment boundaries exclude certain major industrial facilities, or conversely, EPA has included certain jurisdictions as part of a nonattainment area even though they have no influence upon measured pollutant values.²¹

A nonattainment designation also initiates more stringent air pollution control requirements for certain pollutants and emission sources. Additional requirements will depend on the pollutant for which the AQMA is in nonattainment. If, for example, the AQMA is nonattainment for ozone (which many are), the additional requirements could involve measures to reduce traffic. It will also include requiring compliance with air pollution regulations by smaller industrial emitters²² and requiring emissions offsets. The offset requirements stipulate that any new sources seeking approval or existing sources seeking to expand operations in these ozone nonattainment AQMAs must permanently offset any proposed emissions increases at a ratio greater than 1:1.²³ Qualifying offsets could include installation of additional emissions controls at the facility that seeks to expand; installation of emissions controls at another facility in the same AQMA (and

²⁰ EPA's timeframes to revise pollutants can overlap. For example, EPA revised the ozone standard and the fine particulate standard in the same year, so two letters were sent to Governors that year.

²¹ The boundaries for an ozone planning area in Seattle specifically were negotiated so as to avoid two major Boeing aircraft manufacturing facilities. Conversely, two counties in Connecticut were included in the New York City PM_{2.5} nonattainment area even though, by EPA's own data, these counties had no influence upon the nonattainment status. These examples are not common, and in the Seattle case, Boeing was still required to reduce its emissions, but by a less stringent quantity than would have been required had the two plants been incorporated into the nonattainment boundaries.

²² For example, a "major source" is defined as one with annual pollutant emissions greater than 100 tons in AQMA classified as attainment. In AQMA classified as nonattainment, the definition of a "major source" may be one with emissions as low as 10 or 25 tons of air pollutants per year.

²³ This ratio can be as high as 1.5:1 in severe ozone nonattainment areas. In these areas, each stationary source that proposed to increase ozone causing emissions by 100 tons would have to permanently ensure that 150 tons of reductions occurred in the same AQMA before it would be permitted to operate.

paid for by the facility that is seeking to expand) or purchase of offset credits from a facility that has either installed additional controls or has shut down part or all of its processes.²⁴

4.5. State-federal planning process is initiated.

Designation of an AQMA as nonattainment triggers a CAA requirement that the region develop an enforceable set of measures to reduce emissions in order to reach NAAQS attainment. This plan is what is referred to as the State Implementation Plan, or SIP. It is a collection of regulations, policies and procedures used by a state to control air pollution within its jurisdiction. Within three years of EPA establishing a NAAQS, states are required to develop and submit the SIP to EPA for review and approval. The SIP must demonstrate how each AQMA will attain and maintain compliance with each NAAQS. The federal CAA requires that states develop regulations to reduce emissions from sources that cause or contribute to pollution in the AQMA. Each regulation adopted must be enforceable by the state.²⁵ The regulations must define and specify: the affected emitters and applicability requirements, emissions limits imposed, the averaging period used to measure compliance, and record keeping and reporting requirements that apply to affected sources to assure compliance. If the state fails to submit a SIP adequate to attain the NAAQS, EPA is required to reject it and require revision. If the state continues to fail to adopt an adequate SIP, EPA has authority to substitute a Federal Implementation Plan (FIP) that is adequate.

The CAA requires that SIP emissions reductions must be sufficient, when combined with direct federal emission control regulations such as those applicable to motor vehicles and new industrial sources, to reduce pollutant concentrations to below the applicable NAAQS, and to keep them below the NAAQS even when future population and industrial growth occurs. AQMA with the most severe pollutant concentrations are given longer periods of time to reduce emissions to meet the NAAQS. For example, the Los Angeles, California AQMA measured the highest ozone pollutant concentrations in the U.S., and was classified as severe by EPA. Los Angeles was given 17 years (or until 2007) by the Clean Air Act of 1990 to attain the NAAQS. The longer time frame recognized that multiple regulations were required, that every economic sector was affected, and that reducing the severe level of pollution required complete turnover in vehicle fleets and industrial processes.²⁶ Despite significant improvements in air quality, Los Angeles nonetheless failed to attain the ozone NAAQS as required.

Each state or local air quality agency has a planning section for preparing the SIP. This section is responsible for analyzing the air quality monitoring data, assessing what sources contribute to pollution in the AQMA, determining what technologies or processes can be effective to reduce the pollution, and setting the level of pollution reduction to meet the NAAQS. The planning section is also responsible for drafting the regulations that will be applied to the industrial sectors responsible for the pollution in the AQMA. These regulations are emission regulations applicable within the state or AQMA. Often these cover sources not covered by the federal

²⁴ The subject of offsets is dealt with in greater detail in Chapter Five on nonattainment issues.

²⁵ Each state develops a penalty policy that describes the level of fines that can be assessed based upon the severity and duration of a violation.

²⁶ Los Angeles has banned the use of lighter fluid for outdoor cooking, spray on deodorant and even spray paint in order to reduce ozone causing emissions.

regulation. Where there is overlap, the CAA allows for more stringent state standards, but prohibits states from having less stringent standards.

Connecticut, with a population of 3.4 million, has a total staff of 110 (about 25 of these work in air quality planning) with an annual budget of approximately \$15 million. In California, with a population of 38 million, air quality planning is performed by the state and about 35 local air quality districts. Total staff size ranges from five people in rural districts with a population of less than 100,000 to several hundred in Los Angeles, with a population of nearly 13 million. Annual agency budgets in these air districts range from a few hundred thousand dollars in the smallest districts to well over one hundred million dollars for Los Angeles.

It may require several months for EPA to reach a decision on the appropriate classification for an AQMA before a formal finding is issued to the state's Governor. However, state planning staff begin work from the time that the air quality monitoring data conclusively determines the air quality in their AQMA to investigate technologies and processes that can be effective at reducing pollution. Though a state is required to submit its SIP within three years of a federal NAAQS, this process usually takes anywhere from six months to three years, depending upon the complexity of the regulations and the amount of public comment.

State emissions inventories inform the planning section efforts to assess source contribution to pollution in the AQMA and the ability to reduce these emissions to attain ambient air quality meeting the NAAQS. Inventory data are categorized as *stationary* (large sources), *area* (small sources such as auto body shops and printing operations) and *mobile* sources. Stationary source data is updated annually, based on reports that are filed by companies in the AQMA. Area source and mobile source inventories are based on a combination of demographic factors, such as population, number of vehicles registered in the AQMA, and assumptions about economic growth. Data precision and accuracy are improved by continuous emission monitoring on major industrial emitters and inspection of vehicles, and the updated information is reflected in future inventories and emissions projections.

The planning section evaluates the effects of emissions on the AQMA's air quality through air quality dispersion models. These predict the influence of regulatory limits applied to sources that contribute to pollution in the AQMA. Several modeling runs are completed under a variety of atmospheric conditions and for a range of potential emissions controls. Emissions controls are required to demonstrate attainment of the NAAQS under all atmospheric conditions. A worst case analysis is evaluated to determine the efficacy of potential controls during periods of the highest anticipated air pollution concentrations, such as heavy demand for electricity in the winter (conditions favorable to increased PM_{2.5}) and high demand coupled with stagnant air caused by hot, sunny days in the summer (conditions favorable to the formation of ground level ozone and PM_{2.5}).

Once assessments of the pollution sources and control options have been completed, the state will convene a stakeholder process. The process seeks to gather information to develop regulations and enforcement mechanisms to achieve the level of emissions reductions needed to attain the NAAQS. Stakeholders typically include representatives from affected industries and their consultants, the public, environmental nongovernmental organizations, and professors from

local universities. The CAA requires that, in addition to attaining NAAQS within the state, a SIP must also reduce emissions that would prevent or interfere with attainment in neighboring states. It has proved to be very difficult to get states to adopt pollution controls for the benefit of those living in other states, though planning processes have been adopted to encourage interstate cooperation. Where AQMA cross state boundaries, and where sources that contribute pollution to another AQMA exist, multi-state and multi-agency planning processes are convened. Many states also invite EPA to participate early in the regulatory process, since EPA has to review and approve any regulations developed. EPA can also advise the state based on its experience in other states and on specific language that can be included in the regulation to ensure clarity and enforceability.²⁷

Depending upon various factors, such as the complexity of the industrial processes to be regulated, the availability and costs of various emissions controls, the relationship between the state and enterprises, etc., several months to a year may be required to develop the draft regulation(s). The Clean Air Act requires SIPs to be subject to a minimum 30-day public comment period, and a public hearing on the SIP must be conducted. A record of public comments is included as part of the SIP when it is submitted by the state to the EPA regional office. SIPs do not become effective until EPA publishes in the Federal Register a final federal rule approving the state regulations (as explained below).

4.6. Three offices at EPA work with state authorities to develop, approve, and enforce plans.

While states are designated by the Clean Air Act as the lead government entities in air quality planning, EPA plays a significant oversight and advisory role, as well as having the final decision as to whether the SIP is adequate to meet the CAA's requirement to attain the NAAQS. While a number of offices at EPA may work on state regulations and SIP requirements, there are primarily three EPA offices responsible for working directly with states to develop, review and approve air quality plans.

EPA has ten regional offices throughout the United States. Each regional office has air pollution program-specific staff that work with state agencies within its jurisdiction to provide and interpret federal guidance, assist in assessing technologies that can reduce emissions, and help states to develop regulations that meet the requirements of the Clean Air Act so they can be approved by EPA. The regional office staff are closest to states and serve as liaisons between them and other EPA offices. In addition to actively participating in state regulatory processes, EPA regional office staff work with two other EPA offices, the Office of Air Quality Planning and Standards (OAQPS) and the Office of Enforcement and Compliance Assurance (OECA). These offices help to ensure that the state regulations are consistent with federal regulations and guidance, and are enforceable.²⁸

²⁷ More information about regional air quality management can be found in Chapter Seven.

²⁸ The Office of General Counsel is also an important player, although it may rarely work directly with the states. OAQPS and OGC work together to provide guidance on what is required in plans, and for some critical aspects of plans, OGC has an important role in the review process.

The CAA requires EPA to review state air quality plans, and EPA may approve, revise or reject them. Approval of SIPs requires concurrence by the local EPA regional office, OAQPS and OECA. Following concurrence by EPA offices, EPA publishes a proposed rule in the Federal Register approving the state's SIP as consistent with the requirements of the CAA. EPA approval of SIPs has frequently taken so long that states have sometimes begun implementation of them before EPA approval. In recent years, EPA has been working to improve the timeliness of its review process. If the state process is considered non-controversial (a case-by-case decision made after discussion with the state), EPA can publish the draft regulations to approve with those of the state. This can save several months of processing time.²⁹ The proposed SIP is then subject to public comment for a 30- or 60-day period, depending upon the complexity of the regulations and whether any controversy is expected to occur. Any person can comment on them, even if he/she does not live in the state or is not affected by pollution from that state. EPA is required to address public comments. If the public comments are significant, EPA can require the state to revise its SIP and restart the EPA approval process. While this is not common, states have also been required to revise regulations when they differ from or appear to be less stringent than applicable federal requirements.

OAQPS, located in North Carolina, frequently works with groups of states in the populous Eastern United States on air quality modeling exercises to evaluate the benefits and impacts from applying consistent emissions controls to the same sources across several or more states. OAQPS is also responsible for conducting tests on emissions from various industrial and mobile sources. The results of these tests are used to develop and improve the precision of emissions factors that states use to calculate emissions from sources in their AQMA.

OECA is responsible for enforcement and compliance assistance for the Clean Air Act and its implementing regulations. OECA, located in Washington, D.C., reviews state regulations, helps to train state and regional office inspectors, and, with regional offices, conducts audits of state programs to ensure their effectiveness. OECA also coordinates enforcement of regulations across state boundaries. For example, many companies operate identical facilities in several states. OECA helps to ensure that air quality regulations are consistently implemented and also observes industrial behavior to determine whether companies exhibit a pattern of non-compliance.

Since the early 1990s, OECA has coordinated many national-level enforcement actions against companies that violate the Clean Air Act in many states. These high-profile actions against wood products mills, power companies and oil refineries generated significant visibility and media coverage, resulted in millions of dollars of penalties paid and up to several billion dollars of investment in new emissions controls. The actions also sent a message to industry that EPA is watching, and help to ensure that compliance with air quality regulations is consistent across state boundaries. Enforcement (discussed in greater detail in Chapter Thirteen) has produced significant air quality benefits. The NO_x and SO_x reductions from actions against owners and

²⁹ Some observers have criticized the requirement for federal rulemaking for being inefficient for source-specific requirements. It would be more economical to require the general plan elements to be included in the SIP (and hence subject to federal rulemaking) and allow source-specific standards and standard revisions to be adopted through permits.

operators of coal-fired power plants in the Midwestern U.S. were greater in quantity than those from the first phase of EPA's Clean Air Interstate Rule (CAIR).³⁰

EPA can also implement its own FIP if a state does not timely submit its plan, or if the state plan is inadequate to attain the NAAQS. Under the Clean Air Act, the requirements for EPA to initiate a FIP are mandatory and non-discretionary. EPA first officially notifies an AQMA that its air quality plan is inadequate; this starts a sanctions clock. If the AQMA has not corrected the deficiency within 18 months after being notified, EPA must impose sanctions that include more stringent offset requirements for new sources, at a ratio of 2:1. Then EPA withholds federal highway funding in those AQMA that have still not addressed the SIP's deficiencies. This is a significant incentive for AQMAs to ensure that their air quality plans meet the EPA requirement. The U.S. government provides up to ninety percent of the funding for construction, maintenance and expansion of the interstate highway system. Withholding federal highway funds can add up to hundreds of millions or even a billion dollars. Actual withholding of highway funds has occurred only a few times in 30 years, but the increased offset requirements have been imposed over 20 times.

4.7. Plans are continuously re-evaluated.

Planning processes associated with the NAAQS are an integral part of a state's overall air quality program. The NAAQS set the air quality objectives. States develop plans to achieve those objectives based upon their assessment of the sources that contribute pollution in their jurisdiction. States work with EPA to develop regulations that reduce and control emissions from these emission sources. The plans are not static. States improve and periodically update them based upon how effective the implemented regulations are, and adjust plans based on influences from population and economic growth. Each regulation projects to achieve a specific quantity of emissions reduction, and air quality improvement. The projection is based upon an assumption that the terms and conditions included in the regulation will be enforced, and that the regulation will be applied universally across all affected sources.

The success of the air planning process is evaluated through continued monitoring of ambient air quality. If monitored ambient air concentrations do not decrease as anticipated, data are evaluated to determine what is influencing the observed pollutant levels. If pollutant levels are not decreasing to anticipated levels, or are falling too slowly, the planning process resumes again. Additional requirements may be imposed on those sources already regulated, and/or new requirements will be developed to reduce emissions from sources that have not been regulated. This process continues until the NAAQS is met. At any point in the process, EPA also has the authority, which it occasionally uses, to issue a "SIP call," requiring a state to modify the plan to make progress toward attaining the NAAQS.

States that attain the NAAQS receive a redesignation letter from EPA, and are required to continue to implement and enforce their regulations so that the NAAQS is maintained into the future. Areas redesignated attainment for ozone can choose to lift offset requirements for new or

³⁰ OECA also works with EPA criminal investigators and their state equivalents to prosecute knowing and willful violations of the Clean Air Act. Stiff fines and jail sentences are sought against plant owners and company officials for such violations.

expanded stationary sources, as long as this would not cause air quality in the area to degrade back to levels that exceed the NAAQS. Attainment is seen as a real success for air quality planning agencies and for protection of public health and the environment.

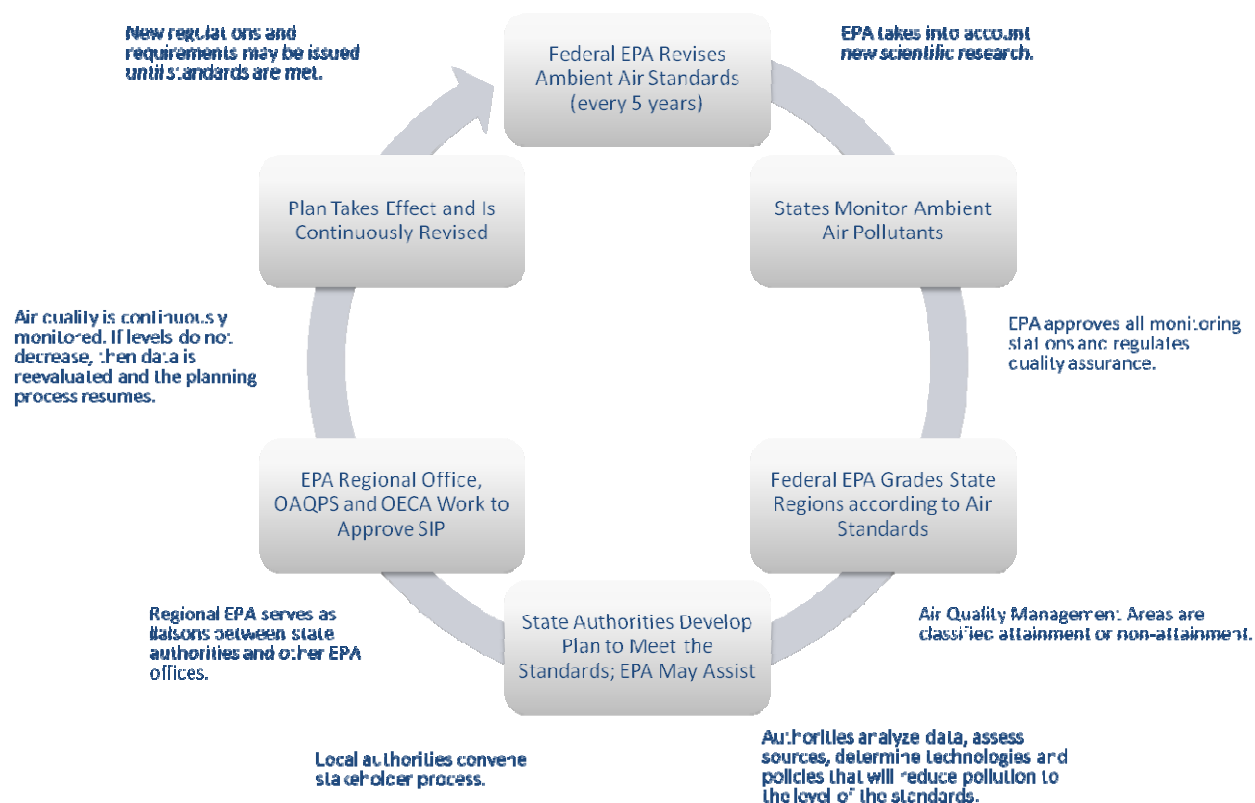
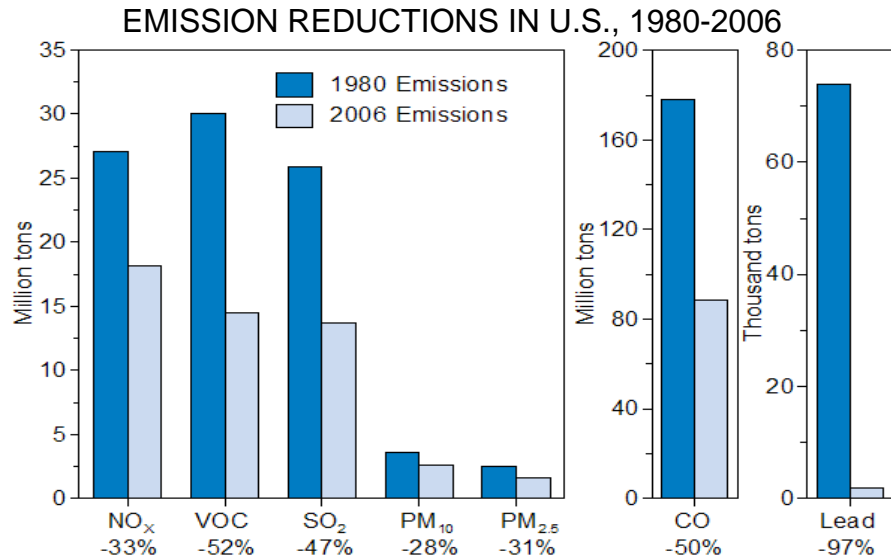


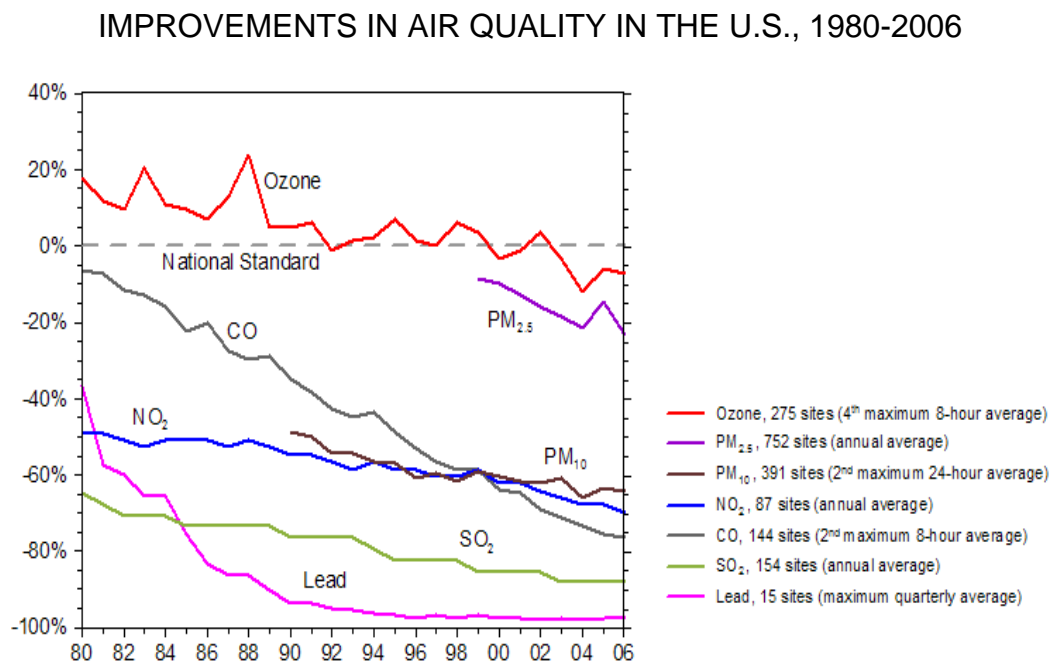
Figure 1. NAAQS/SIP Process. The graphic illustrates the iterative nature of U.S. air quality joint-management between state and federal authorities.

4.8. Air Quality Improvement Has Been Impressive

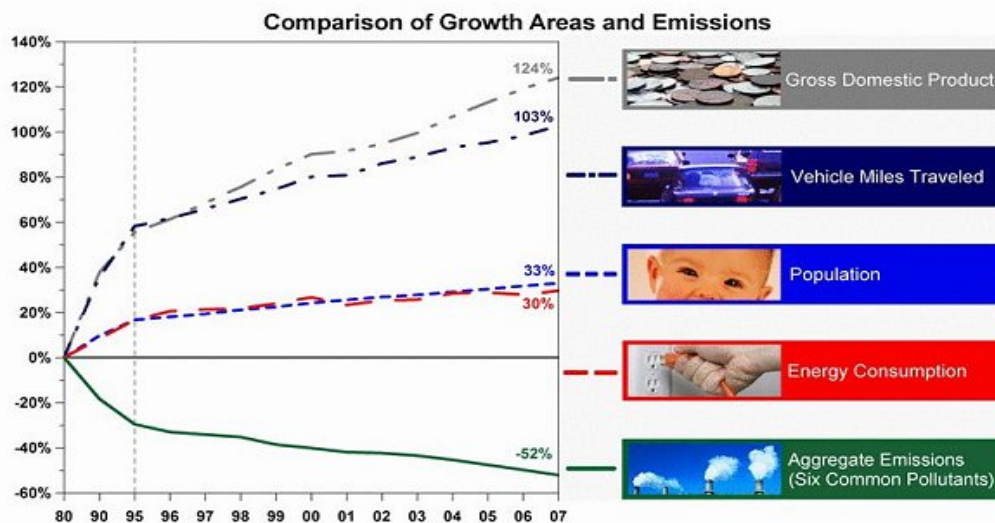
Together with centralized programs, the SIPs have resulted in substantial improvements in air quality in the U.S. over the past 39 years, even as the U.S. economy grew. As the following chart shows, since 1980 emissions of the NAAQS pollutants have been reduced from by between 28 and 97 percent, depending on the pollutant.



As a result of these emission reductions, concentrations of pollutants in the air have fallen dramatically over the same time period. The following table shows the measured concentrations of the NAAQS pollutants at a large number of sites across the U.S. over the 1980-2006 period.



The improvements in air quality have been made in concert with significant growth in gross domestic product, population, energy consumption, and vehicle miles traveled, as the following chart shows.



5. LESSONS FOR CHINA

There are numerous success stories to be studied from the U.S. example of state and federal joint-planning for air quality management. It has helped force states to assume a long-term perspective in evaluating and implementing air pollution control measures. The process has produced uniform methods for quantifying emissions and has promoted regionally consistent measures, such as those adopted by northeastern states to reduce ozone pollution. SIPs have also been important to facilitate dialogue between the affected public, industries and state agencies to characterize the issues faced in the AQMA and to discuss and agree upon measures that will predictably and consistently reduce pollution while still promoting economic growth.

However, the SIP process has significant shortcomings that an effective Chinese system should seek to avoid. It has been criticized for being overly bureaucratic, process-oriented, and prescriptive, and for consuming large amounts of staff time and resources at the state levels, detracting from those available to be dedicated to management and implementation. Additionally, the SIP's narrow focus on individual, pollutant-by-pollutant standards and regulatory reduction plans has prevented the adoption of integrated, whole-system approaches, which consider multiple pollutants simultaneously. These multi-pollutant approaches are more cost-effective because they permit enterprises to optimize investment in pollution control technologies and encourage longer-term planning efforts that take into account how levels of one pollutant impact those of another.³¹ China in turn should establish a system which places emphasis on performance over process, and should seek to utilize multi-pollutant frameworks as a central component of its control strategy.

Taking a step back, it is important to recognize that U.S. domestic political circumstances over the last forty years have shaped the development of the SIP process and the air quality management system that exists today in the United States. By nature, in name and in practice, the state implementation planning process puts much responsibility into the hands of the states.

³¹ A more detailed discussion of multi-pollutant strategies for air quality management appears in Chapter Eleven.

Because authority is dispersed in this way across the fifty states, as a result there is an inconsistent level of commitment from states, from different offices within states, and from political administrations as they come and go from power. This inconsistency has created a fragmented system to the detriment of sustained improvement in the country's overall air quality and other environmental objectives.

China will need to strike a balance between concentrated and dispersed authority in order to establish a strong air quality management planning system. In this regard, the U.S. dispersed-authority model may not set an appropriate example for China to follow. A more appropriate air quality management system would involve strong central institutions (with enhanced regional capacity directed by the center), providing clear direction to the provinces and local authorities on all important issues from implementation to monitoring. This model would require a large build-up of enforcement capabilities and substantial increases in funding and staff resources to support these efforts at the central, regional and the local levels. It would further require that accountability and funding for local implementation come not from the provincial authorities, where opportunities are greater for competing interests to abuse the system, but instead from central authorities.

An alternative, hybrid approach would be for a strong central authority to manage the large sources of emissions across provinces, such as the transportation sector, large electric generators and industrial facilities. This is direction the U.S. has headed in over the last twenty years or more. This scenario would leave emissions from smaller sources to be controlled through a SIP-like process led by local authorities. One reason for this division of labor would be that large sources can typically be governed by general, uniform rules easily applied from a central level. Likewise, large sources are often the most difficult for local authorities to control, because they may have significant political and economic influence within a region. Holding large emitters accountable to central authorities can help resolve this problem.

In either case, effective air management will require accountability. Similar to how the U.S. federal government threatens to withhold highway funding from air quality management areas if SIPs do not produce emissions reductions, China needs to find a way motivate officials. Creating clear incremental targets and linking progress toward those targets to career advancement would be a powerful way to drive implementation and resource allocation at local levels.

CHAPTER FIVE

REQUIREMENTS IN U.S. “NONATTAINMENT” AREAS

David Novello

1. SUMMARY OF RECOMMENDATIONS

Below are the principal lessons that we have learned from the United States’ 39-year (often difficult) history of striving to attain the various ambient air quality standards:

- Nonattainment may be seen as an overuse of the available air resources in a region. Effective air quality management must find a way to balance the goals of restoring the quality of the air resources to levels that protect public health, and at the same time continuing to allow for economic growth.
- Attaining the NAAQS for ozone and fine particulate matter has proven more difficult than originally expected.
- The U.S. has learned that the most effective way to achieve significant emission reductions is to have federal legislation or rules specify requirements for nonattainment State Implementation Plans in detail, rather than leaving the choice to the states.
- More stringent requirements for more severely polluted areas have helped in progress towards attainment. It also makes sense to allow a longer period to attain the ambient standards for these more polluted areas.
- In the U.S., if an area does not attain the NAAQS by an attainment date, or is not making reasonable further progress towards attainment, additional federally mandated pollution control requirements automatically apply to the state. We believe that having the air pollution law or the SIP specify what controls will be put in place if there is a lack of progress in achieving the NAAQS will assist in improving air quality. The threat of such actions often has helped to prod the states to adopt further requirements. Similar automatically increasing requirements for areas that fail to achieve air quality objectives could help China achieve its goals.
- The U.S. requirement that new or modified emitters in nonattainment areas “offset” the new pollution they add to the area’s air often has not led to an improvement in air quality because many of the offsets have simply been obtained by shutting down old facilities that would have closed down in any case. It would be far more beneficial to require the “overcontrol” of emissions (reducing them below levels required by the SIP and CAA) from operating facilities in an area than to allow the use of “shutdown credits” to meet offset requirements. In addition, in the early years of the U.S. nonattainment program companies often misrepresented information about the operations of the shutdown facility. As a result, this overstated the quantity of emissions offsets available for use by the new or modified emitter. To avoid this outcome, we recommend that China adopt the

U.S. requirements that the offsetting emissions reductions be “real, permanent, enforceable, quantifiable, and surplus.”

- The U.S. requires the installation of pollution controls on new and modified emitters in nonattainment areas that attain the “lowest achievable emission rate” (LAER). This requirement, applied by the state on a case-by-case basis, has led to significant emissions reductions. Such a technology requirement might also help China restore its overused air resources without adverse effect on economic growth.³²

Based on these findings from the U.S. experience, we make the following specific recommendations for China’s Air Pollution Law amendment:

- **Consequences for Nonattainment.** The Air Pollution Law amendment should clearly state consequences for the failure to meet ambient air quality and Total Emissions Control targets. Elements of U.S. nonattainment practice can be melded with China’s regional project approval limitations system to make the system more effective in the Chinese context.
- **Stricter Requirements for More Polluted Areas.** Areas that are nonattainment should have stricter oversight and specific rules for getting into compliance from the central government. More heavily polluted areas can receive a longer time to attain standards, but strict schedules with interim targets must be put in place.
- **Technology-based Standards.** Centrally determined technology-based emissions standards for enterprises (see Chapter Eight for more detail about such standards) in nonattainment areas can help to reduce pollution significantly. These should be coupled with energy efficiency standards to encourage process and operations innovations beyond end-of-pipe solutions.
- **Nonattainment and Missed Deadlines Should Trigger Automatic Consequences.** Air quality will be improved if these requirements are automatically triggered when compliance or specific progress is not made by certain deadlines.
- **Offsets.** Offsets of existing pollution should be required before new polluting enterprises can be constructed in a nonattainment area. “Overcontrol” offsets (i.e., obtaining greater reductions at plants still in operation) should be preferred, as cheating is easier when claims for “shutdown” offsets are made. The U.S. has had to deal with significant cheating in the offsets area and many of the measures taken to combat cheating (described below) may be considered for implementation in China.

2. INTRODUCTION

In Chapters Two and Three, we discussed the importance of setting clear, health-based national ambient air quality standards, and establishing consequences for local governments that fail to meet these air quality standards. The ultimate goal is to reduce air pollution, improve public health, and reduce the costs to Chinese society of environmental degradation, while spurring

³² Technology-based standards are discussed in detail in Chapter Eight.

economic development and poverty alleviation. In order to bring about achievement of air quality standards, there must be consequences for failing to meet air quality targets. China is experimenting with regional project approval limitations () and bureaucratic official evaluation criteria as ways to spur local governments to meet ambient air quality standards and Total Emissions Control targets. These initiatives are very promising and should be expanded significantly.

The U.S. has established a comprehensive system for addressing jurisdictions that have not attained ambient air quality standards (nonattainment areas). This system has been calibrated over many years to create consequences for local governments that do not achieve air quality targets, while still allowing room for economic development. We believe that the system offers valuable lessons for China both in terms of good practices and mistakes to be avoided. This chapter sets forth the details of this system below.

As discussed in Chapter Four, for “criteria pollutants”³³, areas in the United States are designated (on a pollutant-specific basis) as (1) attaining the National Ambient Air Quality Standards, (2) not attaining the standards, or (3) unclassifiable. This chapter focuses on requirements in “nonattainment areas.” It covers general nonattainment plan mandates and more briefly discusses pollutant-specific requirements added by the 1990 Clean Air Act Amendments. CAA nonattainment requirements can apply to new and existing stationary emitters, smaller emitters of pollution known as “area sources,” and motor vehicles and other “mobile sources.” Because the SIP chapter discusses the *process* for the state development and EPA approval of implementation plans—which applies to SIPs for both attainment and nonattainment areas—this chapter will not repeat that discussion.

Nonattainment plan mandates are overlaid on top of general SIP requirements that apply in all areas of the country. As areas continued to fail to meet the NAAQS for certain pollutants during the 1970s and 1980s, Congress and EPA began to include more specific (and often very detailed) mandates that states and localities³⁴ had to adopt for nonattainment areas. Thus, the federal-state partnership described in the SIP chapter began to tilt more towards federally-prescribed programs known to reduce pollutant emissions. For most of the 1970s—and up to the present time for attainment areas—states generally were free to choose the mix of controls they deemed appropriate to attain and maintain the NAAQS. Beginning in 1977, however, Congress directed states to adopt into their SIPs certain measures for nonattainment areas.

In some cases, these measures provided the states with a fair degree of latitude to determine the specific contours of the programs. But with the continued failure of many areas to attain certain NAAQS (especially those for ozone, carbon monoxide, and particulate matter), both Congress and EPA began to dictate measures known to significantly reduce emissions. Some of these measures (such as more stringent “inspection and maintenance” programs for motor vehicles in use) proved quite controversial. At times, EPA forced states to adopt the measures by

³³ These pollutants are particulate matter, ozone, carbon monoxide, lead, sulfur dioxide, and nitrogen dioxide. See the chapter on NAAQS for the origin of the term “criteria pollutants” and for the development of ambient standards for those pollutants.

³⁴ Note that although some local governments rather than state governments adopt certain air quality measures, in this chapter the term “states” refers to both states and localities.

threatening to disapprove the SIPs and impose sanctions. Many other times, however, political pressure caused EPA to back down.

Because many areas still did not attain the ambient standards in the late 1980s, Congress in the 1990 Amendments to the CAA prescribed extensive and very detailed measures to improve air quality. EPA previously had attempted to require a number of these measures. Congress created a classification system for ozone, carbon monoxide, and particulate matter nonattainment areas so that all areas would not be treated the same. Instead, those with more severe pollution had more time to attain the standards but also were required to adopt more stringent requirements for emitters.

For several of the criteria pollutants (lead, nitrogen dioxide, and sulfur dioxide), reductions in emissions in the 1970s and 1980s resulted in the vast majority of the country meeting the NAAQS. Ambient concentrations of ozone, carbon monoxide, and particulate matter have decreased since states have adopted the measures mandated by the 1990 CAA Amendments. EPA's web site includes graphs showing these declines. See www.epa.gov/air/airtrends/2008/report/SixCommonPollutants.pdf and www.epa.gov/airtrends. Some of this improvement, however, can be attributed to EPA's national emissions standards that are outside of the SIP system.

3. GENERAL REQUIREMENTS FOR NONATTAINMENT AREAS

As noted above, beginning in 1977 the CAA required states to adopt a number of specific measures in their SIPs for areas that have not attained one or more NAAQS. With the 1990 Amendments, Congress specified *general* mandates for nonattainment areas, with a number of *more specific* requirements for two pollutants for which attainment of the ambient standards had proven to be most difficult—ozone and particulate matter.

The general requirements that apply to all nonattainment areas (and therefore must be adopted in all nonattainment SIPs) include:

- **A comprehensive inventory of emissions from all sources.** EPA and states have learned over the years that it is impossible to obtain the required reductions resulting in attainment unless the state has credible and complete information on emissions from all contributing economic sectors in the area. Accordingly, states must prepare and submit to EPA “emissions inventories” for the pollutants for which the ambient standard is exceeded in an area. Preparing emissions inventories is an early step in the SIP development process. Although development of inventories is a time-consuming process, an accurate accounting of emissions from various emitters represent critical data inputs to the computer models that states use to demonstrate attainment and maintenance of a NAAQS, and progress towards meeting that goal. The inventories allow states to calculate the baseline from which future emission reductions are measured. EPA develops guidance for the prediction of emissions from industrial facilities, more widespread and smaller emitters, and motor vehicles. It develops “emissions factors” to estimate emissions based upon, for example, the amount of a particular type of fuel that a

boiler uses. The Title V operating permit system (discussed in Chapter Six), with its requirement for the submission of periodic emissions monitoring reports to state agencies, has helped increase the accuracy of emissions inventories.

- **Attainment (and continued maintenance) of the NAAQS by a specified date.** The general rule is that an area has five years to attain the standard, but EPA may extend the date for up to an additional seven years. For ozone, carbon monoxide, and particulate matter, the 1990 CAA Amendments prescribed attainment dates based upon the severity of pollution in the area. (Areas classified as “extreme” for ozone severity, for example, were given 20 years to attain the ambient standard.) The SIP also must demonstrate that after the area attains the NAAQS, necessary control measures are in place so that the standard will not be exceeded despite growth in the area.
- **Reasonable further progress (RFP) toward attaining the standards, in the years prior to the attainment deadline.** In the early years of the CAA, states sometimes did not adopt emission standards until shortly before the attainment date—and then failed to attain the ambient standard by the deadline. Congress therefore required states to demonstrate that control measures achieve emission reductions for the entire time leading to the attainment date—usually a linear reduction in emissions from the date the state adopts the SIP until the attainment date. This steady reduction in emissions (1) allows for mid-course corrections if emission reductions are not leading to the anticipated progress towards attaining the NAAQS, and (2) results in improved air quality earlier.
- **The identification and quantification of emissions from new and modified sources, and a demonstration that the area will meet RFP requirements and attain the standards despite these new emissions.** The SIP has to account for growth in the area.
- **Enforceable emission limitations and other control measures and techniques, as well as schedules and a timetable for compliance.** As described in the SIP chapter (Chapter Four), the implementation plan includes the array of emission limitations the state has selected for various emitters. In some cases, the emissions reduction requirements are not expressed in terms of emission limitations, especially where it is difficult to measure emissions. For example, there are requirements known as “work practice standards” that require emitters to follow certain procedures to minimize emissions. In other cases, the state may require emitters to use a particular control technology (such as technology to reduce volatile organic compound emissions at gasoline filling stations).³⁵ Whatever the measure, EPA requires that it be enforceable. There are several aspects to this “enforceability” mandate. The measure must clearly identify what it applies to, and it may not be ambiguous. The state or locality also must have authority to enforce the measure. Furthermore, the state or locality must include sufficient monitoring, record keeping, and reporting requirements in the SIP so that it can identify periods of noncompliance and initiate an enforcement action where necessary. Emission limitations must specify when emitters must comply.

³⁵ Through the mid-1980s, EPA often provided the state discretion to change a SIP requirement as appropriate without a formal revision process in which EPA participated. A number of states abused this discretion, however, and EPA began to require that the state change the requirement through a rulemaking process that EPA could review (and which required EPA approval of the SIP revision).

- **Reasonably available control technology (RACT).** For some pollutants, the size threshold for existing factories that need to install specific control technologies is lowered (i.e., smaller emitters fall within the scope of regulation) in areas with more severe pollution. Thus, even relatively small sources must install RACT controls in more severely-polluted areas.³⁶ RACT applies to existing sources on a pollutant-specific basis; facilities must adopt these technology-based emission limits only for the pollutants for which the area is designated as nonattainment. States decide what RACT is for different types of emitters. But EPA provides guidance to the states on what it considers RACT to be for certain categories of emitters, and states generally follow this guidance. (If states adopt less stringent standards, they generally need to explain their departure from the guidance to EPA.) EPA and the states consider cost in determining what controls are “reasonably available.” As the name suggests, a RACT level of control generally is not more stringent than what some emitters in the country already have adopted. EPA maintains a database (available to everyone) that identifies RACT limits throughout the country. See <http://cfpub.epa.gov/RBLC/htm/bl02.cfm> for the “RACT/BACT/LAER Clearinghouse” database. States often use this database (particularly in the absence of EPA guidance) to identify RACT limitations for emitters.
- **“Reasonably available control measures” (RACM) for certain other types of emitters (generally non-industrial widespread emitters, such as emissions from burning in agricultural fields).** As with RACT, the measures apply to existing sources, and a state determines what constitutes RACM by reviewing EPA guidance and considering the stringency of measures adopted by other states. Examples of RACM for particulate matter are (1) measures to avoid high ambient concentrations due to widespread use of wood stoves in a valley during particularly cold weather, and (2) dust suppression methods in arid areas.
- **The identification of contingency measures that must be implemented if the area fails to make expected progress towards attaining the NAAQS, or fails to meet the ambient standard by the deadline.** In the early years of the CAA, states often failed to take corrective actions if emissions reductions from the control measures in the SIP did not result in expected reductions in ambient pollutant concentrations. As a result, there was no mid-course correction through the adoption of additional measures to further reduce emissions. The requirement for contingency measures aims to avoid this result. The contingency measures must be ready to implement.
- **A “new source review” permit program with specified substantive requirements for major emitters that companies construct or modify.** This complex “pre-construction” permitting program is described in the next section.

The more specific SIP requirements for ozone, carbon monoxide, and particulate matter are contained in parts of the CAA added by Congress in the 1990 CAA Amendments. The pollution controls and other measures depend upon the severity of the pollution in the area. For example,

³⁶ Usually only emitters that have the potential to emit 100 tons per year or more of a pollutant are classified as “major” and thus subject to RACT requirements. But, for example, in areas with worse ozone pollution, the threshold ranges from 10 to 50 tons per year of potential emissions. As a result, the SIPs for more severely polluted areas prescribe RACT for many more facilities than do SIPs for areas where ambient concentrations exceed the NAAQS by a lesser degree.

for areas classified as “marginal” severity for ozone, the SIP must contain specified measures. For “moderate” nonattainment areas, the SIP must contain all these measures and also additional specified ones. For “serious” areas, the requirements of “marginal” and “moderate” nonattainment apply, as well as additional ones. There are then additional requirements for “severe” and “extreme” areas. In essence, an area with higher ambient levels of ozone, carbon monoxide, or particulate matter must adopt additional and more stringent control measures in return for having more time to attain the standard. See the chart below showing the increasing stringency of requirements for more severely polluted ozone nonattainment areas.

**Summary of Requirements and Attainment Deadlines for Ozone Nonattainment Areas
(by Classification) under 1990 Clean Air Act Amendments**

Extreme 20 years	Severe requirements, major source threshold of 10 tpy of VOC or NO _x , nonattainment new source review offset ratio of 1.5:1, boiler clean fuel/advanced technology, mid-course review
Severe 15/17 yrs	Serious requirements, major source threshold of 25 tons per year of VOC or NO _x , transportation control strategies to offset growth in vehicle miles traveled, program to reduce number of employees who commute to work, nonattainment new source review offset ratio of 1.3:1
Serious 9 years	Moderate requirements, major source threshold of 50 tons per year of VOC or NO _x , enhanced emissions monitoring, photochemical grid modeling attainment demonstration, 3% VOC emission reduction per year after 1996 until attainment, enhanced vehicle inspection and maintenance program, clean-fuel vehicle program, transportation controls, nonattainment new source review offset ratio of 1.3:1
Moderate 6 years	Marginal requirements, 15% VOC emission reduction by 1996, RACT for specified sources of VOC & NO _x , Stage II controls for gasoline refueling at gasoline stations, nonattainment new source review offset ratio of 1.2:1
Marginal 3 years	Emissions inventory, improve RACT rules, improve vehicle inspection and maintenance program, nonattainment new source review offset ratio of 1.1:1

Note that states still have a degree of discretion in deciding upon control measures in nonattainment areas, despite the increasing prescriptiveness of the CAA and EPA policy. Thus, to some extent states can take into account local factors in adopting air quality requirements. But the SIP and accompanying models must demonstrate continuous improvement in air quality towards attainment. Furthermore, for areas that do not attain the NAAQS by the specified date, the states must adopt more stringent requirements and once again demonstrate how the required measures will provide for attainment.

4. NONATTAINMENT “NEW SOURCE REVIEW” PERMIT PROGRAM

In 1977, Congress added pre-construction permitting requirements for both attainment and nonattainment areas. The one that applies in attainment areas, known as the “prevention of significant deterioration” (PSD) program, is described in Chapter Four on SIPs. The program that applies in nonattainment areas is called nonattainment “new source review.”

The origins of nonattainment new source review program date to what EPA called its “offset policy,” adopted in 1976. Faced with the possibility that construction or modification of new emitters would be prohibited in areas that had not attained a NAAQS, EPA issued a policy stating that such construction or modification would be allowed as long as “offsetting emissions reductions” were obtained from existing sources in the area. Congress essentially codified this requirement for “major” emitters (see definition immediately below) in the 1977 CAA Amendments, and also added a requirement that the major source install emissions controls representing the “lowest achievable emission rate” (LAER). Thus, there are two components to the nonattainment new source review program: (1) the requirement to obtain sufficient offsets, and (2) the requirement to install stringent technology-based controls. These requirements are discussed below, following a brief description of how the new source review program applies to certain new and modified sources.

4.1. Applicability

As noted above, only new construction *or* modification of a “major stationary source” as defined by the CAA is required to obtain a new source review permit. Unless specified otherwise, a major emitter is one that has the *potential* to emit³⁷ at least 100 tons per year of a criteria pollutant for which the area is designated as nonattainment, or its pollutant precursors(s).³⁸ In the 1990 CAA Amendments, Congress lowered the potential emissions thresholds for ozone, carbon monoxide, and particulate matter in more polluted areas. Thus, for ozone, the threshold ranges between 10 and 100 tons per year depending upon the nonattainment classification, for carbon monoxide, the threshold is either 50 tons per year or 100 tons per year, and for particulate matter the threshold is either 70 tons per year or 100 tons per year.

Any planned new emitting source that exceeds one of these “potential to emit” thresholds must obtain a new source review permit before beginning construction (thus, the reference to the requirement as obtaining a “pre-construction permit”). The requirement applies on a pollutant-specific basis. For example, a steel mill in an area that is not attaining the standard for sulfur dioxide need only obtain “offsets” for that pollutant, and the LAER emission controls need only address sulfur dioxide.

Determining applicability for modifications of emitters is more complicated. First, the permitting requirement only applies to physical changes or changes in operations to the facility. Mere increases in production or routine maintenance, repair or replacement of the facility do not

³⁷ The general assumption in measuring potential to emit is that the emitting source runs for 24 hours a day, 365 days a year.

³⁸ For ozone, the emitted precursors are volatile organic compounds and oxides of nitrogen. For fine particulate matter (PM_{2.5}), the precursors are oxides of nitrogen and sulfur dioxide.

constitute changes that are subject to new source review. There has been enormous controversy over exactly what constitutes routine maintenance, repair, or replacement. Second, the increase in emissions must be at least a level that EPA defines as “significant.” For example, for volatile organic compounds an emissions increase must be at least 40 tons per year to be considered “significant.”³⁹

4.2. Obtaining Emissions “Offsets”

The principle behind the requirement to obtain emissions “offsets” is that air quality should not worsen (or should even improve) when a new emitting facility is built or undergoes a major modification. The requirement places the responsibility of finding these emissions reductions on the company planning the new or modified emitting facility. Many observers question, however, whether the mandate to secure offsets has truly resulted in emissions reductions in areas not attaining the ambient standards. As is discussed below, companies would have made many of the reductions used for offset purposes regardless of the offset requirement.

Companies can create “emissions reduction credits” (ERCs) used to meet offset requirements in nonattainment areas in one of two ways. First, an emitting source can “overcontrol” so that it achieves greater emission reductions than required under the SIP and other CAA requirements. Second, the company can shut down emitters at a facility (or even shut down the entire facility), thereby reducing emissions.

In the early years of the new source review program, there was a fair amount of cheating in the use of emissions offsets. As a result, emissions from new and modified emitters often were not offset by corresponding true emissions decreases. To address this problem, EPA required the company to demonstrate that the emissions reductions meet certain requirements to qualify for the creation of an ERC. Thus, EPA established that an ERC represents a “real, permanent, enforceable, quantifiable, and surplus reduction” in air pollutant emissions equal to one ton of pollutant per year that exceeds the amount of reduction required under state or federal law. EPA defines these terms in the following way:

- Emission reductions are considered “real” if they represent the reduction in actual emissions emitted into the air.
- Emission reductions are considered “permanent” and “enforceable” if they are assured for the life of the corresponding emission reduction credit through an enforceable mechanism such as a permit limit or other requirement. A company official may have to certify that the reductions are indeed permanent.
- Emission reductions are considered “quantifiable” if the amount, rate and characteristics of the emission credit can be estimated through a reliable, reproducible method.
- Emission reductions are considered “surplus” if they are not required by any local, state, or federal law, regulation, order, or requirement.

³⁹ Note that, as with the definition of “major stationary source,” the threshold for a “significant” emissions increase in ozone nonattainment areas decreases with the severity of pollution in the area.

A state or local agency must approve an application to create ERCs from emissions reductions that meet these criteria. Once the agency has verified ERCs, a company that plans to build or modify an existing source subject to new source review permitting mandates can use the ERCs to satisfy its offset requirements.

A company may use either ERCs that it has generated itself or ones generated by other emitters in the area. Large emitters (such as a petroleum refineries) often use ERCs they have generated themselves. To facilitate the exchange of ERCs between companies, a number of state and local agencies have established “offset banks,” which are also known as “registries.” The “bank” holds ERCs that the state or local agency has verified. As part of its new source review permit application, an emitting source generally will request to withdraw ERCs from the bank. The emitting source pays the company that generated the ERCs directly. An example of an agency bank listing ERCs is one run by the Bay Area Air Quality Management District (BAAQMD), the air agency for the San Francisco area. The agency’s web page for its bank is found at http://www.baaqmd.gov/pmt/emissions_banking/index.htm; a link at the top of the page shows the ERC owners in the district.

In addition to buying ERCs from other companies directly, some emitters that need offsets utilize the services of an emissions “broker” to purchase the necessary ERCs. These brokers facilitate transactions between the companies, and some even sell ERCs that they hold in their name. The air agency for the Los Angeles area (the South Coast Air Quality Management District) has a web page listing the brokers active in the area: <http://www.aqmd.gov/permit/ERCbrokers.html>.

The 1990 CAA Amendments strengthened the offset requirements for ozone nonattainment areas by increasing the offset ratios for more severely polluted areas. For example, for nonattainment areas classified as “marginal” or “moderate” for ozone pollution severity, an emitting source must produce 1.1 tons of emission offsets for each 1 ton of pollutant that will be emitted; for areas classified as “serious,” the required ratio increases to 1.2 :1.

Although the emissions offset requirement seemingly would result in emissions decreases to offset the new emissions from the new or modified emitting source, in reality the system often does not work this way. Companies usually generate ERCs by shutting down emitters that would have ceased operation anyway. Thus, these “shutdown credits” often do not represent any additional decrease in emissions. Companies generate ERCs through shutdowns of emitting facilities far more often than by “overcontrolling” emitters that are subject to emission limitations (i.e., by achieving emissions reductions beyond what the rules require).

4.3. Installing Controls Representing the “Lowest Achievable Emissions Rate”

Emitters subject to the new source review permit program also must install air pollution controls that result in what the CAA terms the lowest achievable emissions rate (LAER). LAER, which is determined on a case-by-case basis, is the most stringent emission limitation contained in a SIP rule of any state – or achieved in practice – for the relevant industrial category. Unlike the “best available control technology” (BACT) site-specific control technology requirement for major new and modified emitters in areas attaining an ambient air quality standard, with LAER the state or local agency cannot consider costs in deciding upon the emissions limit. Moreover,

the LAER limits increase in stringency over time. Once an emitting source becomes subject to a strict emissions limit, LAER for any similar source must be at least that stringent. In practice, LAER and BACT are often the same, however.

As with RACT, EPA maintains a publicly-available web-based database of LAER determinations. See <http://cfpub.epa.gov/RBLC/htm/bl02.cfm> for the “RACT/BACT/LAER Clearinghouse” database. Thus, a company applying for a new source review permit can obtain a sense of the stringency of the emissions limit that will apply. Similarly, the state or local agency can find the most stringent LAER determination in the country for the particular type of industrial emitting source.

5. FAILURE TO ATTAIN NATIONAL AMBIENT AIR QUALITY STANDARDS

The CAA uses several different mechanisms for areas that have not attained a NAAQS by the attainment deadline. The general rule requires the state or locality to submit a SIP revision including additional measures that EPA may prescribe. EPA then may issue a new attainment date.

For ozone, carbon monoxide, and particulate matter nonattainment areas, an area that does not attain the NAAQS by the deadline was automatically reclassified to the next highest level of pollution severity – thereby giving it more time to attain the standard and also automatically requiring the state or locality to adopt the control measures that the CAA specifies for areas with that classification. For example, an area classified as “moderate” for ozone nonattainment that did not meet the 1996 NAAQS attainment deadline was reclassified to “serious” at that time. The state or locality then had to submit a SIP revision that included all the control measures specified in the CAA for serious areas. Such measures include enhanced monitoring on ozone, oxides of nitrogen, and volatile organic compounds; emissions offset requirements of at least 1.2:1 for new and modified sources (as compared to 1.15:1 in moderate areas); more rigorous motor vehicle inspection and maintenance programs; a clean fuel vehicle program; and transportation control measures.

The CAA provides EPA with another tool for requiring areas to reduce emissions if they have not met a NAAQS by the attainment deadline. The agency can issue what is known as a “SIP call.” A SIP call notifies the state that the SIP is inadequate to attain or maintain the NAAQS (or to allow “downwind” neighboring states to attain the standard). It requires the state to adopt additional control measures to further reduce emissions. If the state fails to adequately respond to the SIP call, EPA may impose sanctions or develop its own Federal Implementation Plan (FIP). See the discussion of sanctions and FIPs in Chapter Four (on the SIP process).

6. CONCLUSION

Although progress for several pollutants has been slow, ambient concentrations of the six criteria pollutants have decreased since the 1970 enactment of the CAA. Congress’ inclusion of increasingly prescriptive measures for nonattainment areas over the years has helped in achieving these declines in pollutant levels. The decision to make controls for ozone, carbon

monoxide, and particulate matter in the 1990 CAA Amendments more stringent in more severely polluted areas proved effective. It has also been helpful to require states to make continual progress toward attaining the NAAQS, and to make mid-course corrections if an area is not making that progress. The nonattainment “new source review” program has had mixed success, with the requirement for major new and modified emitters to install stringent air pollution “technology controls” proving more successful than the requirement to obtain emission “offsets.”

CHAPTER SIX

THE TITLE V OPERATING PERMIT PROGRAM

David Novello

1. SUMMARY OF RECOMMENDATIONS

China has many years of experience with pollution permitting, but until the 2008 amendment of the Water Pollution Prevention and Control Law had not instituted a national pollution permitting scheme. There is now significant interest in establishing a national air pollution source permitting scheme. Air permits utilized in China at present do not contain a number of requirements that would improve compliance and enforcement. U.S. air permits include elements, such as operational, monitoring, reporting and record-keeping requirements that could be utilized in China to significantly improve the effectiveness of China's air pollution permitting scheme. Based on our evaluation of the Clean Air Act's Title V operating permit program, we set forth the following findings and specific recommendations for consideration in the amendment to the Air Pollution Law:

- The U.S. established a federal operating permit program in 1990 in order to deal with many difficulties in air pollution enforcement that had existed since the passage of the 1970 Clean Air Act.
- Operating permits consolidate in one document the exact requirements that apply to a particular emitter, making it easier for enterprises, regulators and the public to understand what requirements apply to an emitter. Such requirements (particularly for more complex emitters) were often difficult to ascertain prior to the creation of the operating permit program because of the numerous and complicated requirements of air pollution laws and regulations.
- Operating permits make it easier to assess compliance and bring enforcement actions for violations of emission limitations and other requirements.
- Requiring a senior company official to swear to the truth, accuracy, and completeness of the permit application and monitoring reports submitted to the agency is a useful measure to improve information accuracy and deter cheating.
- It is useful to allow a central authority (such as EPA in the United States) to object to a deficient permit issued by a state or provincial agency. In the United States, this authority often leads the state agency to correct a problem that EPA identifies.
- A citizen should be able to appeal a permit to a higher level in the issuing agency, and also should be able to seek judicial review of a permit that it considers inadequate.
- Requiring emitters to pay a fee for the operating permit can help to fund air quality programs at the agency.
- The government and citizens must be able to enforce the terms of a permit and to sue a company that fails to obtain a permit.

- In order to reduce administrative burden, not all emissions sources should necessarily be required to obtain a permit. However, all larger sources and those emitting hazardous substances should be required to obtain permits.

Based on these findings, we make the following specific recommendations for China's Air Pollution Law amendment:

- **Require permits to specify all applicable environmental requirements.** Mandate that all applicable air pollution control requirements pertaining to a given enterprise be specified in the permit to improve ease of enforcement/compliance and help the enterprise itself to understand the range of environmental requirements to which it is subject. This should include emissions standards, including process and operation guidelines.
- **Monitoring, reporting, and record-keeping.** In particular, permits should include detailed monitoring, reporting, and record-keeping provisions. Effective monitoring is critical to determining compliance with emission standards. In addition, periodic reports and records of emissions often indicate problems in operations and emissions, and thus can alert emitters to correct those problems and also can provide enforcement officials with an easier avenue for enforcement.
- **Public access to permits.** The public should have access to permits and related records. This can provide enforcement officials with valuable supervision assistance. Creating a public interest litigation provision to allow citizens to enforce against permit violations also provides assistance to enforcement officials.
- **Public participation.** Permits should undergo a public comment process prior to approval. This can alert officials to any problems in advance and increase public awareness and acceptance of enterprises. A public comment requirement can also help to address regional pollution issues by giving neighboring jurisdictions an opportunity to comment on permit applications for enterprises whose emissions may affect their air quality.

2. INTRODUCTION

Title V of the Clean Air Act, added by the 1990 CAA Amendments, creates a federally mandated operating permit program to be implemented by the states. The issuance of Title V permits in recent years has made major changes to the CAA implementation scheme that evolved between passage of the original act in 1970 and passage of the 1990 CAA Amendments. This paper provides an overview of Title V's principal permitting requirements.

The CAA created a joint federal-state program to make emission reductions sufficient to improve air quality to the levels required by the federal National Ambient Air Quality Standards. States are responsible for creating a State Implementation Plan that includes the necessary measures. To assure that the emission limitations of the SIP and all other CAA emission limitations and requirements are effective, the 1990 CAA Amendments created a federal-state operating permit

program. Under this authority, EPA has issued rules that describe the elements required in a state operating permit program. Under these federal rules, states have adopted operating permit programs that must comply with the federal regulations.

Once EPA approved these permit programs, states issued permits to individual emitters within their jurisdictions. These permits are critical to compliance because they contain clear, enforceable requirements applicable to the particular emitter.

As described below, the operating permit system aids greatly in implementation and enforcement of air emissions standards and other air quality requirements. The benefits of the permit program include the following:

- All emitters of consequence must obtain and operate under the terms of a permit that specifies all the requirements for them.
- In preparing their permit applications companies need to undertake a careful review of exactly which requirements apply to their emitters.
- The permit makes it clear to EPA and state and local agencies which mandates apply to each permitted emitter.
- The permit identifies exactly which monitoring, record keeping, and reporting requirements apply to the emitter.
- Because the permit, the permit application, and reports to agencies are public documents, citizens as well as regulators can ascertain the requirements that apply and the compliance status of the emitter.
- Citizens can also provide comments on proposed permits and ask EPA to object to permits that they believe are deficient.
- All elements of the permit may be enforced in court by the issuing state or locality, the federal government, and citizens.

CAA Title V calls on states to establish their own operating permit programs and to issue permits themselves. Many states over the years had developed and implemented operating permit programs, even though such programs were not mandated by federal law. These programs varied widely in their scope and requirements. With enactment of the 1990 CAA Amendments, however, all states are now required to carry out state operating permit programs that meet the minimum requirements of Title V and the EPA's implementing regulations. For facilities subject to Title V, the operating permit has become the implementation vehicle for nearly all stationary emitter requirements found in the CAA.

Title V required the EPA to issue regulations describing the minimum elements of state permit programs. The EPA issued the final federal rules on July 21, 1992⁴⁰. The federal rules are codified in Part 70 of Code of Federal Regulations (C.F.R.) chapter 40. Thus, they are often referred to as the "Part 70 rules." States were required to comply with these EPA rules when they adopted their own permit legislation and regulations. Companies are not directly regulated under the Part 70 rules; rather, these EPA rules represent the minimum required for state-adopted

⁴⁰ 57 Fed. Reg. 32,250.

permit programs. Companies with plants in different states need to apply for and receive permits under each state's rules.

In states that fail to adopt approvable programs, the EPA is required to intervene and issue operating permits. To this end, in 1996 the agency issued *federal* permit regulations—found in 40 C.F.R. Part 71—to use if it needs to act as the permitting agency in any state, and also for EPA permitting of facilities on Native American tribal lands.⁴¹

3. GOALS OF THE TITLE V OPERATING PERMIT PROGRAM

The EPA advocated the operating permits concept so that all applicable CAA requirements for an emitter could be consolidated in one document. The operating permit for a chemical plant, for example, would contain:

- All relevant air emissions limitations, monitoring, and reporting requirements for “criteria pollutants” found in the state implementation plan (SIP)⁴²;
- Hazardous air pollutant regulations under CAA Section 112;
- New source performance standards (NSPS) under CAA Section 111;
- Prevention of significant deterioration (PSD) or nonattainment New Source Review (NSR) *pre-construction* permits; and
- Other applicable CAA rules.

4. APPLICABILITY

The applicability provisions of the CAA and EPA's permit rules answer two basic questions: who must obtain a Title V operating permit, and what CAA requirements the permit must include.

4.1. Who Must Obtain a Permit?

State permit programs are required to issue permits to:

- Emitters defined as “major” under the permitting rules;⁴³
- Emitters subject to a standard or regulation promulgated under CAA Section 111 (the “New Source Performance Standards (NSPS)” provision) or Section 112 (the hazardous air pollutant provision);
- Emitters subject to the acid rain program provisions of the act;
- Emitters required to have a major source pre-construction permit;⁴⁴ and

⁴¹ 61 Fed. Reg. 34,228 (July 1, 1996).

⁴² These criteria pollutants are particulate matter, sulfur dioxide, ozone, carbon monoxide, lead, and nitrogen dioxide. See the NAAQS chapter for a description of how EPA sets the NAAQS for these criteria pollutants.

⁴³ The CAA includes a number of different definitions of “major,” depending on the regulatory program. Whether an emitter is classified as “major” usually depends on its potential to emit pollutants (assuming continuous operation) rather than the actual emissions.

- Any other industrial sources in a category designated by the EPA.

Not all emitters are required to obtain a Title V permit, because permits were deemed not cost-effective for smaller industrial plants. Thus, the permit system is designed to avoid unnecessary burdens for companies, and it sets thresholds for which entities need permits.⁴⁵

EPA may exempt source categories from permitting requirements if the agency finds that permitting for them would be impracticable or unnecessarily burdensome, although exemption is not allowed for “major sources.” States may include additional sources in their permit programs.

Note that states may issue one permit for the entire source or different permits for the various units, as long as all requirements that apply to the entire source are incorporated. The applicability provisions determine whether a source needs to have a permit; they do not dictate that the state must issue only one permit, rather than multiple ones.

4.2. What CAA Requirements Must Be Included in the Permit?

As for the second applicability question, what CAA requirements the permit must include, EPA’s rules state that a permit for a major source must contain all applicable requirements for each of the source’s regulated emission units. In other words, though an emitter may be classified as “major” owing to its sulfur dioxide emissions, all relevant CAA requirements for all pollutants—such as air toxics standards and ozone SIP requirements—must be in the permit.

For a “non-major” emitter required to have a permit, the EPA’s rules require only that the permit include all requirements applicable to emission units that cause the emitter to be subject to the permit program. Thus, if a “non-major” emitter must obtain a permit only because it contains an oil-fired burner subject to a federal emissions standard, the permit would only have to address the burner.

5. STATE PERMIT PROGRAMS AND EPA REVIEW OF PROGRAMS

The CAA and EPA’s federal permitting rules set forth the minimum elements for state permit programs. In addition, the federal rules describe how the EPA is to review state programs (and program revisions).

⁴⁴ Major source pre-construction permits include both “prevention of significant deterioration” (PSD) permits and “nonattainment new source” permits. PSD permits, issued in areas that are attaining the NAAQS, are briefly described in Chapter Three. Nonattainment new source review permits, issued in nonattainment areas, are discussed in Chapter Five. Enterprises must obtain these pre-construction permits before building a major new emitter or making certain types of significant modifications to an existing emitter.

⁴⁵ Many emitters reduce their emissions so that they fall below the threshold and are not required to obtain a permit. This represents another way that the Title V operating permit program leads to decreases in emissions.

5.1. State Program Requirements

Each state (or locality) was required to submit its permit rules, a program description, and copies of enabling statutes and regulations to the EPA by November 15, 1993 (three years after the 1990 Clean Air Act amendments were signed into law). The state's attorney general or the attorney for the air pollution control agency also had to sign an opinion asserting that the state has legal authority to carry out the program. The EPA's rules specify several requirements the state must show it can implement. The most significant requirements include:

- The state cannot issue permits with more than a five-year term;
- The state must make available to the public all permit applications, compliance plans, permits, and monitoring and compliance reports (although the emitter may be able to protect confidential business information in all documents except the permit);
- The state shall not issue a permit if the EPA objects;
- The state must allow for judicial review of the final permit in state court; and,
- The state must also collect adequate permit fees (based on the quantity of emissions or other factors), and make personnel and funding available to develop and administer the program.

The state must also demonstrate that it has adequate enforcement authority—both civil and criminal. States must demonstrate that they can enforce permit terms and bring legal action against emitters that illegally operate without a permit. The enforcement mandates require, among other things, that states have the power to seek injunctive relief, and recover civil and criminal penalties.⁴⁶

Another required program element addresses the problem of expiring permits. EPA's rules require that emitters submit applications in a timely manner, and that the state issue or deny permits within a specified period of time. States must provide that a permit remains in effect after its term if the permittee has submitted a timely and sufficient application for renewal or, alternatively, provide that the terms and conditions of the expiring permit remain in effect.

5.2. EPA Review of State Programs

Following a state's submittal of its permit program to the EPA, the agency had to determine whether the submission was complete. The CAA then required the EPA to approve, disapprove, or partially approve the program within one year of receipt of the complete submission, although the EPA often did not meet the deadlines.

The EPA publishes notice of these actions in the *Federal Register*. A disapproval (complete or partial) includes a statement of the revisions required. The state must make necessary revisions within 180 days of the EPA's disapproval. If the state does not make the corrections—or if it never submits a program or fails to adequately implement it—the EPA must impose sanctions

⁴⁶ See Chapter Six for a description of both a state's and EPA's authority to enforce the requirement for an emitter to obtain a permit and the permit terms.

against the state, and it is ultimately required to adopt and carry out a permit program in the state. To date, EPA has not imposed sanctions or taken over a state permit program.

EPA's permit rules also provide for partial permit programs. The EPA may approve a partial program limited in terms of geographic scope (such as for a local air pollution agency), as long as the program ensures compliance with specified provisions of the CAA. However, the failure to submit an approvable "whole program" still could subject the state to sanctions.

6. PERMIT APPLICATIONS

An application is the company's vehicle for supplying the permit writer with information needed to craft the permit terms. Title V also mandates that the application include a compliance plan and compliance schedule. Finally, as discussed in the following paragraphs, filing a timely and complete application will protect the emitter if the state delays in issuing the permit.

6.1. Timely and Complete Applications

Each emitter in the permit program needs to submit a timely and complete application to the state agency. Otherwise, the owner or operator is in violation of the CAA, and may be assessed civil penalties. An emitter applying for a Title V permit for the first time must file its application no later than twelve months after becoming subject to the program. A renewal application must be filed at least six months before the end of the permit term, but in no case may the state require it to be filed more than eighteen months before expiration.

A complete application is one that includes information sufficient to evaluate the subject emitter and its application and to determine all applicable requirements. Generally, a permit engineer in the state or local environmental agency will determine if the application is complete. A completeness finding, however, does not relieve the emitter of its duty to supply any additional information requested by the state in writing. An emitter that has never received a permit or whose permit has expired may continue to operate as long as a complete application for an initial permit or permit renewal has been filed on time.

6.2. Content of Applications

The EPA decided against adopting a national permit application form. Instead, the EPA permit rules list data that the EPA requires to be included in the state's application form, including company information; a plant description; emissions-related data, including emission rates; a description of emission points and air pollution control equipment; and a description of applicable CAA requirements and test methods for determining compliance.

6.3. Insignificant Activities and Emission Units

The EPA decided it may approve as part of a State program a list of "insignificant activities and emission levels" which need not be included in permit applications. This exemption was included so that states would not need to collect unreasonable amounts of information on even

the most trivial emissions at facilities. The EPA rules, however, require the application to list the “insignificant activities” in certain cases. Moreover, an emitter may not omit information needed to calculate permit fees or to determine if a CAA requirement applies.

6.4. Compliance Plans, Schedules, and Certifications

The EPA’s permit rules compel all emitters to submit with their application a compliance plan showing how an emitter that is not meeting requirements will comply with them. The plan must include a “schedule of compliance,” which, for emitters not in compliance, must contain “an enforceable sequence of actions with milestones, leading to compliance.” Again, requirements are minimal for emitters already in compliance and for emitters subject to regulations that will become effective during the permit term. The schedule is part of the permit. It is therefore enforceable against the emitter.

The application, as well as reports and required additional periodic compliance certifications, also must include a responsible official’s certification (sworn statement) of truth, accuracy, and completeness. A knowing violation of this requirement would subject a person to criminal penalties. This provision is intended to create a strong incentive for higher company officials to carefully review the permit application and compliance certifications to make sure that they are accurate.

6.5. The Process of Applying for a Permit

A company must conduct a careful review of operations at its facility before submitting a permit application to the state agency. Congress and EPA intended that this careful review take place; it helps to ensure that company officials are aware of the emission limitations applicable to the emitter, and have reviewed their compliance with the requirements.

Many companies hire consultants familiar with the Title V operating permit process to assist company staff in ascertaining the emission standards and other air quality mandates that apply. Consultants often play a major role in preparing the permit application. Companies also usually have their lawyers review the application to make sure that it complies with the state’s permit rules and to minimize potential risk to the responsible company official, to confirm its truthfulness prior to the official’s signature on the document attesting to its content.

The first step in preparing the application is to identify the sources of emissions within a facility, as well as the control equipment limiting those emissions. Company staff then must identify all the CAA emission limitations and other requirements that apply to the emitter. In developing their initial Title V permit applications, many companies discovered that they were not complying with applicable CAA requirements. Thus, the operating permit program has produced significant reductions in emissions simply because companies began to install control equipment to comply with the overlooked mandates.

As noted above, a high “responsible official” at the company must review the permit application before submittal, and swear to its truth, accuracy, and completeness. After the emitter submits the application to the state agency, the company must supply the agency with information that

agency staff determines is missing. Company staff also must answer the inevitable questions raised by the agency. If they do not supply the requested information and answer the agency's questions, the agency can refuse to issue the permit. Once the agency determines that the permit application is complete, it proceeds according to the process described below in the section discussing "Permit issuance."

7. PERMIT CONTENT

The Title V permit must assure compliance with all applicable CAA requirements. The regulations on permit content are critical to realizing this mandate because the permit terms translate generally applicable standards and duties into source-specific emission limitations. In practice, a permit engineer at the state or local permitting agency, working with the permit applicant, will determine what is to be included in the permit.

7.1. Permit Terms

Among other things, each permit must include emission limitations⁴⁷ and standards as well as monitoring, record-keeping, reporting, and inspection and entry requirements to assure compliance with those limits. Generally a Title V permit (and also the application) can cite to or cross-reference regulatory requirements—rather than repeat these requirements in the permit itself—if the information is currently and readily available to the permitting authority and the public.

The monitoring requirements in the permit deserve special attention because without adequate monitoring, it would be difficult or even impossible to determine if a facility were complying with the applicable emission standards. Thus, the importance of detailed monitoring (as well as record keeping and reporting) requirements cannot be overemphasized. The EPA permit rules state that if the emitter is not required to do periodic testing or monitoring by a federal rule under the CAA, then the permit itself must supply periodic monitoring sufficient to yield reliable data from the relevant time period that are representative of the emitter's compliance with the permit.

The permit must include provisions for periodic "certifications of compliance" by a high official of the company that owns or operates the emitter. As with the certification found in the application, this is a sworn statement, and the company official is subject to civil and possible criminal penalties if the certification is not true. Emitters not in compliance with any CAA requirements also must file semiannual progress reports stating whether they met compliance deadlines (and if not, why not).

In recognition of the fact that many manufacturing processes change often in order to make different products, the EPA rules require states to include in the permit "reasonably anticipated operating scenarios" that the emitter identifies in its application. The emitter therefore can switch

⁴⁷ Emission limitations can be expressed in a variety of ways, such as (1) amount of pollutant emitted per unit of production; (2) amount of pollutant emitted per unit of input; or (3) concentration of pollutant in the emissions. EPA generally favors the first type (amount of pollutant emitted per unit of production) because it provides an incentive to increase efficiency of the manufacturing process.

among several scenarios without the need for a permit revision, *if* it was able to foresee the need for the different operating modes and it asked the state to include these various permit terms.

7.2. General Permits

The CAA allows states to issue a “general permit” covering numerous similar emitters, as long as the permit complies with all Title V requirements and the emitters apply for it. A general permit contains terms just like an individual permit. In some ways, however, it more resembles a rule because it states what a number of emitters can and cannot do. The EPA and states have used general permits to great benefit in the Clean Water Act permit program, especially for permitting smaller, simpler emitters, and a number of states have utilized them under the CAA as well. For example, a state might issue a general permit for dry cleaners.

The EPA’s rules make clear that although public participation is required when a general permit is issued, it is not needed when an emitter applies to be covered by the terms of the permit. The application for coverage under a general permit need not contain all the information required for regular permit applications.

The EPA has advised that, in deciding whether a general permit is appropriate, states should consider whether the emitters are (1) generally homogeneous in terms of operations, processes, and emissions; (2) subject to case-by-case standards or requirements; and (3) subject to the same or substantially similar requirements governing operation, emissions, monitoring, reporting, or record keeping. General permits may also cover discrete emission units located at many types of facilities. In practice, states have often used general permits for smaller facilities that meet the criteria in (1) and (3) above, such as dry cleaners and gas pipeline transmission stations. In addition, some states allow a larger facility with a typical Title V permit to cross-reference a general permit applicable to production or emission units at the facility (such as degreasers).

8. PERMIT ISSUANCE, JUDICIAL REVIEW, RENEWALS, AND REOPENINGS

8.1. Public Involvement in Permit Issuance

The EPA’s permit rules require public participation for issuance of the initial permit, including adequate notice of what the agency calls the “draft proposed permit.” The EPA also requires states to provide for public availability of all non-confidential information submitted by the applicant, a 30-day comment period, and an opportunity for an informal public hearing. The state must provide notice of a hearing at least thirty days in advance.

The state need not hold a public hearing in all instances; the request for a hearing must be germane to the requirements that apply to the emitter. For example, a hearing may not have to be held if the requester only protests the emitter’s location. In contrast to the Clean Water Act permit program, the hearing need not be a trial-type adjudicatory hearing, with formal procedures such as the cross-examination of witnesses. Because this type of hearing is time-consuming and expensive, most state Title V programs call for informal hearings instead.

The state must provide a statement of the legal and factual basis for the draft permit conditions. The “basis statement” plays an important role if the applicant or another party decides to challenge the final permit, since it will be a critical part of the administrative record on the permit.

Applications for permit modifications are reviewed by state regulators and—for more important changes—are made available to the public. The permit modifications provisions in EPA’s rules, which engendered heated debate among stakeholders, are complex. Suffice it to say that EPA’s rules classify modifications into three types, with increased review and process required for the more significant revisions.

8.2. Judicial Review of Permit

The EPA permit rules require states to provide an opportunity for judicial review in state court for the applicant, any person who participated during the public comment period, and any other person who could obtain judicial review under state law. Petitions for judicial review must be filed within ninety days of the state’s final action on the permit, or a shorter period that the state may choose. This judicial review of permit terms is the only forum in which a person can contest permit provisions. Thus, challenges to permit terms may not be raised as a defense in an enforcement action; they may only be brought following issuance of the permit.

8.3. Permit Renewals

Under the EPA’s rules, applications for permit renewals and re-openings will be processed in the same manner as applications for initial permits. A major emitter’s permit must be reopened if the EPA or the state issues a new, applicable CAA standard and three or more years remain in the permit term; the state then incorporates the standard in the permit within eighteen months. In addition, the state (or, in some cases, the EPA) may reopen the permit for other reasons specified in the state’s permit rules.

9. PERMIT REVIEW AND EPA OVERSIGHT OVER STATE PROGRAMS

9.1. Review of Permits by the EPA and Neighboring States

EPA’s regulations require States to furnish the EPA with copies of each permit application, draft proposed permit, and final permit. They must also transmit copies of a draft proposed permit to states that are within fifty miles of the emitter and to states whose air quality may be affected that are contiguous to the issuing state. The neighboring states then can comment on the draft proposed permit (but they have no authority to block it). The EPA may waive the furnishing of such documents for some categories of emitters (but not “major” sources). If the issuing state does not accept a neighboring state’s recommendations, it must explain why it is rejecting them.

The procedures governing EPA review are more complex. The CAA provides that the EPA shall object to issuance of a permit containing provisions the agency determines are not in compliance with applicable CAA requirements, including the SIP. The EPA must object to (i.e., veto) the

permit within forty-five days after receiving it, or the permit may automatically issue. If the EPA objects, the state may not issue the permit as written; a refusal to correct the problem will lead the EPA to issue or deny the permit itself. If the EPA does not object during the review period, under certain circumstances a person may petition the EPA to object to it afterwards.

The CAA provides that the EPA administrator's decision to deny such a petition is subject to judicial review in federal court. Environmental non-governmental organizations have taken advantage of these provisions by petitioning EPA to object to a number of state-issued permits, and on occasion by challenging EPA's failure to object. In a number of cases, EPA has required a change to the permit as a result of an environmental group petition.

9.2. EPA Oversight Over State Permit Programs

As discussed earlier, EPA's rules require the agency to apply sanctions against a state (and ultimately to issue Title V permits itself) if the state fails to submit an approvable permit program. These sanctions would follow the EPA's filing of a "notice of deficiency" with the state. The statute and EPA's rules call for similar action if the EPA finds that the state is not adequately enforcing or implementing its program. The EPA rules also set forth criteria for withdrawal of federal approval of state permit programs. But EPA is very reluctant to exercise these authorities. In the seventeen years following issuance of its Part 70 operating permit rules in 1992, EPA has not imposed sanctions, taken over permitting in states, or withdrawn approval of state permit programs. Still, EPA threats to take such actions have at times led states to improve their permit programs (as well as implementation and enforcement of them).

10. PERMIT FEES

The Title V fee provisions were designed to ensure that states receive adequate funding to carry out their permitting responsibilities. The CAA requires permitted emitters to pay an annual fee, or the equivalent over some other period, sufficient to cover all reasonable (direct and indirect) costs required to develop and administer the permit program requirements. States needed to establish fee schedules and demonstrations showing that they would collect and retain enough money to pay permit program costs.

Required fees may be used only for the permit program's direct and indirect costs. A state could not, for example, use fees necessary to run the permit program to fund social services programs or even air quality programs unrelated to Title V permits. However, EPA has stated that the CAA does not prohibit a state from assessing greater fees than required by the Act and using those additional fees for purposes other than supporting the permit program.

11. DIFFERENCES WITH NEW EU MULTIMEDIA PERMIT PROGRAM

The European Union, in its January 15, 2008 Integrated Pollution Prevention and Control Directive (IPPC Directive), requires permits that address several environmental media. The IPPC Directive states that "[t]he objective of an integrated approach to pollution control is to prevent emissions into air, water or soil wherever this is practicable, taking into account waste

management, and, where it is not, to minimize them in order to achieve a high level of protection for the environment as a whole.” It also provides that “[t]he competent authority or authorities should grant or amend a permit only when integrated environmental protection measures for air, water and land have been laid down.”

In the United States, by way of contrast, there has been very little movement towards multimedia permits. In the 1990s, Washington State enacted legislation calling for a multimedia permit pilot program. But EPA has shown little interest in permits that address air, water, and waste management. Moreover, Congress almost certainly would need to amend the Clean Air Act, Clean Water Act, and Resource Conservation and Recovery Act to allow the issuance of multimedia permits.

12. CONCLUSION

The CAA Title V operating permit program has significantly strengthened compliance and enforcement. It has helped companies, government agencies, and citizens to better understand which air quality emission limitations and other standards apply to emitters. The permit collects in one document all requirements that the emitter must comply with. It also aims to require the emitter to undertake adequate monitoring, record keeping, and reporting of emissions and other information that allows the government and citizens to determine whether the emitter is complying with those emission limitations and other standards. As a result, enforcement for violation of permit terms is much easier. In addition, the permit program allows citizens to provide comments on a draft permit before the agency issues it.

We recommend that China adopt an operating permit program that addresses all regulated pollutants and all air pollution requirements that apply to an emitter. Such a system will assist in compliance by clarifying for emitters the requirements to which it is subject and aid enforcement by consolidating all legal requirements, providing enforcement officials with more facility-specific information, and increase the public’s role in supervising polluting enterprises.

CHAPTER SEVEN

THE ROLE FOR AIR QUALITY REGIONS AND REGIONAL OFFICES IN CHINA'S AIR QUALITY MANAGEMENT SYSTEM

Art Williams
Jessica Olson

1. SUMMARY OF RECOMMENDATIONS

There are many important roles and functions for enhanced regional mechanisms within China's environmental management system. The national law should provide sufficient and clear authority for all anticipated roles and functions of regional bodies. This includes ensuring that existing and future regional offices are adequately staffed, funded and trained; that pilot projects be used to test roles and functions; and that officials at the provincial and local levels are fully integrated into regional mechanisms in all appropriate and necessary ways.

To ensure sufficient authority in the Air Pollution Law to achieve the benefits and perform the roles and functions of regional mechanisms described in this chapter, it is recommended that authorizing language be added to the Air Pollution Law as follows:

- **Authorizing Robust, Well-resourced Regional Offices.** MEP should be allowed to identify and divide the country into environmental management regions of appropriate size using criteria determined by MEP such as airshed, historic, socio-economic, scientific, and other geographical factors that scientifically and practically relate to the goals of regional environmental management. MEP should be authorized to establish one principal office in each region and other lesser offices as may be necessary. The offices would be authorized to carry out at the regional level any functions, duties, programs or other activities or responsibilities of the central government or of the agency. The regional offices would provide a presence for and extension of the national government in important regions of the country to ensure the effective performance of local and provincial officials in environmental management and to assist them as appropriate and necessary in those efforts. Such assistance could be in the form of technical and policy advice, the provision of environmental equipment and supplies, training, information, financial support or any other appropriate support. The Law should provide that regional offices be adequately staffed, trained, equipped and funded.
- **Establish Air Quality Management Regions.** MEP should be authorized to designate regional areas comprised of several provinces, which may or may not be the same as the aforementioned management zones, to address specific air pollution issues that need to be managed by the national government. MEP would develop the criteria to determine which regions should be established and the basis for establishing the regions.

- **Designation of Specific Air Quality Management Regions.** The following regions should be designated in the law as Air Quality Management Regions: (1) the Beijing, Tianjin, Tangshan region, (2) the Yangtze River Delta region, (3) the Pearl River Delta region, and (4) any other logical regions and airsheds. MEP should be authorized to establish a primary regional office in each of these regions with the same duties as indicated above.
- **Provincial Authority to Petition for Air Quality Management Regions.** Provinces should be authorized to petition MEP to establish a regional Air Quality Management Region based on criteria established by MEP. MEP would be authorized to approve, deny or amend such request as appropriate. The Petition would be required to be based on scientific factors such as one or more Provinces being adversely affected by trans-boundary pollution from one or more other Provinces. See for example the U.S. CAA, Section 126 (42 USC Section 7426) which provides this type of authority to states and political subdivisions.
- **Authorize Voluntary Regional Bodies Composed of Provincial Representatives.** Provinces, working through Provincial EPBs, should be authorized to form voluntary regional bodies to jointly address pollution issues. MEP should be authorized to provide appropriate support to any such regional bodies as may be established including technical, policy, and financial resources.
- **Local cooperation with MEP regional offices.** Local and Provincial EPBs should be required to submit to regional MEP offices any relevant environmental or related information requested by MEP.

2. INTRODUCTION

The current Air Pollution Law does not adequately address regional air pollution problems, such as those associated with city clusters or trans-provincial areas impacted by the transport of pollution.

Regional approaches for air quality management are especially timely in China today because the country is in the early stages of establishing regional environmental offices called Regional Supervisory Centers. China already has valuable experience using regions to manage environmental problems. Notable is the successful application of regional approaches in implementing the SO₂ acid rain control program.

China can build on these successes and expand the use of regional approaches to support the efforts of local provincial Environmental Protection Bureaus and effectively address the challenges of air pollution that does not adhere to provincial or local governmental boundaries. Assigning greater managerial responsibility and resources to regions and regional offices will strengthen the presence of the central government and provide new, additional levels of environmental oversight to foster local expertise and enforcement capabilities. Allocating adequate staff, training and funding to these offices will be vital for success.

This chapter discusses why China should adopt more regional approaches to air quality management. It will discuss the United States and European Union experiences with regional approaches to air quality and recommend changes in the Air Pollution Law to achieve the benefits of these regional approaches to air quality.

3. FUNCTIONS OF REGIONAL OFFICES FOR AIR QUALITY MANAGEMENT

There are many potential roles and functions for a regional office in a national environmental management system. These roles can be categorized in the following way.

(1) Functions that serve the interests of the national government:

- Monitor and guide action at provincial and local level;
- Provide oversight of provinces and local government air programs;
- Gather and analyze data and information;
- Manage and facilitate national air programs and policies at the regional level;
- Help prioritize national government investments in provinces, local areas and regional areas;
- Serve as the conduit for provincial, local and regional funding by national government and the point at which provinces, locals and regions are held accountable for expenditure of nations funds; and
- Provide additional opportunities to train officials for national leadership roles.

(2) Functions that serve the interests of provinces and local governments:

- Oversee air quality plan development and implementation;
- Build capacity, provide technical and policy assistance; and
- Provide and conduct appropriate training.

(3) Functions that serve the interests of the region:

- Evaluate and make recommendations to regional bodies about management of regional issues;
- Perform regional modeling; and
- Support regional organizations that may be formed by provincial and local governments to assist in addressing regional issues.

4. POTENTIAL BENEFITS OF REGIONAL AIR QUALITY MANAGEMENT IN CHINA

There are numerous reasons that an enhanced and expanded role for regions and regional offices can help China achieve the goals of the Air Pollution Law. While China has begun a process of creating Regional Supervisory Centers, these centers are currently narrowly focused on enforcement issues. These Centers should either have their purpose, role and authority expanded to include air quality management, planning, permitting and monitoring, or new regional air quality offices with expanded responsibilities should be created.

Benefits of using regions and regional offices for air quality management include:

1. Regions are geographically closer to the locations where air pollution actually occurs. This proximity will improve the scientific knowledge and understanding of the local air quality issues that need to be addressed.
2. Proximity to local circumstances improves knowledge of the local and provincial officials and other stakeholders, and it improves relationships which will facilitate program implementation, conflict resolution, and information gathering. The presence of a regional center and staff provides a face for the central government to local officials, which will bolster the efforts of the central government. These local officials will be well positioned to address complaints, including those submitted as part of the recently announced MEP hotline.⁴⁸
3. Pollution reduction planning can be more effective and improvements in air quality may be achieved in a more timely manner, including Total Emissions Control reductions and other air quality goals. Emission reduction strategies that are specifically developed for a region's emission sources, based on local political and economic realities and other unique circumstances, such as meteorology, climate and topography, are more likely to achieve success quickly and efficiently.
4. Regional approaches allow the national government to more accurately account for the costs of programs in regional areas by developing regional budgets and allocating fiscal resources to each region that can be tracked accordingly. This allows for better scientific planning and financial accounting—and thus more cost-effective expenditure of national monies.
5. Regions can become laboratories for testing innovative programs and pilot projects.
6. Regional approaches in one field of environmental regulation give provinces an opportunity to build relationships that may benefit other environmental or important policy fields.
7. Deep knowledge and understanding of regional conditions can better inform the central government to set more appropriate priorities and develop more effective air pollution control programs given the issues and concerns from around the country.
8. Local and regional levels may be better positioned to respond more rapidly and effectively to emergencies and other particularly pressing issues than otherwise would be possible from the central level.

It is important to note that while a regional presence can provide these various benefits, regional offices may also be more susceptible to lobbying by local political and economic interests. Continued engagement and oversight by central authorities are critical to maintaining the integrity of regional offices.

5. REGIONAL APPROACHES IN THE UNITED STATES

Regional mechanisms have played an increasingly crucial role in the United States. Their application in the U.S. can be organized according to the three main functions outlined above:

⁴⁸ “China to Open Environment Hotline”, Xinhua News, June 5, 2009, available at http://www.chinadaily.com.cn/china/2009-06/05/content_8250331.htm.

(1) regional offices developed for administrative support of the national environmental agency and its major functions; (2) regional areas and approaches used by the national government to address specific air pollution issues; and (3) regional areas and approaches created by states to address regional air pollution issues.

5.1. Federal EPA Administrative Functions

Soon after the U.S. EPA was created by Congress in 1970, it created ten regional offices throughout the U.S. to manage large geographic regions into which it divided the U.S. These regions conformed to generally accepted geographical and socio-economic regions of the U.S. and also followed state boundaries.⁴⁹ These offices were established to facilitate the administration of the Federal EPA's many functions and programs.

Because EPA has found the regional offices to be very effective in managing programs, policies and functions, many roles and functions of the regional offices have expanded over the years. Most regional EPA offices now have several hundred staff, large budgets and multiple program areas. For example, the EPA Region 4 office in the southeast U.S. has 15 discrete units that address, among other issues, air quality, asbestos, permitting, modeling, mobile sources, planning and enforcement.⁵⁰

These regional offices maintain very close ties to EPA headquarters. Because regional offices cultivate thorough understandings of regional issues, collaborative approaches have been used in which regional offices play a key role in the development of national policies. Even though the regional offices are part of the central government, they are flexible enough to be able to work with states to pilot new ideas, and apply the lessons learned, advantages and disadvantages, to national policy. The regional offices also help develop the leadership staff of EPA and staff with substantial expertise in specialized areas of environmental management. This strong staff expertise has strengthened the capacity of EPA to successfully address environmental problems.

5.2. National Air Pollution Issues

In 1970, with the adoption of the Clean Air Act, states were given the main responsibility for achieving national air quality standards. The role of the federal government was to set and enforce standards, but to otherwise play a supporting role in planning and implementation.

While the Clean Air Act contains authority for the EPA to designate interstate areas as "Air Quality Control Regions," it did not ultimately assume this authority. This was probably because EPA, as a relatively new agency with little experience in air quality management, did not fully appreciate the benefits of regional approaches. Air quality modeling and science were also nascent disciplines at the time; states and scientists suspected, but could not yet conclusively prove, the impacts of transported pollution and acid deposition.

⁴⁹ For information on the methods by which the U.S. EPA divides the country by region, see: <http://www.epa.gov/epahome/where.htm>.

⁵⁰ For a more detailed assessment of the organizational structure of the EPA Region 4 office in the southeastern U.S., see: <http://www.epa.gov/region4/air/>.

Specifically, CAA Section 107(c) provided that:

The Administrator shall...after consultation with appropriate State and local authorities, designate as an air quality control region any interstate area...which he deems necessary or appropriate for the attainment and maintenance of ambient air quality standards.

By the 1990s, it had become very clear that some of the most difficult air pollution issues, specifically ozone, could only be addressed successfully through regional mechanisms. Thus, in 1990, when Congress amended the Clean Air Act, it not only strengthened the authority for EPA to establish control regions, called Interstate Transport Regions, but it also specifically created an ozone transport region.⁵¹ This ozone transport region was to be administered by the Ozone Transport Commission (OTC) to address ozone issues in the eastern United States.⁵²

The OTC is made up of 12 states, EPA and the District of Columbia.⁵³ And while it advanced the understanding of the ozone issue at the stakeholder level, ozone has presented a much larger problem than could be addressed by 12 states. Soon after the creation of the OTC from 1995-97, an assembly of 38 states and other stakeholders voluntarily assembled under the Ozone Transport Assessment Group.^{54,55} This regional mechanism led to EPA developing and implementing a major regional regulatory program known as the NO_x SIP Call. This program reduced power sector NO_x emissions in most of the eastern U.S. by nearly 70 percent in 2003, as compared to a 1990 baseline.⁵⁶

Another recent application of regional approaches has been in addressing the problem of impaired visibility. This has involved reducing pollution, focusing on especially fine particles (PM_{2.5}), from numerous sources that impair the visibility in many areas, especially areas of national significance such as national parks. In the 1990 CAA Amendments, Congress specifically authorized EPA to establish Visibility Transport Regions and Visibility Transport Commissions when EPA finds that transport of air pollution from one state to another significantly contributes to visual impairment.⁵⁷ Pursuant to this authority, Visibility Transport Regions and Commissions have been identified and funded by EPA for several years. These

⁵¹ Clean Air Act Section 176.

⁵² Clean Air Act Section 184.

⁵³ For more information on the Ozone Transport Commission, see: <http://www.otc.org/about.asp>.

⁵⁴ A provision added by the 1990 CAA Amendments regarding the OTC is worth mentioning here. It contains a mechanism that permits states to recommend control measures to EPA, and requires that if this happens, then the EPA should direct the states to adopt these measures. Although this approach usually has not proved necessary in the U.S., it may be a useful model for China. It would allow MEP to order the adoption of control measures if the environmental agencies of the provinces recommended them to MEP.

⁵⁵ For more on OTAG, see: <http://www.epa.gov/ttn/naaqs/ozone/rto/otag/aboutotg.html>.

⁵⁶ "The U.S. EPA's State Implementation Plan for Reducing Regional Transport of NO_x," The Regulatory Assistance Project, 2008, available in English at http://www.raponline.org/showpdf.asp?PDF_URL='Pubs/Schultz%20DEPA%5FNOx%5FSIP%5FCalEN%2D11Mar09%2Epdf' and in Chinese at http://www.raponline.org/showpdf.asp?PDF_URL='Pubs/Schultz%20DEPA%5FNOx%5FSIP%5FCall%5FCN%2D11Mar09%2Epdf'. The NO_x SIP Call is also described in greater detail on the EPA's website, available here: <http://www.epa.gov/airmarkets/progsregs/nox/sip.html>.

⁵⁷ Clean Air Act Section 169B.

organizations have developed and begun to implement long-range plans to achieve visibility improvement goals.

5.3. State-initiated Regional Efforts

Just as EPA has evolved the use of regional offices and mechanisms described above, the states found value by joining together in voluntary regional associations to achieve further improvements air quality. Groups of states, collectively referred to as Regional Planning Organizations (RPOs), have been formed corresponding to the ten EPA regions. For example, in the southeastern U.S., the eight states (including the 17 key cities) of that region have formed an RPO to better cooperate, communicate and collaborate on issues of mutual concern.⁵⁸ The southeast RPO focused on the Great Smoky Mountains, where visibility impairment impacted tourism revenue. While all RPOs were originally initiated to focus on technical issues and research, some subsequently have expanded their portfolio of activities to include policy development. In another example, eight northeastern states have formed the Northeast States for Coordinated Air Use Management (NESCAUM), an organization to lead key policy research on air quality issues of mutual concern.⁵⁹ In general, these RPOs are designed to enhance communication between states, promote efficient air quality management, conduct research and training, evaluate issues, build capacity in staff, and develop recommended policies to improve air quality.

In another recent, significant example of states coming together voluntarily, 41 states (plus nine provinces in Canada, six states in Mexico and three Indian tribes) have formed The Climate Registry.⁶⁰ The Climate Registry seeks to develop inventories of greenhouse gases and lay a foundation for action to address climate change.⁶¹ Similarly, ten northeastern and mid-Atlantic states have formed the Regional Greenhouse Gas Initiative (RGGI). This is the first U.S. program to require a mandatory cap-and-trade program for CO₂ emissions from the power sector, with a goal of reducing those emissions by 10 percent by 2018.⁶² With implications for industrial and economic productivity and regional competition, climate change will continue to employ regional approaches like these around the world.⁶³

After almost 40 years of experience with regional mechanisms in the U.S., it is clear that there are quantifiable benefits to their use. Over the period of time from 1990 to 2007 ozone concentrations have been reduced nine percent, PM₁₀ has been reduced 28 percent, fine particle pollution 11 percent, and SO₂ 54 percent. Although other pollution reduction programs have been operating over this same time period, such as the federal acid rain program, regional mechanisms were a factor in these air quality improvements. Another indicator of the effectiveness of regional approaches is the comparison of costs and benefits of reducing key pollutants on a regional basis. For example, the U.S. Clean Air Implementation Rule (CAIR), a

⁵⁸ A more complete description of the southeastern RPO can be found at: <http://www.metro4-sesarm.org/>.

⁵⁹ More on NESCAUM can be found on its website: <http://www.nescaum.org/>.

⁶⁰ The two most recent states to join are the coal-dominated states of Kentucky and West Virginia.

⁶¹ For more information about The Climate Registry, see its website: <http://www.theclimateregistry.org/>.

⁶² For more information about RGGI, see: <http://www.rggi.org/home>.

⁶³ Regional approaches to reducing greenhouse gases was a focus at the UN climate change meetings in Bonn in June 2009.

federal program focused on significant NO_x and SO₂ reductions in the eastern U.S., was projected to provide health and environmental benefits at more than 25 times the cost of compliance in 2015, with health benefits in the range of U.S. \$85-100 billion and \$2 billion in visibility benefits.⁶⁴ Other key analyses indicate a very favorable cost/benefit ratio exists for regional approaches to environmental management, especially pollution reduction strategies.

U.S. experience has shown that regional approaches can be effective to identify contributing sources of pollution and measuring the efficacy of control technologies. Indeed, some of the best regional cooperation has been in the area of technical assistance.

Several state-based regional initiatives underscore the proven and significant value of regional mechanisms for improving air quality. One such initiative is the eight states in the northeastern U.S. which have joined together as the Northeast States for Coordinated Air Use Management (NESCAUM). This not-for-profit organization provides scientific, technical, analytical and policy support to the air quality and climate change programs of the eight states. NESCAUM hosts committees and workgroups on key air quality issues, has forums for public education, promotes research initiatives, such as the Northeast Diesel Collaborative, and sponsors an annual Clean Air Academy providing advanced air quality training for the states' air quality officials. NESCAUM is also a frequent commenter on proposed EPA regulations, and testifies in the U.S. Congress on proposed federal legislation.

The Southern Appalachian Mountains Initiative (SAMI) is also a not-for-profit organization created by eight southern states to identify potential solutions to regional air quality problems. Technical support for modeling various regional air quality scenarios for SAMI is provided by a unique partnership between the Tennessee Valley Authority and Alpine Geophysics, a private sector air quality modeling organization. One substantial focus of the work of SAMI has been on addressing the visual impairment in the Great Smoky Mountains National Park.

In the western U.S., the Western Regional Air Partnership (WRAP), a coalition of 13 western states, 12 Native American Tribes and three federal agencies (U.S. EPA, the Department of Interior and the Department of Agriculture), have joined together since 1997 to develop data, tools and policies to improve visibility in parks and wilderness areas across the region as required by the regional haze regulations of the U.S. EPA. The collaboration that began during WRAP has evolved and helped to coordinate policy and the development of regulations to reduce greenhouse gases through the Western Climate Initiative.

The Ozone Transport Commission, another good example of technical cooperation, has also led to information sharing about control measures and subsequent decisions by various states to jointly adopt measures. In this case, the decision by some states to move forward has created political pressure on other states to follow suit and adopt the measures. Even though there were at times holdouts, states like Virginia which resisted taking action, for the most part, the states decided on a series of aggressive emissions reductions without EPA playing a significant role.

⁶⁴ EPA CAIR webpage: <http://www.epa.gov/cair/>. For EPA's March 2005 Technical Support Document on the final Clean Air Interstate Rule, "Modeling of Control Costs, Emissions, and Control Retrofits for Cost Effectiveness and Feasibility Analyses," see <http://www.epa.gov/cair/pdfs/finaltech07.pdf>.

In some cases, states and regional EPA offices have sought measures more stringent than federal headquarters have sought. One example of this is the development of an ozone federal implementation plan for the Chicago area. EPA headquarters was reluctant to take action on what seemed like a politically infeasible effort. The regional office, on the other hand, disagreed and was more inclined to require imposition of federal controls. That Federal Implementation Plan (FIP) process led to the development of the Lake Michigan Air Directors Consortium (LADCO), a regional body to facilitate air quality management including the states of Illinois, Indiana, Wisconsin, Michigan, and Ohio. Relationships between these states on the problem of air quality had been highly contentious. However, the LADCO process enabled the states work together with EPA, not only to do the necessary modeling and other technical work, but to develop control measures as well.

There are also cases where the regional offices have championed initiatives that EPA headquarters would not have supported, but which eventually proved to be very successful. In Region 4, for example, the EPA regional air team identified exposure to toxics in the city of Louisville as a problem. Over a ten-year period (1996-2006), the EPA regional team channeled over \$1 million in direct federal grant support to Louisville for monitoring, risk assessment, stakeholder groups and related work, and provided substantial policy and technical guidance. Largely as a result of EPA regional support, Louisville was able to adopt one of the toughest local air toxic programs in the United States.

Despite these success stories, it is important to note that there are inherent dangers to placing responsibility and accountability in the hands of regional authorities. In geographically large countries such as the U.S. and China, regional offices are necessary to project the power of the central government, and they are useful because local authorities are more knowledgeable about local situations. However, there is considerable risk that these offices can become too close to, and consequently too entrenched in, local political and economic concerns. Sometimes U.S. EPA regional offices have developed inappropriately close relationships with the regulated industries and as a result have taken actions that did not serve the interests of air quality.⁶⁵ The execution of regional programs requires consistent and persistent oversight from the national authorities, without which the agreed upon regional approaches will not achieve the forecast level of results. Central oversight is critical not just in the development and approval of a regional plan, but also for overall regulatory effectiveness.

6. CASE STUDY: THE CLEAN AIR INTERSTATE RULE

6.1. Background

In the U.S., some states that have effectively controlled emissions from in-state sources are still unable to attain the NAAQS because of pollution carried on the winds from other states. Ozone and fine particle (PM_{2.5}) pollution, and acid rain, caused by emissions of SO₂, NO_x and hydrocarbons, are problems that affect large regions of both the U.S. and China. In 1990, the

⁶⁵ This has occurred most notably at the level of the regional administrator, which is a politically appointed position. The role of the public and environmental groups has been important in these instances to ensure that both civil servants and political appointees are accountable for consistent administering and enforcing of regulations.

U.S. amended the CAA to add the acid rain program, which imposed by federal law a nationwide cap on emissions of SO₂ from fossil fuel-fired electric generating units (EGUs). But the CAA continues to place responsibility for attaining the NAAQS at the state and metropolitan level through the SIPs. In what follows, we describe in greater detail one particular attempt EPA has made to create a regional program within the SIP structure, the Clean Air Interstate Rule (CAIR).

The CAA provides two mechanisms by which SIPs are supposed to address regional, or interstate, pollution problems. But neither has proved effective in dealing with long distance transport of pollutants. First, Congress included a “good neighbor” provision in the CAA. The provision prohibits emissions in upwind states that will “contribute significantly” to a neighboring state’s nonattainment or will “interfere with” a neighboring state’s maintenance of its attainment. Second, any state may “petition the Administrator for a finding that any major industrial source or group of industrial sources emits or would emit any air pollutant in violation [of the NAAQS]” unless an upwind state takes steps to reduce downwind emissions. However, it is extremely cumbersome to identify upwind emitters. Emissions from multiple states travel downwind and affect air quality in many other states. EPA has never granted such a petition, called a §126 petition, because of the difficulty of tracing emissions back to the source state.

The CAA also preserves the right of states to sue emitters in other states in federal or state court to abate air pollution that is causing damage to the health or welfare of the plaintiff state. Recently a federal court in North Carolina ordered the clean-up of large coal-fired power plants in Tennessee in response to such a “public nuisance” suit brought by the state of North Carolina. The court’s order requires installation of pollution control equipment that is estimated to have a capital cost of \$1.2 billion, with continuing operating costs approaching \$500 million each year. Such nuisance suits are rare, however, because of the cost and difficulty of proving the contribution to in-state health and welfare effects from out-of-state emission sources.

6.2. EPA’s Clean Air Interstate Rule

To address the continuing problem of nonattainment caused by out-of-state sources EPA adopted a regional pollution control program called CAIR.⁶⁶ CAIR regulated pollution from the largest sources of NO_x and SO₂ emissions (mainly fossil fuel-fired electric generating units (EGUs)) in the eastern half of the country, by implementing a state-by-state cap and trade program. Because the attainment of the NAAQS is entrusted to the states, EPA did not have power to require each state to adopt specific emission limitations. Instead, EPA determined the reductions in NO_x and SO₂ emissions it believed the regulated emitters could contribute towards attainment of the NAAQS, then required each state to revise its SIP to achieve its emission cap. States were allowed to use any measures they wanted in order to achieve the emission reductions, but the EPA made it clear that it would expedite approval of SIP revisions that imposed new emission limitations on EGUs and opted into an emission trading system that EPA set up.⁶⁷

⁶⁶ The U.S. Court of Appeals for the D.C. Circuit overturned the CAIR rule for reasons that are not pertinent to these comments. EPA is currently revising the rule to comply with the Court’s decision.

⁶⁷ CAIR was patterned on the CAA’s Title IV Acid Rain cap and trade program for SO₂ emissions, another regional program administered by EPA, discussed at length in Chapters Two and Three dealing with Total Emissions Control and NAAQS.

CAIR was a federal program designed as a means to assist states to attain NAAQS, but the emission reductions required by CAIR were based on the capabilities of current technology rather than what reductions were necessary to attain NAAQS throughout the multi-state region. EPA wanted to infringe as little as possible on states' authority to administer the program, but also wanted to control as large a quantity of emissions as possible. The agency's compromise was to cap the largest sources of emissions (EGUs) and allow states to determine how to best meet the cap.

To determine the national cap, EPA first determined what types of emissions controls were demonstrated and available, taking into account the reduction capability of those controls. Second, EPA determined the cost-effectiveness of demonstrated and available emission controls by comparing control costs to the average and marginal cost effectiveness, in dollars per ton of pollution reduced, of other regulatory actions. EPA set the regional cap for NO_x and SO₂ emissions based on these two determinations. EPA used air quality modeling techniques only to determine what level of emissions of NO_x and SO₂ could be achieved if cost-effective emission controls were installed on coal units throughout the eastern half of the United States.

6.3. Determination of Demonstrated and Available Technologies

EPA determined that two wet scrubber systems and one dry scrubber system were demonstrated and available technologies to control SO₂ emissions. EPA found that a limestone forced oxidation system (wet scrubber) and a magnesium enhanced lime system (wet scrubber) could achieve 95 percent and 96 percent reductions of SO₂ emissions, respectively. According to EPA, the lime spray dryer (dry scrubber) can achieve 90 percent reductions. To control NO_x emissions, EPA determined that selective catalytic reduction systems (SCR) were demonstrated and available and could control 90 percent of emissions. The regional cap was based, in part, on the reduction capability of these control technologies.

6.4. Determination of Cost-effectiveness of Available Technologies

EPA also took into account the cost-effectiveness of NO_x and SO₂ emission controls by calculating dollars spent per ton of emission reduction achieved in compliance with existing regulations. The agency found that the average and marginal cost-effectiveness of the controls described above is consistent with NO_x and SO₂ emission reductions that yield substantial benefits in downwind nonattainment areas. Said another way, EPA found the NO_x and SO₂ emission controls identified above to be cost-effective. Thus, EPA set the regional cap based on the reduction capability of scrubber and SCR units installed on EGUs.

6.5. Apportionment of Allowances

After deriving regional caps for both pollutants, the agency then apportioned allowances to each state in the region. For SO₂, the agency piggybacked on the existing Title IV acid rain program.⁶⁸ That program requires one allowance be paid to the government for each ton of SO₂

⁶⁸ See discussion of this program in Chapter Three on the NAAQS and TEC approaches.

emitted. Under CAIR, EPA simply increased the obligation: beginning in 2010, two Title IV allowances would have to be provided for each ton of SO₂ emissions; and beginning in 2015, 2.68 allowances for each ton of SO₂. As in the existing Title IV program, allowances could be freely traded, and unused allowances could be banked for future use.

The Acid Rain program does not include an emission trading system for NO_x, so a different means of allocation needed to be created for CAIR. The rule used “fuel factors” as the means of allocation. Rather than allocate allowances in proportion to, e.g., the total heat input of units in the state compared to the total for the region, EPA adjusted the number of allowances allocated according to the fuels used in the state. Heat input from coal-fired units was fully counted, but only 60 per cent of heat input from oil-fired units, and 40 per cent from gas-fired units were counted. The result was to skew the allocation of NO_x allowances toward states that are heavily dependent on coal for electricity generation, increasing the burden on states that use more natural gas.

EPA could have calculated state NO_x budgets using an output-based methodology. Public comments on the CAIR program urged EPA to base the budget on the relative efficiency of EGUs by considering output in terms of pounds of NO_x emitted per kilowatt-hour of electricity generated. This formula would have rewarded states with relatively more efficient EGUs with greater allowance allocations. But the agency rejected an output-based program.

Once EPA determined a budget for each state, the state could then decide how to allocate the budget among in-state sources. The CAIR rule gave states flexibility to design their own programs to meet the emission budgets. States could choose to participate in the EPA-administered interstate cap and trade system or to implement their own program to achieve required reductions within the state. If a state chose to participate in the EPA trading program it would be required to adopt EPA rules governing the program, but the state could make some changes. CAIR would have allowed states to decide three aspects of their state CAIR program: 1) whether to allow EPA to allocate NO_x allowances among individual units, 2) whether to allow units that are not otherwise covered by CAIR to individually opt into the trading system, and 3) whether to allow non-electric generating units to participate in the trading system. EPA intended these options to present states with flexibility in the way they chose to meet their CAIR emissions budgets.

The CAIR approach would allow the central government to require a regional emissions level equal to the level of reductions demonstrated to be achievable by a specific control technology. It would make it possible for the states/provinces to impose any additional requirements needed to achieve those levels. In other words, a CAIR-type program would set technology-based standards to control interstate pollution and require implementation of the standards using a market-based system where the cap is determined by the most cost-effective control technology available. We think such an approach can be effective in reducing emissions and in garnering support from industry.

6.6. Applicability to China

The CAIR program could provide a model for dealing with regional pollution loading in China. As in the U.S., regulation of many sources of pollution is largely delegated to provincial and local officials. In the CAIR program, the federal government identified a group of very large existing emitters who contribute materially to regional pollution problems, and required them to curtail emissions. EPA then determined how much emissions reduction is practical from these large sources, and effectively directed states to require emitters to install and operate such practical measures. By requiring careful monitoring and reporting, the federal government maintained control over the program. States were more able to enforce the emission reductions because the program was mandated, and enforceable by, the federal government. Because of the small number of EGUs, and their very large emissions, the CAIR program was a highly efficient means of reducing regional air pollution and nonattainment of the NAAQS.

7. REGIONAL MECHANISMS IN THE EUROPEAN UNION

The European Union has less history in regional approaches for environmental management than the U.S.—whether groups of member States working together or the EU forming regional mechanisms. The European Commission (EC) has administrative offices in most EU countries but the EC lacks a well-developed regional office system for the administration of environmental management, due largely to the lack of strong sovereignty over the region and the autonomous nature of the member countries.

There are, however, notable initiatives. For example, several EU member States have ratified the Geneva Convention on Long-Range Transboundary Air Pollution. The Convention became effective in 1987, providing a formal framework for intergovernmental cooperation on air pollution that affects several countries. When it was signed in 1979, among the initial goals of the Convention was the reduction of sulfur emissions by 30 percent. Additional reduction goals for sulfur emissions were established in 1998, and other pollutant emission goals have been established: for nitrogen oxides in 1991, for volatile organic compounds in 1997, and for ozone in 2005.

Pursuant to the Convention, member States develop and implement appropriate policies and strategies, particularly systems of air quality management. Cooperation extends to: science research and development to reduce emissions of major pollutants, monitoring and measuring emission rates and concentrations, and understanding the effects of pollution. Importantly, member State cooperation is required for the sharing of key information and training. The Long-Range Transboundary Air Pollution Convention has demonstrated how information sharing regarding technology and control measures among the various players can be enormously useful.

The European Commission Directive on Ambient Air Quality and Cleaner Air for Europe (CAFE), adopted in 2008, demonstrates EU intentions for regional approaches in air quality management. Article 25 of the directive provides for member States to cooperate by developing joint or coordinated air quality plans. The article further authorizes the EC to consider and take additional actions at the regional level to address emissions responsible for trans-boundary pollution. The directive also requires member States to share information with other member

States when a State learns that pollution thresholds are exceeded at or near national borders causing or potentially causing trans-boundary pollution.⁶⁹ This provision, while still in the early stages of implementation, may serve as a useful example of how China's provinces could work together on regional air quality issues that affect more than one province.

8. REGIONAL APPROACHES IN CHINA

China already has notable experience in using regional approaches for environmental management. For instance, it has addressed water pollution and water quantity issues through the concept of watersheds. Although air pollution does not flow in channels as discrete as water, the concept of airshed management has merit in China. This is because several of China's most vexing air pollution problems in China occur in areas that are aligned along relatively discrete topographic areas where common trans-boundary pollution is shared, such as the Pearl River Delta region, the Beijing/Tianjin area and the Yangtze River area. China's experience with watershed management has been, in large part, a harmonious undertaking between the national, provincial and local levels of government, and this sets a strong example for similar methods of air quality management.

Another leading example of regional approaches in China is the use of regions in SO₂ and acid rain control areas. For these areas, the Air Pollution Law authorizes the central government environmental agency (formerly SEPA, now MEP), to identify the areas that have been or may be seriously polluted by acid rain and sulfur dioxide. The establishment of the areas is subject to approval of the State Council. In determining what areas to establish as control areas, the Air Pollution Law instructs the environmental agency to take into consideration the relevant meteorological, topographical, soil and other natural conditions that pertain to the area.

Recent years have also seen instances of cooperation between provincial-level Environmental Protection Bureaus, such as in 2006 when the Guangdong Provincial EPB and Hong Kong EPB shared important Air Quality Index information on ozone for the Pearl River Delta Regional Air Quality Monitoring Network.

As just mentioned, China does have a system of local environmental management agencies in the form of Environmental Protection Bureaus (EPBs), a number of which exist in China's largest cities and in provincial governments. These EPBs typically have a broad range of environmental management functions such as monitoring, permitting, inspection and enforcement. But, too often, these EPBs operate in significant isolation from the central government environmental agencies.

In part to address this deficiency, the central government has newly created regional offices for administrative and enforcement support of the national environmental agency. There are six Regional Supervision Centers primarily focused on enforcement of air pollution laws at the provincial and local levels. These Centers, under the jurisdiction of the Environmental Supervision Bureau within the Ministry of Environmental Protection, constitute an important

⁶⁹ Directive on Ambient Air Quality and Cleaner Air for Europe (Directive 2008/50/EC). Available at <http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2008:152:SOM:EN:HTML>.

initial effort to use regional mechanisms to improve the national supervision system. They also represent an important foundation on which to build additional regional mechanisms.

The first two Regional Supervisory Centers were established in 2002 in East China in Nanjing and in South China in Guangzhou. In 2005, the State Council issued Decision 81 (2006) to further strengthen environmental protection by, in part, building up the regional supervisory institutions, coordinating trans-provincial environmental protection and emphasizing inspections at the provincial and local levels. In implementing that decision, the State Environmental Protection Administration (SEPA) formally established four additional regional centers in the North, Northwest, Southwest and Northeast in July 2006—the last of which, the Northeast China Supervision Center, officially opened in December 2008.

The Centers, constituting a national environmental supervision system, are currently designed to have eight key functions. As outlined by MEP, they are:

- Supervise implementation of local regulations and standards;
- Investigate major pollution and ecological destruction cases;
- Serve as an information node between governmental levels;
- Handle major environmental disputes across provinces and basins;
- Participate in supervision on major environmental emergency responses;
- Undertake or participate in law enforcement supervision;
- Supervise major pollution sources and MEP project approval for pollution abatement; and
- Supervise law enforcement in nature reserves.⁷⁰

As MEP Vice Minister Zhang Lijun noted in the opening ceremony of the North China regional center, the hope is that an expanded and empowered regional presence can effectively address the local protectionism that currently stands in the way of national environmental standards. Vice Minister Zhang additionally noted, “In the past, it has been difficult to resolve some long-standing trans-boundary pollution disputes because local governments alone could only deal with problems within their own administrative areas... Now the regional supervision centers have been granted wider powers to deal with such disputes.”⁷¹

While these are laudable and important functions, there are additional critical undertakings for regional offices as part of a comprehensive air quality management scheme. These include monitoring, planning, permitting and training—responsibilities which have not yet been assigned to the Centers, but should be assigned to them (e.g., through the Air Pollution Law amendment).

There are multiple factors that will determine the effectiveness of these regional offices. One key issue is the relationship between the local and provincial Environmental Protection Bureaus and the Regional Supervisory Centers. The EPBs, because of their close ties to local enterprises and government may have considerable access to information. However, under current practices,

⁷⁰ MEP describes the functions of the regional offices in English on its website:
http://english.sepa.gov.cn/About_SEPA/Regional_offices/200708/t20070814_107907.htm.

⁷¹ “China Intensifies Regional Environmental Supervision,” China.org.cn, December 18, 2008, available at
http://china.org.cn/environment/news/2008-12/19/content_16977637.htm.

EPBs are not required to report or share information or otherwise cooperate with the Centers. Another important factor is adequate funding and staffing levels at the Centers. Based on observations and comparisons with similar agencies in the U.S. and EU, the Centers are currently woefully under-staffed.

A particular example is that of the North China Supervision Center, which covers six provinces and a large geographic area. According to Xiong Yaohui, director of the North China Supervision Center, of the estimated 200 enterprises inspected as the end of 2008, most of them were found to be involved in activity in violation of environmental standards.⁷² Mr. Xiong further indicated that weak enforcement by some local environmental protection departments was encouraging, or at least allowing, certain polluting enterprises to violate environmental protection standards. With such significant levels of violation, the Centers need additional inspection resources as soon as possible, and they need to establish a basis for their relationships with provincial EPBs. A March 2009 assessment conducted by a consultant to the American steel industry also reached these same conclusions.⁷³

Given the many important roles and functions of these offices, the national government should accelerate the allocation of staff and support services to the Centers and require local EPBs to report key information to and coordinate efforts with MEP or other appropriate national-level government agencies. The Air Pollution Law presents an opportunity to address these shortcomings.⁷⁴

⁷² Ibid.

⁷³ *An Assessment of Environmental Regulation of the Steel Industry in China*, prepared by Garvey Schubert Barer for the Alliance for American Manufacturing, March 2009. Available at <http://www.americanmanufacturing.org/assessment-of-china/>.

⁷⁴ It is noteworthy that the Asia Development Bank and MEP have a joint process underway to study key aspects of the Regional Supervisory Centers. In September 2006 a joint report was issued which focused on the role of the Centers related to environmental information and emergency response. Future areas of review will include functions, responsibilities and powers, operational mechanisms, laws and regulations and training for capacity building. These reports will undoubtedly be helpful, but MEP need not wait on the completion of these reports to consider expanding and enhancing the roles and functions of the Regional Supervisory Centers.

CHAPTER EIGHT

REDUCING AIR POLLUTION THROUGH TECHNOLOGY STANDARDS: COMPARING THE U.S., E.U. AND CHINA

Art Williams
Richard Ayres

1. SUMMARY OF FINDINGS AND RECOMMENDATIONS

Various countries have had experience utilizing technology-based emissions standards and energy efficiency standards. China is experimenting now with sophisticated energy efficiency standards for specific industries which consider cogeneration and waste heat recovery, but has not utilized the types of technology-based emissions standards utilized in the U.S. The two approaches in combination can provide a superior mechanism for reducing pollution.

- **Technology-based emissions standards.** The U.S. has utilized various technology-based emissions standards (BACT, LAER, RACT, MACT—described below) to drive significant reductions in pollutant emissions. China should consider development of such technology-based emissions standards, coupled with strong enforcement provisions to ensure that equipment is not installed and left unused. Technology-based standards should be expressed as a level of performance (such as grams of pollutant per unit of product manufactured) rather than simply requiring that a particular control technology be employed. This will help to spur the development of improved air pollution control technology (as well as cleaner technology for the manufacturing process itself), and will also allow the emitter to reduce pollutant emissions in the most efficient and cost-effective manner possible.
- **Energy efficiency standards.** One shortcoming of technology-based emissions standards is their emphasis on end-of-pipe pollution reduction. Jurisdictions, including the EU and now China, have experimented with output-based, energy efficiency standards that drive enterprises to reevaluate production processes and lead to more efficient production. China's energy consumption standards for 22 industries provide a strong policy foundation that should be built upon by environmental regulators.
- **Combining the approaches.** By jointly mandating high-efficiency technology and advanced pollution control technology, environmental regulators could take advantage of synergies in management, enforcement and compliance.

2. INTRODUCTION

This section will look critically at mechanisms employed in the U.S. and EU for controlling industrial air pollution emissions vis-à-vis China's own evolving regulatory framework. Both the United States and the European Union have developed mechanisms that seek to apply control technology standards to industrial production processes in key industries. The U.S. has a rich

experience with technology standards and these standards have played a significant role in reducing emissions in the U.S. The EU and China are now implementing industrial energy efficiency standards, which drive consideration of process and operational changes such as cogeneration and waste heat recovery. China can take advantage of the many years of experience in these jurisdictions and leapfrog directly to a combined approach that mitigates the problems presented by each approach implemented by itself.

3. U.S. MECHANISMS

3.1. U.S. Technology-based Requirements for Industrial Emitters

The U.S. Clean Air Act combines two different, and complementary, means of reducing pollution. One approach starts with air quality standards, such as the NAAQS. Based on measurements of the concentration of pollutants in the air, air quality managers calculate back to the total emissions in the area that are consistent with achieving the desired air quality. The second approach begins with pollution control technology without regard to the existing air quality. Under this approach, the air quality manager's job is to find out how much emission reduction technology is capable of delivering. The CAA incorporates both these approaches.

The CAA includes five separate major types of technology standards. Two require EPA to adopt federal rules applicable directly to the emitters.

- ***New Source Performance Standards*** (NSPS)—These nationally-applicable standards are established by EPA rule for many categories of industrial emitters, such as coal-fired boilers or cement kilns. They cover commonly-emitted substances (such as those subject to NAAQS) and apply only to major new industrial facilities.
 - The NSPS are supposed to require the best technology currently available, taking into account cost and energy impact. These standards remain the same until changed through a new EPA rulemaking, so they are the same for every new emitter.
 - NSPS do not typically require the most advanced pollution control technology. Demanding requirements seldom emerge from the rulemaking process, and as time passes the standards become increasingly out-of-date. Still, the NSPS does serve as a “floor” that prevents states from competing for new industry by offering lax pollution control requirements.
- ***Hazardous Air Pollutant Standards*** (HAPS)—Maximum Available Control Technology” (MACT) standards for HAPs are also established by nationally-applicable EPA rule on an industrial category-by-category basis. MACT standards are adopted for sources of “hazardous air pollutants,” which are (1) more toxic in their effects on humans, and (2) usually emitted from a much smaller number of production facilities than the pollutants regulated under the NAAQS. The law with regard to HAPS is complex, but it can be simplified as follows.

- The CAA identifies almost 200 air pollutants that are considered hazardous and directs EPA to adopt MACT standards for each one.
- EPA establishes standards for each category based on the best performance of other facilities in that category. Any new production unit must have performance equal to the best existing unit; an existing production unit must upgrade performance to a MACT standard set by EPA at a performance level not worse than the average of the 12 percent best-performing existing units.
- If the application of the MACT standards is inadequate to reduce the risk to the exposed public, EPA is required to take any additional steps needed to bring the risk down to the one in one-million level for exposed individuals.
- States have the right to establish their own MACT standards, so long as they are at least as stringent as the federal MACT standard for the particular industrial category.
- As with NSPS, HAPS tend to lag behind the capabilities of advanced technology because they are established through a slow and drawn-out rulemaking process.

The other three types of technology standards are administered by the states, under the guidance of the federal EPA. These technology requirements also differ from the federal technology standards because they are applied through a case-by-case process that is designed to find the best technology at the time the new unit is constructed. These requirements also apply to “modified” industrial units, not just new ones.

- **Best Available Control Technology (BACT)**—When a new or modified unit is proposed for an area that attains the NAAQS—a “clean air area”—it must obtain a permit to construct. In order to obtain a permit, the owner must demonstrate the new or modified unit will install BACT. In order to determine what BACT is for the particular type of industrial unit, the state agency reviews all the information it can collect about available pollution control technology. EPA maintains a special “BACT/RACT/LAER Clearinghouse” where it keeps records of each state’s past BACT determinations.⁷⁵ States may search the Clearinghouse to see what other states have required of industrial units similar to the one seeking a permit from them. But the states are not bound by the Clearinghouse. They may choose a technology more stringent than any included in the Clearinghouse.
- **Lowest Achievable Emission Rate (LAER)**—When a new emitter is constructed or modified in a nonattainment area—a polluted area where NAAQS are not attained—it must also obtain a permit. The emitter must demonstrate that it will be equipped with LAER pollution control technology. State LAER determinations, like BACT determinations, are recorded in the BACT/RACT/LAER Clearinghouse. Because LAER applies in areas where health standards (NAAQS) are not attained, the CAA

⁷⁵ See <http://cfpub.epa.gov/RBL/htm/bl02.cfm> for the “RACT/BACT/LAER Clearinghouse” database.

intended for LAER decisions to give less weight to the cost and availability of pollution controls, and more weight to the need to protect public health, compared with BACT determinations which apply in areas where the air quality already attains NAAQS. In practice, however, there has been little difference in the BACT and LAER determinations.

- ***Reasonably Available Control Technology (RACT)***—RACT, unlike BACT and LAER, applies to existing industrial emitters. SIPs for nonattainment areas are expected, at a minimum, to require installation of RACT on existing industrial emitters. The term “reasonably available” rather than “best available” is intended to give states greater flexibility to take into account factors that could increase the cost of installing a technology on an existing unit, as well as the remaining economic life of the unit, when determining the appropriate control technology. Consequently RACT requirements are usually less demanding than BACT or LAER. RACT determinations are sometimes made by states on a category-by-category basis, and sometimes on an emitter-by-emitter basis.

While the terminology of these technology standards is confusing, the following table illustrates the conceptual distinctions relatively simply.

Consideration of Cost	Federal Rule	State Case-by-Case
Least	MACT	LAER
Middle	NSPS	BACT
Most		RACT

Despite the confusing terminology, it is apparent that these terms are intended to express policies that balance risk against cost. Where Congress concluded that the risks to public health are high (i.e., in areas where NAAQS are not attained, and in the vicinity of emissions of toxic pollutants) the CAA directs EPA and the states to give less consideration to the cost of reducing pollution. Where the dangers are lower (i.e., in areas where NAAQS are attained, or where EPA was directed to write a standard for the entire country, like the NSPS), or where pollution control costs can be expected to be higher (i.e., existing sources), Congress allowed EPA and the states to give greater consideration to cost.

In the U.S. experience, NSPS has been broadened beyond technology, in the strict sense of the word, to include best operational practices that can be implemented to achieve reduced emissions. The law provides that if an emissions standard is not feasible, then EPA may establish a design, equipment, work practices, operational standards or any combination of these. States are also encouraged to consider alternative production processes, as well as alternative fuels or combustion techniques in making a BACT determination.⁷⁶ The state and local permitting

⁷⁶ The U.S. Clean Air Act defines Best Available Control Technology as follows: “. . . an emission limitation based on the maximum degree of reduction of each pollutant subject to regulation . . . emitted from or which results from any major emitting facility, which the permitting authority, on a case-by-case basis, taking into account energy, environmental and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems, techniques, including fuel cleaning, clean fuels, or

authority and the enterprise ascertain what combination of measures constitutes the most stringent level that can be achieved cost-effectively for that particular facility. Generally, as it has been implemented, the regulation considers add-on technology controls that treat the end-of-process or end-of-pipe emissions, as opposed to addressing whole processes and plant systems.

4. EU TECHNOLOGY MEASURES

With the 2008 Integrated Pollution Prevention and Control (IPPC) Directive, the EU has gone considerably beyond the U.S. approach by requiring major industries to apply Best Available Techniques (BAT).⁷⁷ BAT represents a much broader range of practices and approaches to manufacturing and related processes to reduce pollution – not just into the ambient air, but also into water and onto soil. In this way, the BAT approach effectively forces an integrated approach to pollution reduction to ensure that pollution does not just get shifted from one environmental media, like air, to another, like water.

Importantly, the BAT approach also includes an express requirement that industries and other effected sources use energy efficiently, a requirement not found in the BACT mechanism. This rule is general and lacks specific terms, because member states could not agree on the viability of imposing mandatory energy efficiency standards across industries. Thus, the generic energy efficiency BAT is aspirational in nature and may be too general to be consistently effective across member states and implementation authorities. At this point, the program is still too new to judge.⁷⁸

Reinforcing the generic rule, the EU process has begun to formulate industry-specific energy efficiency BAT standards. These are typically established as output-based generation performance standards on a per unit product basis, which, like energy intensity targets, encourage efficient production as opposed to reduced fuel input. For example, for the ferrous metal industry, the energy BAT for the hot rolling process limits energy use to between 72-140 kilowatt hours per ton of material produced; the generation of steam for hydraulic acid pickling lines is limited to a specified number of gigajoules of BTUs per ton of material produced, depending on a range of processes and fuel input types.

There are some potential shortcomings to the EU program. While BAT does consider energy efficiency a means of pollution control, this part of the regulation is secondary to the primary goal of reducing emissions through advanced control technologies on processes, much like the focus of BACT. Consequently, it may not be as strictly enforced, and various waivers weaken the effectiveness of the efficiency rule from the outset. For example, under the BAT scheme, if

treatment or innovative fuel combustion techniques for control of each pollutant” [42 USC Section 7479 (3); Clean Air Act Section 169(3)].

⁷⁷ Full text of IPPC Directive 2008/1/EC is available at <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:024:0008:01:EN:HTML> (as of April 28, 2009). A summary of the Directive is available at <http://europa.eu/scadplus/leg/en/lvb/l28045.htm> (as of April 28, 2009).

⁷⁸ The generic BAT for energy efficiency, while technically final in February 2009, has not yet been formally adopted by the European Commission. Thus, as of April 2009, it is not yet in effect. While the rule is generic, the Best Available Techniques Reference documents (BREFs) include valuable guidance on how to evaluate and manage energy use and achieve maximum efficiency at the facility level. The BREF for energy efficiency is available at http://ftp.jrc.es/eippcb/doc/ENE_Adopted_02-2009.pdf (as of April 28, 2009).

an industry's greenhouse gas emissions are covered under the EU Trading Scheme, then the energy efficiency BAT does not apply. Further, the power sector – the largest single source of emissions – can be exempted from the energy efficiency BAT at the discretion of a Member State with jurisdiction over the source. When adopted by the European Commission, the BATs take legal effect, and member states are required to apply the BAT standards in the development and issuance of environmental permits. However, for most of the energy-intensive industries, BATs have not yet been adopted,⁷⁹ and it is too early in the course of the program to determine how the affected industries are in fact applying the BATs.

Although secondary, the inclusion of energy efficiency in the BAT program could possibly be more effective than the BACT program in reducing emissions. This is because additional regulatory focus on energy efficiency can drive the enterprise to make fundamental, early-stage changes in energy processes. In many cases, these energy-consuming processes are significant sources of emissions, particularly in energy intensive industries, such as iron and steel, pulp and paper, textile and cement industries. Combined with the traditional pollution control technology standards, energy efficiency standards for industrial production can encourage fuel-switching, improved energy management systems, and improved fuel-use through technologies like combined heat-and-power (CHP), polygeneration, and waste-heat recovery – all of which lead to meaningful reductions in both the direct and indirect emissions of a facility.

5. CHINA'S INDUSTRIAL ENERGY EFFICIENCY STANDARDS

In contrast to the approaches by the U.S. and the EU, China has recently developed and imposed comprehensive energy efficiency standards on an output basis for 22 key industries.⁸⁰ These standards apply to specific production and system processes within a facility, which in the case of steel for example cumulatively account for approximately 85 percent of a facility's total energy consumption.

In the case of the energy consumption standards for cement, the rule sets minimum efficiency standards per unit product for both existing and new facilities. The quotas are organized by plant size (tons produced per day), type (clinker production, cement production or cement grinding plants), and by fuel and/or electricity consumption (kgce/ton and kWh/ton). (See Tables 1 and 2 below.) The minimum allowable levels of energy consumption are mandatory, while the standards also include recommended energy efficiency targets to help facilities make the necessary incremental transitions and upgrades.

A complementary set of standards for the cement industry provides detailed specifications for production processes in new and expanded facilities.⁸¹ These include information and guidance on energy management, specific requirements for motors, fans, pumps, and transformers, and

⁷⁹ A list of the industry-specific BAT standards that are underway or completed is available at <http://eippcb.jrc.es/reference/> (as of April 28, 2009).

⁸⁰ These 22 industries are cement, steel, caustic soda, ferroalloy, coke, calcium carbide, architecture and sanitary ceramics, yellow phosphorous, carbon materials, synthetic ammonia, flat glass, electrolyzed aluminum, wrought aluminum alloy for architecture, copper and copper-alloy tube, coal-fired power, and the metallurgy of copper, zinc, lead, nickel, magnesium, antimony, and tin.

⁸¹ GB 50443-2007: Code for the Design of Energy Conservation in Cement Plants

energy consumption and heat standards for all key processes and systems in cement production. The standards recommend specific processes and systems while prohibiting others, and require new and expanded plants to incorporate waste heat recovery or ensure built-in capacity for future installation.

Table 1. Minimum allowable values of energy consumption per unit product for existing cement plants

Categories	Comparable comprehensive standard coal consumption of clinker (kgce/ton)	Comparable comprehensive electricity consumption of clinker* (kWh/ton)	Comparable comprehensive electricity consumption of cement** (kWh/ton)	Comparable comprehensive energy consumption of clinker (kgce/ton)	Comparable comprehensive energy consumption of cement (kgce/ton)
≥ 4,000 ton/day	≤ 120	≤ 68	≤ 105	≤ 128	≤ 105
2,000~4,000 ton/day	≤ 125	≤ 73	≤ 110	≤ 134	≤ 109
1,000~2,000 ton/day	≤ 130	≤ 76	≤ 115	≤ 139	≤ 114
<1,000 ton/day	≤ 135	≤ 78	≤ 120	≤ 145	≤ 118
Cement Grinding Plants			≤ 45		
*Only applies to clinker production plants. ** Applies to cement production plants, including cement grinding plants.					

Table 2. Minimum allowable values of energy consumption per unit product for new cement plants⁸²

Categories	Comparable comprehensive standard coal consumption of clinker (kgce/ton)	Comparable comprehensive electricity consumption of clinker* (kWh/ton)	Comparable comprehensive electricity consumption of cement** (kWh/ton)	Comparable comprehensive energy consumption of clinker (kgce/ton)	Comparable comprehensive energy consumption of cement (kgce/ton)
≥ 4,000 ton/day	≤ 110	≤ 62	≤ 90	≤ 118	≤ 96
2,000~4,000 ton/day	≤ 115	≤ 65	≤ 93	≤ 123	≤ 100
Cement Grinding Plants			≤ 38		
*Only applies to clinker production plants. ** Applies to cement production plants, including cement grinding plants.					

A high-efficiency industrial plant will be cleaner than a less efficient one with the same pollution controls. Industrial standards for energy consumption can bring about significant reductions in criteria and other hazardous pollution emissions and reduce carbon dioxide and other greenhouse gases. If the energy efficiency standards are implemented and enforced successfully, the affected industries in many cases will have to shift their energy use to cleaner fuels and cleaner

⁸² The source of both Tables 1 and 2 is GB 16780-200x: The Norm of Energy Consumption per Unit Products of Cement, available for purchase in Chinese at <http://www.spc.net.cn/produce/showonebook.asp?strid=33233> (as of April 28, 2009).

production processes, including CHP, polygeneration and waste-heat recovery. These industrial energy consumption standards, consequently, directly serve the interest of environmental regulators.

Indeed, viewed from an environmental perspective the energy efficiency standards are essentially output-based CO₂ emission standards which consider cogeneration and waste heat recovery. This is a world-class mechanism that, if broadened to include other pollutants, implemented and enforced, and combined with strong BACT technology standards, holds the promise of being significantly more effective than either the U.S. BACT or the EU BAT approaches.

6. COORDINATING ENERGY AND ENVIRONMENTAL REGULATION

China has a strong track record of recognizing the intrinsic links between energy and environmental management. China's current industrial energy consumption standards provide a valuable regulatory framework on which environment controls can be built. Stricter energy efficiency standards can effect pollution reductions, and so these standards provide an effective lever for the environmental regulator. By jointly mandating high-efficiency technology and advanced pollution control technology, environmental regulators could take advantage of synergies in management, enforcement and compliance. By jointly regulating air pollution and energy efficiency, as the EU has begun to do through the recent IPPC Directive, China can put forth a more comprehensive, integrated, and effective industrial technology policy.

As China considers the U.S. BACT and EU BAT models for driving advanced pollution control technology in the industrial sector, it should not overlook the strong foundation it already has in place with its industrial energy consumption standards. Additionally, China should be mindful of the lessons learned from international experiences, which include:

- Approach policies for advance pollution control technology on a multi-pollutant basis. China's industrial energy efficiency standards are essentially output-based CO₂ standards. Integrating high-efficiency technology and advanced pollution control requirements such as BACT and considering the full range of pollutants simultaneously will lead to better outcomes;
- Devise a system for periodic, thorough, transparent and scientific review and tightening of the standards, with special consideration for tightening power sector emission standards if and when existing generation pricing reflects market pricing;
- Design the regulations to reward performance beyond the standards and drive innovation;
- Effectively implement the standards. This will include linking the standards to the permitting process, and ensuring that the industries are well-informed about the applicable standards and are educated on how to meet them, including identifying opportunities to improve production processes and utilize combined heat and power, cogeneration and polygeneration opportunities; and
- Build on the strong elements of the EU Energy Efficiency BAT. It offers guidance, in particular, on the development and implementation of a formal and systematic energy management system.

CHAPTER NINE

MOTOR VEHICLE POLLUTION CONTROL IN THE UNITED STATES

Michael Walsh

1. SUMMARY OF RECOMMENDATIONS

Pollution from transportation is one of the greatest air pollution challenges China faces today. We recommend two particular proposals, among other things, for the air pollution law amendment based upon our review of U.S. experience in motor vehicle pollution control that we believe have the ability to make dramatic improvements in China's air pollution control:

- **Fuel-quality.** Poor fuel quality, such as fuel high in sulfur content, can hinder the ability of emissions control technologies to function properly. It has long been recognized in the U.S. that fuel quality and emissions control standards must be coordinated. We propose that authority over fuel quality and emissions standards be given to the Ministry of Environmental Protection. Alternatively, a coordination mechanism should be established to ensure that fuel quality standards keep up with China's rapidly improving auto emissions standards. Beijing's Environmental Protection Bureau, for example, was given greater authority over fuel quality in the lead up to the 2008 Summer Olympic Games.
- **Non-road Engines.** The range of mobile sources regulated by U.S. EPA and states such as California is mind-boggling. We recommend that the air pollution law amendment make special provisions for the regulation of non-road engines that can be a significant source of air pollution.
- **Smart Growth.** City plans should undergo EIA to ensure they have incorporated smart growth principles and fully considered the development of public transportation.

2. INTRODUCTION

During the 1950's, motor vehicle related air pollution began to emerge as a serious issue in the U.S. Much of that decade and the next were directed toward fact finding and initial studies related to important issues such as defining the problem, establishing the motor vehicle role, developing test procedures and emissions measurement techniques etc. as well as assessing the environmental damages. In addition some initial but modest control efforts were initiated. But by the end of the 1960's it became clear that motor vehicles were already a major source of emissions causing serious air pollution and health problems and that without aggressive action the problem was likely to worsen.

In reaction, the environmental movement began to emerge across the U.S. culminating in the first "earth day" in 1970. This was also the year in which Senator Muskie (who was at the time expected to become the likely Democratic candidate for President in 1972) spearheaded adoption

of the landmark 1970 Clean Air Act Amendments and President Nixon (in an effort to prevent Muskie from co-opting the environmental issue) created the Environmental Protection Agency.

This article will briefly summarize the evolution of the motor vehicle pollution control effort in the U.S. It will conclude with an assessment of what the author considers to be the most critical elements of the 1970 law and its subsequent amendments which have resulted in the U.S. program being the world's leader.

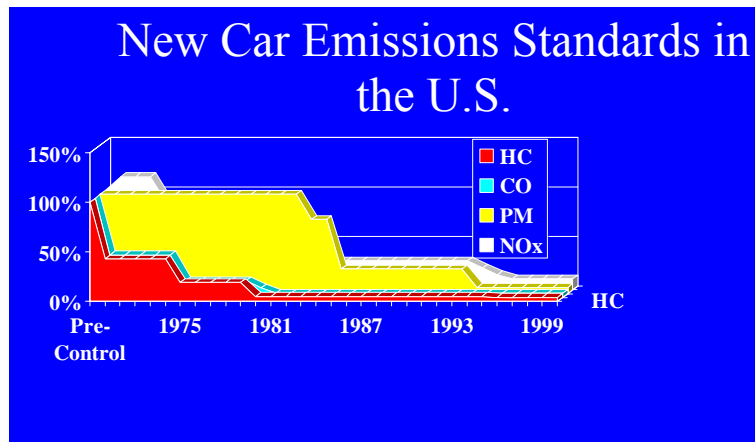
3. DEVELOPMENT OF THE U.S. PROGRAM

In 1960, California adopted legislation which called for the installation of pollution control devices as soon as three workable control devices were developed. In 1964, the State was able to certify that three independent manufacturers had successfully developed such devices which triggered the legal requirement that new automobiles comply with California's standards beginning with the 1966 model year. Soon afterward the major U.S. domestic manufacturers announced that they too could and would clean up their cars with technology which they had developed, thus mooted the need for the independently developed devices.

Subsequent to California's pioneering efforts, and as a result of recognition of the national nature of the auto pollution problem, in 1964 the U.S. Congress initiated Federal motor vehicle pollution control legislation. As a result of the 1965 Clean Air Act Amendments, the 1966 California auto emission standards were applied nationally in 1968.

In December of 1970, the Clean Air Act was amended by Congress, "to protect and enhance the quality of the nation's air resources." The Congress took particular notice of the significant role of the automobile in the nation's effort to reduce ambient pollution levels by requiring a 90% reduction in emissions from the level previously prescribed in emissions standards for 1970 (for carbon monoxide (CO) and hydrocarbons (HC)) and 1971 (for nitrogen oxides (NO_x)) models. Congress clearly intended to aid the cause of clean air by mandating levels of automotive emissions that it was hoped would essentially remove the automobile from the pollution picture.

In many ways the serious effort to control motor vehicle pollution can be considered to have begun with the passage of the 1970 law. By including the stringent "technology forcing" requirements in the law and providing only very limited flexibility to the EPA in implementing these requirements, it forced the manufacturers to work aggressively toward compliance because only the Congress itself could provide relief if it was needed. In addition, the law provided EPA with broad authority to implement the requirements, including provisions to mandate a recall of vehicles whenever "a substantial number of properly maintained and used" vehicles failed to meet standards in use over their useful lives, and to modify fuel quality including lead levels in gasoline if necessary to enable compliance. This latter authority was especially critical since the principle technology that emerged to enable compliance with the emissions standards was the catalytic converter, a technology that was poisoned by lead additives. Finally, the 1970 law grandfathered in the California motor vehicle pollution control program and left that state with the unique authority to set its own standards and regulations for vehicle emissions. This proved critical over the years that followed as California, suffering from the most serious vehicle related air pollution problem in the country, consistently pushed the technology envelope over the next



three decades and continues to do so to this day. In 1977, the Act was "fine tuned" by Congress, delaying and slightly relaxing the auto standards under pressure from the vehicle industry but at the price of authorizing other states to adopt the California requirements as long as they did not require the creation of a "third car." They also expanded the law by authorizing EPA to impose similarly stringent emissions

requirements on heavy duty trucks. More recently, Congress passed the 1990 Clean Air Act Amendments further expanding EPA's authority.

As a result of these requirements, substantial and rapid improvements in light duty vehicle (car) emissions occurred over the remainder of the 20th century, as illustrated in the figure below.

Shortly after the 1970 law went into effect, a gradual phase out of the use of lead in gasoline was initiated which allowed auto manufacturers to introduce lead intolerant catalysts on most 1975 Model Year cars. Further tightening of the NO_x standards, first in California and then across the country in the early 1980's, accelerated the introduction of advanced electronic controls which also enabled improvements in fuel economy during this same period. By the mid 1980's particulate standards were also introduced for diesel cars. Following the 1990 Clean Air Act Amendments, as illustrated in the figure, a further reduction in all of the pollutants was phased in throughout the 1990's.

As cars were becoming cleaner, it became obvious that heavy trucks and buses were becoming more important mobile sources of pollution. EPA published an Advanced Notice of Proposed Rulemaking (ANPRM) indicating its intention to aggressively regulate these vehicles in late 1980. However, it then failed to follow up for several years until the Natural Resources Defense Council using the "citizen suit" provision of the Act challenged EPA's inaction in court. NRDC eventually prevailed when in the mid 1980's the courts ordered EPA to meet its responsibility and to seriously address this vehicle category. By the late 1980's, in response, EPA had started down the road toward bringing control of these vehicles and engines in line with the increasingly stringent light duty vehicle requirements.

While the Congress was in the late stages of the debate regarding what became the 1990 Clean Air Act Amendments, two significant events occurred:

1. In September 1990, California adopted the so called Low Emissions Vehicle (LEV) Program which was distinctive in several important respects:
 - a. It provided flexibility to manufacturers by allowing them to certify vehicles meeting several distinct categories or sets of emissions standards (called "bins") as long as their fleet sales on average complied with an overall standard for non-

methane organic gases (NMOG) which declined year by year throughout the 1990's.

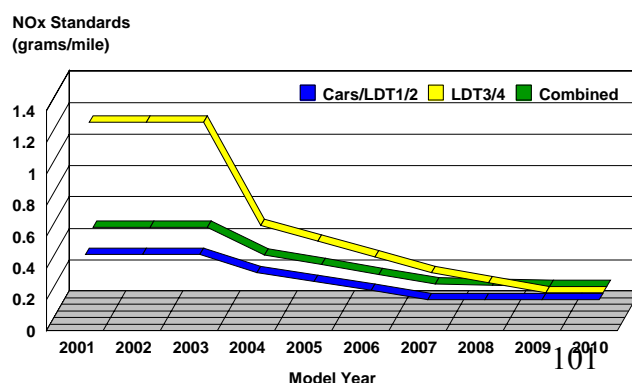
- b. It created a new category of vehicles, Zero Emitting Vehicles (ZEVs), in an effort to force the vehicle industry to devote significant resources to the development of and introduction into the marketplace of vehicles which effectively did not rely on the internal combustion engine. This has arguably resulted first in the introduction of electric cars, then hybrid electric cars and may eventually lead to commercially available fuel cell powered vehicles.
 - c. It also specifically linked vehicles and fuels and forced the introduction of "reformulated" gasoline which included reduced sulfur levels, lower volatility and other changes in composition.
2. At almost exactly the same time that California was adopting the LEV program, New York became the first state that used section 177 of the 1977 Clean Air Act Amendments to adopt California's vehicle emissions standards. Subsequently a number of other states have also adopted the California requirements.

As a backdrop to all these developments, the air pollution problem in the U.S. while improved has remained widespread and serious and a growing body of health studies required EPA to tighten NAAQS for both ozone (or photochemical smog) and particulate matter. As the 21st century arrived, EPA embarked on the next stage of its motor vehicle pollution control effort, putting in place over several years an almost mind boggling suite of regulations addressing virtually all categories of on and off road vehicles and fuels. When completed, every vehicle will be emitting at most a tiny fraction of the emissions which were the norm in 1970.

The combination of the broader authority provided to EPA under the 1990 Clean Air Act Amendments, the surge in California to push the technology envelope even further to address its serious air pollution problem, and the healthy cooperation and occasional competition between EPA and California to mandate clean vehicles and fuels has resulted in several additional important elements in the U.S. program. These include:

1. In response to the unexpected emergence of a new class of vehicles, Sport Utility Vehicles (SUVs) which took almost half the U.S. light duty vehicle market and which were legally classified as light trucks, and thereby allowed to meet more lenient emissions standards, the latest requirements will require light trucks to meet the same requirements as cars. This is illustrated in the figure below.

US Tier 2 NOx Standards



2. Light duty diesel vehicles have traditionally been allowed to meet a more lenient NO_x standard than their gasoline counterparts. Both California and EPA now require diesel and gasoline vehicles to meet the same standards.
3. The close linkage between vehicle emissions requirements

and fuel quality is now recognized and established with the result that very low levels of sulfur in both gasoline and diesel fuel are being mandated not only in California but across the entire country.

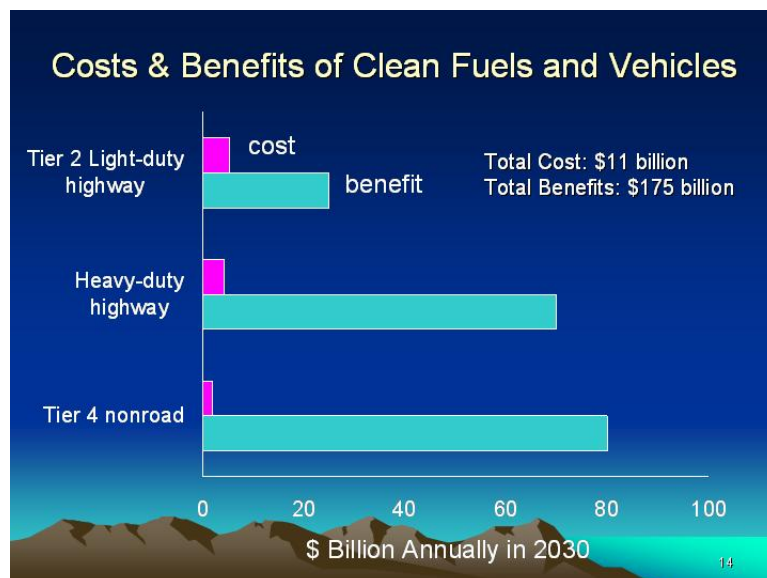
EPA did not stop with cleaner cars, however. In spite of some progress in controlling heavy truck emissions, EPA estimated early in the new century that heavy-duty trucks and buses accounted for about one-third of nitrogen oxides emissions and one-quarter of particulate matter emissions from mobile sources. In some urban areas, the contribution was even greater.

In response, EPA adopted a comprehensive national control program that regulates the heavy-duty vehicle and its fuel as a single system. As part of this program, new emission standards are starting to take effect this year, and will apply to all heavy-duty highway engines and vehicles. These standards are based on the use of high-efficiency particulate filters or comparably effective advanced technologies. Because these devices are damaged by sulfur, EPA also mandated over 95% reductions in the level of sulfur in most highway diesel fuel by mid-2006. The program provides substantial flexibility for refiners, especially small refiners, and for manufacturers of engines and vehicles. These options ensured widespread availability and supply of the low sulfur diesel fuel from the very beginning of the program, and provided engine manufacturers with the lead time needed to efficiently phase-in the exhaust emission control technology that will be used to achieve the emissions benefits of the new standards.

Perhaps even more important than the standards, EPA imposed a revolutionary approach to in use compliance – the so called Not-To-Exceed provision—which assures that vehicles will be clean however they are driven, not just under the standardized conditions of the laboratory. This program – tight engine standards, clean fuels and strong in-use compliance—will reduce particulate matter and oxides of nitrogen emissions from heavy duty engines by 90 percent and 95 percent below year 2000 standard levels, respectively.

Finally in 2004, EPA put in place the Nonroad Diesel Rule which will cut emission levels from construction, agricultural and industrial diesel-powered equipment by more than 90 percent. The new rule will also remove 99 percent of the sulfur in non road diesel fuel by 2010, resulting in dramatic reductions in soot from all diesel engines.

In the aggregate, when the light and heavy duty on road vehicles and fuels as well as the non road sector requirements are fully phased in, tens of thousands of premature deaths will be prevented each year. As illustrated below, the monetized benefits will dwarf the overall costs.



Most recently, EPA took the first step toward cleaning up diesel engines used in locomotives and marine vessels. Standards proposed will apply to new marine diesels and both new and existing diesel locomotives. Without new standards, the Agency projects that railroad and marine diesels will

cause some 27 and 45 percent respectively of total nitrogen oxides (NO_x) and particulate matter (PM) pollution coming from mobile sources.

The Agency's Clean Diesel Program accentuates the benefit of these historic rulemakings through a suite of voluntary programs that focus on vehicles and equipment in use today. These include the Clean School Bus USA Program, the Voluntary Diesel Retrofit Program and SmartWay Transport Partnership.

4. CONCLUSIONS

As a direct result of the Clean Air Act Amendments of 1970, the U.S. today has the strongest and most comprehensive motor vehicle pollution control program in the world. While the comprehensive nature of the Act has been critical to its success in cleaning up vehicles and their fuels, three aspects of this landmark law are considered most critical:

1. Health based air quality standards that are routinely updated have maintained a constant pressure on EPA to control vehicle emissions.
2. The “technology forcing” nature of the Act which was first demonstrated when the so called “Muskie standards” were introduced in 1975 set a precedent that EPA has followed in the period since then and has kept the U.S. program on the cutting edge of available controls, and
3. Whenever EPA became too complacent or the political forces reduced the priority that was being placed on vehicle controls, the potential and in some cases the reality of citizen suits forced EPA to remain vigilant and to continue to move toward zero or at least lowest feasible emissions levels for all categories of vehicles.

Looking to the future, it is clear that the linkage between clean fuels and clean vehicles has been well established and will be a key element of the next major mobile source regulation dealing with locomotives and marine vessels. Global warming will need to be brought into the regulatory arena to a much greater degree than it has in the past. Considering both climate and urban air pollution, it will be interesting to see how EPA and California collaborate in the future to completely remove motor vehicles from the air pollution problem, which was after all, Senator Muskie’s intention back in 1970.

CHAPTER TEN

INTEGRATING ENERGY AND ENVIRONMENTAL POLICY

David Moskowitz
Rebecca Schultz
Art Williams
Chris James

1. SUMMARY OF RECOMMENDATIONS

Recommended Institutional Reforms

China's current institutional structure discourages the integrated consideration and making of energy and environmental policies. Energy agencies focus narrowly on energy issues and assume the Ministry of Environmental Protection and associated environmental agencies will deal with environmental issues. Meanwhile, MEP focuses on the many severe and pressing environmental problems and assumes that it has no need or responsibility to be engaged in the development of energy policy.

We suggest several amendments to the Air Pollution Law to address these institutional problems. The Law should:

1. Give the environmental agency the responsibility and capacity to assess the environmental consequences of proposed energy-related decisions and to provide their assessment to all appropriate energy agencies;
2. Give the energy agencies the obligation to consult with the environmental agency in the ordinary course of their decision making; and
3. Establish a division of the Ministry of Environmental Protection, within the Department of Policies, Laws and Regulations, to develop expertise in energy and environmental linkages, evaluate the environmental impacts of proposed and current energy policies, develop opportunities for cooperative policy reforms, and expand inter-agency relations.

Recommended Policy Reforms

In addition, we note below four specific policy reforms with immediate relevance for China that have the potential to serve both energy and environmental priorities, while reducing emissions from electric generators and industrial facilities.

1. Multi-pollutant strategies for air quality management in the power sector;
2. Best available technology standards for reduced industrial pollution;
3. Output-based performance standards for electricity generation; and
4. Environmental dispatch of electric generators using continuous emissions monitoring systems (CEMS).

2. INTRODUCTION

Greater integration and coordination of energy and environmental regulation and policy making is critical to cost-effective environmental protection in China. Whether related to electricity pricing, generation and transmission planning, power sector reform, or market rules, energy decisions have significant environmental consequences. Yet all too often these consequences are not fully understood or evaluated by the energy agencies. Better integration and coordination of energy and environmental institutions and processes will lead to better results in both sectors. Failure to improve coordination will lead to unintended and undesirable environmental results. Climate change, for example, is a policy area in which energy and environmental concerns are closely intertwined and energy and environmental policies should be closely coordinated.

At its core, enhanced integration of energy and environmental policymaking denotes a conceptual shift toward whole-systems thinking – a recognition that no single aspect of resource management can be considered in isolation. This integration is the type of specific action needed to implement the December 2005 decision of the State Council, *“Decision on Implementing the Outlook on Scientific Development and Strengthening Environmental Protection.”* At the time, Premier Wen Jiabao’s statement stressed three important transformations in environmental policy: 1) a change from putting the priority on economic development, to putting the priority equally on economic development and environmental protection; 2) a change from the maxim *develop now – clean up later*, to a practice of simultaneous environmental protection and economic development; and 3) a change to address environmental issues in a more integrated manner.

In announcing this new approach to environmental protection, China was recognizing that energy and the environment are inextricably linked and that energy and environmental issues need to be considered jointly.

The Air Pollution Law should reflect these policies and seek to implement the April 2006 State Council decision through the institutional reforms and substantive policy reform described below.

3. BACKGROUND

3.1. What does it mean to integrate energy and environmental priorities?

Climate change especially has shone a spotlight on the critical intersection between the two policy areas of energy and the environment. In the United States, one of the best examples of energy/environment integration in recent years is the Regional Greenhouse Gas Initiative (RGGI) among ten states in the northeastern part of the country. The design of the RGGI cap-and-trade program marks an important departure from the U.S. Acid Rain Program. The key difference is that RGGI includes an auction of emission allowances and the revenue generated from the auctions are invested in energy efficiency and renewable energy. The investments in energy efficiency and renewable energy produce much greater reductions in GHG and other criteria pollutant emissions than the consumer response to the price the cap-and-trade system places on carbon (see Chapter Fourteen for in-depth discussion of this point). This feature of the program was the direct result of the coordinated efforts of energy and environmental regulators in designing the market-based program.

While examples of institutional coordination may be easier to grasp, the otherwise abstract concept of integrated energy and environment is best illustrated through specific examples of policy approaches. Fortunately, there have been numerous recent instances in which Chinese energy and environmental regulators have worked together to successfully establish policies that promote both energy and environmental objectives. These examples provide a solid foundation upon which China's next steps should build. These include:

- A price premium for electricity produced with flue-gas desulfurization equipment in operation. The premium price helps remove the competitive disadvantage to clean generation by compensating owners for incremental cost of sulfur dioxide pollution controls;
- The “efficiency dispatch policy” for power plants which gives priority to more efficient and cleaner power plants in the loading order;
- Emissions data sharing between MEP, the State Electricity Regulatory Commission (SERC) and electricity system operators, which has led to immediate and dramatic improvement of the flue-gas desulfurization operational performance of power plants;
- “Small Plant Closing Policy” (*shangda yaxiao*) and “Generation Rights Trading Policy” (*dianquan jiaoyi zhengce*) aimed at closing small and inefficient coal-fired plants.

Additionally, China has numerous other energy policies adopted to reduce energy consumption that have environmental benefits even though they were not implemented with environmental objectives in mind. It is likely that these policies would be much more effective if they were thoroughly reviewed by environmental regulators. These include:

- Differential electricity pricing for energy-intensive industries, which offer lower electricity rates for industrial customers with higher efficiency performance. Input from environmental regulators might have led to the policy applying to other industries with high levels of pollutant emissions.
- The recent adoption of output-based energy consumption standards for 22 industrial sectors, including the power sector. Greater involvement on the part of environmental regulators might have led to standards that optimized both pollutant emissions and energy use.

Most importantly, there are many energy decisions expected to be made in the next few years for which greater integration and cooperation will improve power sector and environmental outcomes. For example:

- China's new environmental dispatch rule, discussed above, reduces coal consumption and air pollution. But this rule is being implemented administratively and will not work in the competitive generation markets that may be adopted in the next few years. The challenge will be how to maintain – and improve on – the achievements of the dispatch rule as the power sector moves to competitive generation. Input from environmental regulators can assure that the issue is addressed.
- Future steps in power sector reform may separate grid companies' transmission and

distribution assets and redefine the grid companies' legitimate lines of business. These decisions may affect the ability of grid companies' to invest in end-use energy efficiency. The cleanest and lowest-cost way to meet customer energy needs is to reduce demand by investment in more efficient motors, appliances, and other energy-consuming equipment. How restructuring is implemented will determine whether the competitive market and the existing regulatory frameworks will provide incentives for investment in energy efficiency. Environmental regulators should value energy efficiency as a pollution reduction strategy and should weigh in on the decision.

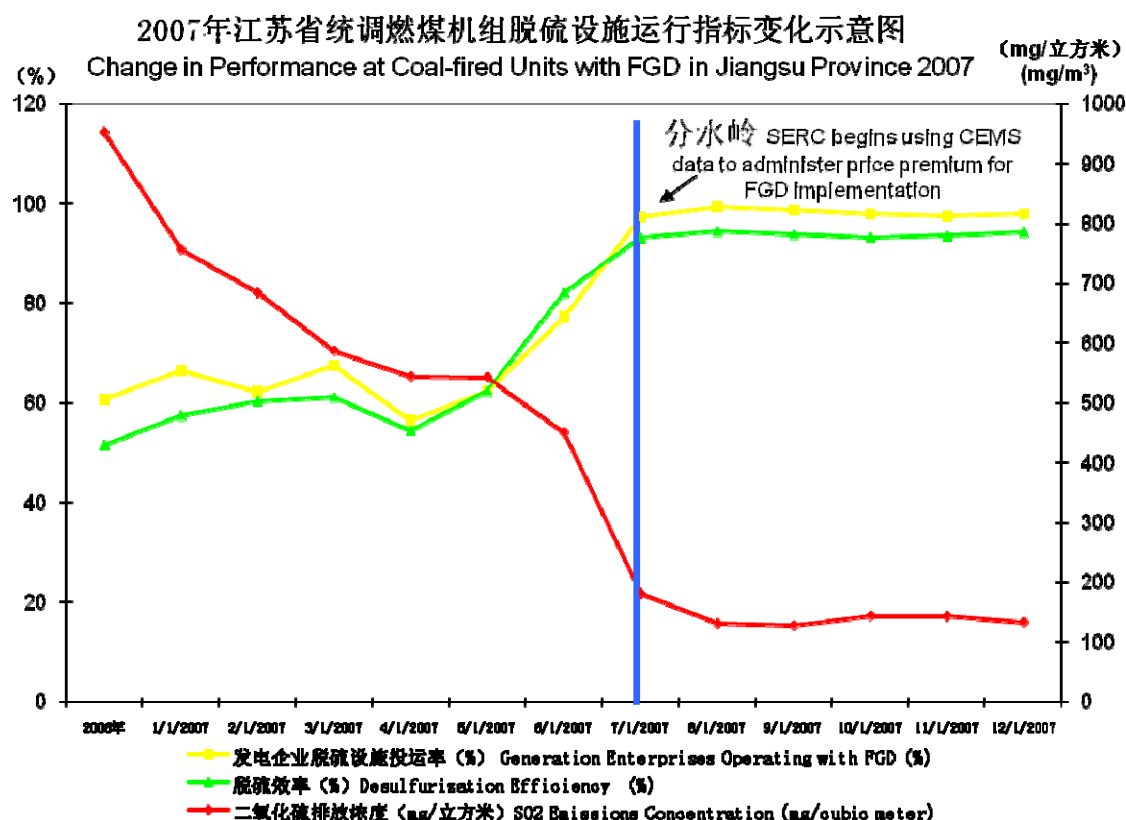
- Decisions about market infrastructure – computer hardware and software – will affect the ability to track emissions and other attributes of power generation. China plans to allow direct retail access by power consumers. One of the promises of retail competition is that consumers will have the option of buying clean or renewable power. International experience shows this is possible, but adequate tracking systems need to be built into generation markets at the outset, otherwise the ability to use markets to improve the environment will be difficult or impossible. Environmental regulators will have a strong interest in assuring the hardware/software meets their needs.
- Energy regulators may adopt better Scientific Energy Planning methods for the power sector. Environmental regulators will be interested in the ability of the planning methods to consider environmental costs.
- Energy regulators may adopt policies for other coal-based industries (synfuels, chemicals, fertilizers, etc.) that can promote high-efficiency combined heat and power (CHP) and polygeneration. Roughly 50 percent of coal use in China is for purposes other than power generation – for example, in industrial boilers and, increasingly, as a feedstock for chemicals and fertilizers. Input from environmental regulators will assure overall emissions are reduced.
- Energy regulators will be refining China's GHG reduction policies. Input from environmental regulators will help assure that the effect of different GHG policy options on emissions of other air pollutants are fully considered.

One reason that opportunities like these to integrate environmental priorities into energy policies are so critical is that they can enhance enforcement. Enforcement of environmental regulations is an acknowledged weakness in China. Integration of energy and environmental rules can greatly improve the enforcement of emissions requirements and the collection of pollution fees.

This fact is illustrated powerfully by the graph below. The graph shows the dramatic improvement in environmental performance of coal-fired power plants in Jiangsu Province in 2007. The improvement occurred around the time when the State Electricity Regulatory Commission (SERC) began using real-time emissions data from CEMS to administer price premiums for electricity from plants operating with Flue Gas Desulfurization (FGD) units.

Previously all plants that had installed FGD units were offered the price premium of 1.5 fen/kWh. However, because running the scrubber consumes energy and reduces plant efficiency, many of these plants – 40 percent in the case of Jiangsu – were not actually operating the equipment. Putting the real-time emissions data into the hands of the energy regulator to administer the price premium proved enormously effective. According to the table below, SO₂ emissions concentrations were reduced by more than 75 percent over the course of 2007 and the

compliance rate increased from 63 percent to 98 percent. The graph suggests that many plants began operating the FGD in advance of SERC's policy change, underscoring how influential the energy regulator can be in enforcing environmental policies.



指 标 Table	2006年 2006	2007年 1-5月均值 Jan-May 2007	2007年 6月 June 2007	2007年 下半年均值 July-Dec 2007
设施投运率 (%) Plants Operating with FGD (%)	60.7	63.1	77.31	98.15
脱硫效率 (%) Desulfurization Efficiency (%)	51.8	59.2	82.2	93.8
SO2排放浓度 (mg/立方米) SO2 Emissions Concentration (mg/cubic meter)	952.24	622.8	450.27	143.26

Source: China State Electricity Regulatory Commission

The power sector, unlike most other sectors, is largely centrally controlled. The system requires central dispatchers who know at every moment which power plants are operating, and this can be an asset for environmental regulators. With integrated power sector and environmental rules, like CEMS data to administer FGD price premiums as described above, the power market system

operator can more effectively serve as environmental monitor, enforcer, and collector of pollution fees.

In summary, the examples described above demonstrate: (1) the successful integration of energy and environmental policy objectives; (2) recent policies where opportunities for coordination were missed; and (3) a sample of future decisions that would benefit greatly from the joint input of energy and environmental regulators.

4. FOUR RECOMMENDED POLICY REFORMS

Of special concern to the Air Pollution Law and China's air pollution control measures generally, as listed above, are four policy reforms that we recommend be incorporated into China's Air Pollution Law to integrate energy and environmental objectives.

4.1. Multi-pollutant Strategies for Air Quality Management

An integrated multi-pollutant approach to regulating air emissions from the power sector can drive resource choices toward those with lower environmental impacts. Whereas a single pollutant approach can be very effective at reducing the targeted pollutant, it often results in an increase in emissions of other pollutants and a higher cost of compliance for regulated sectors. An integrated multi-pollutant approach on the other hand, treats the pollutants simultaneously by implementing incremental and coordinated targets across the full range of pollutants that regulators want to control now and in the future. Whether regulations apply to power sector emitters or industrial emitters more broadly, a multi-pollutant approach sends long-term signals to industry to plan pollution control technologies and strategies that are effective and efficient for reducing the full range of controlled emissions. For China, this might mean adapting the Total Emissions Control scheme for SO₂ to include other pollutants with incremental, longer-term targets. Such an approach would permit an enterprise to plan for future regulatory measures, and consequently optimize its investment in and configuration of pollution control equipment – making cleaner, more costly fuel types significantly more competitive. Chapter Eleven discusses these costs and benefits in greater detail.

4.2. Technology Standards for Reduced Industrial Pollution

China should implement standards to force the adoption of leading industrial control and production technologies, like the Best Available Technology Standards (BACT) in the United States and Best Available Techniques (BAT) in the EU. Those standards can be expanded to include both direct and indirect emissions, as the EU program has begun to do in recent years. In this way, the “best available technology” does not apply only to pollution control equipment, which tends to be limited to end-of pipe interventions, but addresses production technology, industrial processes and configuration. By controlling and reducing industrial energy use, regulators can reduce the indirect emissions associated with that energy production. Energy efficiency standards for industry can promote fuel-switching, improved energy management systems, and improved fuel use through technologies like combined heat and power,

polygeneration, and waste-heat recovery – all of which lead to considerable emissions reductions, both direct and indirect.

China's current industrial energy consumption standards for 22 energy-intensive industries provide a valuable regulatory framework in which environment controls should be integrated. By jointly standardizing high-efficiency technology and advanced pollution control technology, environmental regulators can take advantage of inter-agency synergies in management, enforcement and compliance, and put forth a more comprehensive, integrated, and effective industrial technology policy than either the U.S. or the EU have in place today. See Chapter Eight for more on this topic.

4.3. Output-based Generation Performance Standards

Output-based generation standards are electric sector emissions regulations that define performance in terms of the productive output (i.e., the electrical generation) of the affected facility. In an environmental context, output-based regulations relate pollutant emissions to the productive output of an industrial process, for example, pounds of emissions per kilowatt-hour of electricity. They consequently encourage the most efficient means of production. Furthermore, if the standards are set on a uniform (i.e., fuel-neutral) output-basis, they remove any regulatory biases or unfair competitive advantages that might favor one technology over another or the dirtier plants over the cleaner ones. Environmental regulators have an enormous opportunity in regulating power sector emissions on an output-basis because such an approach to regulation can encourage the deployment of cleaner coal plants, combined heat and power, energy efficiency, renewables and clean distributed generation.

Output-based emission standards for the power sector constitute an important evolution in air pollution regulation in the United States. It is an evolution that, in the last decade, has been driven, not by the federal government, but by states, who have begun to recognize several virtues that such regulations have over the fuel input- and technology-based approaches:

- Generation performance standards do not prescribe the means of compliance, but instead give generators the freedom to discover the best way to meet the requirements. In the short run, this means that output-based regulations reward improvements in thermal efficiency; reward investments in low- and non-emitting technologies; and promote innovation. Collectively, these attributes reduce the total cost of compliance.
- Output-based emissions standard are equally compatible with both vertically integrated electric systems and competitive generation markets. Indeed, their strong, resource-blind incentives for efficiency and innovation complement well-designed competitive markets. Additionally, they can complement emissions trading schemes that allocate allowances based on generating output.

China currently, in fact, has efficiency standards for conventional thermal power plants, both new and existing. These are essentially output-based CO₂ emission standards. This approach can be applied to other pollutants and other sectors.⁸³

4.4. Environmental Dispatch Using Continuous Emissions Monitoring Systems (CEMS)

The environmental dispatch policy for power plants is a breakthrough innovation in electricity dispatch that prioritizes more efficient and cleaner power plants in the loading order. Implementation will require accurate and reliable emissions and thermal efficiency data. Currently, the dispatch policy is being piloted in several provinces using various approaches to estimating coal-use per kWh. Broader deployment of Continuous Emissions Monitoring Systems (CEMS) capable of monitoring CO₂ and practices to increase the accuracy and reliability of CEMS data would greatly improve implementation of the program. In fact, better CEMS data from power plants will improve a number of current environmental policies, including the pollution levies and flue gas desulfurization (FGD) fees and premium pricing, and will be indispensable for a wide range of policies being considered for the near-term future, such as output-based emissions standards and emissions trading. To enhance performance, emissions data should be shared between the energy and environmental regulators, i.e., MEP, SERC, and the system operators.

China's Air Pollution Law should require all power plant operations and planned generation markets to fully incorporate emissions monitoring information. Furthermore, the enforcement of environmental requirements and collection of pollution fees should also be incorporated into power plant operations and planned generation markets such that prices and competition take into account pollution emissions and control technologies.

⁸³ For more information on out-put based generation performance standards see "Generation Performance Standards in the U.S. Electric Sector: Lessons for China," The Regulatory Assistance Project, September 2008, available online at http://www.raponline.org/Pubs/RW-Generation_Performance_Standards-final-24Sept08.pdf.

CHAPTER ELEVEN

MULTI-POLLUTANT CONTROL POLICIES: AN INTEGRATED POLICY FRAMEWORK FOR MORE EFFECTIVE AIR QUALITY MANAGEMENT

David Moskowitz
Rebecca Schultz

1. SUMMARY OF RECOMMENDATIONS

There are currently a variety of pollutants commonly regulated in the developed world that are currently unregulated or not comprehensively regulated in China. This has historical reasons related to China's stage of development and available capacity and resources. However, the fact of the matter is that the negative impacts of these pollutants on human health and the environment are well known and as China continues to develop at a rapid clip it will certainly in the near- to mid-term seek to strengthen regulation of these pollutants. If advanced planning is not put into how this process will develop in China, the costs to industry and to Chinese society will be much higher than they need to be. A multi-pollutant approach that encourages long-term, holistic planning is a way to avoid these problems and excess costs. Based upon our review of experience in the U.S. and elsewhere we make a specific recommendation that the Air Pollution Law amendment include language to require:

- A multi-pollutant approach on air regulation focused on total emissions control for SO₂, NO_x, particulate matter, and mercury, and emission intensity for CO₂.
- Greater consideration of how efforts to regulate a particular pollutant through emissions controls or production processes may worsen emissions from pollutants that are not being considered by the regulation or standard.

2. INTRODUCTION

Emission control policies have traditionally focused on one pollutant at a time – setting limits and standards for a single pollutant, leading power plants and other industrial facilities to develop separate control strategies for each pollutant. These single-pollutant approaches can be very effective for the pollutant of concern, but these strategies often inadvertently increase the emissions of other pollutants.⁸⁴ Because many environmental problems are caused by more than one pollutant,⁸⁵ single-pollutant approaches fail to achieve, as effectively as possible, over-

⁸⁴ For example, most pollution controls have an associated heat rate penalty (i.e., they require more fuel to power the equipment). As a result, other emissions that are not reduced by the control may increase. An SO₂ scrubber will often result in additional NO_x and CO₂ emissions (about a 1.7% increase). Another example is the Selective Catalytic Reduction (SCR) technique to control NO_x, which can lead to increased sulfuric acid and SO₃.

⁸⁵ Examples of combined pollutants causing environmental problems include: VOCs and NO_x which contribute to O₃; SO₂ and NO_x which contribute to acid rain; and SO₂, NO_x, Black Carbon, etc., which contribute to PM_{2.5}.

arching environmental or public health goals, such as reducing water bodies' acidification or reducing excessive morbidity or mortality from respiratory illness. Controlling one pollutant can fail to address the problem and may even make the problem worse, as in the case of reducing NO_x which can cause an increase O₃ in some conditions. Single-pollutant approaches also tend to waste resources (e.g., fuel, steel) and cost more for industry, government, and society than an integrated, multi-pollutant approach.

More recently, the U.S. and Europe have adopted multi-pollutant approaches to create an integrated framework that includes pollutants the authorities want to control now and in the future. These approaches effectively encourage industry to develop long-term financial and environmental plans to optimize investment in and configuration of pollution control equipment. A primary objective in a multi-pollutant approach is to treat the pollutants in an integrated way that allows industry to plan, finance, install, and operate pollution control technologies and strategies that are effective and efficient to reduce all the desired emissions. Such an approach offers better planning, greater certainty, lower costs, and more environmental benefits per dollar invested.⁸⁶

As for air pollution control in China, various policies regulate a number of different pollutants. To name a few: the Total Emissions Control program of the 11th Five Year Plan covers SO₂; the national Integrated Emission Standard of Air Pollutants (GB 16297-1996) covers SO₂, NO_x, PM, and 30 other air pollutants.⁸⁷ National ambient air quality standards have been set for SO₂, Total Suspended Particulate (TSP), PM₁₀, benzo(a)pyrene (BaP), NO₂, CO, ozone, lead, and fluorine. Emissions discharge standards set emissions limits for a range of stationary and mobile sources, including PM, SO₂, and NO_x from industrial cement production and SO₂, NO_x and soot from thermal power plants.

While these measures indeed cover multiple pollutants, they fall short of an integrated multi-pollutant strategy. For China to shift these measures into a comprehensive and integrated scheme, it would have to implement ambitious, graduated, and synchronized reduction targets capable of achieving health-based ambient air quality standards for the full host of pollutants that the government will want to regulate over a mid-term horizon. Incremental and coordinated targets for all pollutants would be determined through analysis and modeling of current and projected emission sources, pollution intensity data, transport factors, pollutant level impacts on other pollutants, and available mitigation technology and policy options. Moving to a multi-pollutant approach would mean adding CO₂, VOCs, mercury and other pollutants of concern, to cover all major pollutants which are known to jeopardize environment and public health. This cannot happen overnight, nor should it subvert the progress currently being made. This would be a proactive endeavor, leapfrogging outdated policy tools, to take advantage of the range of technical, scientific and practical lessons learned in industrialized countries, and provide signals and certainty to the power and industrial sectors so they can plan accordingly.

⁸⁶ For resources related to the U.S. EPA's multi-pollutant analyses and technical supporting documents, see <http://www.epa.gov/airmarkets/progsregs/cair/multi.html>. Also see, Sam Napolitano, et. al., "A Multi-pollutant Strategy," *Public Utilities Fortnightly*, January 2009, available at <http://www.epa.gov/airmarket/resource/docs/multipstrategy.pdf>.

⁸⁷ For select cities, the Integrated Emission Standard of Air Pollutants is more aggressive. In Beijing, for example, the standard covers 52 pollutants, including PM_{2.5} and VOCs.

The revision to the Air Pollution Law offers a chance for China to adopt a multi-pollutant approach on air regulation focused on total amount control for SO₂, NO_x, particulate matter, and mercury, and emission intensity for CO₂.

2.1. Why use a multi-pollutant approach?

By establishing goals for multiple pollutants in a consistent timetable, government encourages industry to plan accordingly. This approach offers advantages for industry, government, public health and the environment. Five main benefits include:

- Provides industry with the opportunity for an integrated strategy that includes environmental and energy factors to control pollutants. A multi-pollutant approach with synchronized deadlines leads to better planning, greater certainty, lower costs, and more environmental benefits per dollar expended.
- Reduces the administrative and transaction costs and complexity of program implementation.
- Encourages the development of control technologies to address multiple pollutants. Early adoption of multiple-pollutant control technologies builds confidence in the technology, helps to drive down costs, and improves overall performance.
- Creates a strong economic incentive to evaluate production processes to look for pollution prevention opportunities. These pollution prevention efforts often provide significant energy efficiency improvements and resource savings.
- Synchronizes with the effects of pollution on public health and the environment. Humans, plant and animal life, and the built environment feel the combined and cumulative effects of all pollutants, not just NO_x, SO₂ or fine particulates. It also addresses interactions and chemical changes of pollutants, such as the impact of SO₂ and NO_x on acid rain and fine particulates, and the impact of sulfate deposition in waterways on the methylation of mercury.

When facilities develop an integrated pollution control strategy, they can configure the air pollution control equipment to maximize control of multiple pollutants. For example, an electrostatic precipitator (ESP) upstream of the air preheater (“hot side”) effectively reduces particulates, but has almost no effect on mercury emissions. By contrast, an ESP downstream of the air preheater (“cold side”) provides similar particulate control while also providing 30-40 percent mercury removal.

Conversely, an approach that looks solely at controlling SO₂ may lead to effective reductions of this pollutant, through the installation of FGD. But, if, some years later, the focus moves to NO_x, regulators and industry may find that control equipment to reduce such emissions is either limited in efficacy or has higher incremental costs, since the available space at the power plant is restricted, due to the earlier choice of where the FGD was located.

For the electric sector, a multi-pollutant strategy would encourage industry to ask: what is the best way to produce a megawatt or megawatt hour of electricity ? Not, what is the cleanest way

to burn coal or natural gas? In other words, long-term regulatory signals would help industry plan for future environmental compliance costs and consequently shift resource decisions away from dirtier fuels.

Likewise, a multi-pollutant framework would steer investment in continuous emissions monitor systems (CEMS) toward more reliable and incrementally less expensive technology choices. Enterprises considering SO₂ requirements singularly, for example, are more likely to invest in in-situ or in-stack monitors. This is the trend in China today where approximately 50 percent of industrial facilities and power plants outfitted with CEMS use in-situ monitors. These monitors may be less expensive initially, but due to complicated maintenance and calibration requirements, they tend to produce much less accurate data. The alternative, an extractive technology which draws a sample away from the flue to analyze it, may be more than double the cost of in-situ monitors due to first-time infrastructure modifications. However, with one extractive CEMS already installed, the incremental cost of additional monitors is minimal, approximately \$10,000 USD per monitor as compared to \$120,000 USD for in-situ monitors, while accuracy can reach +/- 2.5 percent and reliability 99 percent, as levels do in the U.S. Given the right signals, enterprises can make the planning and investment decisions best suited to meeting current and future requirements cost effectively.

2.2. Where have multi-pollutant approaches been adopted?

Multi-pollutant strategies are increasingly being applied in advanced environmental management systems around the world. Recent international examples include: the European Commission's National Emissions Ceiling; the State of Massachusetts' Multi-pollutant Regulation 310 CMR 7.29; the State of North Carolina's Clean Smokestack Act; and the city of Louisville, Kentucky's adoption of an Integrated Air Quality Action Plan. The cases of the European Commission and Massachusetts illustrate well this type of policy approach.

The European Commission's National Emissions Ceiling was established through Directive 2001/81/EC to address the cross-boundary pollution transport issues that were expected to persist after the achievement of the reduction targets of individual member states. These issues include the acidification of streams, lakes and other water bodies, extensive eutrophication and ground-level ozone. Extensive modeling found that using a multi-pollutant framework would permit the optimization of technology choices, both in terms of cost and energy efficiency, to meet various environmental objectives simultaneously.⁸⁸

The new directive undertook additional national total caps for atmospheric emissions for four pollutants: SO₂, NO_x, VOCs and ammonia (NH₃). The EC set upper limits for each member state for the total emissions that could be discharged in 2010 against a 1990 baseline. While it mandated the use of multi-pollutant and multi-media approaches, it left the specific design strategies to achieve the targets up to member states to determine. These limits were further

⁸⁸ The EC used the RAINS (Regional Air Pollution Information and Simulation) and GAINS (Greenhouse Gas Air Pollution Interactions and Synergies) models. Each model allows for a very dynamic assessment of strategies that can be modeled with many variables (including energy use, population, and climate changes) and for various effects (such as costs, air pollution benefits, etc.), adjusted to each member state's unique characteristics and circumstances for various scenarios.

revised downward in 2005 and new targets established for 2020. A more recent directive, 2008/1/EC on Integrated Pollution Prevention and Control, additionally addresses NO₂, PM₁₀ and PM_{2.5}, lead, benzene, CO and ozone (O₃). Supporting the EC multi-pollutant approach are annual reports that update and revise modeling projections, any new or changed key factors, progress to date in achieving the target goals, any changes in member States' relevant laws, new information on technologies and costs and other relevant data and information.

Massachusetts has similarly attempted to address a wide range of air quality related issues with its Multi-Pollutant Regulation 310 CMR 7.29. These issues include acid deposition, climate change, mercury levels, nitrification, eutrophication, ozone, fine particles, regional haze and impaired visibility. In-depth modeling analysis demonstrated that environmental control systems for the pollutants of concern were so interactive that strategies to address them collectively would be significantly more cost-effective.⁸⁹ This led Massachusetts to develop a multi-pollutant emission reduction program focused on the six largest emitting electric generating units in the state. Adopted in 2001, this program sets reduction targets for NO_x, SO₂, CO₂ and mercury (Hg). To address NO_x, SO₂, and CO₂, the state established maximum output-based emission rates on a pounds per MWh basis. Mercury emissions are controlled through either a maximum output-based emission level or a minimum removal efficiency. Caps for CO₂ and mercury have been set as well.

2.3. How might China implement a multi-pollutant approach?

China should consider an integrated emission control policy, with total emission control limits for SO₂, NO_x, particulate matter, and mercury, and an emission rate standard for CO₂ (e.g., CO₂/unit of production (kWh)). China's government, power plants, and industry are taking significant action to reduce SO₂ and particulate matter, and improve energy efficiency. During the 12th FYP, the government is likely to also focus on NO_x emissions. While these three pollutants are clearly interrelated (e.g., SO₂ and NO_x contribute to PM_{2.5} emissions; SO₂ and NO_x both contribute to acid rain and deposition), there are other pollutants, such as mercury and carbon dioxide, that also share a relationship with SO₂, NO_x, and particulate matter. For both mercury and CO₂ there is a simple near-term step China can take that will yield zero cost pollution reduction.

Mercury: China's policies have the potential to significantly reduce mercury emissions with no or little additional cost or effort. The large-scale installation of FGD technologies to reduce SO₂ can significantly affect mercury emissions. On some kinds of coals, a wet FGD combined with an SCR unit, for example, can remove a significant fraction of mercury emissions as a co-benefit. While the FGD installations will reduce mercury emissions, China's co-benefit mercury reductions are not well publicized within China or internationally. By setting a mercury limit that is initially equal to the mercury co-benefit control levels (i.e., reductions that will happen by controlling SO₂ and NO_x), China can demonstrate their international leadership on an important international problem – global transport and deposition of mercury. It also sends a signal to

⁸⁹ To analyze costs, Massachusetts used the Integrated Environmental Control Model (IECM) developed for the U.S. Department of Energy which provides plant level performance, emissions and cost estimates for a variety of environmental options for coal-fired power plants. The model accounts for emissions of SO₂, NO_x, particulates, major air toxics, including mercury, CO₂ and other greenhouse gases and also solid waste and byproducts.

industry that mercury is a pollutant of concern and they should adopt technologies and configure these technologies so as to maximize the mercury control co-benefits. Incorporating mercury into an integrated framework, China will also be in a strong position to make further reductions. It should be recognized that there are highly efficient, cost-effective, existing controls which could substantially reduce mercury beyond the level of current co-benefits. In cases in which the FGE/SCR combination is not very effective, the add-on technology Activated Carbon Injection (ACI) can bring significant additional reductions from the power sector – up to 90 percent.⁹⁰ China can and should be working to toward these levels of reductions, and a multi-pollutant framework can put it on track to do so.

CO₂: Similarly, China’s policy of closing small power plants is essentially an efficiency standard (or CO₂ emission standard) for power plants that is leading to significant CO₂ emission reductions. While a key objective of energy efficiency policies is to conserve resources, China also deserves recognition for the significant progress toward another important international problem – climate change. By setting a CO₂ intensity target (equal to the energy efficiency target) as part of a multi-pollutant control strategy, the government can encourage resource conservation, promote energy efficiency, and recognize the substantial reductions in greenhouse gas emissions compared to “business as usual” conditions.

⁹⁰ “Mercury Emissions from Coal-Fired Power Plants: The Case for Regulatory Action,” NESCAUM, October 2003, available at <http://www.nescaum.org/documents/rpt031104mercury.pdf/>.

CHAPTER TWELVE

INFORMATION GATHERING & TRANSPARENCY

Richard Ayres
Alex Wang
Jessica Olson

1. SUMMARY OF RECOMMENDATIONS

Disclosure of accurate, timely environmental information is a fundamental prerequisite of an effective environmental regulatory regime. China has already recognized this and is moving forward to utilize information transparency as a tool to improve its environmental protection regime. We believe, however, that critical elements of open information disclosure are currently missing from China's environmental protection regime. Based on our experience with the U.S. framework, we make a number of specific recommendations for consideration in the amendment of China's Air Pollution Law that we believe will have a marked effect on environmental protection in China:

- **Government authority to gather information.** Strengthen authority of lower levels of government and MEP authority to gather information from emitters about emissions data and pollution control equipment. Dramatically increase penalties for false reporting, tampering with monitoring and pollution control equipment and obstruction of inspections to send a signal that China will not tolerate false information and cheating.
- **Public disclosure of emissions. Pollutant** emissions should be disclosed to the government and the public. Disclosure of emissions data has been proven to lead to reductions in emissions.
- **Public disclosure of environmental impact assessment reports.** Complete environmental impact assessment reports should be disclosed to the government and the public. This has been proven in other countries to enhance government and public supervision both before and after construction or implementation of projects and plans. Moreover, jurisdictions all over the world have managed this sort of public disclosure in a way that protects business secrets. China's current practice of only disclosing an abridged version of the EIA report is not within the mainstream of international practice and is less effective for environmental protection and the avoidance of projects that are high in pollution energy use and resource consumption ().
- **Transparency in policymaking makes for better policy.** Adopt measures to make the policymaking process more transparent (e.g., hold public hearings, solicit public comment, and require MEP to respond to public comment).

2. INTRODUCTION

Globally, the trend has been toward greater transparency of environmental information, including emissions data, company violation records, and environmental impact assessment reports. Information regulation has been called a “third wave” of environmental regulation after command-and-control regulation and regulation using market-based measures. For decades, disclosure of emissions and other environmental information to government and the public has been a core part of the efficacy of the U.S. Clean Air Act and important support for the regulatory mechanisms set forth therein. In the 1980s, in the aftermath of the Union Carbide chemical accident in Bhopal, India, the U.S. developed a new approach to regulation, through which environmental improvements were driven by the very act of disclosure and the ways that the public could then utilize that information.

Information disclosure has worked in various ways. Companies in some cases have taken action on their own to reduce pollution once confronted with public disclosure of their pollution. Environmental information regulation has given the public and environmental organizations the tools to supervise and monitor for violations of environmental laws and regulations, giving environmental officials much needed assistance. More recently, environmental information gathering and disclosure has allowed banks to start “green credit” programs, companies to implement “green supply chain” initiatives, and securities regulators to pursue “green credit” programs.

China has made important moves toward open information disclosure, particularly in the environmental context. In 2005, China’s State Council issued its *Decision of Enhancing Environmental Protection under the Concept of Scientific Development*, which specifically listed open information disclosure as an important tool for enhancing the role of public supervision in environmental protection. More recently, China passed two major national regulations on open information disclosure – the 2007 State Council “*Open Government Information Regulations*” and the 2007 Ministry of Environmental Protection “*Measures on Open Environmental Information*.” These are important steps that will begin to pay off for China in the form of reduced pollution and a more informed public as implementation starts to improve.

2.1. Environmental Impact Assessment

With the passage of the National Environmental Policy Act in 1970, the U.S. became the first nation to establish a system for environmental impact assessment. A key aspect of this system was the disclosure of potential environmental impacts to the public before commencement of an action. This was an important part of the process of making the initiator of a project, plan, policy or other action take a “hard look” at the negative environmental impacts of the action and ways to reduce environmental impacts. The U.S., like many countries around the world, has a robust system of open, early public participation in the EIA process with full disclosure of the EIA report to the public. This allows the public to comment on an action fully before it is taken and also allows for accountability later after an action has been taken to check whether initial estimates of impact were correct. China currently only requires disclosure of an “abridged” () EIA report, which often omits the detailed information of greatest interest and use to the public. The objection is often that protection of business secrets demands such partial disclosure of EIA reports. The U.S. and numerous other jurisdictions have managed to operate a very open

disclosure policy, without compromising business confidentiality, and we believe China is able to accomplish this as well.

2.2. Policymaking

Finally, the U.S. has a long history of public participation in the regulatory and policymaking process. China has moved strongly in this directly with public participation in licensing proceedings, EIA and other decision-making processes. This is an evolving area in China and there are lessons learned from the U.S. experience that can benefit China.

3. BACKGROUND

The 1970 Clean Air Act Amendments were a milestone in U.S. pollution control law for many reasons. For the first time, the federal government was given extensive powers to compel data from emitters that could be used for policymaking and enforcement. Also, for the first time, all emissions data and most other information collected by the federal and state governments from emitters was made available to the public.

There were several reasons for these sweeping reforms. First, the information the government gathered from emitters could be used by the government and by citizens, through the citizens' suit provision of the law (also added in 1970), to assure compliance or penalize noncompliance. Second, government policymaking would be greatly enhanced when government knew more about the emitting industries. Third, when citizens have more information, they are less likely to believe irresponsible rumors about pollution or government actions in response to pollution. Fourth, citizens organizations often provide different and valuable information that can improve government policymaking. Senator Eagleton, the father of the citizen suit provision, said he was tired of passing laws that were not enforced, and he thought that citizens should have a legitimate way to make sure that both government and emitters were doing what the law requires.

As a result of the disclosure provisions of the CAA, and two other general disclosure laws – the U.S. Administrative Procedure Act (APA), and the Freedom of Information Act (FOIA) – an elaborate disclosure program has developed at the Environmental Protection Agency. Later the creation of the Toxics Release Inventory (TRI) in the 1980s led the way in a new generation of information regulation.

4. EPA'S INFORMATION-GATHERING AUTHORITY

The CAA gives EPA broad authority to collect information relevant to policy making and enforcement directly from emitters and through its partnership with states.

4.1. Requirements for State Information-Gathering Programs

The greatest amount of data gathering is performed by the states because federal requirements for information gathering are implemented through state permits issued to individual emitters. State permits must contain provisions respecting the installation of emissions monitoring equipment and reporting of emissions and emissions-related data, as prescribed by EPA. (The Title V permit system is discussed at length in Chapter Six.) EPA may also require the state to verify that the emissions reports show compliance with applicable emission limitations or standards. The reports must be available for public inspection at “reasonable times.”

EPA has promulgated regulations detailing what reporting requirements states must include in their permits. All permits must require:

- Records of required monitoring information including: date, place, and time of sampling or measurement; date(s) analyses were performed; company or entity that performed the analyses; analytical techniques or methods used; results of such analyses; and operating conditions as existing at the time of sampling or measurement;
- Retention of records of all required monitoring data and supporting information for a period of at least five years from date of monitoring sample, measurement, report, or application;
- Submittal of reports of any required monitoring at least every six months; and
- Prompt reporting of deviations from permit requirements, the probable cause of such deviations, and any corrective actions or preventative measures taken.

Permits for electric generating units must also require continuous emissions monitoring systems (discussed below). State environmental agencies are responsible for including these requirements in air permits issued to covered emitters.

4.2. EPA’s Broad Authority to Require Emitters to Disclose Information

The CAA gives the EPA Administrator broad authority to gather information directly from emitters. EPA can require an emitter to disclose any information needed to: 1) develop or assist in development of any State Implementation Plan, emissions standards for new industrial sources or sources of toxic air pollutants; 2) determine whether an emitter is in violation of any of the above; 3) carry out any other provision of the CAA.

EPA may require manufacturers of emission control equipment or process equipment, in addition to emitters, to provide information on a one-time, periodic or continuous basis to establish and maintain records of emission data and make reports to EPA about such data. EPA could also mandate the installation, use, or maintenance of emission monitoring equipment and audit facilities to ensure compliance with the requirements. The agency has the authority to require emission sampling and recordkeeping on control equipment parameters, production variables, or other indirect data when direct monitoring of emissions is impractical. Facility owners may be

required to submit certificates of compliance with EPA requests and any other information EPA reasonably requires.

EPA uses this broad authority to ensure compliance. The threat of enforcement is a strong incentive for reporting emitters to comply with applicable emission requirements. These powers also help EPA assemble an enforcement case when necessary.

If the state demonstrates, as part of a State Implementation Plan submission, that it has all of the authority EPA does under federal legislation (i.e. the state has adopted legislation and promulgated regulations granting the state the same information gathering and disclosure powers within its borders as EPA has nationally), EPA must approve the state implementation plan with respect to information gathering and disclosure. The state then becomes the primary data-gathering agency. However, EPA retains independent authority to compel disclosure.

All information obtained by EPA or the state in this manner must be made available to the public unless it can be properly classified as containing trade secrets (i.e. confidential business information). However the trade secrets exception does not apply to emission data, which must be made available to the public.

4.3. Information Gathering Authority for Motor Vehicles and the Acid Rain Program

Several U.S. CAA programs provide additional authority for EPA to require information disclosure. For example, the CAA requires manufacturers of motor vehicles, motor vehicle engines, and engine parts to establish and maintain records, make reports, perform tests, and provide the information EPA may reasonably require to determine whether such manufacturer has acted or is acting in compliance with the motor vehicle provisions of the CAA. These provisions also allow EPA to inspect and observe (at reasonable times) the manufacturer's monitoring and recordkeeping activities and to inspect records, files, papers, processes, controls, and facilities used in performing such activities. Any information obtained by EPA must be available to the public, unless the manufacturer can make a satisfactory showing to EPA that the information contains trade secrets (i.e. confidential business information). However, this exception does not apply to emission data, which must be available to the public.

In the Acid Rain program, the CAA requires coal-fired electric generating units to install and operate continuous emission monitoring systems (CEMS). The Act requires EPA to specify the requirements for such equipment and to specify any alternative monitoring system that is demonstrated as providing information with the same precision, reliability, accessibility, and timeliness as CEMS. EPA must also specify the recordkeeping and reporting requirements for CEMS.

EPA has defined a CEM system to include an SO₂ concentration monitor, a NO_x concentration monitor, a volumetric flow monitor, an opacity monitor (which measures the percentage of light that can be seen through flue gas), a diluent gas (O₂) monitor, and a computer-based data acquisition and handling system for recording and performing calculations with the data. A CEM system must be in continuous operation and must be able to sample, analyze, and record data at least every 15 minutes. Emissions and flow data is reduced to 1-hour averages. EPA

rules specify procedures for converting the hourly emissions data into the appropriate units of measure.

Producers, importers, and exporters of ozone-depleting substances are subject to a different set of monitoring and reporting requirements. Title VI of the CAA requires each such person to report the amount of substance produced, imported, or exported during the reporting period. EPA determines the frequency of reporting required but it must require at least annual reports. The CAA also required producers, importers, and exporters of CFCs and halons to file, with their first production/import/export report, a report disclosing the amount of substance produced, imported, and exported during the baseline year (1986 or 1989, depending on the substance).

5. TOXIC RELEASE INVENTORY REPORTING

For certain toxic chemicals, a U.S. environmental statute other than the CAA has proven to be one of the most effective means for providing regulatory agencies and the public with information on the magnitude of air emissions. Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 (EPCRA) established a program for Toxic Release Inventory (TRI) reporting. The federal TRI program does not establish requirements for reducing releases of toxic pollutants. Rather, it requires emitters from a number of specified industries to report releases to the air, water, or land annually if the emitter manufactures, imports, processes, or uses more than a threshold amount of a toxic chemical that EPA has listed. Only facilities with ten or more full-time employees must report their releases.

The TRI program, which EPA administers directly, provides forms on which the emitter must record its calendar year emissions by July 1 of the following year. The emitter must generally use a standard form that includes information on the use of the listed chemicals and the amount of the pollutants entering each environmental medium. Under certain circumstances, an emitter may use a more abbreviated standard form. More detailed information on the program can be found at EPA's web site at www.epa.gov/TRI.

The TRI program has had an enormous impact in the slightly more than 20 years that it has been in existence. It has helped regulators and the public to identify trends in aggregate pollutant emissions and other releases to the environment. In addition, local newspapers regularly report on the annual TRI numbers for individual facilities located in the area, and citizen groups publicize these numbers. The program therefore provides emitters with a powerful incentive to reduce their air emissions and other releases to the environment. Chemical companies and other manufacturers often have cut their emissions to avoid bad publicity. Thus, although the TRI reporting is purely an information system (there are no regulatory requirements other than to report releases), most observers credit the program with significant decreases in toxic releases from many emitters.

6. DISCLOSURE IN THE EIA PROCESS

The concept of environmental impact assessment originated in the United States with the passage of the National Environmental Policy Act (NEPA), which was signed into law on January 1,

1970.⁹¹ NEPA made it “the continuing policy of the [U.S.] Federal Government...to use all practicable means and measures...to create and maintain conditions under which man and nature can exist in productive harmony;” however, the law did not work by mandating any specific substantive outcomes.⁹² Rather, NEPA set forth a mandatory “action-forcing” procedure designed to ensure that federal agencies fully-considered the environmental impacts of their activities.⁹³ A key element of this “action-forcing” procedure was the public disclosure of the environmental impact evaluation.

The overall framework of the NEPA process is similar to the Chinese EIA process described above and, broadly speaking, includes the following components.⁹⁴

- Identification of proposal;
- Screening;
- Scoping;
- Environmental Impact Statement Preparation;
- Review (public and agency);
- Decision Making; and
- Monitoring.

In contrast to the Chinese system, the U.S. system requires more substantial disclosure about a project at the screening and scoping stages, and then full disclosure of draft and final environmental impact assessment reports (known in the U.S. as Environmental Impact Statements). This full disclosure informs the public about the details of an action and its potential environmental impacts, and frankly puts greater pressure on the proponent of an action to be accurate and forthcoming. A common objection to disclosure of the full EIA report is that business confidentialities will be revealed; however, this has not been a barrier to full disclosure in the U.S. or numerous other countries and jurisdictions.

Full disclosure of an EIA report will drive more accurate estimates of environmental impact. In 2009, MEP has made a strong commitment to ensuring that EIA play a powerful role in holding the line on environmental protection even in the face of an economic downturn. Broadening disclosure of EIA reports can be a simple, easy step that will pay great dividends for China’s environmental protection.

7. EPA’S GENERAL TRANSPARENCY OBLIGATION IN POLICYMAKING

Like all U.S. federal agencies, when EPA is engaged in policymaking, whether through rulemaking or enforcement actions, it is required to conduct an open and fair public comment process. The notion of transparent governance by federal agencies began in 1946 when Congress enacted the Administrative Act (APA) in response to the many new federal agencies

⁹¹ Pub. L. 91-190, codified at 42 U.S.C. §§4321-4370a.

⁹² 42 U.S.C. §4331(a).

⁹³ See *Vermont Yankee Nuclear Power Corp. v. NRDC*, 435 U.S. 519 (1978) (“NEPA does set forth significant substantive goals for the Nation, but its mandate to the agencies is essentially procedural... It is to insure a fully informed and well-considered decision...”).

⁹⁴ See Wood (2003: 23-32).

created by President Roosevelt to implement social welfare programs. The APA sets forth procedural requirements for the way federal agencies must exercise the authority granted to them by Congress. The APA details two ways in which an agency may act: formal and informal rulemaking. Statutory language instructs the agency as to which process is required. EPA rarely engages in a formal rulemaking proceeding, which requires public notice of the proposed action and a formal hearing to develop a record.

Instead, nearly all EPA actions are taken through informal rulemakings. The APA requires an agency engaged in an informal rulemaking to follow three basic steps: (1) publish public notice of the proposed action in the Federal Register,⁹⁵ (2) allow opportunity for public comment on the proposed action, and (3) respond to public comment before, or concurrently with, publication of the final agency action. In the proposed rule the agency must state the basis and purpose of the proposed action along with a description of the rule. The agencies must allow at least thirty days between publication of the proposed rule and final rule in order to give the public adequate time to comment on the action. The APA states that “the agency shall afford interested persons an opportunity to participate in the rule making through submission of written data, views, or arguments with or without opportunity to present the same orally in any manner.” Federal agencies have discretion to decide the forum for presentation of comments such as informal public hearings (with or without a stenographic transcript), conferences, consultation with industry committees, submission of written views, or any combination of these.

If an agency does not follow the APA requirements during a rulemaking, and the agency’s missteps are challenged in court, the court may throw out the rule or require the agency to reconsider it. For example, if EPA publishes a final rule but does not adequately address public comments on the proposed rule, the court may require EPA to reconsider the rule and republish a final rule that responds more fully to the comments.

The APA requires agencies to give adequate public notice, allow for public comments, and consider those comments when it takes regulatory action. Another important statute, FOIA, enacted in 1966, gives the public a right to access records in the possession of the federal government. This right applies to existing records only and does not require the federal government to create new records to comply with a request. FOIA also does not require agencies to collect information they do not have or to do research or analyze data in response to a request. FOIA has been interpreted to mean that information is presumed to be public unless an exemption applies. There are nine exemptions under FOIA.⁹⁶

⁹⁵ The Federal Register is a daily publication printed by the Government Printing Office (GPO). It is available online at GPO’s website and in print. All agency actions, proposed and final, requiring notice to the public are printed in the Federal Register.

⁹⁶ The government is not required to disclose:

- (1) Information properly classified as a secret in the interest of national defense or foreign policy;
- (2) Certain records related solely to an agency’s internal rules and practices;
- (3) Personal information that would also fall under other applicable public access laws such as tax returns;
- (4) Proprietary information and any other information which may harm the competitive standing of a business;
- (5) Information that would allow insight into the agency’s deliberative process, material that could be construed as attorney-client privilege or attorney work-product, and material that documents inter-agency or intra-agency communications;
- (6) Records which are personnel-related and medical and similar files the disclosure of which would constitute a clearly unwarranted invasion of personal privacy;

FOIA requires the federal government to disclose even exempted documents containing the above information if the exempted data can be redacted. This provision of FOIA is intended to prevent the government from withholding disclosure because a few lines or words in a document are exempted from disclosure.

7.1. Transparency Requirements of the Clean Air Act.

As discussed above nearly all EPA rulemakings under the CAA are informal rulemakings. The process begins with a proposed rule in which EPA explains the proposed a regulation and solicits comments on it. Along with the proposed regulation, a proposed rule must also include the agency's basis for authority to promulgate the rule and its justification for the type of rule it chose to promulgate. For example, in a 100-page rule, the agency would typically use about 10-15 pages to explain the statutory language that authorizes the rulemaking or the court decision that requires the agency action.

Proposed rules are published in the Federal Register and are typically followed by a 60-day comment period. During this time EPA may hold public hearings and invite affected industries and the general public to speak in support of or in opposition to the proposed action. Comments may also be submitted in writing to EPA at any time during the comment period. The agency collects any comments received at hearings or in writing and compiles the documents in a "docket." The docket for a particular proposed rule is a list of all of the supporting documents associated with a rule. It includes technical support documents generated by EPA's staff or consultants. An example of a technical support document would be a report containing emission data that EPA relied on to set an emission limit in a proposed rule. Another example would be an assessment of the availability of pollution control technology that supports an emission standard or standards imposed by the rule. The docket also includes policy analysis by EPA staff and advisory committees (discussed below) as well as public comments supporting or opposing the proposed rule. The docket is available online at EPA's website for the general public to view and comment on. However, there is an exception for comments that contain confidential business information, which can be redacted in the documents available for public viewing. Once the comment period expires, EPA must then consider and respond to all comments it has received. For a large rule, this process can take 3-6 months. Typically, the agency responds to comments in the preamble, or introduction, to the final rule. The last step in promulgating a regulation is publication of the final rule in the Federal Register.

EPA also provides opportunities for public input in its advisory committees: the Clean Air Scientific Advisory Committee (CASAC) and the Clean Air Act Advisory Committee (CAAAC). Congress established CASAC in the 1977 CAA Amendments. CASAC provides independent advice to the EPA Administrator on the technical bases for EPA's national ambient air quality standards. CASAC also addresses research related to air quality, sources of air pollution, and the strategies to attain and maintain air quality standards and to prevent significant

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- (7) Information compiled for law enforcement purposes;
 - (8) Documents which are related to specified reports prepared by, on behalf of, or for the use of agencies which regulate financial institutions; and
 - (9) Geological and geophysical information and data, including maps, concerning oil wells.

deterioration of air quality. The EPA Administrator appoints CASAC members, but EPA solicits nominations from the public. CASAC holds public meetings and teleconferences during which members of the public may comment on committee recommendations. Meeting minutes, materials prepared for committee deliberation, and information about committee activities are available for public review upon request.

CAAAC is a senior-level policy committee established by the CAA Amendments of 1990 to advise EPA on issues related to implementing the CAA. Members of CAAAC are appointed by EPA and include approximately 50 people representing state and local government, environmental and public interest organizations, academic institutions, unions, trade associations, utilities, industry, and other experts. CAAAC meets four times a year in Washington, D.C. It provides advice and counsel to EPA on a variety of important air quality policy issues. The committee has formed several subcommittees to provide more detailed discussion and advice on technical issues such as air quality management, economic incentives, mobile sources technical review, permits, new source review, and toxic substances.

8. CONCLUSIONS

8.1. Information Disclosure from Emitters

The extensive monitoring and reporting of emissions and other information disclosure from emitters required by the CAA has contributed greatly to the success of the law. The decision to make virtually all the information collected from emitters, or developed by the government, available to the public, was not without its detractors when first proposed in 1970. Nearly four decades of living with a “full disclosure statute” have convinced the U.S. government that openness has enhanced government environmental policy.

Emissions monitoring and reporting requirements also significantly enhance compliance and enforcement. An emitter that must monitor and report emissions is more likely to comply with emission standards or limits because if he does not, he knows that EPA has the data to bring an enforcement case against him. When EPA chooses to bring an enforcement action, it already has the data it needs to prove the violation, or it has the authority to collect the necessary data.

China has already experimented with TRI-like systems, such as the Greenwatch initiative in Jiangsu Province, and some cities are reporting daily, even hourly, emissions at the facility-level. These types of disclosure systems have proven effective in driving pollution reduction in country after country, and deserve further implementation in China.

Likewise, full disclosure of EIA reports is typical practice around the world, and China’s disclosure of an abridged EIA is the exception. Greater disclosure in this regard is a simple step that China can make that will improve the quality of EIA and help to drive better assessment of environmental impacts.

8.2. Transparency

EPA's transparent public rulemaking process encourages participation in policymaking by both industry and the general public. This process often works to forge compromises among competing interests and results in rules that most stakeholders can support. The US experience has been that compliance with regulations is higher when emitters feel they have had a say in the regulation they must comply with.

Perhaps more important, a transparent public rulemaking process provides a legitimate channel for public opinion to be expressed in a controlled process. This is far preferable to, and more constructive than, public demonstrations and protests. In the U.S., the availability of legitimate channels for discontent has contributed to the creation of organizations like the Environmental Defense Fund and Natural Resources Defense Council (NRDC) (and many smaller and more local organizations), which have given the public a greater sense of involvement in government policymaking and satisfaction with the outcomes.

CHAPTER THIRTEEN

ENFORCEMENT OF THE U.S. CLEAN AIR ACT

Richard Ayres

1. SUMMARY OF RECOMMENDATIONS

China's Air Pollution Law currently lacks strong enough mechanisms to guarantee information accuracy, deter environmental violations, and fully utilize the public to help supervise enterprises and local government implementation. Based on our review, we recommend several key proposals for the amendment to China's Air Pollution Law that we believe can help to solve one of China's most vexing challenges – the weak enforcement of its environmental laws and regulations:

- **Penalties for Falsifying Emissions Information.** The accuracy of emissions and monitoring information are the foundation of an effective air regulatory system. We recommend criminal penalties (including jail time and fines) for “responsible corporate officers” who file false emissions reports, omit or conceal facts, or fail to file reports.
- **Fines Per Day.** It is well known that fine levels in China are too low to deter enterprises from violating the air pollution law. Establishing fines that accrue per day of violation is a simple way to increase the deterrent value of fines and increase the incentive for enterprises to rapidly cure their violations.
- **Economic Benefit and Supplemental Environmental Projects.** Enterprises should not profit from their environmental violations, so fines should be set to remove any economic gains that enterprises obtain from their violations of the law. Supplemental Environmental Projects, which are projects violators must implement to make environmental improvements, are another mechanism for imposing consequences on violators that can also at the same time bring about environmental improvements.
- **Strengthen EPB Authority to Order Injunctive Relief ().** The authority of the environmental agency to order stoppage of illegal pollution or to take actions to comply with the law (backed by the availability of judicial enforcement) is a critical one in the U.S. Strengthening EPB authority in China to order injunctive relief and compliance with the law is critical. Authority to appeal to the provincial level courts or to higher levels of EPBs, for example, may help to address this EPB authority problem. Certain enforcement powers, such as the ability to halt operations of enterprises in serious and continual violation of laws, should be shifted from the government at large to the environmental protection bureaus.
- **Citizen Suits.** Citizen lawsuits to enforce environmental laws can be structured to work well with government enforcement actions and to minimize frivolous lawsuits. These can be a powerful tool for pushing government offices and enterprises to follow the law.

- **Integrate energy and environmental rules.** By coordinating energy and environmental regulations, the environmental agencies can leverage the resources and authority of energy regulators to enhance enforcement. This is illustrated well by the case of China's State Electricity Regulatory Commission using CEMS emissions data to administer a price premium for plants operating with FGD equipment. For more detail on this, refer to Chapter Ten.

2. INTRODUCTION

It is often said in China that “there are many environmental laws, but enforcement is poor.” The U.S. has faced similar challenges. Prior to the 1970s, U.S. federal air pollution laws were largely lacking in effective enforcement mechanisms and the impact of these laws on air pollution reduction was minimal. It was not until the 1970 Clean Air Act Amendments that a stronger enforcement system involving more effective tools for government agencies and the public was put in place. This system has been amended over the years generally to strengthen the law and address enforcement deficiencies.

In China, the amendment of the Water Pollution Prevention and Control Law made incremental improvements in the enforcement provisions, most notably increasing many of the fine caps, establishing personal liability for enterprise leaders in the event of accidents, and a variety of other improvements. However, the amendments did not fundamentally resolve the problem of penalties for violations of environmental laws and regulations being too low to deter bad behavior. Rational economic actors will still choose to pay for violations rather than comply with the law. Moreover, enforcement capacity in China still remains too low, with insufficient “troops” and financial resources for environmental enforcement, and insufficient utilization of public supervision. The failure to bring greater public supervision into play represents a tremendous leaving of “money on the table,” an untapped resource of epic proportions that can help to drive better environmental enforcement in China.

The amendment of the Air Pollution Law offers a once-in-a-decade opportunity to truly make an impact on improvement of environmental enforcement in China. We make four very concrete, straightforward proposals that we believe would dramatically improve environmental enforcement in China. We recognize the imperative in China to maintain strong economic growth, and firmly believe the U.S. experience demonstrates that good, effective environmental enforcement can go hand-in-hand with strong economic growth. The following chart shows the economic growth in the U.S. over three decades even as pollution was drastically reduced.

Figure 1. Economic Growth and Energy Consumption in the US, 1970-2005⁹⁷

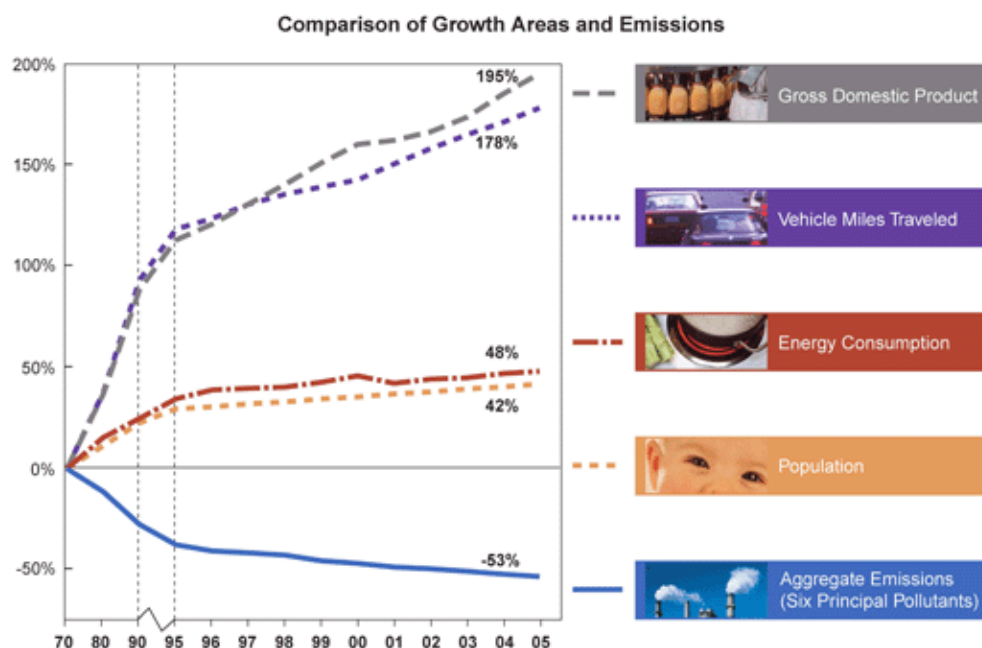
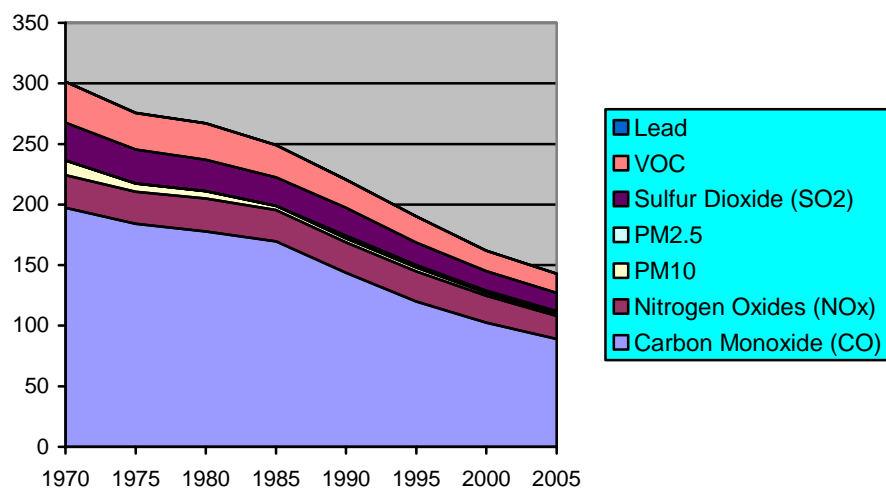


Figure 2. U.S. Air Pollutant Emissions Estimates, 1970-2005 (millions of tons per year)⁹⁸



This chapter summarizes key aspects of the enforcement system set forth in the U.S. Clean Air Act, including improvements made over the years to cure deficiencies in the system (such as expansion of criminal liability in the 1990 amendments to the Clean Air Act). The U.S.

⁹⁷ Source: <http://www.epa.gov/airtrends/econ-emissions.html>.

⁹⁸ Source: <http://www.epa.gov/airtrends/econ-emissions.html>. Fires and dust excluded.

experience offers important lessons for how China might solve this problem of “poor compliance with the law and insufficiently strong enforcement” (“□□□□□□□□”).

3. BACKGROUND

Until the 1970’s the primary legal controls on pollution in the U.S. were ancient common law doctrines such as nuisance, which could be enforced in state courts (and, on rare occasions, in the federal courts). These common law doctrines were developed as a means of compensating the victims of egregious pollution events rather than abating pollution to avert the harm from occurring. A plaintiff who brings a nuisance case must prove to the court that the conduct of the defendant caused the specific, identifiable damage to the plaintiff. For environmental harms, where typically many are harmed from the conduct of many others, such proof is extremely difficult. It is still possible to use nuisance and other such ancient common law doctrines in the U.S.,⁹⁹ though these doctrines are now seldom used. They are most likely to be used where a plaintiff seeks monetary compensation for harm, which is not available under the Clean Air Act.

Beginning with the 1970 Clean Air Act Amendments, a far more effective enforcement system has been created in the U.S. Today, most industrial enterprises are subject to state and federal rules that have precise numerical limits on emissions of pollutants from the enterprise. As discussed in Chapter Six, these emission limitations are incorporated into federally-approved and federally-enforceable state-issued permits. Violation of these permit conditions makes an enterprise subject to enforcement at both state and federal governments, as well as by individual citizens under the “citizen suit” provision of the CAA.

The CAA offers EPA a broad suite of remedies for illegal behavior (most states have similar provisions adopted as part of their SIP). Members of the public can also sue an enterprise in federal court to seek compliance with the requirements of a permit or the CAA. The public may also sue EPA if the agency fails to perform a non-discretionary duty required by the CAA.

These tools are discussed in more detail below. It should be noted that over the past four decades, the U.S. has learned an important lesson for effective enforcement. The CAA has evolved to give the federal government increasing authority over air pollution programs and over enforcement of those programs. In the early 1970’s, when EPA had just been established, states took most of the responsibility for enforcing CAA programs even though the CAA Amendments of 1970 gave broad new enforcement powers to the federal government. As EPA has grown and matured, it has become the primary enforcement agency against the largest industrial enterprises. As to these enterprises, who can threaten to leave a state that enforces vigorously, state environmental agencies often find effective enforcement difficult. The CAA continues to allow enforcement by both the federal government and states, and both levels are active enforcers.

⁹⁹ Nuisance cases are difficult, but not impossible. The State of North Carolina recently won a nuisance case against the Tennessee Valley Authority (TVA), which has 11 coal-fired power plants upwind of the State of North Carolina. The State offered extensive – and expensive – testimony by more than a dozen renowned expert witnesses to prove its case against TVA. One of the authors was counsel to the State of North Carolina in this case. A federal judge ruled that TVA must clean up the four of its large power plants closest to North Carolina.

4. FEDERAL ENFORCEMENT UNDER THE U.S. CLEAN AIR ACT

The CAA provides a broad variety of enforcement tools to the federal government to use against industrial polluters. EPA can assess a variety of fines or issue its own order to stop the pollution. The agency also has the option of suing the enterprise in federal or state court. The court can impose civil liability, which can include a court order (or “injunction”) that directs the enterprise to install pollution controls, change its practices, or even close down a factory or emitting unit. As part of a civil order, the court may order the enterprise to pay monetary penalties as well. The EPA may ask the U.S. Department of Justice to bring a criminal case against the enterprise. In cases where EPA determines there is an “imminent and substantial” endangerment to public health and welfare, the CAA authorizes EPA to issue an emergency order or to ask the court to issue an injunction for up to 60 days that can halt industrial activity in order to relieve the emergency. In addition to these general powers, the CAA provides special enforcement provisions for the cap and trade acid rain program (see Chapter Seven) and for the control program for motor vehicles and fuels (see Chapter Nine).

4.1. Industrial Sources of Pollution.

4.1.1. Investigatory Powers

As discussed in more detail in Chapter Twelve the U.S. CAA gives the federal government, and state governments in some circumstances, broad authority to require enterprises to monitor and report emissions. The EPA may require enterprises to:

- Establish and maintain records (including operating records for pollution control equipment, production, or any other indirect indicators of emissions, as well as direct monitoring of emissions);
- Provide EPA with reports of the recorded information;
- Install, maintain, and use emission monitoring equipment and use audit procedures or methods;
- Sample emissions at stated intervals, locations, or for certain periods;
- Submit compliance certifications, which if untrue can be the basis for criminal or civil prosecution;
- Provide any other information EPA deems “reasonably necessary.”

Besides using this information to enforce the law, EPA also uses it as an investigative tool – for example, to determine whether boiler manufacturers have supplied new boilers to utilities that should have applied for “New Source Review” permits requiring installation of modern pollution control equipment when a production unit is modified.

EPA also has the power to enter the property of any enterprise, or anyone EPA reasonably believes may have information relevant to enforcing the CAA. EPA may sample emissions, copy records, and inspect monitoring equipment or methods. Every Title V operating permit must include a provision specifically authorizing such entry and inspection. Any attempts by the enterprise to constrain or encumber EPA inspections may provide sufficient cause to enforce a civil penalty against the enterprise.

In addition to its general authority to require monitoring, reporting, and recordkeeping, EPA also is granted specific monitoring and reporting authorities to enforce New Source Performance Standards (see Chapter Eight), Hazardous Emission Standards, motor vehicle fuel and additive requirements, acid rain, as well as to enforce the requirements of SIP and New Source Review permits. If EPA finds that emissions monitoring is not being properly performed, the agency can require additional monitoring or different monitoring equipment or EPA can bring an enforcement action against the enterprise.

The CAA requires one person at each enterprise to be responsible for monitoring and reporting emissions to EPA. This person must sign emissions reports and swear to their accuracy. As discussed in Chapter Twelve, EPA can require enterprises to disclose any additional data that EPA may reasonably request. EPA may also enter an enterprise to inspect emissions monitoring equipment and measure emissions to verify the enterprise's emissions reports.

4.2. Enforcement Options

When the EPA concludes that an enterprise is in violation of the law, the CAA provides many options for enforcement, such as administrative compliance orders, civil actions in federal court, and criminal actions in federal court.

4.2.1. Administrative Compliance Order

EPA can issue an administrative order compelling the enterprise to come into compliance with the CAA whenever the agency finds that the person is violating, or has violated, any of the requirements applicable to industrial enterprises.¹⁰⁰ EPA often uses administrative compliance orders to save the time involved in filing and pursuing a case in federal court. Except for orders related to emissions of hazardous air pollutants, the order cannot become effective until the enterprise has had an opportunity to confer with EPA. EPA may assess an administrative penalty of up to \$37,500 per day of violation. The total fine is limited to not more than \$295,000, unless the EPA and U.S. Attorney General agree that a larger fine is reasonable. Failure to comply with an administrative order is a violation of the CAA and may subject an enterprise to additional civil penalties assessed by a court.

EPA must subtract from the assessed fee the amount of any expenditure made by the enterprise for the purpose of bringing the facility into compliance during the same quarter during which the

¹⁰⁰ These obligations include any requirement of a SIP, NSPS, a Hazardous Air Pollutant Standard, a New Source Review requirement, or any requirement of a Title V permit, or the acid rain program, or any requirement designed to protect the stratospheric ozone layer.

violation occurred. EPA may delegate this authority to the states, but may also resume its authority to assess a penalty if the state to which authority has been delegated fails to do so.

EPA may also issue an administrative compliance order to an enterprise when a state fails to require new or modified enterprises to install technologies required by law (BACT/LAER)¹⁰¹, obtain offsets, or meet the other requirements of New Source Review. The order may prohibit construction or operation of the enterprise. Typically such orders are issued when EPA disagrees with a state's implementation of the NSR program. For example, EPA may believe that the Best Available Control Technology (BACT) for a given facility will achieve greater emission reductions than the state has required, or whether sufficient offsets have been obtained, or whether a given exemption to the permit was lawful. EPA may also issue an order to prevent construction or modification if the enterprise fails to obtain a permit or violates the air quality planning requirements of the Prevention of Significant Deterioration program (see Chapter Four).

Even if it assesses an administrative compliance order, EPA may still separately bring a civil suit in court to assess and collect larger penalties and impose compliance conditions on the enterprise.

If EPA makes a finding that violations of permit requirements or the SIP are so common in a state that it can reasonably be inferred that the state is failing to enforce, EPA may assume federal enforcement of the entire program upon notice to the state.

Finally, EPA also has the authority to issue a “noncompliance penalty” if an enterprise is not in compliance with the requirements of the CAA. The purpose of the penalty is to recover the “economic advantage that might otherwise accrue to a source by reason of its failure to comply” with the law. Because assessing a noncompliance penalty requires a cumbersome administrative process, EPA does not often seek such penalties.

4.2.2. Civil Action in Federal Court

EPA can file a lawsuit in federal court seeking an injunction to stop the violation and/or seeking a civil penalty. A civil action is authorized against any enterprise who violates, or has violated, any requirement or prohibition of any SIP, permit, NSPS, Hazardous Air Pollutant standard, emergency EPA order, the acid rain program, or the stratospheric ozone program. EPA must give a 30 day notice to the enterprise. The case may only be brought in the federal district where the violation occurred or where the offender does business.

The court may issue an injunction ordering specific steps to be taken to comply, or even closing the enterprise down until it complies with the law. In addition, the court may assess a civil

¹⁰¹ Best Available Control Technology (BACT), required for new or modified sources in areas that are in attainment of ambient air quality standards. Lowest Achievable Emissions Rates (LAER), a more stringent level of control than BACT required for new or modified sources in nonattainment areas.

penalty of up to \$37,500 per day and/or a penalty to deprive the enterprise of the economic benefit of his non-compliance, which could be much larger.¹⁰²

Normally the Department of Justice (DOJ) represents EPA in civil litigation. DOJ is “the government’s law firm” which typically represents all Executive Branch agencies in civil and criminal litigation. A Presidential Executive Order requires that DOJ make a “reasonable effort” to settle a case before proceeding to trial. DOJ usually sends a letter to the alleged offender that details the alleged violations, proposes a penalty acceptable to the government, and suggests a place and time to meet to discuss settlement. If the enterprise fails to respond, DOJ proceeds directly to a trial.

If the enterprise chooses to seek settlement with the government, the DOJ calculates a minimum acceptable penalty that will recover the economic benefit the violator gained from noncompliance, plus an amount to account for the seriousness of the violation, plus an amount intended to deter other potential violators. Often the government’s initial proposed penalty is compromised because of legal or factual arguments the enterprise can make to justify its actions. When a settlement is reached, it is incorporated into a “consent decree” that is then proposed for approval by the court. Consent decrees usually specify exactly what the enterprise must do in order to remedy its noncompliance, state the penalties the enterprise will pay, and provide a timetable by which the remedial measures will be taken. If the penalty amount is large, DOJ may insist upon having the enterprise place the amount of the penalty in an escrow account, from which the government can withdraw the penalty over a specified time. Proposed consent decrees must be made available for comment to the public for at least 30 days before they can be made binding by the court.

The requirement that all major sources have a federally approved state “Title V” permit (see Chapter Six) provides a powerful enforcement tool. Prior to 1990, when permits were not required, enforcement litigation often foundered because it was unclear exactly what requirements the enterprise was supposed to comply with. Now that all such requirements are codified in a single document for each major emitting enterprise, the emitter can rarely avoid enforcement by claiming a lack of clarity in what the emitter was supposed to do to comply. “New Source Review” (see Chapter Five), which requires any new or modified major source of emissions to demonstrate that it will install Best Available Control Technology (BACT) or Lowest Achievable Emission Rate (LAER) technology has often provoked enforcement litigation. Typically the government takes the position that the emitters have made changes that constitute a “modification” triggering the BACT or LAER requirement, while the emitters claim that the changes they have made do not. EPA may also bring an enforcement action against an emitter that fails to meet any applicable emission limitations that are not included in the permit or specifically excluded from it.

¹⁰² U.S. courts have held that a new violation occurs for every day an enterprise is out of compliance, in the case of most stationary sources, or every excess pound of ozone-depleting substance (CFCs, HCFCs) emitted, in the case of the Stratospheric Ozone program.

4.2.3. Criminal Action in Federal Court

Before 1990 CAA criminal offenses were considered misdemeanors and could be punished by fines up to \$37,500 per day of violation. For the most part only knowing violations of SIPs, NSPS, and Hazardous Air Pollutant standards were punishable criminally. Knowingly making false statements in EPA-required reports, falsifying monitoring data, or tampering with monitoring equipment were also crimes. There were few prosecutions.

When Congress adopted the 1990 Clean Air Amendments, it expanded greatly the number and seriousness of crimes under the CAA. Now a knowing violation of almost any significant aspect of the CAA is a crime, and most are now considered felonies, punishable by up to five years in prison and/or criminal fines of up to \$250,000, or twice the gross monetary benefit of the crime, whichever is greater. EPA can request that the U.S. Attorney General commence a criminal action against the emitter by suing the company that owns the emitting facility, or an individual responsible employee.

DOJ can criminally sue the responsible employee if EPA has evidence that the employee did not accurately report emissions. Congress also made it a crime to omit or conceal facts, make any false statement in such a report, or fail to file reports required under the CAA. For the first time, “responsible corporate officers” were subject to criminal prosecution. Under the 1990 CAA Amendments, a company must name a particular corporate officer who must swear to the accuracy of all monitoring reports filed with EPA. Within corporations, these officers are often jokingly referred to by their fellow executives as the “designated felons,” because of their potential criminal liability if information provided EPA is false or misleading.

In 1990, Congress also added new criminal liability for those who endanger others by releasing hazardous (toxic) air pollutants into the ambient (outdoor) air. Any person who knowingly causes such a release that negligently places another person in “imminent danger of death or serious bodily injury” may be convicted of a felony that carries a sentence of up to 15 years in prison and/or a fine. If the release is attributed to an organization (such as a corporation), the organization is subject to a fine not to exceed \$1 million for each offense. If convicted a second time, the offender’s penalties are doubled. Criminal liability may be imposed for releases of toxic air pollutants that are not regulated by any CAA program, if they cause “imminent endangerment.” If the air pollutant released into the ambient air is in compliance with any emission standard or Title V permit, criminal liability may not be imposed.

The CAA also makes it a crime to release a Hazardous Air Pollutant or toxic substance under the Emergency Planning and Community Right-to-Know Act into the ambient air that “negligently places another person in imminent danger of death or serious bodily injury.” Negligently exposing another to harm is a misdemeanor, punishable by up to one year in prison and fines.

Criminal prosecutions rose substantially after the 1990 Clean Air Amendments were adopted, although they fell considerably in the 2001-2008 period under President Bush. EPA has increasingly targeted corporate officials for criminal liability when companies have failed to report, falsely reported, failed to obtain a Title V permit, or violated permit obligations or emission standards.

4.3. Acid Rain Cap & Trade Program

As discussed in Chapter Three, the Acid Rain program is a regional cap and trade program with its own compliance requirements. In “command and control” programs, each emitter must demonstrate compliance with a specified emission limitation for each pollutant. If the emitter fails, it is out of compliance and subject to enforcement. In the acid rain program, compliance is measured in a different way. Each year each emitter must surrender to the federal government a number of SO₂ “allowances” equal to its annual emissions. Although all the emitters covered by the program are subject to a single cap, each individual emitter may emit whatever amount it wants, so long as it obtains sufficient allowances. Each emitter receives a number of allowances each year, but if the emitter needs more, it must buy them in a national market. Thus each emitter has an incentive to reduce its emissions in order to avoid having to buy additional allowances.

Because compliance is defined in this different way in a cap and trade program, enforcement also differs. If an emitter fails, at the end of the year, to surrender sufficient allowances to match its emissions, the CAA provides for an excess emissions penalty of \$2,000 per ton of SO₂ emitted (adjusted for inflation-in 2008, the penalty was \$3,337 per ton) in excess of the quantity of its allowances for the following year. In addition, the emitter is also subject to an excess emissions offset, which requires that owner or operator of the plant must offset the excess emissions by reducing its emissions by an equal amount in the following year. In addition, the Administrator must deduct the same quantity of allowances from the emitter’s allowance allocation for the next calendar year. In effect, the emitter is forced to reduce SO₂ emissions in amount equal to its excess emissions during the prior year.

4.4. Motor vehicles

The CAA program to control emissions from motor vehicles and fuels has separate enforcement provisions, based on a system of certification for motor vehicles and motor vehicle engines. This system covers non-road engines and vehicles, as well as those intended for use on the road. Each year manufacturers and importers of motor vehicles and engines must go through an elaborate emission test program before they can obtain a certificate of conformity that allows the vehicle or engine to be sold into interstate commerce or imported into the U.S. Once engine and vehicle prototypes pass the emission test program, each motor vehicle and motor vehicle engine manufactured or sold in the U.S. or exported must have a certificate that shows compliance with all applicable requirements under the CAA.

If a manufacturer sells vehicles or engines into interstate or international commerce without the required certificate, it could face an EPA enforcement suit that could impose up to a \$37,500 fine per engine or vehicle, as well as an injunction against sale of the offending engines or vehicles. EPA may assess such a fine through an administrative order, but the total fine is limited to \$295,000, unless the Attorney General and the Administrator of EPA jointly determine that such large total amount is appropriate.

For larger violations, EPA will typically file a civil action in a federal district court in the district where the violation is alleged to have occurred or in which the defendant resides or does business

seeking an injunction against sale or shipment of the offending engines or vehicles, and assessment of a civil penalty of up to \$37,500 per day per engine or vehicle that does not have a valid certificate of conformity. In determining the appropriate civil penalty, the court must take into account the gravity of the violation, the economic benefit or savings to the vehicle or engine company from the violation and other factors.

4.4.1. An Enforcement Example: U.S. versus Diesel Engine Manufacturers

In 1998 EPA and the U.S. Department of Justice brought suit against the five major manufacturers of large diesel truck engines – Caterpillar, Cummins, Mack, Volvo, and International Harvester. According to EPA, these companies had installed “defeat devices” on their engines, computer-based machinery that adjusted the engine parameters to pass the EPA emissions test, but in real over-the-road use readjusted the parameters for maximum fuel economy and power, without regard to emissions. The companies vigorously denied this charge, arguing that EPA’s regulations and emissions test were both designed to limit emissions in urban operation of trucks. According to the companies, to install a device that would increase power and mileage in non-urban settings was entirely consistent with the EPA rules.¹⁰³

EPA took the position that the agency would not issue a certificate of conformity for any engines equipped with the capability to make such adjustments in the future, and that the certificates of conformity the manufacturers had for the current year were invalid. In effect, the government was threatening to halt further production and shipment of engines, and levy a fine of (at the time) \$27,500 per engine for the thousands of engines already built during that year – fines that would have amounted to hundreds of millions of dollars.

Because penalties and fines of such a magnitude would have put the companies out of business, they immediately began discussions with the government seeking a settlement of the case. More than a year later the case was settled. But in order to reach a settlement, the companies had to agree to pay steep fines (\$25 million for each of the largest companies) and support “supplementary environmental projects” that would reduce emissions from existing engines already on the road (an additional \$35 million for each of the largest companies). In addition, the companies agreed that they would meet new, far more stringent, emission limitations by 2006 on all their engines. EPA estimated that the companies would spend a total of more than \$1 billion dollars on developing commercializing such clean diesel engines, and that the settlement would result in reductions of 1.3 million tons of nitrogen oxides emissions annually.

4.5. Motor Vehicle Fuels

Motor vehicle fuel is also extensively regulated. The CAA requires manufacturers of fuel to register the fuel with EPA and to detail the composition of the fuel, including its vapor pressure, sulfur content, and lead content. Motor vehicle fuel cannot be manufactured or sold in the U.S. until it is registered. These provisions are enforceable by civil and criminal penalties. EPA may assess a fine of not more than \$37,500 per day of violation (not to exceed \$295,000) or may bring an action for an injunction in court to halt manufacture or sale of the fuel. The court may

¹⁰³ One of the authors represented one of the engine manufacturers in this litigation.

also assess a penalty, the amount of which is determined by considering: the gravity of the violation, the economic benefit or savings resulting from the violation, the size of the violator's business, the violator's history of compliance with the motor vehicle fuel regulations, action taken to remedy the violation, the effect of the penalty on the violator's ability to continue in business, and "such other matters as justice may require."

Violation of any of the following requirements may trigger an enforcement action:

- Fuel registration requirements
- Regulations concerning fuel additives
- Regulations concerning Reid Vapor Pressure requirements
- Requirements for the sale of new fuels and fuel additives
- Limits on the sulfur content of diesel fuel
- Requirements for reformulated gasoline
- Requirements for detergent content of gasoline (to prevent accumulation of deposits in engines)
- Requirements for oxygen content of gasoline in certain nonattainment areas for carbon monoxide
- Prohibition on leaded gasoline
- Requirements for renewable fuels

To help cover the cost of the motor vehicle enforcement program, the CAA allows the EPA to charge a fee to cover all reasonable costs associated with enforcement. Domestic and foreign manufactures may be required to pay a fee based on a formula determined by EPA, such as the number of vehicles or engines produced. The fee covers the cost to EPA of testing, certifying, and monitoring new and in-use vehicles and engines.

5. STATE ENFORCEMENT AUTHORITY

The CAA authorizes states to enforce any standard or limitation respecting emissions of air pollutants or any requirement respecting control or abatement of air pollution. State agencies are the primary enforcement authorities for much of the CAA. The federal government usually brings enforcement cases against large companies, but states perform a bulk of the enforcement work. States are responsible for enforcing the requirements of the SIP, which include all of the EPA-approved emission control measures to bring the state into attainment (or maintain attainment) with the National Ambient Air Quality Standards. States are also responsible for issuing acid rain, preconstruction, and operating permits for large industrial sources and for enforcing the permit requirements.

States cannot adopt or enforce standards or limits that are less stringent than standards or limits set by EPA for new stationary sources and sources of toxic air pollutants. However, states may adopt and enforce standards that are more stringent than EPA's standards under these programs. States with the largest sources of pollution often do not adopt such requirements because the largest sources of pollution tend to be large companies that make significant contributions to the state's economy and thus have significant influence on state government officials.

For motor vehicle emissions, states may not adopt more stringent emission standards unless California has done so. Other states may then adopt the California standard for motor vehicle emissions. Congress provided California with this special exception because of the state's extraordinary pollution problem, due in large part to the traffic in Los Angeles, and because California had already established a motor vehicle emissions control program before 1970, when the first federal emissions control program for vehicles was adopted. In each instance, however, EPA must grant a specific waiver for the proposed standards to allow California, and, in turn, other states, to adopt the standards. EPA has denied a California waiver request only once, for its AB 32 greenhouse gas emissions standards for new motor vehicles. But that decision was made under the Bush Administration and is now being reconsidered by the Obama Administration. Fifteen states are poised to adopt those standards once the waiver is granted.

6. CITIZEN SUITS

When the U.S. Congress considered strong national air pollution control legislation in 1970, Senators were frustrated that in pollution matters, the government often responded to pressure from large industrial interests by failing to enforce the law as intended. Senator Eagleton, a Democrat from Missouri and later candidate for Vice President of the United States, proposed the idea that Congress should empower ordinary citizens to enforce the law. Eagleton said he was tired of passing laws that were not implemented, and he felt that giving citizens the right to sue would assure that both government and regulated industries did what the law required.

The result was the “citizen suit” provision of the CAA, adopted in 1970, which allows an ordinary citizen to bring suit to abate pollution in a federal district court. It is important to know both what the citizen suit provision allows a citizen to do, and what it does not. Most important, it does not allow a citizen to bring suit seeking payment of monetary damages to the citizen from either the government or an emitter. The citizen suit provision is not a “class action” statute.¹⁰⁴ The case must be brought in a federal district court, located in the federal district in which the defendant resides or does business, or where the offense occurred. The court may require the defendant to pay the court costs of the plaintiff – that is, the costs of paying a lawyer, expert witnesses, etc.

The purpose of the citizen suit is not to compensate the victim. Rather the purposes are: (1) to assure that the government adopts the regulations and policies required by the CAA; and (2) to allow citizens to enforce the requirements of the CAA against companies or others that do not comply with the law.

6.1. Citizen Suits against the EPA

One type of citizen suit may be brought against the EPA Administrator for failing to perform an action “which is not discretionary.” This phrase both conveys and limits the jurisdiction of the

¹⁰⁴ Ancient state common law doctrines of “trespass” and “nuisance,” dating from the middle ages, allow a person who suffers damage as a result of pollution to sue the source of the pollution for compensation. The CAA does not outlaw such common law actions, but there is no such remedy in federal common law or the CAA.

courts in such cases. The CAA includes many “non-discretionary” duties for the Administrator. For example, it required that EPA shall adopt NAAQS within one year of the enactment of the 1970 CAA Amendments, and it requires EPA to adopt certain emission standards for motor vehicles. These duties are non-discretionary – that is, the law prohibits the Administrator from exercising his discretion to decide not to adopt NAAQS within one year after enactment. If the Administrator fails to carry out these duties, a citizen may bring suit asking the court to order the Administrator to carry out the non-discretionary duty. If EPA continues not to act, the Administrator may be held in contempt of court.

By contrast, the content of the NAAQS – how much pollution is allowed and over what period of time, how it is to be monitored and measured, etc. – are discretionary decisions. Under the CAA, it is up to the Administrator to determine, based on scientific and technical information, the appropriate standard level, time period for measurement, measurement techniques, etc. A citizen suit cannot be brought to question these discretionary judgments.¹⁰⁵ Thus the kinds of suits an ordinary citizen may bring against the EPA are carefully limited by the CAA.

Though some feared an avalanche of cases would be brought against the government, the actual number of citizen suits brought against the government has been small. One study found that only about 2,000 citizen suit cases had been brought against the government under the CAA, the Clean Water Act, and other environmental laws that provide for citizen suits, over the nearly four decades since these laws were passed. This reflects the cost and difficulty of litigation, and no doubt the fact that the plaintiff cannot obtain an award of damages. Most citizen suit litigation has been brought by environmental organizations, such as the Sierra Club, Earthjustice, and the Natural Resources Defense Council (NRDC), and by state governments.

Some of these cases have been momentous, however. For example, a citizen suit brought by the Sierra Club in 1973 obtained a court order that EPA must develop a program to protect against “significant deterioration” of air quality in the vast areas of the U.S. where air quality is better than required by the NAAQS. As a result of this case, EPA developed a whole new program, which was later codified in the amendments to the CAA passed in 1977. Successful citizen suit litigation by NRDC held that emitters could not comply with the CAA by dispersing pollution through tall smokestacks; that EPA must adopt regulations to eliminate lead from gasoline; that EPA must adopt emission limitations for off-road vehicles, and that the Bush Administration could not make illegal changes to a variety of clean air regulations.

6.2. Citizen Suits against Emitters

A citizen may also sue an enterprise for three general objectives: (1) to prevent construction of a new or modified facility without first obtaining a Title V permit (described in Chapter Six); (2) against an enterprise who is violating the terms of his Title V permit; and (3) against anyone who is alleged to have violated or to be in violation of an emission standard or limitation or an order issued by EPA or a state with respect to such standard or limitation. There are important

¹⁰⁵ It is possible for a citizen to question such discretionary policy decisions in court through a general doctrine that requires all administrative decisions to be made rationally, based on the record before the agency. But this doctrine of the Administrative Procedure Act (APA) is entirely separate from the CAA citizen suit provision, and citizen plaintiffs rarely succeed in challenging an administrator’s judgment through the APA

limitations on this right. A citizen may not sue separately if either the federal or state government is diligently pursuing an enforcement case for the same acts. The citizen must give notice to the EPA of its intent to sue at least 60 days before filing suit, in order to allow the government to bring its own enforcement action. Also, EPA may intervene in a citizen suit at any time after it has been filed.

In the 39 years since the citizen suit provision was added to the CAA, the number of citizen suits brought against enterprises has been quite small. From 1995 to 1998, for example, only 12 citizen suits were filed against enterprises, an average of three per year. But some have had important effects. In 1977, NRDC and other citizens sued the Tennessee Valley Authority (TVA) to abate excessive emissions of sulfur dioxide from its 12 coal-fired power generating units. At the time, TVA emitted 10 percent of the entire national total of sulfur dioxide. As a result of the litigation, TVA installed pollution controls to cut its emissions in half at a cost of more than \$1 billion (1980 dollars).¹⁰⁶ More recently, citizen suits brought by states and citizens have resulted in major reductions in emissions of sulfur dioxide and nitrogen oxides from electric generating facilities in the eastern half of the U.S.

The relatively small number of cases filed under the citizen suit provision is no doubt a result of how it was carefully designed by the Senators whose idea it was. They wanted to create a means for citizens to influence both the government and the enterprises to higher compliance with the law. They did not want to create a class action system that would lead to lawyers organizing spurious lawsuits demanding multi-million dollar settlements from industries. By limiting the courts to awarding only litigation costs, the Congress removed lawyers' incentive to stir up poorly-supported actions against legitimate business interests.

Despite the relatively small number, citizen suits have served several important functions in the U.S. system. Without question, they have been responsible for making sure the EPA performs the functions assigned to it in the CAA on the timetable required by the law. Often citizen suits have prevented the EPA from adopting policies that are in conflict with the CAA. Citizen suits have also affected compliance by enterprises. In some cases, such as the TVA case described above, citizens have obtained major reductions in pollution as a direct result of citizen suits. But more generally, the fact that citizens may sue, and have sued, to obtain compliance with the law has created a deterrent effect on the compliance behavior of many other companies.

¹⁰⁶ One of the authors represented NRDC in this litigation. An article on the website of the Ayres Law Group describes this litigation.

CHAPTER FOURTEEN

U.S. CLIMATE POLICY

Jessica Olson
Richard Ayres

1. SUMMARY OF FINDINGS AND RECOMMENDATIONS

China is well aware of and has publicly acknowledged the harm that it will suffer due to climate change impacts. While important actions have already been taken to mitigate emissions that lead to climate change, much more still needs to be done in China, the U.S. and the rest of the world. In order to drive the debate forward on how to tackle climate change and maintain sustainable development, we set forth the current thinking in the U.S. on steps to address climate change and greenhouse gas emissions, and set forth a series of recommendations for China as well:

- Based on economic theory, a cap on carbon emissions will increase fossil fuel-based energy prices and incentivize development of lower-carbon sources of energy. In the U.S., however, it has become clear that simply placing a price on carbon through a market-based, cap and trade program is only one part of a strategy to address global warming. “Command and control” and other kinds of regulations will be needed to reduce emissions from motor vehicles and to capture the energy efficiency opportunities available in buildings and industry.
- Cap and trade will most effectively reduce emissions of carbon dioxide and other greenhouse gases when regulated industries have low-carbon or no-carbon alternative means of producing their product and the resources to transform their production processes.
- Because no such technologies exist for conventional pulverized coal boilers, emission reductions must be achieved indirectly, through increasing energy efficiency. The government must become directly involved in mandating energy efficiency standards for buildings, motor vehicles, industrial processes, and consumer appliances.
- Because many of the same impediments exist in China, the experience of U.S. policymakers may be helpful as China considers a policy to address global warming.
- Effective climate regulation in China will require coordination among national agencies (e.g., between MEP and NDRC), just as it requires coordination in the U.S. between EPA, the Department of Energy, and the Department of Transportation.
- Substantial economic opportunity awaits those countries that develop and lead in technologies for carbon capture and sequestration, renewable energy, and energy efficiency. The bill now under consideration in the U.S. Senate would provide significant new funding to U.S. companies to help them with research, development, and deployment of such technologies.

In amending the air pollution law, China has a window of opportunity to establish a legal framework that can anticipate and establish a sound framework for addressing the factors listed above. To take advantage of this opportunity, the air law should explicitly seek to:

- Integrate climate change and air quality management;
- Enhance coordination between energy and environmental policy and regulation;
- Build capacity and firmly establish the Ministry of Environmental Protection's leadership role in monitoring, verification and reporting of greenhouse gases, especially CO₂; and
- Ensure that a cap and trade platform designed for SO₂ and/or NO_x trading is also compatible with CO₂.

2. INTRODUCTION

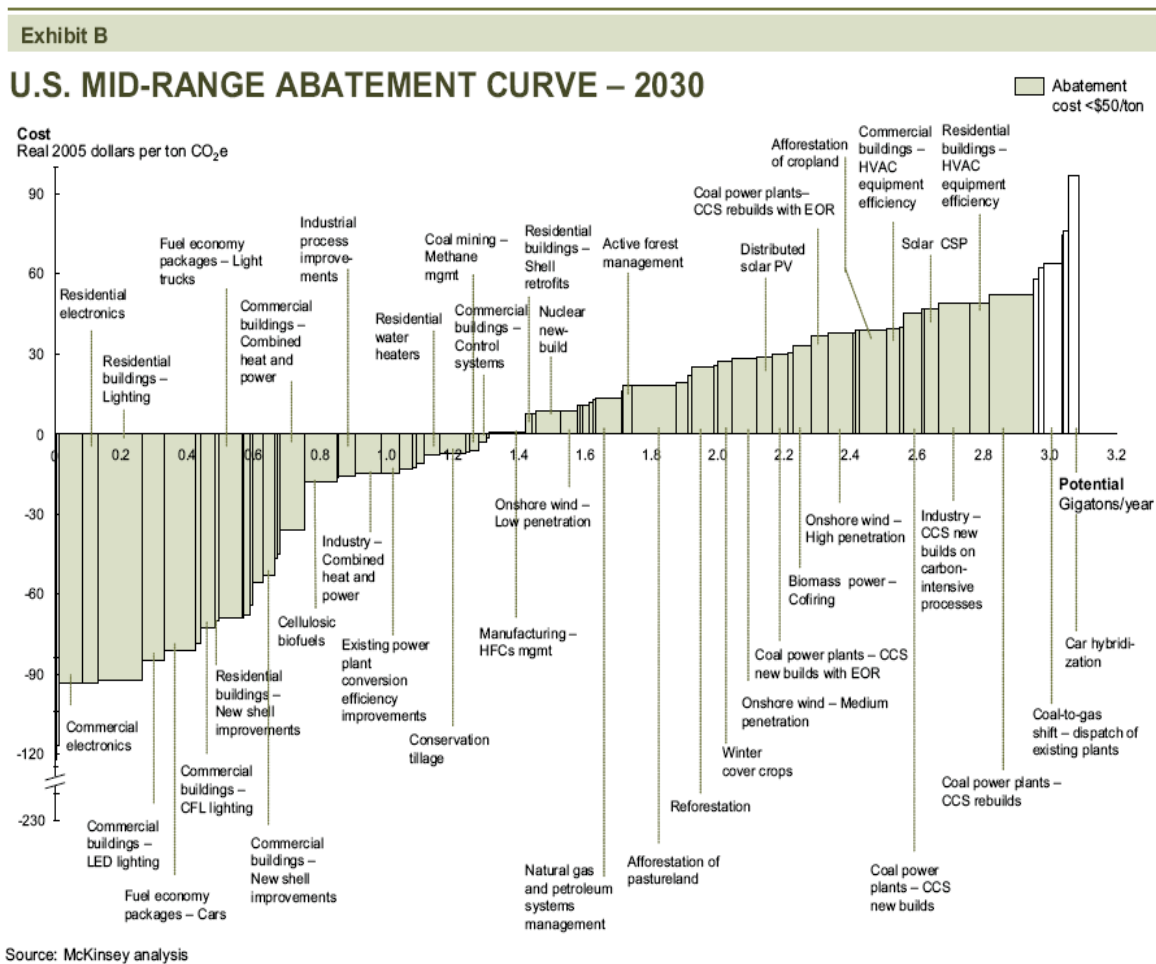
Climate change is an issue of utmost importance to China, the United States, and indeed the entire world. China and the U.S. are both actively considering important new policies and laws to tackle the problems posed by climate change. This chapter sets forth the current thinking in the U.S. on approaches to reducing greenhouse gas emissions, including state and regional initiatives, as well as current and proposed federal legislation.

Air pollution regulation has a direct impact on many of the largest sources of greenhouse gases, such as industrial and mobile sources. We therefore offer proposals we believe essential to maximizing the benefits of the air pollution law amendment to climate change mitigation. These include integration of energy and environmental protection functions and strengthening the role of the Ministry of Environmental Protection in monitoring, verifying and reporting greenhouse gas emissions.

3. DEVELOPING U.S. APPROACHES TO REDUCING GREENHOUSE GAS EMISSIONS

The developing greenhouse gas policies in the U.S at the federal and state level are based on a belief that if energy efficiency measures are exploited fully, the societal cost of developing and deploying alternative energy technologies and technologies to capture and sequester emissions from coal-fired units, can be largely offset by the societal savings from greater energy efficiency. Table 1, from a study by the internationally-respected management firm, McKinsey & Company, demonstrates the point.

Table 1. Greenhouse Gas Emission Reduction Measures by Cost



Though the U.S. has long been aware of the contributions of high levels of GHG emissions to global climate change, the political climate has forced delay of legislative and regulatory action for many years. With the election of President Obama, the U.S. is committed to taking action on climate. Over the past six months, U.S. policymakers have begun to seriously address climate change. Congress is working on an aggressive schedule to pass comprehensive climate and energy legislation before the end of 2009. At the same time, EPA has begun the regulatory process under the existing CAA to address GHG emissions from motor vehicles and other sources as directed by the Supreme Court in 2007. EPA's efforts to use the CAA in this way have persuaded many emitters to support legislation in Congress to mandate GHG emission reductions and preempt EPA's authority to regulate GHG emissions under the existing CAA.

While the federal government has been unwilling to act over the past eight years, several important climate initiatives have been taken by states or groups of states. Two are particularly significant: (1) the "Regional Greenhouse Gas Initiative" (RGGI) undertaken by ten states in the northeastern part of the U.S.; and (2) the greenhouse gas emission control program undertaken by the State of California under state greenhouse legislation called Assembly Bill 32 (AB 32).

The substantial amount of work and thought put into these initiatives have provided important insights for U.S. federal legislation that may be of considerable value to China.

The U.S. approach to climate policy is three-pronged. It consists of: (1) regulatory measures to reduce demand for electricity, reduce the carbon-intensity of electricity generation, and provide incentives for carbon capture and sequestration; (2) a law adopted in 2008 that will increase fuel efficiency standards for new motor vehicles; and, (3) proposed legislation to regulate GHG emissions from industrial emitters using a market-based cap and trade system. We discuss the first and third prongs in great detail because Congress is currently considering both approaches. The second – fuel efficiency standards for motor vehicles adopted in 2008 – is already going into effect at the federal level. EPA and the Department of Transportation have also begun the regulatory process to set GHG emission standards for motor vehicles.

4. FUNDAMENTAL POLICY CONSIDERATIONS

Reducing emissions of greenhouse gases from motor vehicles, increasing energy efficiency in buildings, and increasing the share of energy generated with renewable energy resources requires the use of direct regulation and government incentives, not only the market-based cap and trade approach so favored by market economists. There are two reasons for this in the U.S. First, demand for electricity is relatively inelastic to price – in other words, increases in price do not markedly alter demand. Second, U.S. power plants are dispatched according to their cost of generating electricity, which typically means that coal-fired plants are dispatched first. This contrasts with China, which has adopted and is now in the process of implementing dispatch of power plants according to environmental impact, thereby guaranteeing a market for low- and zero-carbon sources of electricity. Third, the U.S. economy contains numerous structural obstacles that often prevent the energy consumer from seeing the economic benefit of investments in energy efficiency technology. In all likelihood, many of the same structural problems exist in China as well.

4.1. U.S. Demand for Electricity is Inelastic

There is solid evidence extending over several decades that demand for electricity in our modern economy is relatively inelastic. Demand does respond somewhat to price, but the long-term reduction due to price increases is relatively small.¹⁰⁷ A 10% increase in power prices will, over 20 years, reduce demand by just 2.5% to 3%, which might offset the amount of load growth normally expected in less than 2 of those 20 years. It would take a much larger price increase to offset expected load growth, much less to produce reductions in demand that could permit absolute reductions in emissions from the nation's huge generation fleet.

¹⁰⁷ The long-term price-elasticity of demand is approximately -0.25 to -.32. The U.S. DOE's National Energy Modeling System (NEMS) has price elasticities built into it. Their long run elasticities (assuming price effects remain for 20 years) are -0.31 for residential electric use and -0.25 for commercial electric use. See http://www.eia.doe.gov/oiaf/issues/building_sector.html.

4.2. Cost-based Dispatch of Power Plants

One problem with cap-and-trade designs that rely on carbon prices to alter power sector emissions is that, as a practical matter, given the make-up of the U.S. generation fleet (mostly coal and natural gas), it takes a very high carbon price to materially alter the dispatch order for electric generating plants, and thus to alter emissions. While this fact can be demonstrated through complex power models, the reasons are logical and straightforward.

- On a daily and hourly basis, U.S. power plants are dispatched largely in the order of their *marginal operating costs*, or in competitive wholesale markets, their bid prices, which are logically based on those marginal costs. For practical purposes, the marginal operating cost is equal to the fuel cost or any other costs associated with generating an additional unit of electricity.
 - Because they do not burn fossil fuels, power plants with the lowest GHG emissions (such as hydro stations and wind farms) tend to have low marginal costs and so are dispatched whenever they are available. Nuclear units are also dispatched whenever they are available. Thus, the existence of high carbon prices does little to cause these units to run more often.
- Carbon prices will force modest improvements in the performance of fossil plants, and some efficient plants will displace less efficient plants in the dispatch order. However, these impacts are small in GHG terms. To greatly improve the emissions profile of the existing U.S. power fleet, it will be necessary for lower-emitting gas units to displace higher-emitting oil and coal units in the dispatch.
- Since carbon taxes and allowance auction prices affect all fossil-fired power plants to some degree, carbon prices drive up the cost of gas as well as coal, and it takes a relatively high price on carbon to cause the marginal price of coal generation to exceed the marginal price of gas generation.

4.3. Consumers' Inability to See Full Price Signal from Higher Energy Prices

The effect of increased energy prices on building energy efficiency is attenuated for a variety of reasons that have been explored at length in the energy efficiency literature.¹⁰⁸ Builders, who will not bear the lifetime energy costs of buildings, have little incentive to adopt energy efficiency measures that raise the purchase cost of a building to a buyer – whether an owner of an office building or a new house or apartment. Add to this the remarkable persistence of habit in the construction industry, and plain ignorance of the potential to reduce energy use, and you have a formidable set of obstacles to change, even though improving energy efficiency could save owners and tenants significant amounts of money.

¹⁰⁸ See, e.g., David B. Goldstein, *Saving Energy, Growing Jobs: How Environmental Protection Promotes Economic Growth, Profitability, Innovation, and Competition* (2007).

5. FEDERAL AND STATE INITIATIVES

In summary, increased energy prices alone are not enough to change how buildings are constructed, lighted, and heated. Over the past 30 years, California has demonstrated that it is possible to achieve impressive gains in energy efficiency through regulation, in the form of stricter building and appliance codes and standards, and policies that promote investments in energy efficiency. In 1970, Californians used about the same energy per capita as Americans in the other 49 states. As a result of the concerted efforts of state regulators to increase energy efficiency, Californians now use only two-thirds the electric energy used by other Americans.¹⁰⁹

5.1. Proposed Federal Legislation

The climate change and energy bill now being considered in the Senate, called the American Clean Energy and Security Act (ACES), includes a host of regulatory measures to improve energy efficiency. Some of these new measures would be paid for by the proceeds of the sale of emission allowances issued under the cap and trade program discussed below. The bill would set energy efficiency standards for outdoor lighting and portable light fixtures, and for water dispensers, hot food cabinets, and spas. These would complement energy efficiency standards already in place for dishwashers, air conditioners, heat pumps, refrigerators, and many other appliances. It would provide incentives to manufacturers and retailers who produce and sell appliances that exceed U.S. Department of Energy standards. By 2020, the bill would require electric generating companies to satisfy 20% of their energy demand through renewable energy and energy efficiency measures.

The bill would also require the Department of Energy to adopt a model national building energy code that would lead to the meeting of energy efficiency targets, based on the work of designated standard-setting organizations (ASHRAE and IECC). One-half of one percent of the allowances would be available to state and local governments that adopt building energy codes meeting or exceeding the national model code. Certain other funds are conditioned on the degree of their compliance with the national target. The bill also now authorizes federal enforcement of the national building code through civil penalties and injunctions. Other building energy provisions in the bill include incentives for retrofitting existing residential and commercial buildings, a rebate program to replace old inefficient manufactured homes, and a building energy performance rating and labeling program.

The bill would also require new electric generating units to be more efficient. The global warming bill includes three major new regulatory requirements for electric generating companies: increased energy efficiency, emission standards, and development of plans for plug-in hybrid electric vehicles.

¹⁰⁹ Steven Mufson, *In Energy Conservation, Calif. Sees Light*, Washington Post, Feb. 17, 2007, at A0 (<http://www.washingtonpost.com/wp-dyn/content/article/2007/02/16/AR2007021602274.html>)

The bill orders new coal-fired power plants to meet emission standards for CO₂ as follows:

- Plants permitted between 2009-2015: 1,100 pounds (0.500 metric tons) of CO₂ per megawatt-hour within four years of operation.
- Plants permitted between 2015-2019: 1,100 pounds of CO₂ per megawatt-hour.
- Plants permitted after 2020: 800 pounds (0.363 metric tons) of CO₂ per megawatt-hour.

The standard for 2009-2019 is equivalent to the emission rate of an average natural gas-fired power plant. It would effectively ban construction of new coal-fired power plants that do not have the ability to capture and sequester carbon emissions. A standard of 800 lbs/MWh would require even gas-fired plants to install carbon capture and sequestration technology.

These standards are intended to not only encourage alternative forms of electricity generation, but also to spur substantial investment in carbon capture and sequestration technology. To further encourage commercialization of carbon capture and sequestration, the bill includes a ten year carbon-intensity assessment program to provide \$1-1.1 billion annually for research, development, and demonstration of carbon capture and storage technology. Additionally, the bill would authorize a performance-based deployment program that would reward companies based on the volumes of carbon dioxide captured, with higher levels of compensation provided for early projects and higher capture rates.

The bill would also require that electric utilities devise a plan for constructing the infrastructure necessary for plug-in electric motor vehicles. The U.S Department of Energy would be directed to develop and implement plug-in hybrid vehicle programs in selected regions.

5.2. Regulation by Northeastern States

The Regional Greenhouse Gas Initiative (RGGI) is the cooperative endeavor of ten Northeastern U.S. states.¹¹⁰ RGGI has a goal of reducing greenhouse gas emissions from the electric power sector by 10% by December 31, 2018, relative to a baseline of emissions in the period of 2000 to 2004.

The RGGI program is built on the policy judgment that GHG emissions reductions will largely be achieved by measures that occur away from the smokestack, through energy demand reduction measures. Extensive modeling completed for RGGI determined that a doubling or trebling of existing state energy efficiency and renewable energy investment funds would be needed in order to predictably achieve the anticipated level of emissions reductions.

Thus the RGGI states decided that GHG allowances should *not* be distributed to emitters for free, as was previously done in the U.S. Acid Rain (SO₂) program, and the first phase of the European Union Emission Trading Scheme. Instead, the RGGI states agreed to auction most of the allowances to generate revenue for the states to invest energy efficiency and other carbon reducing options. The states independently decided to auction between 60-100% of their

¹¹⁰These ten states, which constitute approximately 20% of the U.S. GDP, are Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont.

allowances, and use an average of 74% of the revenue generated from the auction sales for energy efficiency and clean energy activities. The first auction, which occurred on September 29, 2008, involved six of the ten states and generated \$38.5 million dollars. More recently in March 2009, the third auction raised \$117 million dollars. Auctions now occur on a quarterly basis and, with the full participation of all ten states, are estimated to generate as much as a billion dollars per year. Because most of this revenue will be recycled into energy efficiency and clean energy, state investments in these program areas are expected to double. The majority of the CO₂ emission reductions from RGGI are expected to occur through these investments, rather than directly through the cap on emissions from the power sector or the effect of internalizing the cost of carbon in electricity prices.

5.3. California Regulation (Assembly Bill 32)

In 2006, California passed Assembly Bill 32 (AB 32), the Global Warming Solutions Act of 2006, which sets a greenhouse gas reduction target for the state of returning to 1990 level emissions by 2020. Returning to 1990 levels of greenhouse gas emissions in California (~427 million metric tons) is equivalent to a 15% reduction from 2008 levels or a decrease from 14 tons of annual greenhouse gas emissions per person to 10 tons of annual greenhouse gas emissions per person. AB 32 directs the California Air Resources Board (CARB) to develop “discrete early actions” to reduce greenhouse gas emissions and to prepare a scoping plan that identifies technologically feasible and cost-effective measures to reach the 2020 target. Discrete early actions are reduction measures that could be enforceable on or before January 1, 2010.¹¹¹ Other reduction measures identified by CARB are to become mandatory by 2012.

AB 32 also requires the following:

- Mandatory reporting and verification of greenhouse gas emissions from the largest industrial sources in order to track the progress of emission reduction efforts.
- Credit for early voluntary reductions (those made before 2012).
- Creation of an Environmental Justice Advisory Committee to help CARB implement AB 32 in a way that encourages public engagement and maximizes overall societal benefits.
- Creation of an Economic and Technology Advancement Advisory Committee to provide recommendations for technologies, research, and greenhouse gas emission reduction measures.

CARB approved a final scoping plan to implement AB 32 in December of 2008 after holding many public workshops and receiving comments from over 42,000 people. The plan includes reduction measures achieved by using regulation, market mechanisms, and voluntary actions.

6. FUEL EFFICIENCY STANDARDS FOR MOTOR VEHICLES

Motor vehicle GHG emissions can be effectively be addressed by raising fuel efficiency and by policy choices about whether to invest in mass transit or highways. In the U.S., investment in

¹¹¹ Thus far, CARB has identified nine discrete early actions including regulations affecting landfills, motor vehicle fuels, refrigerant in cars, tire pressure, and port operations.

highways rather than public transportation, subsidies to oil companies, and unchanging fuel economy standards have assured a continuing increase in national motor vehicle greenhouse gas emissions. In 2007 the U.S. Congress passed the Energy Independence and Security Act, which requires vehicle manufacturers to increase the average fuel economy of the combined fleet of all new passenger cars and light trucks sold in the U.S. to at least 35 miles per gallon by 2020. The increase must begin with 2011 model year automobiles. Thirty five miles per gallon represents a 31 percent increase above the 2007 new fleet average of 26.7 miles per gallon. The Department of Transportation (DOT) has already promulgated new standards for cars and trucks manufactured between 2011 and 2015.

EPA also recently announced that it plans to adopt greenhouse gas standards for motor vehicles. It is expected that these standards will follow the model of the standards adopted by California, effectively imposing the California vehicle greenhouse gas standards nationally. The standards will cover all greenhouse gases the motor vehicles are responsible for, including the HFC refrigerants used in motor vehicle air conditioning equipment.

The global warming bill currently under consideration in the U.S. Congress would further authorize the government to set vehicle performance standards for light-duty vehicles. It would encourage DOT, to the extent practicable, to set fuel economy standards that would achieve GHG emission standards set by EPA and the state of California.¹¹² The bill would also direct EPA to set GHG emission standards for heavy-duty vehicles, marine vessels, locomotives, and other vehicles.

7. CAP AND TRADE REGULATION OF CARBON EMISSIONS FROM INDUSTRIAL EMITTERS

Although nearly every human activity releases carbon dioxide, the bulk of U.S. greenhouse gas emissions flow from a relatively small number of activities. About 75 percent of the national total greenhouse gases are emitted from three categories of emitters: electric power production, transportation,¹¹³ and certain energy-intensive manufacturing industries. Thus it is possible to achieve very large reductions in total greenhouse gases through policies that affect only a few thousand industrial entities.

In the past most U.S. pollution control programs have been “command and control” systems. Typically, these involve EPA setting standards for emissions or discharges, often on an industry-by-industry basis. Over the last three decades, the U.S. has gradually added market-based, cap and trade programs to its command and control regulations. In the early 1980s Congress refused to consider a proposal to limit SO₂ emissions and allow for trading among major electric generators. In 1990, Congress adopted a market-based, cap and trade system for SO₂ emissions as a means to address the regional problem of acid rain.

¹¹² California has special permission under the CAA to set its own motor vehicle emissions standards. Other states may choose to adopt California’s standards or EPA’s standards.

¹¹³ Of course, emissions of greenhouse gases in the transportation sector come from millions of vehicles, under the control of millions of individuals and entities. But a relatively few entities make choices about the energy efficiency of vehicles driven by millions.

The Acid Rain program, also discussed in Chapter Three, places a statutory cap on the total national emissions of sulfur dioxide from electric generating facilities. The program also provides for trading of the rights to emit sulfur dioxide among electric generating companies. If an electric generating station has excess emissions (perhaps because it is producing more electricity than expected in a given year), it can purchase additional allowances from other electric generating companies who may have extra allowances, avoiding enforcement action while complying with the national emission limitation.

The Acid Rain Program has shown that a cap and trade program can be an economically efficient way to achieve significant emission reductions. The Acid Rain Program has reduced annual SO₂ emissions by 43 percent, from 15.7 million tons annually in 1990 to 8.9 million tons in 2007, at a cost per ton of pollution removed lower than that of any other U.S. air pollution regulatory program. A 2005 study estimated that the Acid Rain Program will result in public health and environmental benefits valued at \$122 billion annually by 2010 while its costs are estimated at \$3 billion annually (in 2000 dollars).¹¹⁴

The ACES bill currently being considered by the Senate would cap U.S. GHG emissions from power plants and most industrial facilities (but not from motor vehicles) at 2005 levels in 2012. The cap would be phased in over four years and would cover 69 percent of total 2005 U.S. emissions in 2012, increasing to 87 percent in 2016. The bill would require emissions reductions from the regulated emitters of 17 percent below 2005 levels by 2020, 42 percent by 2030, and 83 percent by 2050. The draft bill also includes complementary measures such as incentives to encourage energy efficiency, capture and sequester carbon, and reduce the carbon-intensity of electricity generation.

8. MAJOR ISSUES IN DESIGNING A CAP & TRADE SYSTEM TO CONTROL GREENHOUSE GAS EMISSIONS

Free market economists often suggest that a cap and trade program will provide the best of all possible worlds – higher levels of pollution control at lower cost, because of the inherent efficiency of the cap and trade system. The U.S. has had excellent experience with the cap and trade program adopted in 1990 to reduce emissions of SO₂. As we have indicated above, however, global warming is a much more complicated problem. Cap and trade is a powerful and useful tool for controlling pollution under certain circumstances, but where market impediments prevent the efficient operation of a market, government must use others of its tools to abate pollution.

In this section we will explore the kinds of policy issues that must be addressed for a cap and trade system to effectively reduce GHG emissions. Although we focus on the ACES bill, the issues discussed below are common to any cap and trade proposal.

¹¹⁴ Chestnut, L. G., and Mills, D. M. 2005. A fresh look at the benefits and costs of the U.S. Acid Rain Program. *Journal of Environmental Management*, 77(3): 252-256.

8.1. Reduction Targets & Baseline

As an initial matter, the policymaker must establish the environmental objective of the cap and trade system. This determines the emission reduction goal for the program. In the case of global warming, the objective of the pending bill in the U.S. Congress is to limit the increase in average global temperatures to no more than 2 degrees Celsius. To achieve this goal, the bill calls for deep cuts in U.S. global warming emissions from industrial sources by about 2050. President Obama has supported a similar proposal. While there seems to be general agreement on the range of an ultimate reduction target, there is still a heated debate among policymakers about how quickly reductions should be made in the early years. The current bill aims to achieve a 17 percent reduction in covered GHG emissions from 2005 levels by 2020 and an 83 percent reduction by 2050.

8.2. Scope of Regulation

A second important choice is who should be required to reduce emissions. On the one hand, a more all-inclusive system is more economically efficient. If more entities are covered there will be more opportunities to make relatively cheap reductions than would be available in a market with fewer covered entities. On the other hand, economic efficiency may be undermined by the administrative costs if too many small entities are regulated under the system. These competing values are usually compromised. For example, the bill considered by the U.S. Senate last summer and the current bill both address emissions from electricity generation and all the large industrial emitters, but not from motor vehicles. Because of the administrative difficulty of regulating millions of individual vehicles, they are controlled through federal fuel economy standards that apply to the vehicle manufacturers. The bills would require industrial enterprises that emit more than 25,000 tons of carbon dioxide-equivalent emissions per year to be covered under the cap.

8.3. Point of Regulation

Limitations on greenhouse gas emissions could be applied “upstream” to energy suppliers or “downstream” where a final product is produced or consumed. Cap and trade systems are typically applied upstream, in order to minimize the number of entities regulated and ease the administrative burden. For example, the acid rain cap and trade program requires generators of electricity to have allowances equal to their sulfur dioxide emissions. The ACES bill under consideration in Congress would require electricity generators, energy-intensive manufacturing facilities, petroleum refineries, and chemical manufacturing facilities to hold emission allowances for every ton of CO₂ that they emit.

Upstream regulation removes the compliance burden from consumers of fossil fuel-intensive goods and electricity. But it does not remove the cost burden since covered entities will pass the cost of allowances through to consumers in the form of higher prices for goods. One way to address price increases is to distribute some of the proceeds from the sale of allowances to consumers that experience the most dramatic increases, as discussed in the section on “use of proceeds” below.

8.4. Allocation of Allowances

In a cap and trade regime, emitters trade an artificial currency called “allowances” which are denominated in terms of tons of emissions. When it creates allowances the government captures economic value. Based on the prices emitters are paying for acid rain allowances, for example, the annual value of the allowances created in that program is several billion dollars. Economists estimate that a U.S. cap and trade system for greenhouse gas emissions would create between \$100 and \$500 billion annually in allowance value.¹¹⁵

With such large sums at stake, the allocation of allowances can have very large economic consequences. In the Acid Rain program, for example, Congress awarded all the allowances without charge to the electric utility industry in perpetuity – in effect transferring several billion dollars of economic value to the utility industry. On the other hand, there is economic theory behind the idea of auctioning the allowances so as to capture the value for the public treasury. During his campaign, President Obama supported auctioning 100 percent of the allowances. The bill now pending before Congress will initially distribute some allowances for free, but gradually will reduce free allocation in favor of auctioning the allowances. Over the lifetime of the program (2012-2050), about 20 percent of the allowances will be given free to emitters. The remainder will either be given to other entities such as states, which will sell them and use the proceeds to invest in energy efficiency measures, or be auctioned by the EPA.

8.5. Lifetime of Allowances

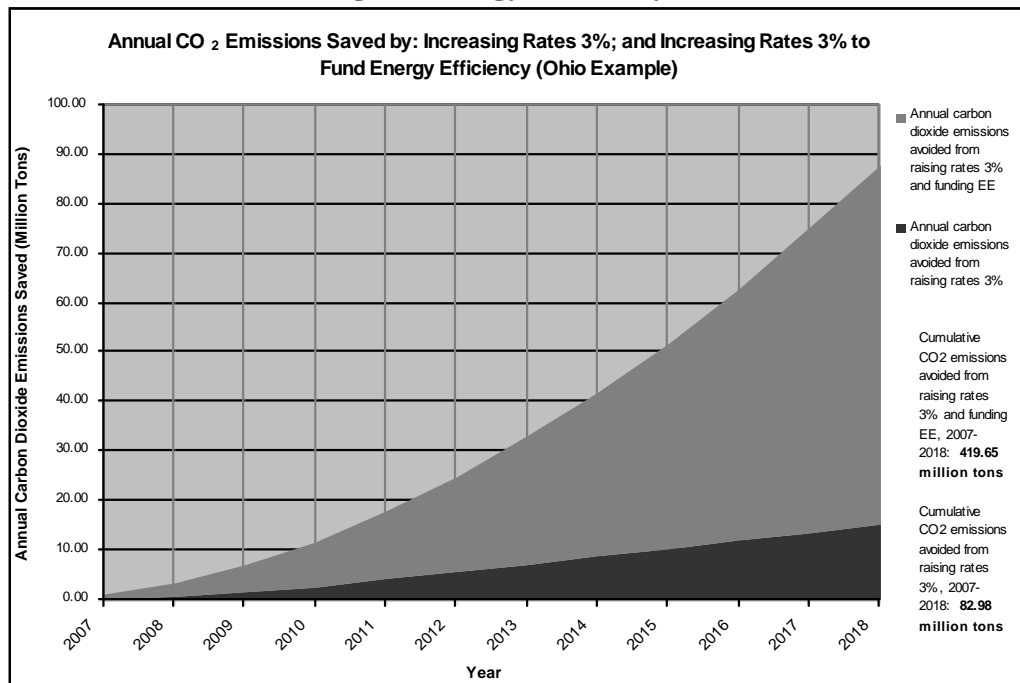
Once issued by the government or bought at auction, how long should allowances continue to confer the right to emit? If allowances have an unlimited life, it will facilitate a market. It allows emitters to bank allowances in years of low production to be used in later years of higher production, or sell allowances to others who expect to use them in future years. Under the current bill, allowances would have perpetual life until used.

8.6. Use of Proceeds from an Auction

As noted above, a great deal of analysis in the U.S. has shown that increasing the price of fossil fuel-based energy because of the additional cost of CO₂ allowances will have a relatively small effect on consumption of energy, particularly electricity. Analysis done for RGGI (see Table 2 below) showed that direct investments in energy efficiency measures will produce a far greater reduction in electricity demand than will the additional cost of electricity alone. In the RGGI program, the cap and trade program could easily be seen as primarily a mechanism to raise the funds needed to invest in energy efficiency.

¹¹⁵ S. Paltsev, J.M. Reilly, et. al., MIT Joint Program on the Science and Policy of Global Change, *Assessment of U.S. Cap-and-Trade Proposals*, http://web.mit.edu/globalchange/www/MITJPSPGC_Rpt146_Summary.pdf.

Table 2. Emission Reductions Achieved from Higher Electricity Costs Combined with Funding for Energy Efficiency Measures



This finding is contrary to EPA’s experience under the acid rain cap and trade program. This is because electric generating units currently have no direct means to reduce their GHG emissions – that is, control technologies, such as carbon capture and sequestration, that can remove GHGs from the combustion exhaust stream, have not yet been fully developed and commercialized. In contrast, under the Acid Rain program, allowances were distributed at no cost to generators. Generators then either retired the allowances as needed or sold them and used the proceeds to invest in control equipment that directly reduced sulfur oxides and oxides of nitrogen emissions at the smokestack. For CO₂, the most cost-effective means to reduce emissions today is indirectly, through investments in end-use energy efficiency and renewable energy. Proceeds from the RGGI auctions are therefore required to be directed to reducing energy consumption, and to constructing renewable generation that will reduce the output of fossil fueled power plants and increase operation of cleaner, less carbon-intensive generation.

The ACES bill would give away more than half the allowances at the beginning of the program to cushion the economic effect of cap and trade on electricity consumers, the poor, heavily affected areas of the country (i.e., those that rely more heavily on fossil fuels), and industries that are “trade intensive.” But these subsidies would gradually be eliminated. As described previously, the bill also includes massive new investments in energy efficiency and new regulations covering buildings and appliances designed to reduce energy demand. In addition, the bill would fund the development of new energy and other technologies that do not emit GHGs, including carbon capture and sequestration technology. Lastly, the bill would create a State Energy and Environment Deployment Fund. States would receive allowances to promote investments in energy efficiency and renewable energy production. The allocation begins with 10 percent in 2012, declines to 5 percent by 2022, and goes to states based on a formula taking

into account population and energy consumption. Funding would be distributed to a range of renewable and efficiency programs (including building code enforcement and building retrofits) which can substantially reduce consumer energy bills and the overall cost of meeting the emission reduction targets. Funds could also be used for transportation efficiency improvements. More funds would allow states to capture even more of the cost-effective energy efficiency potential, which would further lower the cost of capping carbon.

8.7. “Safety Valve” Proposals

The potential variation in allowance prices in response to market forces worries many people because it could send an inconsistent price signal on carbon. If prices are too high, they may impose an unreasonable burden on companies; if they are too low, they will be ineffective in encouraging companies to reduce their emissions and invest in low-carbon technologies. . Those who are troubled have proposed many variations on the notion that there should be a “safety valve” which prevents allowance prices from rising too high. Typically the “safety valve” idea involves setting a price at which the government will issue as many additional allowances, above and beyond the cap, as needed to satisfy demand. Emission reduction targets would also be suspended until allowance prices drop below the “safety valve” level.

These proposals represent a fundamental distrust of the market mechanism as a means to achieve the emissions reductions required under the cap. Rather than allow the market to find a clearing price for allowances, the advocates of a “safety valve” would limit the emissions reductions to those achievable for a specified price. In effect, proposals for a “safety valve” convert the cap into a tax, with a fixed price per ton. Where a cap provides certainty about emission reductions, but not cost, a “safety valve” or tax system provides certainty about cost, but not emission reductions.

8.8. Offsets

Covered entities that cannot cost-effectively reduce GHG emissions (e.g. coal-fired electric generating units) have proposed allowing the use of “offset credits” to supplant actual emission reductions at the covered unit. Each offset credit represents a certain amount of GHG emission reductions made elsewhere in the U.S. or the world. The Clean Development Mechanism under the Kyoto Protocol is an example of an offset program. Types of offset programs could include reforestation, landfill methane capture, and destruction of substances with a high global warming potential (e.g. chlorofluorocarbons or hydrochlorofluorocarbons).

In the U.S. entities that cannot (at least in the short run) reduce their emissions using available control technology, e.g. coal-fired electric generating units and energy-intensive manufacturing facilities, have asked Congress to allow generous amounts of offset credits to be used for compliance. This request has been granted in the bill, at least in the early years of the program while investments are being made in low-carbon generating technologies, and carbon capture and sequestration.

Offset credits can be an extremely cost-effective way for covered entities to meet their compliance obligation. Environmental NGOs and others, however, caution that credits should be awarded only for verified emissions reductions that are certified by a third party that meets certain accreditation standards. The bill addresses these concerns by requiring that offsets be discounted such that only one offset credit would be issued for every 1.25 tonnes of carbon dioxide-equivalent reduced.

Offset projects must be assigned a baseline, i.e., the total GHG emissions prior to the start of the project. GHG emission reductions are then measured against the baseline using a defined measurement protocol and verified by a third party. After the emission reductions have been verified the overseeing authority certifies the emission reductions by issuing offset credits that can be used to satisfy an entity's compliance obligation under the cap. Policymakers must decide the parameters of the offset system including:

- The types of projects that are eligible to generate offset credits (e.g. reforestation, methane capture);
- The quantity of offset credits allowed to be used in a given year;
- The methodologies for setting baselines and measuring emission reductions for each type of project;
- The requirements for verification and certification of emission reductions; and,
- Whether to apply a discount to the credits (e.g. one offset credit issued for every 1.25 tons of reductions).

9. CONCLUSION

The U.S. has begun to seriously consider climate policy options and what we offer in this paper is only an overview of the major policy considerations inherent in developing a regulatory regime for GHG emissions. Some of China's policies are more advanced than the U.S. in this area. For example, the U.S. has no comparable system to China's environmental dispatch system. Instead, electricity distribution in the U.S. is prioritized by cost and thus the cheapest electricity, currently generated by coal-fired units, is distributed first. The U.S. has so far not exploited the energy efficiency opportunities it has, either. China therefore has an important opportunity to become the world's first developing nation to enter the developed world relying on low-carbon technologies. It has the opportunity to create a huge new market for technologies that increase the energy efficiency of buildings, appliances and industry, generate electricity with little or no carbon emissions, sequester carbon, and significantly reduce GHG emissions from cars and trucks. Achieving such a low carbon development path could give China an important advantage in international trade in the 21st century.