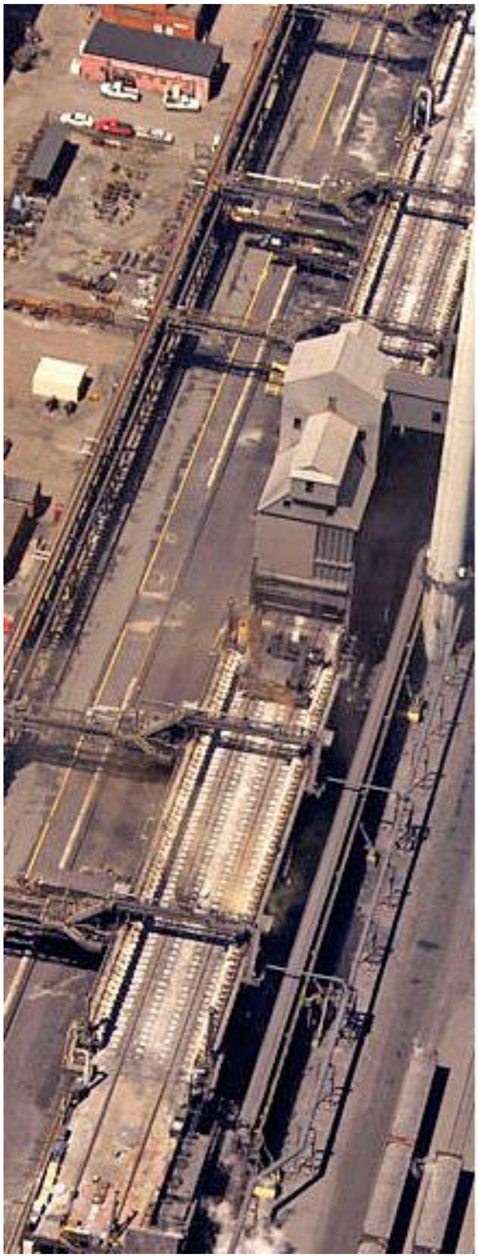

Moving Towards Multi-Air Pollutant Reduction Strategies in Major U.S. Industry Sectors

A Report to the U.S. Environmental Protection Agency from the Clean Air Act Advisory Committee (CAAAC)

Final Clean Air Act Advisory Committee (CAAAC) Report

November 17, 2011


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In this complex era of air pollution control, optimal clean air investments could benefit from a consideration of many air quality goals. Reductions in criteria air pollution emissions such as sulfur dioxide, nitrogen dioxide, or fine particulate matter might benefit from a consideration of reductions in air toxics emissions such as benzene. Furthermore, clean air investments may be optimized when they are implemented in a manner that enhances and supports energy efficiency.

To meet this challenge, the U.S. Environmental Protection Agency is developing approaches that consider more than one type of air pollution at a time. The purpose of pursuing sector-based multi-pollutant approaches is to achieve equal or better environmental and public health protection at lower overall cost across air pollutants. These "multi-pollutant" approaches have been recognized by the EPA as a key component of the next generation of clean air strategies. The EPA is pursuing these approaches in many priority sectors of the U.S. industrial economy. The potential benefits of these multi-pollutant sector-based approaches are accompanied by significant challenges.

The EPA's Clean Air Act Advisory Committee and its Subcommittee on Economic Incentives and Regulatory Innovation established a Work Group to assess the development of these approaches. This report presents a summary of the Work Group's discussions, a *Framework* for evaluating new approaches, and a set of recommendations for moving forward.

Conclusions

The Work Group identified several conclusions from its discussions.

First, the time is right to take a more rigorous look at opportunities to align and optimize across the various air regulations affecting individual sectors. The EPA has more than 20 years of experience with developing sector-specific air standards related to criteria and hazardous air pollutants and the EPA is now able to conduct more sophisticated assessments of multiple types of air emissions from a sector. Given the complexity of the current regulatory landscape and potential costs of achieving further reductions in air emissions within sectors, particularly as energy efficiency and greenhouse gas emissions reductions are considered, the time may be right to consider multi-pollutant approaches within sectors.

Second, multi-pollutant approaches promise benefits in many sectors, although the challenges to moving towards multi-pollutant approaches are real and will require effort by the EPA, industry, and other stakeholders to overcome. The primary benefits anticipated include equal or better environmental and public health outcomes at lower cost to business and government. Sector-based multi-pollutant approaches could also promise a simpler regulatory system that reduces redundancy across regulations in ways that make it easier for sources to manage compliance with applicable requirements. The challenges of moving to multi-pollutant approaches are real and take substantial time and work to navigate. Given that there is substantial familiarity with the current system, efforts must proceed carefully to develop and demonstrate the viability and benefits of new approaches.

Third, the availability and nature of opportunities to advance multi-pollutant approaches to air regulations will vary substantially across industrial sectors. While some learning can be transferred across sectors, progress and the possibility of success will require careful, sector-specific exploration and initiative.

Fourth, an incremental approach to exploring and implementing new sector-based, multi-pollutant approaches is underway and should continue within the confines of the existing Clean Air Act. The EPA has begun to explore and develop multi-pollutant approaches within several priority sectors. The following section summarizes the Work Group’s recommendations to the EPA for evolving and expanding these efforts.

Recommendations

The Work Group identified several recommendations for the EPA which they believe will enhance the effectiveness and value of sector-based, multi-pollutant efforts. The first two recommendations address approaches to improve the process of pursuing sector-based, multi-pollutant strategies. Recommendations 3 through 6 address specific opportunity areas which the Work Group believes are ripe for exploration. The final recommendation addresses opportunities to improve the implementation of existing regulation within the context of permitting and guidance. These recommendations are outlined below.

1. The EPA should expand efforts to advance multi-pollutant clean air approaches within sectors, when such approaches can be anticipated to provide the intended health, environment, and cost-reduction benefits despite the anticipated challenges. Each multi-pollutant sector-based effort should include consideration of criteria pollutant, hazardous pollutant, and greenhouse gas emissions. The EPA should
   a. Build on current efforts by the EPA's Office of Air Quality Planning and Standards to pursue sector-based, multi-pollutant opportunities within identified high-priority sectors.
   b. Periodically evaluate the EPA's sector-based, multi-pollutant regulatory efforts to identify lessons and make improvements.
   c. Develop, where appropriate, innovative policies and emission control strategies to advance these approaches.

2. The EPA should establish a clear and transparent process for considering and advancing multi-pollutant clean air approaches within sectors. The process should ensure that clean air regulations are developed in full consideration of the existing and pending regulatory requirements for that sector. The EPA should
   a. Consider the *Framework* in this report to identify and assess opportunities to advance multi-pollutant approaches within specific industry sectors. The *Framework* includes an assessment of a full range of parameters (e.g. public health, legal, environmental, economic, enforcement, feasability).
   b. Conduct periodic informal, multi-stakeholder, sector-focused roundtables to explore opportunities within individual sectors. Roundtables conducted independent of specific regulation developments may identify multi-pollutant opportunities more easily than forums focused on input to specific regulatory actions.
   c. Maintain a clear, publicly-accesible timeline or roadmap for each sector that clarifies the status of regulatory development within each major industrial sector.
   d. Seek public comment on multi-pollutant, sector-based approaches prior to, as well as during, regulatory development opportunities.

3. The EPA should expand engagement with community residents, grassroots organizations, and environmental justice (EJ) organizations, including those residents and organzations located in areas near industries that will be affected by the approach. The EPA should develop approaches that seek to reduce facility-specific, as well as cumulative risks and impacts. Input should be sought

for development of both national-scale sector-based regulations and local facility permits. The EPA should

a. Consider the implications of multi-pollutant, sector-based approaches in its *EJ 2014* initiative.
b. Develop model approaches, where appropriate, for implementing a community monitoring program in residential neighborhoods near facilities using a multi-pollutant approach. This monitoring program should address pollutants of concern to the community, should involve the community in the design and implementation of the monitoring strategy, and provide education on the science and the risks of health effects of air pollution. Fence-line monitoring could be incorporated into a community monitoring program.
c. Develop a model approach for conducting a cumulative impacts assessment in communities near facilities using a multi-pollutant approach. This assessment could identify potential pollutants of concern to the community that could be addressed by the nearby facility.
d. Document case studies of innovative approaches to community monitoring and efforts to address trade-offs and reduce multi-pollutant risks and impacts.
e. Conduct a roundtable discussion with community residents, grassroots organizations, and EJ organizations in order to obtain direct input from these stakeholders on the concept of multi-pollutant regulatory approaches.

4. The EPA should identify and quantify air pollution co-benefits and trade-offs associated with multi-pollutant regulatory approaches. The EPA should
    a. Develop strategies for expanding co-benefits and reducing or eliminating negative trade-offs associated with multi-pollutant approaches.
    b. Seek local community, state and tribal input into decisions regarding trade-offs and co-benefits.

5. The EPA should work with stakeholders to explore opportunities to simplify industrial source category definitions; these may advance multi-pollutant reduction strategies. The EPA should
    a. Identify specific areas or sectors where rethinking of source definitions may be particularly useful.
    b. Identify the technical, legal, and environmental implications of source category definitional change.

6. The EPA should explore, develop, and test integrated approaches to multi-pollutant monitoring, record keeping, and reporting that harness the capabilities of new monitoring and information technologies. The EPA should

a. Develop approaches that could enable facilities to adopt alternative monitoring approaches to address the needs of multiple regulations (including state regulations).
b. Explore the use of continuous emission monitors (CEMs) and other monitoring technologies that might enable simplified reporting of electronic data, uniform emission inventories, and facilitate simultaneous compliance with multiple regulatory requirements while also improving emission inventories.
c. Build in opportunities for course correction to accommodate innovative monitoring strategies that may not deliver anticipated performance or results, recognizing that implementation of innovative technologies or processes is a learning process.

7. The EPA should disseminate information about tools and resources available for basic implementation of industrial sector clean air regulatory programs at the federal, state, tribal, and local levels. The EPA should
    a. Expand awareness and diffusion of innovative permitting approaches that can address challenges within specific sectors.
    b. Consider the expanded use of plantwide applicability limits (PALs) and other flexible permitting approaches, which are currently available under the Clean Air Act, when they can improve environmental benefits and lower compliance costs.
    c. Ensure that implementation guidance is provided simultaneously with new rules.

Moving Towards Multi-Air Pollutant Reduction Strategies in Major U.S. Industry Sectors

A Report to the U.S. Environmental Protection Agency from the Clean Air Act Advisory Committee

I. Introduction

Since the passage by Congress of the Clean Air Act Amendments of 1990, the U.S. Environmental Protection Agency and the U.S. business community have invested significant resources in creating a world-class system of clean air protection. As a result, the air is cleaner and environmental risks have been greatly reduced.[1]

Driving this improvement in air pollution in the U.S. has been a comprehensive system of environmental regulation developed at the federal level and implemented through state and local action. The improvements to air quality in the U.S. have been the result of investments in new technology and new environmental management processes in every sector of the U.S. economy. Developing and complying with the requirements of the Clean Air Act is a complex undertaking for both the regulators and the regulated community alike.

The Clean Air Act outlines numerous programs of air pollution control that require numerous regulations. Title by title, the Act requires investments to reduce the health effects associated with criteria and air toxic emissions and improve the health of our environment by reducing acid rain, smog, and stratospheric ozone depletion. Every industrial sector of the U.S. economy is affected to some degree by these regulatory requirements. Most industrial sectors are subject to numerous Clean Air Act regulations simultaneously. For example, the chemical manufacturing industry is currently subject to 14 air toxics (Maximum Achievable Control Technology - MACT) standards and six criteria air pollutant (New Source Performance Standards - NSPS) standards among others. Some of these regulations reflect updates to existing requirements and others affect new sources and employ new methods of control. A single industrial process can

[1] See "The Benefits and Costs of the Clean Air Act of 1990 to 2020," U.S. Environmental Protection Agency, Office of Air and Radiation, March 2011 Summary Report for a discussion of the costs and benefits of the Clean Air Act (http://www.epa.gov/oar/sect812/prospective2.html), and "Our Nation's Air: Status and Trends," U.S. Environmental Protection Agency, Office of Air and Radiation, 2010, for a summary of air quality improvement (http://www.epa.gov/.airtrends/2010).

be subject to different regulations controlling different forms of air pollution and each of these rules is unique in some way. In some cases, separate rules may regulate the same emission point in a facility using different definitions, emission limits, and separate record keeping and overlapping reporting requirements. In addition, these regulations must be updated on a periodic basis to reflect improvements in air pollution control technology and resultant improvements to the air we breathe. For example, the Clean Air Act requires an update of the technology aspects of the air toxics (MACT) rules every eight years. Likewise, the new source performance standards (NSPS) rules controlling criteria pollutants for industry must also have a review of technology every eight years.

When these various regulatory programs and requirements are considered in the context of a specific industrial sector, the picture can be quite complex. Appendix B provides additional information on key federal air regulatory programs affecting industrial sources and Appendix C provides a detailed description of the federal air various regulation and requirements relevant to the cement manufacturing sector.

In this complex era of air pollution control, optimal clean air investments could benefit from a consideration of many air quality goals. Reductions in criteria air pollution emissions such as sulfur dioxide, nitrogen dioxide, or fine particulate matter might benefit from a consideration of reductions in air toxics emissions such as benzene. Furthermore, clean air investments may be optimized when they are implemented in a manner that enhances and supports energy efficiency, enabling a more efficient use of capital while addressing greenhouse gas (GHG) emissions.

To meet this challenge, the EPA is developing approaches that consider more than one type of air pollution at a time. The EPA has recognized these "multi-pollutant" approaches as an important component of the next generation of clean air strategies and is pursuing these approaches in many priority sectors of the U.S. industrial economy. The potential benefits of these multi-pollutant sector-based strategies are accompanied by significant challenges. This report presents a discussion of these benefits and challenges, a *Framework* for evaluating new multi-pollutant efforts, and a set of recommendations for moving forward.

The sector-based, multi-pollutant regulatory efforts addressed in this report should be considered in conjunction with on-going developments in multi-pollutant atmospheric chemistry and transport, exposure and deposition research, and human health and ecosystem assessments. These latter efforts seek scientific understanding of the interactions of multiple air pollutants and their cumulative risks to human health and the environment within an area.[2] It is also important to recognize that the sector-based,

[2] Many of these topics were the subject of discussion at EPA's "Multi-pollutant Science and Risk Analysis Workshop" held in February 2011 (see http://epamulti.icfi.com/Home.aspx). Also see EPA's "The Multi-pollutant Report: Technical Concepts & Examples," July 2008, (http://www.epa.gov/airtrends/specialstudies/20080702_multipoll.pdf).

multi-pollutant approaches discussed in this report encompass both the EPA's development of sector-based regulations and their implementation in the context of state, local, and tribal air programs and permitting.

II. Work Group Approach

To identify the challenges and opportunities that a multi-pollutant, sector-based approach offers, the EPA's Clean Air Act Advisory Committee (CAAAC) held an initial discussion in May 2010 and formed a Multi-Pollutant, Sector-Based Work Group ("Work Group") to provide advice on the regulatory and technological strategies to consider.

Early Work Group Discussions

At its May, 2010 meeting, the CAAAC's Subcommittee on Economic Incentives and Regulatory Innovation discussed the EPA's initial developments of sector-based approaches to air pollution control. Staff from the EPA's Office of Air Quality Planning and Standards' (OAQPS) Sector Policies and Programs Division (SPPD) addressed efforts to coordinate the development of air toxics (MACT) and new source performance standards in industrial sectors.[3] EPA staff then presented SPPD's multi-pollutant sector-based work for the petroleum refinery sector.[4] Based on interest resulting from these discussions, the CAAAC formed a multi-stakeholder Work Group with the purpose of providing the CAAAC with information, advice, and recommendations regarding the development and implementation of an air pollution stationary source multi-pollutant approach (see Appendix A for the Work Group charter and members).

The Work Group identified a number of questions worthy of exploring and a number of methods to assess these. Some of the questions highlighted for followup included

- How should stationary source air pollution regulation be better coordinated and what are the benefits and challenges of increased coordination?
- What are the regulatory and legal challenges to implementing sector-based, multi-pollutant approaches?
- How should the coordination of regulatory timelines and requirements begin within a sector?
- Which advanced technologies will assist in controlling multiple types of air pollution?
- What are the co-benefit, energy, and research implications of these technologies?

[3] U.S. EPA. "Sector-Based Multipollutant Approaches for Stationary Sources," presented to CAAAC Subcommittee Meeting, May 26, 2010.
[4] U.S. EPA. "Petroleum Refinery Sector Update," presented to CAAAC Subcommittee Meeting, May 26, 2010.

- What are the market-based mechanisms that the EPA should be investigating for sector-based approaches that would help the sector to be more efficient?
- How can the EPA better incentivize facilities to replace outdated or poorly performing equipment and improve energy efficiency while reducing malfunctions? How does a sector-based or multi-pollutant approach help?
- Are there financing and investment programs that can be used to help implement sector-based approaches and specific technologies?

In addition to these general issues, the Work Group considered a number of strategies that could facilitate the adaptation of multi-pollutant, sector-based approaches. During the October 2010 meeting, Work Group member Patrick Traylor presented a paper for discussion that highlighted a number of potential approaches and considerations for implementing source-wide multi-pollutant strategies.[5] These include

- Explore the challenges of reforming air pollution source category definitions from unit-by-unit to facility-wide definitions.
- Explore the challenges of developing emission standards for air toxics (National Emission Standards for Hazardous Air Pollutants – NESHAPs) and criteria air pollutant programs (NSPS, New Source Review - NSR) based on a common set of regulated air pollutants.
- Explore the challenges of coordinating the periodic revision of the National Ambient Air Quality Standards (NAAQS) with the required updates of NESHAPs and NSPS standards.
- Explore the challenges of using work practice standards in situations where quantifiable emission limitations and reductions are needed, such as the new source review program requirements.
- Explore the challenges of using plant-wide applicability limits (PALs), flexible permits, and other forms of averaging emission reductions within a facility's fence-line.

Sector-Based Roundtable Discussions

To further investigate the opportunities and challenges of moving towards a multi-pollutant system of air pollution regulation at stationary sources, the Work Group conducted sector-based roundtable discussions with the iron and steel industry on March 3, 2011, and with the chemical manufacturing industry on March 31, 2011.[6]

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[5] Patrick Traylor. *A Conceptual Framework for a Source-wide Multi-pollutant Strategy.* White paper prepared for the Economic Incentives and Regulatory Innovation Subcommittee of the Clean Air Act Advisory Committee, August 2010.

[6] Iron and Steel roundtable industry participants included the American Iron and Steel Institute, U.S. Steel, Arcelor Mittal, and Nucor. Chemical manufacturing roundtable industry participants included the American Chemistry Council, 3M, and Flint Hills Resources.

Each roundtable discussion included presentations from industry trade associations and representatives from individual companies and used a framework of topics to guide the discussion. Company presentations addressed advanced technology plans and possibilities; air pollution co-benefit assessments for their facilities; multi-pollutant regulatory strategies; and environmental and economic drivers and constraints. Each discussion highlighted the environmental, economic, and legal-regulatory implications of a sector-based approach for the companies. The results of these roundtable discussions are included in the Observations section of this report.

III. Background

Current air pollution control policies and practices have resulted in significant reductions of air pollutant emissions and their concentration in the atmosphere. To obtain these reductions, the EPA has developed a comprehensive system of regulations and guidance to implement the requirements of the Clean Air Act's Section 111 (new source performance standards), Section 112 (air toxics), Section 129 (solid waste combustion) and others.[7] Industrial sources now face the task of developing and installing equally comprehensive air pollution control and compliance systems. Future progress will likely benefit from increased coordination between these clean air programs. This necessity was recognized by the National Academy of Sciences' 2004 report recommending that the EPA take an integrated, multi-pollutant approach to air quality management.[8]

An Overview of the EPA's Multi-Pollutant, Sector-Based Approach

Over the past decade, the EPA has transitioned to a more integrated multi-pollutant approach called the "multi-pollutant, sector-based approach." By using a more holistic approach, the EPA hopes to achieve better environmental benefits in a more efficient manner. To maximize potential environmental benefits, this new regulatory framework challenges the EPA to develop strategies, policies, and regulations that consider the impacts of all air pollutants emitted from the source(s) or industrial sector in a coordinated manner. Specifically, by implementing this approach, the EPA expects to achieve the following results.

- Maximized co-benefits from air pollution control investments.
- Expanded integration of multi-pollutant reduction strategies, such as energy efficiency and pollution prevention considerations into air pollution control investments and management.
- Additional source-wide emission reductions beyond minimum statutory requirements.

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[7] See Appendix B for more details on Clean Air Act requirements.

[8] Committee on Air Quality Management in the United States, National Research Council. *Air Quality Management in the United States*, National Academies Press, Washington, DC. 2004.

- Accelerated development and use of innovative emission reduction technologies, measures, and strategies.

This transition has both recognized and driven improvements in multi-pollutant emission inventories, human and environmental health risk science, and air pollution control technology. The EPA's new analytic capacity includes developments in integrated emissions inventories, integrated air modeling and monitoring capacity, and advancements in multi-pollutant technology and cost assessment tools.[9]

For example, the *Industrial Sectors Integrated Solutions Model* (ISIS) was developed in 2008 and has been useful in developing integrated approaches. This dynamic model is designed to provide information on the optimal industry operation and emission reduction requirements, the suite of cost-effective controls needed to meet certain emission limits, engineering cost of controls, and the economic response of the industry to a proposed policy. The EPA has also been developing new software tools to help estimate the multiple emission reductions available from various emission reduction technologies. For example, the *Control Strategy Tool* (CoST) allows users to generate multi-pollutant emission inventories and reduction projections together with information about the cost of the technologies applied.[10] CoST facilitates a level of collaboration between control strategy development and emission inventory modeling that was not previously possible.

Using this new analytic capacity, the EPA's Office of Air Quality Planning and Standards (OAQPS), has worked with stakeholders to understand and establish priorities and develop regulatory strategies for industrial sectors. This grouping of rule-making activities by industrial sector resulted in a total of 70 sector groupings, 55 of which are covered by stationary source regulations. Using a number of factors (hazardous and criteria emissions, cancer and non-cancer toxicity of emissions, nonattainment area emissions and greenhouse gas (GHG) emissions), the EPA developed several different ranking exercises of these sectors. In general, 10 to 15 industrial sectors consistently showed up near the top of the rankings. These emission-based ranking exercises were then combined with other factors affecting each sector, such as the potential for future emissions reductions, potential for synergistic control of multiple pollutants, significance of MACT and NSPS regulations, legal considerations, and population exposure concerns to assess regulatory plans and resource needs. These prioritization exercises are taken into account, together with legal and court-ordered timetables, to determine the EPA's regulatory agenda for stationary sources of air pollution. Table 1 shows one of the resultant lists of priority sectors, based on emissions inventories available at the time. Readers should note that the absolute level of emissions from these industrial sectors has changed since the 2005 inventory used for this early sector prioritization exercise.

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[9] A review of these developments can be found in the 2008 EPA report: *The Multi-pollutant Report: Technical Concepts & Examples*, http:epa.gov/airtrends/specialstudies/20080702_multipoll.pdf.

[10] http://www.epa.gov/ttnecas1/cost.htm.

For example, emissions from the electric utility sector in 2010 were 5.1 million tons of SO_2 per year and 2.1 million tons of NO_x.[11] Additional information about the EPA's air pollution emission inventories, and the National Emission Inventory which is updated every three years, can be found at the EPA's clearinghouse for air emission information.[12]

Table 1. Summary of 2005 National Emission Inventory Emissions for Industrial Sectors (tons/year)[13]

	Criteria Pollutants				Hazardous Air Pollutants	
Industrial Sector	**$PM_{2.5}$**	**VOC**	**SO_2**	**NO_X**	**Metal**	**non-Metal**
Electric Utilities	530,847	46,885	10,350,289	3,783,214	1,655	401,210
Boilers & Process Heaters	107,204	29,890	1,043,454	697,049	1,031	80,005
Ferrous Metals	26,091	17,010	157,508	73,846	1,052	4,896
Pulp and Paper	55,497	139,926	372,534	252,987	56	71,612
Petroleum Refining	30,339	115,112	247,239	146,185	26	9,668
Cement Manufacturing	17,388	9,004	157,563	228,112	63	3,353
Clay Products	5,053	2,800	16,716	10,315	92	6,792
Non-Ferrous Metals	12,595	11,879	199,550	21,563	194	11,823
Chemical Manufacturing	49,743	236,014	191,775	192,764	46	48,635
Oil and Gas Production & Distribution	14,129	643,352	110,476	1,027,730	*	32,701
Waste Incineration	6,760	11,776	17,072	52,219	67	12,550
Metal Foundries	24,766	43,014	18,561	16,349	206	3,367

* No HAP metals are expected from oil and gas production. Trace amounts of metals can be emitted from internal combustion engines and boilers at oil and gas transmission sites.

To date, work on the rule prioritization, data integration, and tool development has led to the advance of more integrated approaches for industrial sectors. The EPA is taking advantage of the natural overlap of certain air toxics and criteria air pollutant rules and coordinating the development and implementation of MACT and NSPS where it makes sense. For example, the EPA's utility sector strategy will allow a coordinated approach to

[11] http://camddataandmaps.epa.gov/gdm/index.cfm?fuseaction=emissions.wizard

[12] http://www.epa.gov/ttn/chief/eiinformation.html

[13] Elineth Torres, U.S. EPA. *Integrated Multi-pollutant Sector-based Approach for the Cement Manufacturing Industry*. Working Paper, 2011. The table includes information on emissions of fine particulate matter with diameter of 2.5 micrometers or less ($PM_{2.5}$), volatile organic compounds (VOC), sulfur dioxide (SO_2), and nitrogen oxides (NO_x).

MACT, NSPS, and the Clean Air Transport Rule. With regard to refineries and chemical manufacturing facilities, OAR is developing more uniform equipment standards for common sources of industrial air pollution (e.g. storage vessels, equipment leaks). The recent cement sector rulemaking addressed conflicting and redundant requirements and set the same particulate matter requirement for both the NESHAP and the NSPS (see Appendix C).[14]

Many Types of Industry Sectors

The U.S. economy is comprised of, and the EPA develops regulations for, a number of types of sectors. **One type of sector** can be characterized by a single primary emission source. For example, the cement sector's main emission source for hazardous air pollutants (HAPs), criteria air pollutants (CAPs) and greenhouse (GHGs) is the cement kiln. While other emissions occur at a typical cement facility (i.e., mobile source emissions, emissions from the limestone quarry, and storage), the combustion and calcination processes in the kiln produce the primary source of multi-pollutant emissions. For this type of sector, a multi-pollutant approach could streamline emission source definitions, regulatory timelines as well as regulated pollutants based on the primary emission point identified. See Appendix C for a full discussion of the cement sector.

A **second type of sector** may take the form of a set of activities or emission sources involved in the production of a product or a group of products, where not all of the activities involved are necessarily co-located (i.e., located within a facility fence-line). The iron and steel sector is an example of a sector that integrates multiple processes to produce one product. This sector can be characterized as an integrated system of mainly three processes (i.e., coke ovens, integrated iron and steel facilities, and electric arc furnaces at mini-mills) that together make one product—steel.

A **third type of sector** can be characterized by the grouping of similar sources in facilities that are co-located. For example, refineries and chemical plants are complex facilities that contain hundreds of emission points of HAPs and CAPs. These emission points include combustion sources such as boilers and process heaters, flares, and miscellaneous catalyst activities that require catalyst regeneration via combustion (e.g., cracking units), as well as evaporative loss sources such as storage tanks, leaking equipment (e.g., heat exchangers, piping components), wastewater treatment units, miscellaneous atmospheric venting operations, and transfer and loading sources.

It is important that multi-pollutant approaches take this variety of sectors into account. Appendix D presents a more lengthy consideration of sector types by further describing

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[14] U.S.EPA. *National Emission Standards for Hazardous Air Pollutants from the Portland Cement Manufacturing Industry and Standards of Performance for Portland Cement Plants*; Final Rule. Federal Register, Vol. 75, No. 174, September 9, 2010. http://www.epa.gov/ttn/atw/pcem/fr09se10.pdf.

the iron and steel and chemical manufacturing industrial sectors and integrated approaches.

IV. A Framework for Considering Sector-based, Multi-pollutant Opportunities

The Work Group notes that the availability and nature of opportunities to advance multi-pollutant approaches to air regulations will vary substantially across industrial sectors. This section presents a *Framework*, including a set of questions, that the Work Group has developed that could be used to explore multi-pollutant opportunities within specific industry sectors. ***The purpose of pursuing sector-based multi-pollutant approaches is to achieve equal or better environmental and public health protection at lower overall cost across air pollutants.*** Costs include those incurred by regulated entities to control emissions and assure compliance with applicable requirements as well as those incurred by government agencies to develop, promulgate, implement, and enforce air requirements within sectors. To achieve this purpose, the Work Group identified two overarching questions that should be asked regarding specific industrial sectors (see Figure 1).

Overarching Questions (Figure 1)

- How might a sector-based, multi-pollutant strategy optimize the reduction of air pollution from the sector?
- What might optimization look like when considered in terms of emissions reduction, risk and impacts reduction, environmental justice, cost reduction, certainty, and operational and compliance flexibility?

To help address these overarching questions, the Work Group identified seven areas where there may be opportunities to achieve greater environmental and public health benefits at lower cost through enhanced coordination or alignment across multiple regulatory programs applicable to a particular sector. These potential opportunity areas are listed in Figure 2. The Work Group also noted that many of these opportunities are not limited to just the multi-pollutant *Framework*; the EPA should aim for improvement in these areas even outside of this *Framework*.

Multi-pollutant Opportunity Areas (Figure 2)

1. Timing and sequencing of regulations and requirements
2. Source definition and scope of applicable requirements
3. Monitoring and data
4. Reporting and record keeping
5. Emissions control technology and approaches
6. Energy use and efficiency improvement
7. Community-focused strategies

The Work Group identified questions (Figure 3) that could be asked within each of these seven areas to identify the relevant opportunities within a specific industry sector.

Multi-pollutant Opportunity Area Questions (Figure 3)

1. **Timing and sequencing of regulations and requirements**
   - How could the timing and sequencing of air pollution regulations (NSPS, NESHAPs, NAAQS, NSR, etc.) be better coordinated in the sector?
2. **Source definition and scope of applicable requirements**
   - What are the best ways to group emissions sources in the sector for the purpose of coordinated regulation and control?
   - Are there opportunities to reduce the number of regulated emissions sources at a facility by combining similar types of operations or units?
   - Are there significant sources of air pollutants in the sector that are not covered by the scope of current regulations?
3. **Monitoring and data**
   - Could emission monitoring technologies and policies facilitate multi-pollutant approaches?
   - Can fence-line or other community-based monitoring approaches be used to advance multi-pollutant strategies by enhancing understanding of actual ambient concentrations near a facility?
4. **Reporting and record keeping**
   - How could record keeping and reporting requirements be harmonized in a sector approach?
   - Are there opportunities to pursue record keeping and reporting approaches that satisfy a variety of pollutant-specific regulatory requirements?
5. **Emissions control technology and approaches**
   - Which advanced technologies (process and/or emissions control technologies) could assist in controlling multiple types of air pollution in the sector?
   - Are there co-benefits or trade-offs with regard to air emissions or multi-media environmental impacts (e.g., air, water, waste) that arise from pursuing one technology versus another?
   - Are there steps that can be taken to support more rapid technology adoption and replacement?
   - What role could work practice standards play in a multi-pollutant control strategy?
6. **Energy use and efficiency improvement**
   - What is the interaction between energy utilization and efficiency efforts and conventional air pollution control strategies?
   - Would different regulatory strategies help increase energy efficiency or reduce fuel consumption and achieve greater emissions reductions?
7. **Community-focused strategies**
   - How can multi-pollutant, sector-based strategies best support efforts to understand and address health risks and impacts to communities, especially vulnerable populations?
   - How can multi-pollutant approaches advance the consideration and reduction of cumulative health risks and impacts?
   - How can unintended consequences of integrated strategies be identified prior to implementation?
   - Should integrated, multi-pollutant approaches require unique community involvement and communication strategies?

For each potential opportunity identified using the questions above, it is important to consider the benefits and challenges that may be associated with each. The Work Group identified several categories of benefits and/or challenges that are useful to assess. In some cases, measures may be available to mitigate adverse effects of pursuing a particular multi-pollutant approach. The Work Group identified three main categories (and associated questions) of benefits and challenges that may arise when considering opportunities to advance a multi-pollutant approach. See Figure 4 for a list of the categories and questions.

Categories of Benefits/Challenges (Figure 4)

Public and Environmental Health

1. **Environment and public health impacts**
    - How will the multi-pollutant approach affect emissions across all categories of air pollution (e.g., criteria pollutants, hazardous air pollutants, GHG pollutants)?
    - How will the approach affect overall facility environmental performance, including in other media areas (e.g., water, waste)?
    - How will the approach affect the consideration and reduction of human and ecosystem health risks and impacts?
2. **Environmental justice**
    - How will the approach impact disproportionally affected or environmental justice (EJ) communities?
    - How transparent would the approach and its outcomes, when implemented, be to the interested public and local communities?
    - How can we involve local communities, grassroots organizations, and EJ organizations in decisions made regarding this approach?

Economics and Administrative Efficiency

3. **Economic impacts and operational efficiency**
    - How will the approach affect regulatory compliance and pollution control costs in the sector?
    - How will the approach affect economic performance and competitiveness?
    - How will the approach affect the adoption of new technologies?
4. **Regulatory efficiency**
    - How will the approach affect federal, state, tribal, and/or local government resources related to air program implementation?
5. **Ease of implementation**
    - How easy would the approach be to implement by regulated sources?
    - How easy would the approach be to implement, including inspection and enforcement, by federal, state, tribal, and local air agencies?

Consistency with the Clean Air Act (CAA)

6. **Legal feasibility**
    - Can the CAA be reasonably interpreted to accommodate the proposed approach?
    - What is the likelihood that the approach will face and pass legal challenge?
    - Are there legal mechanisms that can be used to prevent challenges, such as agreed orders or consent decrees?

V. Observations

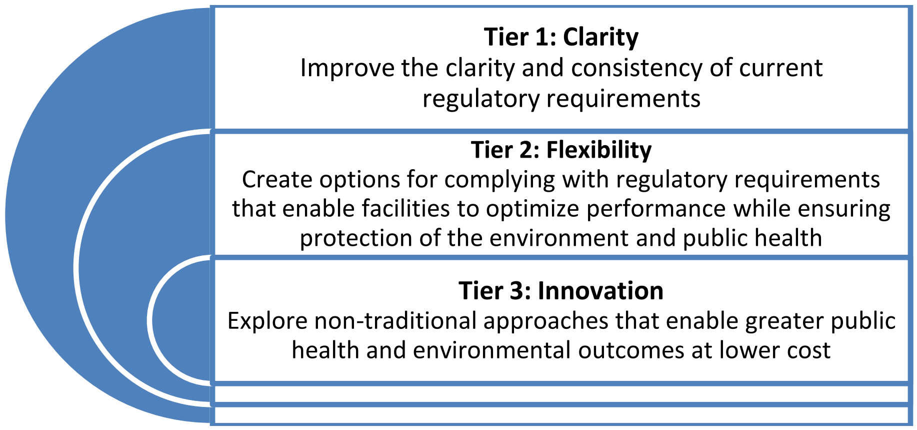
This section discusses opportunities to advance multi-pollutant approaches to address air emissions in industrial sectors. The section summarizes observations on how multi-pollutant approaches can fit within sector-based regulatory initiatives and then explores the seven multi-pollutant opportunity areas outlined in the *Framework*, drawing on observations and examples from the two sector roundtable discussions and other CAAAC Work Group discussions.

Discussions during the two industry roundtables revealed that substantial opportunities remain in some sectors to improve implementation of current regulatory approaches, such as the provision of timely and clean regulatory guidance and source permitting. For example, industry participants pointed to continued challenges with obtaining air permits in a timely manner. The Work Group noted that there are a variety of innovative air permitting approaches—which are available within the confines of the current Clean Air Act—that could likely be used more widely by sources and permitting authorities to address some of these needs and concerns.[15] Efforts to expand awareness of these approaches among permitting authorities and regulated sources, and to develop and test new approaches would likely reduce costs and improve regulatory compliance. There may also be options to consider appropriate strategies for tailoring these approaches for use in specific industry sectors. Many roundtable participants emphasized that it is important to pursue such opportunities in parallel with new efforts to advance innovative multi-pollutant approaches in specific industry sectors.

Several industry participants in the roundtable discussions cautioned that small steps to improve regulatory approaches within specific sectors may be most appropriate given the “relative comfort” most parties have with current approaches. Roundtable participants identified a tiered approach (Figure 5) that enables the EPA to advance toward expanded multi-pollutant approaches as trust among stakeholders grows.

[15] For example, EPA’s Clean Air Act Title V (permitting) White Papers 1 and 2 address a variety of approaches for streamlining and improving the design of permits (see Title V White Paper 1 (http://www.epa.gov/ttn/oarpg/t5/memoranda/fnlwtppr.pdf) and White Paper 2 (http://www.epa.gov/ttncaaa1/t5/memoranda/wtppr-2.pdf)). Plant-wide applicability limits (PALs), made available through EPA’s December 2002 New Source Review rulemaking, can give facilities the opportunity to make operational changes under a plant-wide emissions limit without triggering the applicability of NSR (see http://www.epa.gov/NSR/fr/20021231_80186.pdf). EPA’s September 2009 Flexible Air Permitting Rule clarified the use of additional approaches that can reduce permitting delays and improve the clarity and simplicity of air permits, such as alternative operating scenarios (AOS), advance approval of minor NSR, and approved replicable methodologies (ARMs) (see http://www.epa.gov/NSR/documents/FinalRule2009.pdf).

Figure 5: Tiered Approach to Sector-based Air Regulation



Multi-Pollutant Approach Opportunity Areas

The Work Group identified several environmental management opportunity areas worthy of consideration when developing integrated approaches to air pollution control. Activities in these areas may be closely related to each other. For example, consideration of the definition of air pollution "source category" may entail alternative record keeping and reporting procedures, or may involve innovative emission monitoring technologies. Opportunity areas considered below are

1. Timing and sequencing of regulations and requirements
2. Source definition and scope of applicable requirements
3. Monitoring and data
4. Reporting and record keeping
5. Emissions control technology and approaches
6. Energy use and efficiency improvements
7. Community-focused strategies

1. Timing and Sequencing of Regulations and Requirements

Each Clean Air Act regulatory program—such as NSPS, MACT, SIPs, and NAAQS—has its own timeframe for promulgation of, and revisions to, standards and requirements. For example, NSPS and MACT standards' technology review processes are on an eight year cycle. Efforts to coordinate or align the timing and sequencing of air regulations within a sector may enable optimization of investments in pollution controls and compliance systems, while using common monitoring, record keeping, and reporting approaches.

Potential benefits

- Coordination of regulatory timelines may lead to additional air pollution emission reductions ("co-benefits") that are not available when regulations are pursued independent of each other.
- Coordination of pollution control equipment requirements across regulations may prevent costly shifts in technology and provide longer time periods before new technology investments are required.
- Upfront consideration of potential co-benefit or trade-offs of pollutant emissions from different emission control strategies may result in approaches that best support public health improvements.
- Coordination of regulations and requirements may make it easier to identify common approaches to monitoring, record keeping, and reporting that reduce compliance burdens and costs.
- Coordination of timelines and requirements for multiple regulations at a time may increase efficiency of the permitting process.

Potential challenges

- Workload challenges at regulatory agencies may make it difficult for sector-focused teams to develop and release multiple regulations at the same time.
- Stakeholders may need more time, at least initially, to implement a multi-pollutant approach than what the current process allows.
- Some regulatory timeframes are set by statute or in response to legal actions, and regulatory agencies may have little flexibility to adjust timeframes.

Observations and examples

Work Group and roundtable discussions on timing and sequencing emphasized the importance of ensuring that implementation guidance and test methods are released in conjunction with new requirements, such as NSPS and MACT regulations. Industry participants observed that delay in issuing guidance and test methods imposes compliance risk burdens and uncertainty as well as costs to adjust compliance management systems.

A key driver for aligning the timing and coordination of regulations affecting a facility or emissions unit is to optimize the emissions reduction benefits—and associated public health and environmental benefits—that can be derived from facility investments in emissions controls and regulatory compliance. Participants voiced a strong desire to avoid situations where lack of timing or coordination among regulations targeting the same or related emissions units results in implementation of redundant or conflicting emission controls or other compliance management systems. Many participants expressed an interest to ensure that periodic industry investments in pollution controls (involving pollution control equipment and/or changes to production processes) leverage substantial public health and environmental benefits while enabling the efficient deployment of limited investment capital. Some participants suggested that, if properly aligned, the eight year cycle of NSPS and MACT review could fit well with business capital investment horizons.

One participant suggested that multi-pollutant limits and requirements should be determined through rulemaking processes, preferably by the time rules are promulgated or in a subsequent technology assessment process under notice and comment procedures. Multi-pollutant approaches developed during a rule's development may be easier to implement than approaches developed after rules have been in place. The goal of integrating rulemakings, from this Work Group member's perspective, is to set limits for each applicable regulation in order to assure compliance with all the rules affecting the source category.

In this context, participants discussed the value of aligning the timing of technology reviews and revisions to the NSPS and MACT standards which apply to similar types of processes or emissions units. Given that some industry sectors, such as chemical manufacturing, have numerous NSPS and MACT standards that may be applicable within the facility, participants discussed the complexity and workload challenges of aligning the timing of numerous standards. Participants suggested that it would likely be most feasible to align the timing of standards affecting similar process areas or emissions units within a facility, while also keeping an open eye to important coordination opportunities that may exist with other areas. For example, there may be situations where separate emissions units (with separate applicable requirements) may be able to use common pollution control equipment or compliance management systems. For example, Appendix E depicts the past and future regulatory landscape for the petroleum refinery sector including major air regulations as well as relevant milestones in the development of national ambient air quality standards.

Failure to align the timing of revisions of MACT and NSPS standards can result in situations where facilities are required to comply with older, outdated requirements in one standard that are, in effect, obsolete as a result of requirements in the newer revised standard. Aligning the timing of revisions could help to purge outdated requirements and simplify compliance obligations. A few participants suggested that the Obama Administration's January 18, 2011 Executive Order on *Improving Regulation and Regulatory Review* may provide an opening to identify areas where such alignment among sector-focused air regulations could be improved.[16] Several participants observed that it is also important to work with air permitting authorities to understand the importance of purging obsolete requirements from permits when they are issued or renewed. For example, representatives from iron and steel companies cited examples of facility air permits that included numerous obsolete and outdated requirements that can create confusion and uncertainty.

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16 http://www.whitehouse.gov/the-press-office/2011/01/18/improving-regulation-and-regulatory-review-executive-order.

Another area affecting timing is the periodic revisions to the NAAQS and resulting changes to source-specific requirements associated with State Implementation Plans (SIPs). Some participants observed that revisions to the NAAQS should inform a coordinated, periodic updating of the MACT and NSPS standards so that these three programs become mutually reinforcing. They noted that the timing of SIP revisions could be generally aligned with the roughly decadal review and revisions to MACT and NSPS standards.[17] Other participants noted that direct coordination and alignment with the NAAQS is difficult given the complexity of the SIP process that states use to translate national criteria pollutant standards into specific measures to control emissions within states. Participants observed that there are numerous factors that affect the timing of SIP development and the implementation of source-specific emissions controls that may be required by a SIP. While efforts to align the timing of NAAQS and SIP revisions may not be feasible, regulators could consider how current and anticipated changes to the NAAQS may affect emissions controls relevant to specific NESHAPs and MACT standards when revising these standards in order to optimize approaches.

Finally, participants observed that the New Source Review (NSR) program is another air regulatory program that can trigger new requirements, including pollution control technology review and adoption. Under NSR, however, the timing of requirements is driven on a case-by-case basis by facility construction or modifications. While BACT or LAER requirements triggered by NSR may be discordant with coordinated revisions to the MACT or NSPS standards, a few participants indicated that plant-wide applicability limits (PALs) may be appropriate for some sources to align pollution control technology reviews and upgrades. A few participants also suggested that future discussions could explore opportunities to develop "presumptive best available control technology (BACT) or lowest achievable emission rate (LAER)" determinations that might align with new NESHAP and/or NSPS standards for some period of time.

Strategies to consider

- Coordinate the timing of NSPS and NESHAP/MACT standards. Establish explicit work process steps to review previously issued regulations affecting emissions units and consider them when developing or revising air regulations, using a "checklist" of questions (similar to those presented in the *Framework* section) to guide consideration of alignment options.

[17] Section 109(d)(1) controls the NAAQS revision process. It reads: "[A]t five-year intervals thereafter, the Administrator shall complete a thorough review of the [Section 108 air quality criteria and the Section 109(a) NAAQS] and make such revisions in such criteria and standards and promulgate such new standards as may be appropriate . . . ." Bound up in the revision directive is one non-discretionary duty and one discretionary duty. The non-discretionary duty is for the Administrator to complete a thorough review of the criteria and NAAQS every five years. The discretionary duty is for the Administrator to revise the criteria and NAAQS as may be appropriate. That is to say, while the Administrator must review these standards with regularity, the timing of revisions are wholly within her judgment, subject only to judicial review under the arbitrary and capricious standard of review. (Traylor, August 2010, p. 22)

- Consider how anticipated revisions to the NAAQS may affect SIP requirements addressing emissions controls for the sector and take into account the timing of SIP updates with other source category regulatory developments.
- When promulgating new NSPS and NESHAP regulations, release implementation guidance and test methods simultaneously with the regulations to increase consistency and create certainty for industry and implementing air agencies.

2. Source Definition and Scope of Applicable Requirements

The scope of operations covered under the definition for an air pollution source or emission unit presents another opportunity to pursue multi-pollutant approaches. Aligning how sources are defined across regulatory programs affecting similar operations within a sector, such as the NESHAP and NSPS programs, may enhance the clarity and simplicity of regulatory approaches addressing multiple pollutants. Taking a more expansive view of how sources and emission units are defined may also facilitate innovative approaches to allow greater operational flexibility that translates into measurable reductions in emissions, risk, and impacts at lower cost. In some sectors, there may also be opportunities to adjust source definitions and the scope of requirements to address sources of air emissions that have not previously been regulated but that pose significant risk or impacts to the environment and public health.

Potential benefits

- Combining regulations that address similar operations can create a simpler regulatory system that reduces redundancy across regulations in ways that make it easier for sources to manage compliance with applicable requirements.
- Aligning the source definitions across various regulatory programs, such as NSPS and NESHAPs, may make it easier to coordinate or align specific emission control, monitoring, record keeping, testing, or reporting requirements.
- Expanding the definition of source or emission unit to cover previously unregulated sources of air emissions (which may exist in some sectors) can address substantial risks and impacts to public health and the environment.

Potential challenges

- If sources and emissions units are defined too expansively, it may be difficult for permitting authorities and regulated facilities to understand whether and how a regulation is applicable to a facility's operations.
- If sources and emissions units are defined too expansively, the unique nature of specific processes may not be taken into consideration and may result in unintended adverse consequences.
- Incorporating new, previously unregulated sources of air emissions into the definition of source and emission units covered under various regulatory programs may pose substantial costs or challenges for emission control and compliance.

Observations and examples

The extent and value of opportunities to adjust source definitions varies substantially across sectors. Participants suggested that it may be useful to combine similar regulations within specific regulatory programs (e.g., NESHAP, NSPS) in sectors or types of operations where numerous standards or regulations exist. For example, the chemical manufacturing sector has numerous NESHAP and NSPS standards that cover similar types of operations. Participants also indicated that there may be opportunities to reduce the number of regulations addressing storage tanks and process vessels and improve regulatory clarity by modifying source definitions.

When looking at potential adjustments to the source definition within one regulatory program, it is important to look for opportunities to align this source definition across regulatory programs (at least across the NSPS and NESHAP programs). This is already envisioned in the Clean Air Act. The NSPS source category definition provides an important cross-link to the NESHAPs program, because Section 112(c)(1) of the Clean Air Act provides that "[t]o the extent practicable, the categories and subcategories listed under this subsection [112(c)] shall be consistent with the list of source categories established pursuant to Section 7411 of this title and part C of this subchapter."

In the context of permitting individual sources within a sector, there may also be creative opportunities in the context of NSR to consider a more expansive, facility-wide definition of source for pollutants. The plant-wide applicability limit or PAL concept promulgated by the EPA in 2002 provides a useful example of how taking a facility-wide perspective on multiple types of air pollutant emissions can both enhance operational flexibility and create incentives for emission reductions.[18] It is important for such facility-wide approaches to consider local impacts related to the NAAQS and hazardous air pollutants to avoid issues such as "hot spots" that may pose unacceptable risks or impacts. Innovative permitting approaches have been developed and piloted, such as HAP screening protocols or fence-line monitoring, that enable use of facility-wide approaches with appropriate safeguards.

Finally, there may be some sectors where research and monitoring reveal that significant amounts of air emissions are released from aspects of operations that are not currently addressed by regulatory programs. For example, presentations to the CAAAC on air pollutant regulations in the oil and gas sector (covering exploration, development, and transport, but not refining) indicated that there are likely significant emissions of methane and other air pollutants from some aspects of sector operations that are not currently addressed by air regulations.[19] Efforts to adjust source definitions and the

[18] For a discussion of experiences with PALs and other types of plant-wide emissions limits, see U.S. EPA, *Evaluation of Implementation Experiences with Innovative Air Permits: Results of the U.S. EPA Flexible Permit Implementation Review*, 2002. http://www.epa.gov/ttn/caaa/t5/memoranda/iap_eier.pdf.

[19] *Multi-pollutant Reductions from the Oil and Natural Gas Sector*, Bruce Moore, EPA, presentation to CAAAC Multi-pollutant Sector-based Strategies Work Group, December 15, 2010.

scope of applicable requirements to address such unregulated sources of emissions may bring substantial benefits for air quality and public and ecosystem health. Such steps may assist in meeting requirements associated with other air quality goals such as meeting the NAAQS or regional haze goals. In addition, identifying and controlling previously uncontrolled sources may result in a more economical overall strategy for a facility.

Strategies to consider

- Reduce the number of unit-specific regulations within the NSPS and NESHAP programs that may be relevant to sources within particular sectors, while aligning source definitions and scope across the NSPS and NESHAP programs where possible.
- Work with permitting authorities, regulated sources, and community stakeholders to expand use of facility-wide approaches that afford greater operational flexibility and create incentives for emissions reduction while safeguarding against adverse local impacts.
- Continue efforts to identify and address significant sources of air pollution within sectors which are not currently covered by the scope of current regulations.

3. Monitoring and Data

Monitoring and data can support multi-pollutant approaches in a variety of ways. First, when looking across different air regulations that may address the same process or emission units, there may be opportunities to harmonize monitoring and data collection approaches in ways that provide commensurate information at lower cost. Second, the use of innovative monitoring approaches may help improve understanding of how facility operations affect local community air quality and resulting human and ecosystem health risks and impacts. Such understanding may facilitate creative opportunities to approach the control and management of multiple pollutants in a manner that best reduces risk and health impacts at lower cost. For example, in cases where trade-offs are proposed in pollutant emissions across different control technologies or strategies, monitoring approaches can provide safeguards to ensure that the risks and impacts of selected approach are appropriately managed.

Potential benefits

- Improving the consistency of monitoring and data collection requirements across pollutants and regulatory programs may reduce compliance burdens and costs while providing sufficient information for compliance purposes.
- Innovative monitoring technologies and strategies can help identify multi-pollutant approaches that afford the greatest reduction of human and ecosystem health risks and impacts at the lowest cost.

- Expanded use of monitoring approaches can provide data that could be used to improve the accuracy of models.

Potential challenges

- Deployment of some monitoring technologies and systems can be costly.
- Various factors, such as the placement of monitors and the maintenance and calibration of monitors, can affect the ability of monitoring to provide a comprehensive and accurate picture of ambient pollutant concentrations and local exposure and health risks and impacts.
- Monitoring strategies and data collection needs can vary substantially across pollutants, making it difficult to devise consistent approaches across regulations.
- Due to site and process specific variables, implementation of an ambient air monitoring system will be site specific and may only be useful where site and/or process specific factors allow.
- In cases where a state's monitoring requirements are more stringent than those required by the EPA, it may be difficult for the state to relax or modify a given monitoring requirement to increase consistency or alignment across regulations.[20]

Observations and examples

Participants indicated that there may be opportunities to improve coordination and alignment of monitoring and data requirements across regulations, such as the NSPS and NESHAPs, affecting similar emission units. For example, there may be benefits to aligning the frequency of monitoring, averaging times, data compilation formats, QA/QC approaches, or other aspects of monitoring and data requirements.

New monitoring technologies and approaches, including continuous emissions monitors (CEMS) and fence-line ambient concentration monitors, may support multi-pollutant approaches that lower risk and impacts as well as compliance costs. New monitoring approaches could be used to facilitate multi-pollutant emissions reduction strategies. Similarly, new monitoring approaches may be useful to increase stakeholders' comfort with the use of facility-wide approaches that afford facilities greater operational flexibility, building trust in the local community that public health is being adequately safeguarded. In addition, the use of new monitoring technologies like CEMS may eliminate the cost and burden of having numerous monitoring requirements focused on specific components of an emission unit.

Work Group participants discussed how the experience of one chemical manufacturing facility in Houston with advanced monitoring investments illustrates the potential for enhanced community protection efforts. The TPC Group (formerly called Texas

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[20] SIPs may need to be revised to accommodate new monitoring strategies in accordance with §110(l) of the Clean Air Act.

Petrochemicals) operates a chemical plant in Houston, Texas, one of a handful of chemical plants located within the boundaries of the City of Houston along the Ship Channel. One of the main products from the plant is 1,3-butadiene, emissions of which are a hazardous air pollutant as defined by the Clean Air Act.

Although the facility is subject to the MACT hazardous organic NESHAP (HON) rule and had implemented HON controls in the mid-1990s, concentrations of 1,3-butadiene measured by Texas Commission on Environmental Quality's (TCEQ) monitor at nearby Milby Park, a city park located immediately northwest of the facility, remained higher than desirable in 2004 and early 2005. In 2004, the monitor measured an annual average of 4.0 parts per billion (ppb). In 2005, TPC entered into a voluntary emissions reduction agreement with TCEQ targeted at reducing emissions of 1,3-butadiene. As a result of several projects implemented by TPC and additional work at another (unrelated) nearby facility, levels of 1,3-butadiene at Milby Park dropped to 1.54 ppb in 2005 and 0.59 ppb in 2010. TPC's emissions of 1,3-butadiene were reduced by more than 75 percent or almost 70 tons per year.

TPC's emission reductions of 1,3-butadiene were primarily due to the installation of a flare gas recovery system and other process improvements[21], as well as the installation of a sophisticated fence-line monitoring technology. The facility installed Fourier-Transform Infrared (FTIR) systems to continuously scan a 400-meter distance along its north and south fence-lines. Together, the two systems address prevailing wind directions and help to provide an additional measure of protection for nearby residential communities. The facility responds to an alert or trigger of the fence-line system at 15 ppb 1,3-butadiene. Facility shift supervisory personnel receive email for a fence-line alert and immediately embark on an all-out search to locate and address any source of emissions. Hand-held devices such as the Forward Looking Infrared (FLIR) camera ("gas-find" camera) and highly sensitive VOC monitors provide supplemental tools for tracking down unusual or unexpected sources. The new monitoring technology has allowed the facility to operate a more stringent leak detection and repair program (LDAR) and conduct equipment maintenance and change-overs with significantly reduced associated emissions.

Implementation of the fence-line monitoring strategy at TPC resulted in several benefits. TPC's environmental controls, informed by the fence-line monitoring, reduced "normal" emissions. The fence-line monitoring also enabled the company to respond to real-time information, thereby reducing unexpected emissions. This type of fence-line monitoring can help identify unknown or under-reported emissions sources and support

[21] TPC installed a flare gas recovery system that accounts for the majority of emissions reductions. The facility previous flared continuously, and now has less than a handful of short-duration flaring events per year. Total flare emissions of 1,3-butadiene were reduced by approximately 90 percent. Other pollution control investments included a new "dry break" rail car hose technology that eliminated venting of rail car loading emissions.

on-going improvements in environmental management. The focus on 1,3 butadiene illustrates the ability to target pollutants that pose significant human health or environmental risk. In doing so, TPC's 1,3 butadiene emissions reduction efforts have also served to reduce emissions of other chemicals, where reductions came "along for the ride." For example, emissions of all highly reactive VOC (HRVOC) chemicals were reduced by an estimated 168 tons per year, and emissions of point source (non-fugitive) HRVOC chemicals were reduced by an estimated 58 tons per year.

Work Group discussion of the TPC fence-line monitoring program also highlighted factors that may affect the appropriateness and feasibility of fence-line monitoring strategies. While the Work Group participants generally believed that fence-line monitoring strategies can be very beneficial and are worthwhile to consider, participants observed that the factors discussed below are important to consider when determining the appropriateness of fence-line monitoring strategies in the context of specific sources. Fence-line monitoring can be very costly to install and operate.[22] Therefore, in situations where the separation between the community and facility emission sources is large, fence-line monitoring may have limited value. In some large facilities it may be unfeasible and/or cost-prohibitive to install and manage a sufficient monitoring capacity. In addition, limitations in monitoring technologies may constrain the ability to monitor for multiple pollutants at low detection levels, necessitating focus on a smaller number of pollutants.[23] Finally, when using fence-line monitoring approaches it may be difficult to separate facility emissions from neighboring facility emissions of the same compound. In some cases, wind direction may help to distinguish the source of emissions; in other cases it may be feasible to use a "marker" compound emitted by one facility but not the other to distinguish the source of emissions.

In addition to improvements in facility monitoring technology that may help optimize emission control investments at industrial facilities, several participants observed that emissions and air quality dispersion models themselves may over predict pollution levels, resulting in higher cost for pollution controls and/or compliance systems. They indicated that facility air permitting that requires modeling sometimes makes it difficult to comply with standards which otherwise might be easy to achieve based on monitoring data. For example, a Flint Hill Resources facility had a PM continuous monitor at a facility in a rural area at which they decided to do a new project and model emissions. The modeling results showed they were significantly over levels for Prevention of Significant Deterioration (PSD), but monitoring was showing they were

[22] Installation costs vary significantly based on the size of the facility fence-line and the distance to be covered by monitoring. In light of prevailing winds and adjacent land uses, only parts of a fence-line may need to be covered by monitoring.

[23] For example, TPC reported that monitoring only a single compound allows for a very low detection level with the FTIR technology used in the case example. Where multiple compounds may be of interest for monitoring, the detection level may increase accordingly. Very low detection levels such as the detection level experienced by TPC may only be obtained with the FTIR technology when quantitatively evaluating a single chemical compound.

well below levels. The expanded use of emissions and ambient air quality monitoring should improve understanding of multi-pollutant emissions levels and modeling approaches.

Strategies to consider

- When developing or revising rules, the EPA should examine the specific monitoring and data collection requirements included in other regulations and guidance relevant to the process or emission unit to align or coordinate approaches.
- Document and share case studies of creative approaches for using new monitoring approaches to enable multi-pollutant approaches.
- Explore opportunities to enable industrial sources to propose alternative, locally-specific monitoring strategies.

4. Reporting and Record Keeping

Record keeping and reporting requirements embedded in regulations affecting similar units present another area of opportunity for more efficient and effective multi-pollutant approaches. By aligning and coordinating specific aspects of record keeping and reporting, such as frequency, units of measurement, data elements, and format, compliance management systems can be simplified. Greater alignment and consistency of record keeping and reporting can reduce compliance burden and costs while decreasing errors, providing benefits to both regulated facilities and permitting authorities. Many opportunities in this area are likely to be administrative in nature, without environmental or public health implications.

Potential benefits

- Record keeping and reporting burden and costs can be lowered when regulated facilities can increase use of consistent approaches and avoid the need to shift among approaches when operating scenarios change.
- Improved alignment of record keeping and reporting may reduce errors and improve accuracy.
- Efforts to improve consistency and reduce complexity may also enhance understanding and the usefulness of multi-pollutant compliance information.
- Reduction in reporting and record keeping where they overlap or are deemed unnecessary allows the agency, public, and the company to focus resources and attention to other priorities and needs.

Potential challenges

- Efforts to drive enhanced consistency may reduce the usefulness of information, if differences in record keeping and reporting approaches arise from the nature of specific needs.

- Work is needed to ensure that consistent approaches in regulations get translated into consistent approaches in the context of facility air permits. Overcoming legacy record keeping and reporting requirements contained in permits may be difficult to adapt and align with new approaches.
- SIPs may need to be updated in order to ensure that alternative record keeping and reporting approaches are allowed.

Observations and examples

Participants observed several areas where there are likely to be opportunities for combining and integrating record keeping and reporting approaches relevant to related emissions sources within a sector. Some areas include NESHAPs relevant to the chemical manufacturing sector, as well as NSPS, MACT, and hazardous organic NESHAP standards relevant to storage tanks.

Participants described how current record keeping and reporting approaches in some sectors can be complex, particularly when alternative modes of operation trigger different applicable requirements. For example, some participants described how a facility may have above-ground storage tanks that switch between two different services subject to HON, NSPS, and MACT standards. Record keeping and reporting frequencies and content can change for each standard for each mode of operation—a tank could be subject to two out of the four requirements at one time, then three out of the four at another.

Participants observed that Title V air permits are the place where a variety of regulations get translated into the set of specific record keeping and reporting requirements with which facilities must comply. One industry representative suggested that MACT standards (and other air pollutant regulations) could be written to provide permitting authorities some latitude to align MACT reporting dates with other reporting dates required in the Title V permit so that facilities aren't faced with numerous different reporting deadlines.

Participants also described situations where federal and state record keeping and reporting requirements sometimes differ or conflict. For example, one industry representative commented that a conflict emerged between the HON and state rules about appropriate averaging time (daily versus hourly) for the required CEMS at the facility.

Strategies to consider

- When developing or revising rules, the EPA should examine the specific record keeping and reporting requirements included in other regulations and guidance relevant to the process or emission unit to align or coordinate approaches.
- Allow permitting authorities some flexibility to align the timing (e.g., due dates) of MACT standard reporting obligations with other relevant Title V reporting timeframes.

- Encourage permitting authorities and regulated sources to simplify (where appropriate) and improve the consistency of record keeping and reporting requirements contained in air permits when permits are developed or renewed.

5. Emissions Control Technologies and Approaches

Emission control technologies and approaches represent perhaps the greatest area of potential for optimizing reductions of multiple air pollutants at lower cost. Lack of coordination among regulatory programs can result in situations where facilities must invest in one control system to satisfy one requirement and then turn around a few years later to invest in a different (and potentially incompatible) control technology to meet the requirements of a regulation addressing a different pollutant in the same process area. In some cases emission controls designed to reduce emissions of one pollutant may actually increase the release of other pollutants. This piecemeal approach to deploying control technology can result in an inefficient use of capital, while also producing suboptimal emissions reduction outcomes.

By coordinating and aligning emission control strategies across regulatory programs within a sector, multi-pollutant reduction co-benefits may be highly cost-effective. In addition, in sectors where there may be promising new process technology or emission control technologies on the horizon that demonstrate potential to reduce multiple pollutants, it may be feasible to coordinate and align regulations across pollutant programs to support more rapid adoption of the technology within the sector.

Potential benefits

- Greater levels of emissions reduction may be achieved across multiple types of pollutants at lower cost.
- Coordination of pollution control requirements across regulations within a sector may enable longer capital investment horizons that increase cost-effectiveness and certainty for regulated facilities.
- Alignment of pollution control requirements may help secure reductions of multiple pollutants (as co-benefits) sooner than would otherwise be required.
- Coordination of pollution control requirements within a sector may help regulators make more informed decisions in cases where emission control approaches pose trade-offs among pollutants.
- Coordination of pollution control requirements may enable regulators to encourage adoption of advanced process or pollution control technologies that hold potential for cost-effective multi-pollutant reductions.

Potential challenges

- Developing and testing novel advanced pollution control and process technologies can be expensive and pose significant financial and compliance risks, even if there is substantial promise for emissions reductions.

- For some pollution control systems, there are real trade-offs between greenhouse gas emissions and emissions of other pollutants.

Observations and examples
Industry representatives observed that many pollution control technologies are costly. This means that regulated facilities are interested in ensuring that investments they make in controls will satisfy environmental compliance requirements for some reasonable period of time. Other participants observed that there may be cost-effective opportunities to require emission controls that substantially benefit public health, and that installation of such controls should not necessarily be held hostage by past investments in pollution controls. Efforts within sectors to consider technology options that can control multiple pollutants may reveal important opportunities to maximize returns on investments in pollution controls.

The EPA has supported research efforts to identify viable multi-pollutant emission control options relevant to some industry sectors. For example, the EPA sponsored a 2005 report that analyzed 27 existing and novel control technologies designed to achieve multi-pollutant reductions (of SO_2, NO_x, and mercury) for coal-fired electric generating units.[24] While emissions reduction performance varied across control technologies, some types of controls exhibited potential to significantly control all three types of pollutants. This type of research can be useful to identify existing and emerging technology options that may optimize control of multiple pollutants at lower costs within a sector.

The availability of advanced technology with emissions reduction potential can vary substantially across industry sectors. Some sectors have active research programs to research, develop, pilot, and scale up advanced technologies that improve environmental performance. In other sectors, there may be few (if any) emerging process or emission control technologies that have potential to transform emission reduction opportunities. However, there may be other changes or trends on the horizon that may affect operations and air emissions within the sector. For example, a major area of change in the chemical manufacturing sector involves the transition from fossil-based feed stocks to more renewable, bio-based feed stocks.

In some cases there may be advanced technologies which hold significant promise for reducing emissions within a sector. Facilities are often reluctant to invest in these technologies, however, until there are proven examples of the technology performing in scale-up settings. Piloting a new technology at full-scale production levels, however, can be tremendously costly and also carry substantial risk of non-compliance with environmental regulations. Failure to meet compliance levels for all relevant parameters (e.g., pollutant capture efficiency) can result in non-compliance and the need to install

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[24] U.S. EPA. *Multipollutant Emission Control Technology Options for Coal-fired Power Plants*. EPA-600/R-05/034. March 2005. http://www.epa.gov/airmarkets/resource/docs/multipreport2005.pdf.

other tested pollution control equipment, even if the novel system performs optimally from a multi-pollutant perspective.

Participants indicated that there may be steps that the EPA and state regulatory agencies can take to “create space” for experimentation with promising emerging technologies. One participant indicated that efforts to develop and pilot an innovative emissions reduction technology in the pulp and paper sector in Virginia in the early 2000s, although ultimately unsuccessful, provides a valuable model for how to engage multiple stakeholders to structure pilot projects in ways that mitigate risks and facilitate innovation that can have major multi-pollutant emissions reduction benefits.

Participants also observed that NSR-driven technology requirements can sometimes fit awkwardly into technology approaches driven by NESHAP and NSPS standards. At times there may be alignment, such as when control technologies identified as satisfying NSR-required BACT are the same as those identified as satisfying MACT standards. However, over time, divergence can emerge with BACT and MACT requiring different types of emission controls. To reconcile this divergence, some participants suggested that the EPA could determine in each MACT rulemaking that MACT for *existing* sources in the relevant source category would be presumptively set at the BACT level for a period of time—perhaps five years. After that time, modified sources would have to conduct a non-presumptive case-by-case BACT determination. The statutory grounds for presumptive BACT would be a finding that case-by-case evaluations for existing sources during the five-year presumption period would result in “economic impacts and other costs” that are inconsistent with the overall goal of improving air quality. These participants also observed that the “economic impacts and other costs” principle would be inapplicable to *new* sources, which would be required to coordinate the installation of MACT, NSPS, and BACT technology—along with highly efficient production processes—at the outset.

One Work Group member observed that, in the context of setting multi-pollutant pollution control requirements for NSPS and MACT, one approach might be to identify BACT-like controls that account for the various pollutants to be controlled and then establish different control scenarios that would be declared sufficient to meet the various CAA requirements.

Some participants observed that the work practice standards provisions of the NSPS and MACT statutory programs could be utilized to achieve greater environmental protection along with the opportunities identified elsewhere in this document. The use of work practice standards would need to be fully justified in any regulatory proceeding both on legal and environmental grounds.[25]

[25] See Traylor, August 2010, pp. 8–11 and 17–20.

Finally, participants noted that there can be substantial trade-offs in emission control performance across pollutants. Trade-offs can be particularly salient between greenhouse gas emissions and other pollutants. For example, some pollution control equipment (e.g., thermal oxidizers) involves incineration of air pollutants to break down their harmful properties. While these emission controls decrease volatile organic compound (VOC) and other emissions, they can increase CO_2, SO_2, and NO_x emissions, particularly when natural gas is added to ensure proper combustion. At present, there are not clear guidelines to assist regulators in reconciling trade-offs among pollutants. Several participants observed that pollution control trade-offs can extend to the multi-media sphere—between air, water, and waste. Some pollution control systems are effective at removing contaminants from the air, but these same captured contaminants may pose water quality or waste challenges. For example, scrubbers installed at coal-fired power plants to remove air pollutants from combustion gases creates waste that is either discharged into rivers or buried in landfills.

Strategies to consider

- When developing or revising rules, the EPA should align or coordinate emissions control requirements across various regulatory programs where appropriate and feasible.
- When developing revised pollution control requirements, the EPA should coordinate with other offices to address potential impacts on land, water, and other media in addition to air.
- Consider conducting joint government-trade association-industry efforts to assess the multi-pollutant emission control attributes of existing and novel pollution control equipment and process technologies within specific sectors.
- Consider and develop options to encourage piloting of novel emissions-reducing technologies within industry sectors. Explore whether supplemental environmental projects, temporary exemptions, variances, or other approaches could be used to spur piloting of promising emissions reduction technologies.

6. Energy Use and Efficiency Improvement

Energy use reduction is an increasingly important consideration in the context of multi-pollutant reduction strategies within industry sectors. Combustion-based energy use is a major source of greenhouse gas emissions, as well as criteria air pollutants and hazardous air pollutants. At the same time, energy use can be a significant expense in some industry sectors. Investments in energy efficiency, however, may reduce emissions levels for multiple pollutants without requiring any additional emission control costs. In some cases, pollution control approaches may actually increase greenhouse gas emissions. As the EPA and its partners continue to explore sector-based, multi-pollutant emissions reduction strategies, it is vital to ensure that energy use and greenhouse gas emissions are considered in efforts to optimize overall emission reductions.

Potential benefits

- Energy efficiency improvements typically result in lower emissions of greenhouse gases, as well as some criteria air pollutants and hazardous air pollutants.
- Reductions in energy use can result in substantial financial benefits.

Potential challenges

- For some pollution control systems, there are real trade-offs between greenhouse gas emissions and emissions of other pollutants.
- Air permitting requirements can sometimes pose barriers to making energy efficiency upgrades.
- Substantial increases in energy efficiency may require development and financing of new technology.

Observations and examples

Industry participants observed that substantial progress has been made in reducing energy use across many sectors, including iron and steel and chemical manufacturing, over the past decade. While industry participants noted that companies in energy-intensive sectors often have strong cost drivers for reducing energy use, other participants noted that several studies suggest that substantial energy use reduction opportunities remain across many industrial sectors in the U.S.[26]

Participants observed that some sectors have active research programs to research, develop, pilot, and scale up advanced technologies that improve environmental performance. For example, under the auspices of the World Steel Association CO_2 Breakthrough Program, active research is underway to research and develop "breakthrough technologies" that could dramatically reduce the environmental

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[26] For example, see McKinsey & Company. *Unlocking Energy Efficiency in the U.S. Economy*, July 2009, http://www.mckinsey.com/en/Client_Service/Electric_Power_and_Natural_Gas/Latest_thinking/Unlocking_energy_efficiency_in_the_US_economy.aspx.

footprint, including air emissions, of the iron and steel sector.[27] In the U.S., the American Iron and Steel Institute (in collaboration with the U.S. Department of Energy) is similarly working to advance innovative, breakthrough technologies, such as molten oxide electrolysis and hydrogen flash melting, which promise near zero CO_2 emissions. While some innovations may be decades from commercial application, these efforts highlight the importance of considering longer-term advanced technology development initiatives when designing coordinated multi-pollutant regulatory approaches. As promising low-emissions technologies move closer to commercial use, sector-specific regulations could be tailored to speed adoption and diffusion.

In some cases, conflicting unit-specific standards have the potential to limit certain energy efficiency projects. For example, a representative from an iron and steel company described how boiler MACT requirements prevented a facility from diverting process waste gas from a flare to use as a fuel for its boiler. Although this project would have increased emissions from the boiler, net facility emissions would have decreased as a waste stream would have been converted to productive use for energy generation. Participants observed that efforts are needed to develop creative approaches to address these types of opportunities.

Strategies to consider

- When developing or revising rules, the EPA should align or coordinate emissions control requirements and approaches across various regulatory programs with energy efficiency opportunities where appropriate and feasible.
- Eliminate regulatory and permitting barriers to energy efficiency projects that do not increase net emissions and do not increase health risks and impacts.

7. Community-Focused Strategies

Sector-based, multi-pollutant approaches may open unique opportunities to address local environmental risks and impacts in creative ways. Use of new monitoring strategies can give the regulated facility, regulators, and community members a better understanding of risks and impacts associated with facility air emissions, while informing development of controls strategies that optimize investments. Collaborative approaches that meaningfully engage members of the local community can also build trust and communications pathways that enable consideration of permitting approaches that accommodate more regulatory flexibility and innovation. They may also help to empower communities in ways that allow them to address local air pollution issues and become involved in important decisions regarding a multi-pollutant approach to air pollution. The combination of new monitoring and collaborative approaches may spur opportunities to drive substantial reductions in local public health risks and impacts—

[27] http://www.worldsteel.org/pictures/programfiles/Fact%20sheet_Breakthrough%20technologies.pdf.

looking across the full range of air pollutants—while also safeguarding against adverse effects that may arise if trade-offs emerge.

Potential benefits

- Community-focused strategies align local efforts to identify and manage the sources of greatest risk and impacts to public health and community well-being, enabling more substantial reductions in emissions that impact the community.
- Community-focused strategies can educate local residents regarding sources of air pollution and empower them to take action to reduce air pollution to protect the health of their community.
- Meaningful participation from community residents, grassroots organizations, and environmental justice (EJ) organizations in decision-making regarding multi-pollutant approaches will increase the probability that such approaches are developed in a manner that will benefit residential communities.
- Improved trust and communication pathways between regulated facilities and local community members can provide a foundation for addressing a broad range of environmental and public health challenges that may arise.
- Collaborative efforts with the local community may enable cost-effective risk reduction that improves the financial performance of the enterprise, supporting local economic prosperity and job retention or creation.
- Establishment of new monitoring strategies can inform in order to optimize community and environmental health improvements.

Potential challenges

- Effective development of community-focused strategies that engage local community members in meaningful ways can take substantial time and effort to build.
- When seeking input to sector-based, multi-pollutant regulatory approaches at the national level, it may be difficult to identify who are the most appropriate EJ groups, community organizations, and environmental groups to actively engage for input.
- There may be insufficient information regarding local air quality, exposure, and health impacts to enable productive discussion about community-focused strategies for controlling multiple air pollutants.
- Establishment of robust monitoring systems can be costly.
- Consideration of the cumulative health risks resulting from community member exposure to environmental stressors may open difficult and potentially polarizing debate regarding the broader future of economic activity in a community.
- Communication about human health risks and impacts associated with air quality can be challenging where scientific understanding is less certain.

- There is a lack of consensus on what are acceptable risks when considering air quality impacts, particularly with respect to air toxics, which have no national ambient standards.

Observations and examples
CAAAC Work Group members discussed the importance of pursuing community-focused strategies that can empower communities while building the trust necessary to enable industry to pursue the type of flexibility and innovation that result in lower emissions and human and ecosystem health impacts at lower cost. Increasingly, the use of innovative monitoring technologies can enhance understanding of ambient air quality or even estimates of exposure and health risks. Monitoring, when paired with an effective collaborative process that builds trust and understanding, may produce improved emission control strategies.

Participants recognized that some communities may have sensitive populations and socio-economic factors that exacerbate the health impacts of exposure to pollutants and environmental stressors. EJ initiatives typically seek to address and mitigate situations where communities experience disproportionate impacts to health and well-being.[28] Some participants observed that a major concern of EJ communities is that cumulative impacts from multiple air pollutants and sources are not taken into consideration during development and implementation of air quality standards and permitting processes. The California Environmental Protection Agency has defined cumulative impacts as: "Exposures, public health or environmental effects from the combined emissions and discharges, in a geographic area, including environmental pollution from all sources, whether single or multi-media, routinely, accidentally, or otherwise released."[29] Coordination of a multi-pollutant approach with respect to cumulative impacts has the potential to improve the effectiveness of both. Moreover, multi-pollutant approaches may enable compliance requirements to deliver greater reductions in health risks and impacts across multiple air pollutants at lower cost and greater speed.

Consideration of multi-pollutant approaches may also highlight trade-offs that are important for communities to assess and navigate. For example, control measures that reduce GHG emissions but exacerbate PM emissions may have a disproportionately adverse impact on public health in the local community. Participants observed that it can be difficult to find a "common currency" to compare the relative health and

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[28] The concept of environmental justice (EJ), as defined by EPA, is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. See http://www.epa.gov/compliance/ej/index.html.

[29] CAL. EPA, Addressing the Issues of Cumulative Impacts and Precautionary Approach in the EJ Pilot Projects 1 (2005), available at: http://www.calepa.ca.gov/EnvJustice/ActionPlan/PhaseI/March2005/CI_PA.pdf.

environmental risks across pollutants, populations and exposures, but that some progress is being made in this area.

While coordination of sector-focused regulations at the national level can help navigate potential trade-offs in pollutant emissions, it may be important to allow some flexibility for local communities (involving regulated source, permitting authority, and interested community members) to weigh and select control strategies that balance trade-offs to minimize local health risks and impacts. Participants highlighted the importance of seeking input from EJ groups, Tribal governments, community organizations, and environmental groups both in the context of national-scale sector-based, multi-pollutant regulation development, and in the context of local-scale multi-pollutant permitting. The Work Group recognizes that the specific organizations to engage at the national and local levels will often vary.

The EPA is taking steps to provide meaningful opportunities for community involvement in air permitting processes. A future goal for the Agency, as described in *Plan EJ 2014*, is to focus on permits issued that enable the EPA to address the complex issue of cumulative impacts from exposure to multiple sources and existing conditions that are critical to the effective consideration of EJ in permitting.[30] To this end, the EPA plans to work closely with program and regional offices, Tribes, states, and community stakeholders and develop a common mapping platform and nationally consistent screening and targeting tool to enhance EJ analysis and decision-making in the context of multi-pollutant permitting.

Participants identified a range of considerations that should be factored into efforts to develop community-focused, multi-pollutant strategies. These include

- Potential trade-offs in pollutant emissions associated with different emissions control strategies.
- Importance of plain language communication.
- Need to clarify what pollutants are emitted and in what quantities.
- Understanding of how emissions will be monitored and reported, and how standards and emissions limits and other requirements will be inspected and enforced.
- Need to communicate how to interpret the risk to human health posed by emissions.
- Understanding and development of the role interested members in the community can play in decision-making processes and what specific involvement opportunities exist.
- Understanding of unique characteristics of each community affected (e.g., demographics, socioeconomic status, other polluting facilities in the area, previous history/experience with the EPA and industry, etc.).

[30] http://www.epa.gov/compliance/ej/plan-ej/index.html.

- Opportunities to achieve emissions reductions exceeding those originally contemplated by facilities using a multi-pollutant approach that are located near environmental justice communities.
- Determining how a multi-pollutant regulatory approach interacts with a cumulative impacts approach to air pollution.
- Lessons learned from past projects.

Strategies to consider

- Develop community-focused approaches (including those involving innovative monitoring technologies and collaborative processes) that have sought to 1) advance multi-pollutant emission control strategies that optimize reductions in health risks and impacts; and 2) meaningfully involve and engage community residents. Share these approaches with permitting authorities and industry sector organizations to encourage broader consideration, use, and experimentation involving community-focused strategies.
- Conduct a roundtable with representatives of residential communities, grassroots organizations, and EJ organizations prior to significant development of a multi-pollutant approach in order to obtain ideas, comments, and concerns from a community and environmental justice perspective on the development of such an approach.
- Develop a method to institutionalize meaningful participation from community residents, grassroots organizations, and EJ organizations in decision-making regarding a multi-pollutant approach. This participation should occur at both a national level while the EPA is developing sector-based ideas and regulations regarding a multi-pollutant approach and at a local level where decisions regarding permitting of a specific source will affect a specific community.
- Involve community members in monitoring program efforts to empower them in a manner that increases their capacity to participate in decisions made by nearby facilities that affect local air quality and health.
- Provide input to EJ initiatives and activities the EPA is involved with to highlight opportunities and challenges associated with multi-pollutant considerations.
- In the context of permitting, multi-pollutant strategies could consider the assessment and consideration of cumulative impacts as part of the permitting process.

Moving Towards Multi-Air Pollutant Reduction Strategies in Major U.S. Industry Sectors

Appendices

Final CAAAC Report to EPA -- Appendices – November 17, 2011

Acronyms and Abbreviations

ACI	Activated carbon injection
ACT	Alternative control techniques
AOS	Alternative operating scenarios
ARM	Approved replicable methodology
BenMAP	Benefits Mapping and Analysis Program
BACT	Best available control technology
BART	Best available retrofit technology
BOF	Basic oxygen furnaces
CO	Carbon monoxide
CO_2	Carbon dioxide
CSI	Combustion system improvement
CAA	Clean Air Act
CAAAC	Clean Air Act Advisory Committee
CEMs	Continuous emission monitors
CGC	Convert to reciprocating grate cooler
CoST	Control Strategy Tool
CTGs	Control technique guidelines
CAP	Criteria air pollutant
EAF	Electric arc furnaces
EGU	Electric generating unit
EJ	Environmental justice
EMCS	Energy management and control system
EMD	Efficient mill drives
EPA	U.S. Environmental Protection Agency
FLIR	Forward looking infrared
FTIR	Fourier-Transform infrared
FY	Fiscal year
GIS	Geographical information systems
GHG	Greenhouse gas
GDP	Gross domestic product
HAP	Hazardous air pollutant
Hg	Mercury
HON	Hazardous Organic NESHAP
HRPG	Heat recovery for power generation
HRVOC	Highly reactive VOC
HCl	Hydrochloric acid
IF	Indirect firing
ISIS	Industrial Sectors Integrated Solutions Model
LNB	Low NOx burner
LAER	Lowest achievable emission rate
LDAR	Leak detection and repair program

LWS	Limestone wet scrubber
MACT	Maximum Achievable Control Technology
MMT	Million metric tons
NAAQS	National Ambient Air Quality Standards
NEI	National emission inventory
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NO_x	Nitrogen oxides
NRC	National Research Council
NSPS	New Source Performance Standards
NSR	New Source Review
O_3	Ozone
OAQPS	EPA Office of Air Quality Planning and Standards
OAR	EPA Office of Air and Radiation
OGR	Optimize grate cooler
OPAR	EPA Office of Policy Analysis and Review
PALs	Plantwide applicability limits
Pb	Lead
PM	Particulate matter
$PM_{2.5}$	Particulate matter of diameter of 2.5 micrometers of less
PPB	Parts per billion
PCA	Portland Cement Association
PSD	Prevention of Significant Deterioration
RTO	Regenerative thermal oxidizer
RTR	Residual Risk Review and Technology Review
SCR	Selective catalytic reduction
SHLR	Shell heat loss reduction
SIP	State Implementation Plan
SNCR	Selective non-catalytic reduction
SO_2	Sulfur dioxide
SPPD	Sector Policies and Programs Division
SR	Seal replacement
TCEQ	Texas Commission on Environmental Quality
THC	Total hydrocarbons
TIP	Tribal implementation plan
U.S.	United States
VOC	Volatile organic compound

Appendix A:
CAAAC Work Group Charter and Membership

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF AIR AND RADIATION

Multi-pollutant Sector Approach Work Group
Under the Clean Air Act Advisory Committee's
Subcommittee on Economic Incentives and Regulatory Innovation

Work Group Charter
October 2010

Purpose

Convene a workgroup under the auspices of the Clean Air Act Advisory Committee (CAAAC) to provide the EPA with information, advice and recommendations regarding the development and implementation of an air pollution stationary source multi-pollutant approach.

Background

Current air pollution control policies and practices have resulted in significant reductions in emissions of air pollutants and their concentration in the atmosphere. To obtain these reductions, the EPA has developed a comprehensive system of regulations and guidance to implement the requirements of the Clean Air Act (CAA) Sections 111 (new source performance standards), 112 (air toxics), 129 (solid waste combustion) and others. Industrial sources have responded with equally comprehensive air pollution control and compliance systems. As the National Academy of Sciences recognized in 2004, in order to continue the progress that has been made, new multi-media, multi-pollutant and sector-based strategies are necessary. Future progress depends on increased coordination between these clean air programs as well as the integration of energy efficiency and greenhouse gas emission reduction efforts.

Responding to this challenge, the EPA's Office of Air Quality Planning and Standards (OAQPS) is working toward comprehensive, multi-pollutant and industrial sector-based strategies for the regulation of air pollution from stationary sources. By using a more holistic approach, the EPA hopes to achieve better environmental benefits in a more efficient manner. Ongoing efforts at increased coordination were discussed at past Subcommittee meetings in February and May. The attached presentations provide additional background information and considerations as well as an example of sector-specific assessments (see attached "Sector-Based Multi-pollutant Approaches for Stationary Sources" and "Petroleum Refinery Sector Update").

The EPA believes that there are significant opportunities and challenges associated with these new approaches. By synchronizing regulatory analysis, timing and implementation, air pollution control will become more efficient for industries and result in continued progress at reducing air pollution emissions. Yet the technical, policy and economic challenges of such coordination are significant.

Possible Workgroup Activities and Scope

The EPA requests that the CAAAC's Subcommittee on Economic Incentives and Regulatory Innovation form a workgroup to provide feedback to how EPA can implement a sector-based regulatory strategy for air pollution control for the consumer/durable products sector. Workgroup advice on the regulatory and technological strategies that the EPA may employ to optimize reductions of criteria, air toxics and greenhouse gas emissions for this sector would be welcome. Consideration of the following general issues, among others, may be beneficial:

- How should stationary source air pollution regulation be better coordinated and what are the benefits and challenges of increased coordination?
- What are the regulatory and legal challenges to implementing sector-based, multi-pollutant approaches?
- How should the coordination of regulatory timelines and requirements begin within a sector?
- Which advanced technologies will assist in controlling multiple types of air pollution?
- What are the co-benefit, energy, and research implications of these technologies?
- What are the market-based mechanisms that the EPA should be investigating for sector-based approaches that would help the sector to be more efficient?
- How can the EPA better incentivize facilities to replace outdated or poorly performing equipment and improve energy efficiency while reducing malfunctions? How does a sector-based or multi-pollutant approach help?
- Are there financing and investment programs that can be utilized to help implement sector-based approaches and specific technologies?

In addition to these general issues, the EPA welcomes the work group's deliberations of the following specific issues associated with implementing a sector-based multi-pollutant approach:

- Explore the challenges of reforming air pollution source category definitions from unit-by-unit to facility-wide definitions.
- Explore the challenges of developing emission standards for air toxics (NESHAPS) and criteria air pollutant programs (NSPS, NSR) based on a common set of regulated air pollutants.
- Explore the challenges of coordinating the periodic revision of the NAAQS with the required updates of NESHAPS and NSPS standards.
- Explore the challenges of utilizing work practice standards in situations where quantifiable emission limitations and reductions are needed, such as the new source review program requirements.
- Explore the challenges of utilizing plant-wide applicability limits (PALS) or other forms of averaging emission reductions within a facility's fence-line.

Many of these questions and issues have been explored before by the EPA, and any one of them could constitute a major program of investigation for the work group. Therefore, the EPA requests that the new workgroup select a subset of these issues to address in the context of a specific industrial sector or sectors.

Solicitation of Interest and Suggestions for Detailed Agenda

If you are interested in joining this new workgroup, we would welcome your input. Please contact either Keith Mason, in OAR's Office of Policy Analysis and Review (OPAR) or Elineth Torres, in OAR's Office of Air Quality Planning and Standards (OAQPS) for more information.

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Clean Air Act Advisory Committee
Subcommittee on Economic Incentives and Regulatory Innovation

Multi-pollutant Sector Approach Work Group

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US EPA

Project Contractor and Meeting Facilitator

Tim Larson, Jennifer Major, and Megan Parker
Ross & Associates Environmental Consulting

CAAAC Sector-based, Multi-pollutant Work Group Meetings

Work Group Conference Call, December 1, 2010. *Call included a presentation and discussion of air regulations affecting the chemical manufacturing sector*.

Work Group Conference Call, December 15, 2010. *Call included a presentation and discussion of air regulations affecting the iron and steel manufacturing sector and the oil and gas production sector*.

Work Group Meeting and CAAAC Meeting, January 11-12, 2011, Arlington, VA. *Meeting to discuss topics related to sector-based, multi-pollutant air regulatory approaches and to plan for industry roundtable discussions.*

Work Group Roundtable Discussion – Focus on Iron and Steel Manufacturing Sector, March 3, 2011, Research Triangle Park, NC. *Meeting with representatives from the iron and steel manufacturing sector to explore opportunities that could be addressed by multi-pollutant approaches in the iron and steel sector.*

Work Group Roundtable Discussion – Focus on Chemical Manufacturing Sector, March 31, 2011, Research Triangle Park, NC. *Meeting with representatives from the chemical manufacturing sector to explore opportunities that could be addressed by multi-pollutant approaches in the chemical manufacturing sector.*

Work Group Conference Call, May 17, 2011. *Call to discuss the draft Work Group report on sector-based, multi-pollutant approaches*.

Work Group Conference Call, May 23, 2011. *Call to discuss the draft Work Group report on sector-based, multi-pollutant approaches*.

Work Group Meeting and CAAAC Meeting, June 7-8, 2011, Washington, DC. *Meeting to discuss the draft Work Group report on sector-based, multi-pollutant approaches.*

Appendix B: The Clean Air Act Requirements and Opportunities for an Integrated Approach

The CAA Amendments of 1990 address many types of air pollution problems ranging from urban smog to hazardous and toxic air pollution. As a result of the CAA's multiple legislative goals, a comprehensive system of air quality regulations has been developed and implemented. In addition, complex industrial sources of air pollution are usually subject to multiple regulatory requirements. Since one important goal of a sector-based approach is to reduce conflicting and redundant requirements for industry, it is important that, in evaluating a sector, the EPA identifies and reviews the multiple regulatory actions and requirements in a coordinated manner. Coordinating the timing of requirements enables the facility to determine which control technology minimizes the overall cost of air pollution control and can help the industry avoid stranded costs associated with piecemeal investments in individual control equipment for multiple pollutants that might occur otherwise.

The different types of CAA requirements that may apply to a sector, or which may be relevant to the sector rulemaking, include, among others: National Emission Standards for Hazardous Air Pollutants (NESHAPs), Maximum Achievable Control Technology (MACT) Standards, New Source Performance Standards (NSPS), Residual Risk Review, and Technology Review (RTR). In addition, coordination of technical and analytical efforts for these requirements also supports the enhancement of control technique guidelines (CTGs) for sources in areas where CAP emissions exceed health-based standards in a technically consistent manner. Table 1 shows the CAA requirements for direct federal stationary source regulation and guidance.

In implementing a multi-pollutant sector-based approach, the EPA must consider and take into account the interactions of multiple CAA regulatory requirements applicable to any given sector.

Table 1. Review and Revision Timeframes for Major Clean Air Act Requirements Related to Stationary Source Regulation

Regulatory Program	Review Process	Review Timeframe
Section 112 **Air Toxics** National Emissions Standards for Hazardous Air Pollutants (NESHAPs) Post-1990 NESHAPs called Maximum Achievable Control Technology (MACT) standards	Source category list review	Every 8 years
	Pre-1990 NESHAP reviews	Every 8 years
	MACT technology review	Every 8 years
	MACT residual risk review	8 years after promulgation
	Area source rules	Varies
	Area source rules review	Every 8 years
Section 129 **Solid Waste Incineration**	Technology reviews	Every 5 years
	Residual risk reviews	8 years after promulgation
Section 111 **NSPS** New Source Performance Standards to address criteria pollutants	NSPS technology review	Every 8 years
	New NSPS rules	2 years after listing
Section 110 **CTG/ACT/183(e)**	Control Techniques Guidelines (CTG)/ Alternative Control Techniques (ACT)/ Section 183(e) Consumer Products Rules	Varies
NSR New Source Review	Permitting review of control technology requirements; best available control technology (BACT) or lowest achievable emissions rate (LAER)	Triggered by source-specific construction or modifications
Section 169A **Regional Haze SIPs** State Implementation Plans	Best available retrofit technology reviews	Every 8 years

National Emission Standards for Hazardous Air Pollutants (NESHAP) and New Source Performance Standards (NSPS)

NESHAPs are technology-based stationary source standards for HAPs, pollutants that are known or suspected to cause cancer or other serious health effects or adverse environmental effects. For each new NESHAP, the EPA is required to define the Maximum Achievable Control Technology (MACT) standard based on the top performing facilities in that sector. The NSPS is an emission standard prescribed for criteria pollutants from certain stationary source categories. By evaluating the regulatory requirements across pollutants (e.g., HAPs, CAPs, GHG) for a sector, and by performing an integrated, multi-pollutant analysis, the EPA can identify control technologies that would best achieve multi-pollutant emission reductions while minimizing costs. In an integrated, multi-pollutant approach, the EPA also assesses the applicable and necessary monitoring requirements to reduce administrative and compliance complexities associated with complying with multiple regulations. Within a rulemaking, the EPA strives to ensure that, where monitoring is required, methods and reporting requirements are consistent in the NSPS and NESHAP for regulated pollutants that have similar characteristics and similar or identical emission sources.

Residual Risk Standards and Technology Reviews (RTR)

RTR is a combined effort to evaluate both risk and technology as required by the CAA eight years after the application of MACT standards. For source categories emitting known, probable, or possible carcinogens, if the existing MACT standard does not "reduce lifetime excess cancer risks to the individual most exposed to emissions from a source in the category or subcategory to less than one in a million," the EPA must promulgate standards for that source category. In addition, the EPA must also review the technology requirements "no less often than every 8 years," as required by CAA section 112(d)(6).

To integrate and align the current regulations and future regulatory requirements, the EPA must determine how the NESHAP and/or NSPS under consideration relate to RTR requirements applicable to the sector. In developing a rulemaking, the EPA would consider the potential risk reductions that would be required, as well as any revisions to the technology-based standard, and identify opportunities for aligning these with the other regulatory requirements.

National Ambient Air Quality Standards (NAAQS)

Under the NAAQS program the EPA regulates six criteria air pollutants (CAPs): particulate matter (PM), ozone (O_3), nitrogen oxides (NO_x), sulfur dioxide (SO_2), lead (Pb), and carbon monoxide (CO). Those areas in the country that exceed these health-based ambient air standards are designated as nonattainment areas. For these areas, attaining the standard by reducing emissions of criteria pollutants and their precursors is of great importance. A NESHAP or NSPS rulemaking that directly, or as a co-benefit, results in additional emission reductions of CAPs and their precursors will help areas around the country attain these NAAQS.

New Source Review (NSR)

The NSR program requires new major stationary sources of air pollution and major modifications to major stationary sources to obtain an air pollution permit before commencing construction. Permits for sources in attainment areas are referred to as prevention of significant air quality deterioration (PSD) permits; while permits for sources located in nonattainment areas are referred to as nonattainment permits. Collateral CAP emission reductions resulting from the application of MACT may, in certain circumstances, be used for "netting" or "offset" purposes under the NSR program. "Netting" refers to the process of considering certain previous and prospective emissions changes at an existing major source over a contemporaneous period to determine if a "net emissions increase" will result from a proposed modification. If the "net emissions increase" is significant, then major NSR applies. Section 173(a)(1)(A) of the Act requires that a major source or major modification planned in a nonattainment area obtain emissions reductions called "offsets" as a condition for approval. These offsets are generally obtained from existing sources located in the vicinity of the proposed source and must offset the emissions increase from the new source or modification and provide a net air quality benefit.

Under certain circumstances, reductions of HAPs under a MACT may be available for NSR netting or offset purposes, where the form of the HAP is emitted as a criteria pollutant (e.g., $PM_{2.5}$). Consistent with an integrated, multi-pollutant sector-based approach, the EPA would identify these opportunities and take them into account in development of the regulations.

Regional Haze and Reasonable Progress

The purpose of the regional haze program is the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory national park and wilderness areas which results from manmade air pollution. Under the regional haze regulations, states must submit a state implementation plan (SIP) to show how they will progress toward attainment of the visibility standard. A SIP must address several key elements, including Best Available Retrofit Technology (BART), reasonable progress, and long-term strategies.

A potential benefit for some facilities in a sector is that the technology requirements in, for example, a NESHAP rulemaking, could potentially satisfy a facility's BART requirements under the regional haze program. A rule may establish a framework for states to include certain control measures or other requirements in their regional haze SIPs where such a program would be "better than BART."

Additionally, the level of control achieved through a NESHAP or NSPS may contribute toward, and possibly achieve, the visibility improvements needed to satisfy the reasonable progress requirements, or incremental visibility improvements, of the regional haze rule. Consistent with the integrated, multi-pollutant sector-based approach, the EPA would consider whether a non-BART-related rulemaking controlling emissions which may affect visibility would have an impact on regional haze.

Appendix C: Integrated Multi-pollutant Sector-based Approach for the Cement Manufacturing Industry

ABSTRACT

Considerable work has been carried out by the U.S. Environmental Protection Agency to reduce criteria pollutants (CAPs) and hazardous air pollutants (HAPs). In response to the National Academy of Science recommendations, the EPA has moved from regulating CAPs and HAPs separately, as well as considering processes separately, to a more holistic, integrated multi-pollutant approach that takes into account multiple processes at a facility. This new regulatory framework challenges the EPA to develop strategies, policies, and regulations that consider the impacts of all air pollutants emitted from the source(s) or industrial sectors to maximize the potential of our actions while minimizing unintended disbenefits, and avoiding stranded costs and piecemeal investments in controls. This paper presents the cement manufacturing sector as an example of an integrated, multi-pollutant sector-based approach to regulating air pollution.

Multiple regulatory requirements apply to the cement manufacturing sector. The EPA analyzed how the National Emission Standards for Hazardous Air Pollutants (NESHAP) related to the New Source Performance Standard (NSPS), Residual Risk and Technology Review (RTR) and their collateral impacts to New Source Review (NSR), Regional Haze and the National Ambient Air Quality Standards (NAAQS). The sector-based approach reduced conflicting and redundant requirements by setting the same particulate matter requirement for both the NESHAP and the NSPS. It facilitated the streamlining of monitoring, record keeping and reporting requirements on both rules reducing administrative and compliance complexities associated with complying with both regulations. It promoted a comprehensive control strategy to co-control multiple regulated pollutants (i.e., mercury and hydrochloric acid) while obtaining reductions of sulfur dioxide and fine particulate matter as co-benefits. These collateral SO_2 and $PM_{2.5}$ emission reductions may be considered for “netting” and “offsets” purposes under the major NSR program or as credits that could help areas around the country with attainment of the SO_2 or $PM_{2.5}$ NAAQS.

INTRODUCTION

Over the last two decades, since enactment of the Clean Air Act Amendments of 1990 (CAA), the EPA has made significant progress in reducing CAPs and HAPs. In 2004, the National Academy of Science's 2004 report, "Air Quality Management in the United States," the National Research Council (NRC) recommended to the EPA that standard setting, planning, and control strategy development should be based on integrated assessments that consider multiple pollutants, and that these integrated assessments should be conducted in a comprehensive and coordinated manner.[1] With these recommendations, the EPA began to move toward establishing multi-pollutant sector-based approaches to manage air quality and environmental protection.

To be able to develop integrated multi-pollutant sector-based approaches, one must have an understanding of the sector's processes, emission sources, and emitted pollutants, as well as an understanding of inter-related processes and industries, economic factors, regulatory requirements, and public health and environmental impacts. Taking into account all of these aspects gives us a more refined understanding of the complexity of the air quality problem and leads us to approach the air quality problem with a view of the "big picture," separate from preconceived boundaries. This approach also enables us to identify logical groupings of processes, emission sources, and pollutants and to fully consider multiple CAA requirements and multiple pollutants in a comprehensive and coordinated manner. One can use this more refined understanding to make effective, efficient air quality management decisions. With this vision for the integrated, multi-pollutant sector-based approaches, the overarching goal is to develop sector-based strategies that optimize benefits to public health and the environment in a manner which minimizes compliance costs and other burdens to industries such as regulatory uncertainty.

The following paper presents the cement manufacturing sector as an example of an integrated, multi-pollutant sector-based approach to regulating air pollution. The cement manufacturing sector is an energy-intensive sector that grinds and heats a mixture of raw materials such as limestone, clay, sand, and iron ore in a rotary kiln to produce clinker. Clinker is then cooled and grinded and finally mixed with a small amount of gypsum to produce cement. Pollutants are emitted from the burning of fuels and heating of the raw materials and from the grinding, cooling, and materials-handling steps in the cement manufacturing process. This paper outlines the different components that were used to implement the sector-based approach to the cement manufacturing industry and describes the outcome – a consolidated emission reduction strategy. The approach described below was applied in the New Source Performance Standards (NSPS) and the National Emission Standard for Hazardous Air Pollutants (NESHAP) for the Portland cement industry promulgated by the EPA on September 9, 2010.[2]

OVERVIEW

As stated earlier, an integrated, multi-pollutant sector-based approach is one that requires the consideration of multiple CAA requirements and multiple pollutants in a comprehensive and coordinated manner in order to maximize desired results.

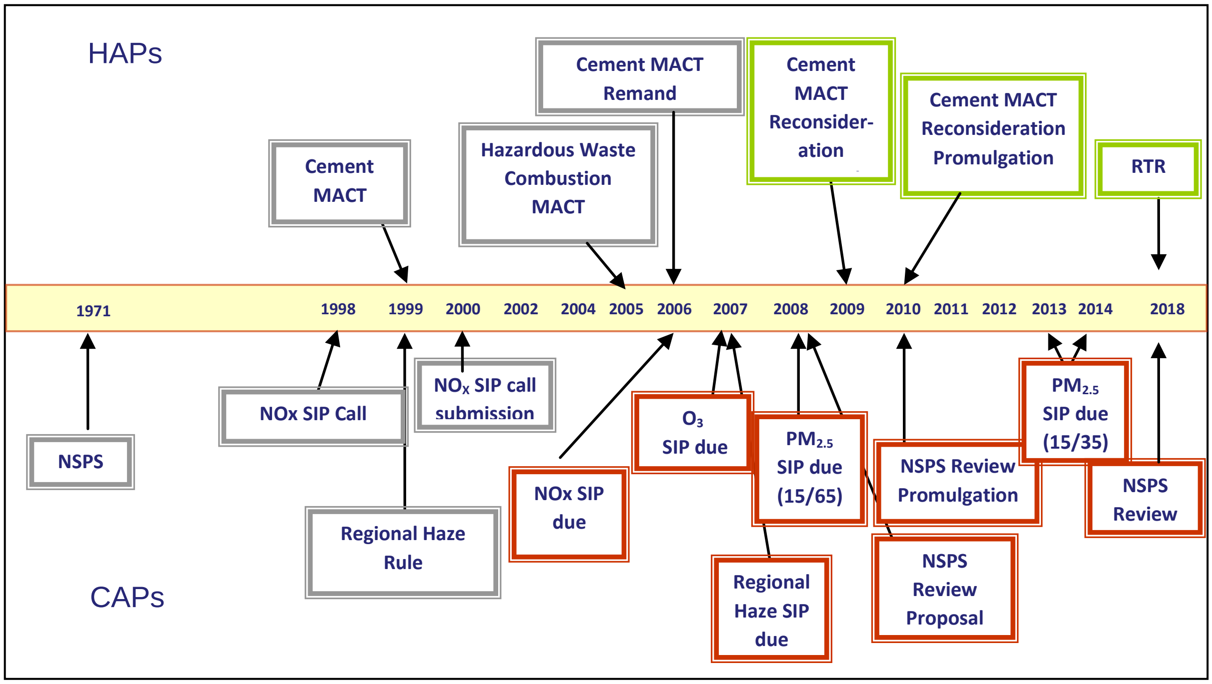
One aspect of the sector-based approach is the evaluation and implementation of multiple regulatory programs simultaneously, to the extent possible. Another is the expansion of the technical analyses with a focus on costs and collateral benefits of particular technologies in a manner which also considers the interactions with the regulatory programs in the sector. For the development of the integrated, multi-pollutant sector-based approach for cement manufacturing industry we considered the following analyses.

Regulatory Analysis

Multiple CAA regulatory requirements apply to the cement manufacturing sector. The first step to develop the integrated, multi-pollutant sector-based approach is to understand these regulatory requirements and their interactions. This regulatory analysis includes existing regulations as well as future actions that will affect the industry. The regulatory analysis for cement included New Source Performance Standards (NSPS), National Emission Standards for Hazardous Air Pollutants (NESHAP), Residual Risk and Technology Review (RTR), National Ambient Air Quality Standards (NAAQS) and State Implementation Plans (SIP). Figure 1 shows the regulatory landscape developed for the cement manufacturing industry.

The regulatory landscape provides an understanding of how the industry has been defined in the past, which pollutants have been regulated, from which emission sources and where improvements can be made. The regulatory landscape is an integral piece in defining the sector, developing the emission reduction strategy, streamlining regulatory actions, and maximizing interactions between HAPs, CAPs, and greenhouse gases (GHGs). The regulatory landscape pointed out programmatic opportunities to consider when developing the sector strategy for the cement manufacturing industry.

Figure 1. Regulatory Landscape: Portland Cement Manufacturing Industry



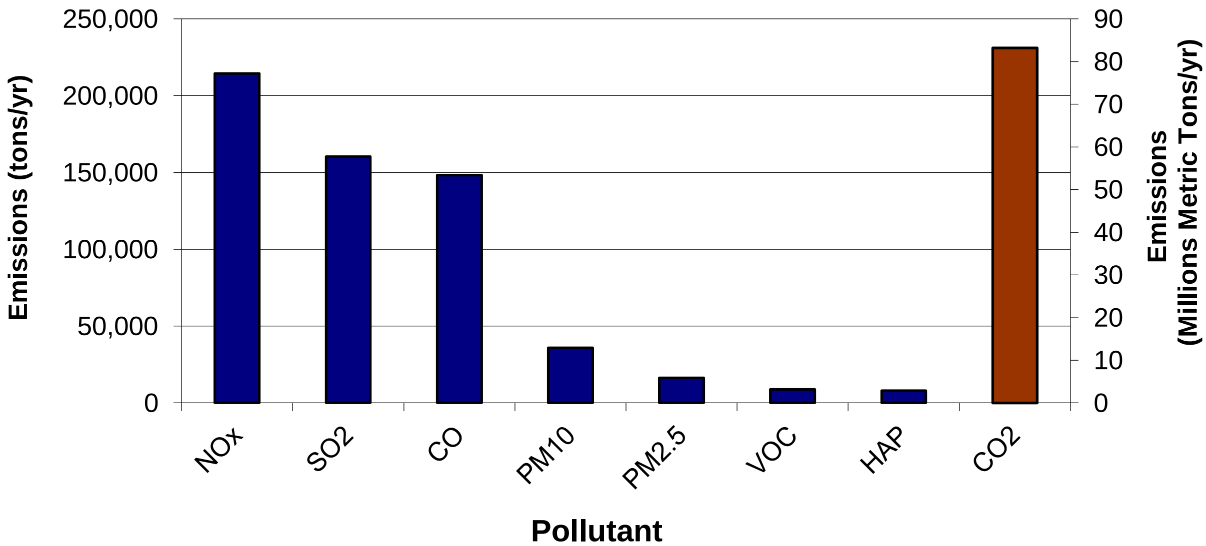
Emission Analysis

Simultaneously, with the understanding of the regulatory analysis, it is important to understand the emission profile for the cement manufacturing sector. The emission profile was used to answer the following questions:

- What are the main emission points in the sector?
- What are the emissions of concern (e.g. emissions with programmatic driver for control)?
- What are the emissions of interest (e.g. emissions that can be reduced when controlling emissions of concern)?
- Are there any gaps in the emission data?

Figure 2 shows the 2005 National Emission Inventory (NEI) emission profile for the cement manufacturing sector.[3] As seen in Figure 2, the cement sector emits CAPs, HAPs, and GHGs. The analysis of the emission profile showed that the main emission points for nitrogen oxides (NO_x), sulfur dioxide (SO_2), and carbon dioxide (CO_2) emissions are related to the cement kiln system (preheater, precalciner, and kiln), which accounts for 95% of NO_x emissions, 97% of SO_2, and almost all CO_2 emissions from cement plants. On the other hand, PM emissions are more ubiquitous that NO_x, SO_2, and CO_2 emissions.

Figure 2. Emission Profile: Portland Cement Manufacturing Industry.



As part of the emission analysis, we compared the emissions from the cement manufacturing sector with the emissions from other industrial sectors. Table 1 shows the summary of 2005 NEI emissions for the cement sector relative to other energy-intensive sectors. As shown in Table 1 the cement manufacturing sector ranks number six due to emissions of SO_2, NO_x, fine particulate matter ($PM_{2.5}$), volatile organic compounds (VOCs), and HAPs.

Table 1. Summary of 2005 NEI Emissions for Industrial Sectors (tons/year)

	Criteria Pollutants				HAPs	
Industrial Sector	**$PM_{2.5}$**	**VOC**	**SO_2**	**NO_X**	**Metal**	**non-Metal**
Electric Utilities	530,847	46,885	10,350,289	3,783,214	1,655	401,210
Boilers & Process Heaters	107,204	29,890	1,043,454	697,049	1,031	80,005
Ferrous Metals	26,091	17,010	157,508	73,846	1,052	4,896
Pulp and Paper	55,497	139,926	372,534	252,987	56	71,612
Petroleum Refining	30,339	115,112	247,239	146,185	26	9,668
Cement Manufacturing	17,388	9,004	157,563	228,112	63	3,353
Clay Products	5,053	2,800	16,716	10,315	92	6,792
Non-Ferrous Metals	12,595	11,879	199,550	21,563	194	11,823
Chemical Manufacturing	49,743	236,014	191,775	192,764	46	48,635

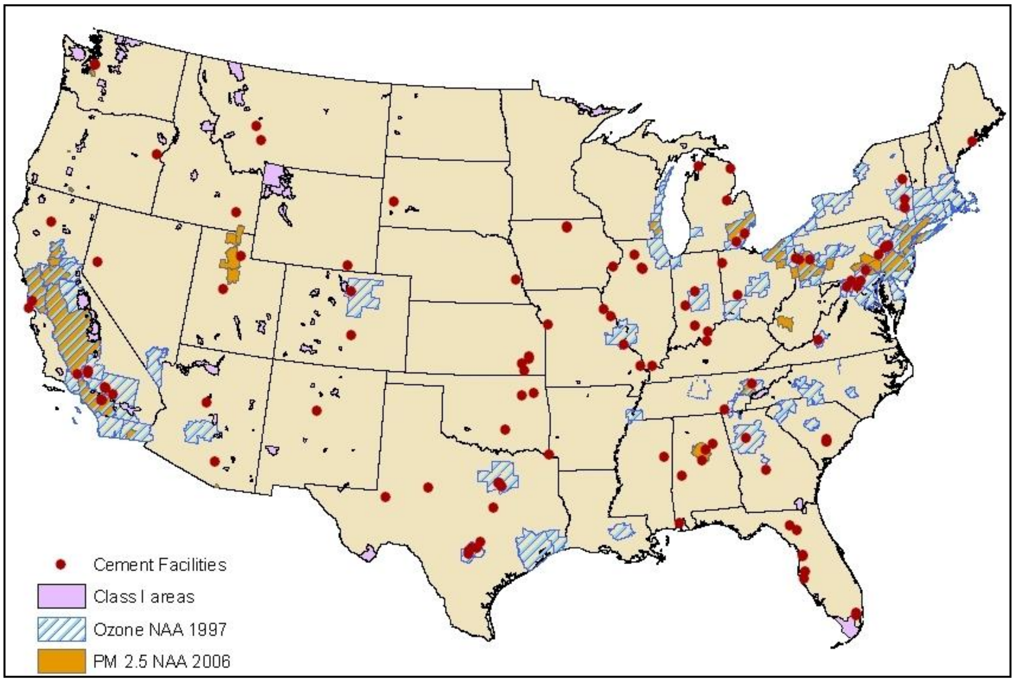
Oil and Gas Production & Distribution	14,129	643,352	110,476	1,027,730	*	32,701
Waste Incineration	6,760	11,776	17,072	52,219	67	12,550
Metal Foundries	24,766	43,014	18,561	16,349	206	3,367

* No HAP metals are expected from oil and gas production. Trace amounts of metals can be emitted from internal combustion engines and boilers at oil and gas transmission sites.

The emission analysis for the cement sector was coupled with a geographical analysis. Using geographical information for the cement manufacturing sector (location of sources), emissions at each facility, and U.S. air quality data, we assessed the proximity and magnitude of emissions of each facility to non-attainment areas, to Class I areas, and to environmental justice (EJ) communities. The geographical analysis is important because strategies designed under a multi-pollutant sector approach can impact areas designed as non-attainment areas under the NAAQS, Class 1 areas, and environmental justice (EJ) communities (e.g. minority populations, low-income, and tribal populations). Class I areas are areas of special natural, scenic, recreational, or historic (national or regional) value for which the Prevention of Significant Deterioration (PSD) regulations provide special protection.

The map in Figure 3 shows the location of cement facilities, non-attainment areas, and Class I areas. The Geographical Information System (GIS) analysis showed that 23 cement facilities were located in 24-hour $PM_{2.5}$ non-attainment areas, 39 were located in Ozone (O_3) non-attainment areas, and 14 were within a distance of 50 km of Class I areas. The cement EJ analysis done using GIS capabilities compared the aggregate population characteristics from the block groups in proximity to cement plants with those of the total population to determine if the cement sector might have EJ concerns. The cement sector EJ analysis showed that the aggregated characteristics of the population in close proximity to cement plants were not very different from the general population.

Figure 3. Cement Sector: Plant Locations and Air Quality



Economic Profile Analysis

All of the previous analyses helped us to understand the environmental footprint of the cement sector. Next, it was important to couple the environmental footprint with the economic analysis of the sector. The following questions were a guide for the economic analysis of the cement sector:

- How significant the cement industry to the U.S. economy?
- How many companies form this industry?
- How does the production of this industry rank with regard to global competition?
- What are the characteristics of the market in U.S.? How much is produced in U.S. vs. imported vs. exported?
- How do the processes used in the U.S. compare to other parts of the world?

The economic profile helped us to understand the forecast of the sector as well as the impact of the economic decisions in the environmental footprint. The economic profile shows that the U.S. cement sector is a significant component of the U.S. economy and ranks 3rd worldwide in cement production behind China and India.[4] This sector is highly dependent on the growth of the gross domestic product (GDP) and interest rates, special construction projects (i.e., highways) and public sector construction spending. In 2005 the annual value of shipments of cement produced in the U.S. was $8.6 billion.[5] Most of the cement is used to make concrete worth at least $48 billion in 2005. In 2005, 39 companies operated 107 cement plants in 35 states. From all these companies, all except two were foreign-owned as of year-end. The 2005 domestic production of cement was 99.3 million metric tons (94.4 MMT Portland cement, 4.9 MMT masonry cement) while imports reached 30.4 MMT. The average plant utilization rate was 93%. The Portland Cement Association (PCA) forecast cement consumption to reach 183 MMT by 2030; 41% growth over 2005 levels.[6]

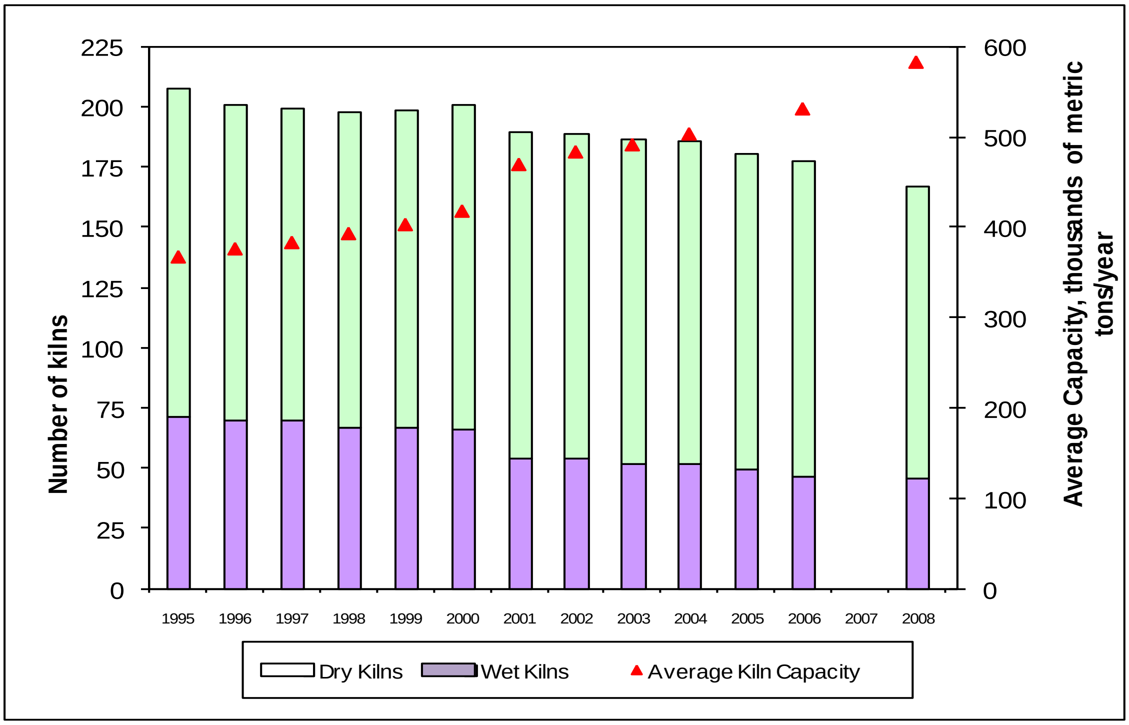
In the U.S. the cement industry is structured around demand centers due to the relatively high transportation costs of cement. PCA reports that the vast majority of cement produced in the U.S. is being transported less than 300 miles by truck due to cement's low value by weight and high cost of transport. However, cement may be transported over longer distances, especially when the less expensive rail and water transportation modes are available.[7]

Technological Analysis

Understanding the technological trends in the industry is important for determining the technological opportunities that are available for the sector. In general, technological opportunities can include changes in manufacturing processes, energy efficiency, and control technologies. The cement manufacturing sector is an energy-intensive sector that grinds and heats a mixture of raw materials such as limestone, clay, sand, and iron ore in a rotary kiln to produce clinker. Clinker is then cooled and grinded and finally mixed with a small amount of gypsum to produce cement. The heart of the cement production process is the rotary kiln. Rotary kilns are broadly categorized as dry- and wet-process kilns, depending on how the raw materials are prepared. Wet-process kilns are fed raw material slurry with moisture content ranging between 30 and 40%. A wet-process kiln needs additional length to evaporate the water contained in the raw material feed. Nearly 33% additional kiln energy is consumed in evaporating the water in the slurry. In dry-process kilns, raw material is fed as dry powder. There are three major variations of dry-process kilns in operation in the U.S.: long dry kilns, preheater kilns, and preheater/precalciner kilns. In preheater kilns and preheater/precalciner kilns, the early stages of pyroprocessing occur before the materials enter the rotary kiln. Preheater and preheater/precalciner kilns have higher production capacities and greater fuel efficiency compared to other types of cement kilns.

Figure 4 shows the trends in the industry regarding cement production technologies. As seen in Figure 4, the trend is for major capital investments to be concentrated in plants that use the dry process of cement manufacture, while the more energy-intensive wet process is being phased out.

Figure 4. Trends in Cement Kiln Type and Capacity in the U.S. (1995 to 2008).[8]



The technological analysis included an evaluation of control technologies and energy efficiency measures available and applicable to the cement manufacturing sector. Table 2 shows the control technologies applicable to the cement manufacturing sector and how these technologies can control multiple pollutants.[9] Table 3 shows some of the energy efficiency measures that can be applied to the cement manufacturing process.[10]

Table 2. Control Technologies Applicable to the Cement Manufacturing Sector.

Control Technologies	Pollutant Removal Efficiency (%)								
	PM	SO_2	NO_x	Hg[1]	THC/HAP[2]	Cr VI[3]	VOC	HCl[4]	CO[5]
Limestone Wet Scrubber (LWS)		90		80				99	
Dry Lime Injection		70						75	
Activated Carbon Injection (ACI)	99.9			90	50/80		*		
Regenerative Thermal Oxidizer (RTO)					98		98		98
Low NOx Burner (LNB) & Selective Non-Catalytic Reduction (SNCR)			65						
LNB & Selective Catalytic Reduction (SCR)			89.5	*	*		*		*
Fabric Filter with membrane bags	99.9					99.9			
LWS & ACI	99.9	90		98	50/80			99	
LWS & RTO		90		80	98			99	

[1] Mercury
[2] Total Hydrocarbons/Organic Hazardous Air Pollutants
[3] Chromium VI
[4] Hydrochloric Acid
[5] Cabon Monoxide
* Emission reductions are possible but they haven't been quantified.

Table 3. Energy Efficiency Clinker Making Measures

Energy Efficiency Improvement Method	Electricity Consumption Change, kWh/ton clinker				Heat Input Change, MMBtu/ton of clinker			
	Dry	Wet	Pre-heater	Pre-calciner	Dry	Wet	Pre-heater	Pre-calciner
EMCS (Energy Management and Control System)	-1.90	-1.50	-1.90	-1.90	-0.15	-0.21	-0.15	-0.15
SR (Seal Replacement)					-0.02	-0.02	-0.02	-0.02
CSI (Combustion System Improvement)					-0.25	-0.35	-0.25	-0.25
IF (Indirect Firing)					-0.16	-0.16	-0.16	-0.16
SHLR (Shell Heat Loss Reduction)					-0.20	-0.20	-0.20	-0.20
OGR (Optimize Grate Cooler)	0.90		0.90	0.90	-0.09	-0.10	-0.09	-0.09
CGC (Convert to reciprocating grate cooler)	2.40	2.40	2.40	2.40	-0.23	-0.24	-0.23	-0.23
HRPG (Heat Recovery for Power Generation)	-18.0							
EMD (Efficient Mill Drives)	-2.00	-1.70	-2.00	-2.00				

Results and Discussion

The multi-pollutant sector analyses helped to design a strategy for the cement manufacturing sector to optimize the reductions of CAPs and HAPs through the synchronization of the NSPS and NESHAP. The optimization included maximizing the use of multi-pollutant controls while minimizing conflicting and redundant requirements in emission limits and in monitoring, reporting, and record keeping of the NSPS and NESHAP. The strategy also aimed to maximize the interactions between the NSPS and NESHAP with other regulatory programs (e.g. NSR, Regional Haze, and $PM_{2.5}$ SIPs).

Below is a summary of the strategy developed to optimize the regulatory actions for the cement sector.

- Aligned the regulatory schedules for the cement NSPS and NESHAP**.**
- Established a THC limit in the NESHAP that provides for greater reductions than those expected from a VOC and CO limits applied within the NSPS.
- Aligned PM limit from NSPS with PM limit from NESHAP to provide greater reductions than those expected from NSPS only.
- Updated the NSPS and NESHAP PM limits to reduce the potential for requiring additional control under an RTR review in 8 years.
- Maximized interactions between the HCl and Hg limits for existing kilns in the NESHAP to produce SO_2 reductions as co-benefits for existing kilns. These collateral SO_2 and $PM_{2.5}$ emission reductions may be considered for "netting" and "offsets" purposes under the major NSR program or as credits that could help areas around the country with attainment of the SO_2 or $PM_{2.5}$ NAAQS.
- Allowed for alignment and consistency of monitoring, record keeping and reporting requirements, where appropriate (e.g., consistent averaging time for HAP and criteria pollutants).
- Allowed facilities to plan to maximize co-benefits of emission reductions while minimizing costs.

Estimated Emission Reduction and Monetized Human Health Benefits

The multi-pollutant cement sector strategy is projected to reduce emissions of PM, Hg, THC, HCl, SO_2, and NO_x.[11] The estimated annual emission reductions in 2013 for these pollutants are shown in Table 4. These emission reductions are based on the regulatory analysis done using the Industrial Sectors Integrated Solutions (ISIS)[12] model and the estimated kiln population in 2013.

Table 4. Estimated Emission Reductions

Emissions (tons per year)					
Policy	**Pollutant**	**Business as Usual**	**With Policy**	**Change in Emissions**	**Percent Change**
NSPS and NESHAP	Direct PM	6,349	622	5,727	90
	Hg	7.25	1.25	6.00	82
	THC	11,915	1,060	10,854	91
	HCl	4,434	137	4,297	96
	NO_x	123,372	96,154	27,218	22
	SO_2	115,164	35,775	79,389	68

In addition to the emission reductions calculated using ISIS, as presented in Table 3, reductions of secondary $PM_{2.5}$ are also expected. Secondary $PM_{2.5}$ is PM that results from atmospheric transformation processes of precursor gases, including SO_2 and NO_x. For the multi-pollutant cement sector strategy, reduction in secondary PM formation represents a large fraction of the total reduction in ambient levels of PM. Reductions of $PM_{2.5}$ are the result of PM controls (fabric filters with membrane bags), as well as the controls for HCl , and Hg controls (LWS and/or ACI) that are projected to be installed to meet the NESHAP limits, and SO_2 controls projected to be installed to meet the NSPS.

To estimate the human health benefits associated with reducing exposure to fine particulate matter ($PM_{2.5}$), we used the environmental Benefits Mapping and Analysis Program (BenMAP)[13] model to quantify the changes in $PM_{2.5}$-related health impacts and monetized benefits based on changes in air quality. The combined benefits of the NSPS and NESHAP significantly outweigh costs, yielding an estimated $7 to $19 in public health benefits for every dollar in costs. The ISIS model calculated the cost of installing and operating controls, at $350 million annually in 2013. Table 5 summarizes the avoided health incidences and the monetized $PM_{2.5}$ benefits estimated for the multi-pollutant cement sector rulemakings (NSPS and NESHAP).[14]

Table 5. Summary of the Avoided Health Incidences and Monetized $PM_{2.5}$ Benefits Estimates for the Multi-pollutant Cement Sector Rulemakings (NSPS and NESHAP)

	Avoided Health Incidences	**Monetized Benefits (millions of 2005$, 3% discount rate)**	**Monetized Benefits (millions of 2005$, 7% discount rate)**
Avoided Premature Mortality	960 to 2,500	$7,600 to $19,000	$6,900 to $17,000
Avoided Morbidity			
Chronic Bronchitis	650	$19	$19
Acute Myocardial Infarction	1,500	$11	$11
Hospital Admissions, Respiratory	240	$0.2	$0.2
Hospital Admissions, Cardiovascular	500	$0.9	$0.9
Emergency Room Visits, Respiratory	1,000	$0.03	$0.03
Acute Bronchitis	1,500	$0.01	$0.01
Work Loss Days	130,000	$1.2	$1.2
Asthma Exacerbation	17,000	$0.06	$0.06
Minor Restricted Activity Days	750,000	$3.0	$3.0
Lower Respiratory Symptoms	18,000	$0.02	$0.02
Upper Respiratory Symptoms	14,000	$0.03	$0.03

SUMMARY

This paper outlined the framework and analyses performed to develop the multi-pollutant sector-based approach for the Cement Manufacturing Sector. The EPA analyzed how the NESHAP related to the NSPS, RTR and their collateral impacts to NSR, Regional Haze and the NAAQS. The sector-based approach for the cement industry utilized findings of control technologies that achieve multi-pollutant reductions to avoid conflicting and redundant requirements by setting the same particulate matter requirement for both the NESHAP and the NSPS. It facilitated the streamlining of monitoring, record keeping, and reporting requirements on both rules reducing administrative and compliance complexities associated with complying with both regulations. It promoted a comprehensive strategy to co-control multiple regulated pollutants (i.e., mercury and hydrochloric acid) while obtaining reductions of sulfur dioxide and fine particulate matter as co-benefits. These collateral SO_2 and $PM_{2.5}$ emission reductions may be considered for "netting" and "offsets" purposes under the major NSR program or as credits that could help areas around the country with attainment of the SO_2 or $PM_{2.5}$ NAAQS.

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7 American Portland Cement Alliance (APCA); *Comments on EPA's Draft Economic Analysis of Air Pollution Regulations for the Portland Cement Industry (May 1996),* prepared for American Portland Cement Alliance by Environomics, January 29, 1997.

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9 Andover Technology Partners; Memorandum: *Costs and Performance Controls*, from Jim Staudt to Ravi Srivastava, Samudra Vijay, Elineth Torres. Dated March 10, 2009

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12 U.S. Environmental Protection Agency (U.S. EPA); *Industrial Sectors Integrated Solutions Model for the Portland Manufacturing Industry*. Research Triangle Park, NC, August 2010

13 U.S. Environmental Protection Agency (U.S. EPA); *Environmental Benefits Mapping Analysis Program (BenMAP).* See http://www.epa.gov/air/benmap/

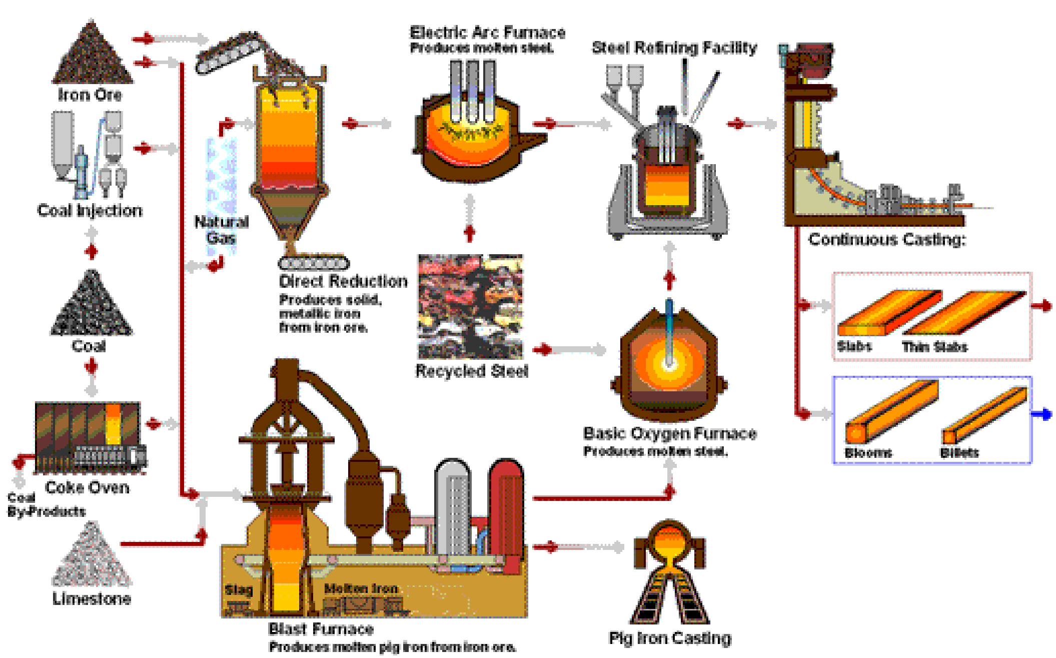
14 U.S. Environmental Protection Agency (U.S. EPA). *Regulatory Impact Analysis: National Emission Standards for Hazardous Air Pollutants from the Portland Cement Manufacturing Industry*. Office of Air Quality Planning and Standards, Research Triangle Park, NC. August 2010. See http://www.epa.gov/ttn/ecas/regdata/RIAs/portlandcementfinalria.pdf

Appendix D:
Types of Industrial Sectors Addressed by Air Regulations

As discussed in the report, under the sector-based approach, a sector may take several forms. The **first type of sector** can be characterized by a single primary emission source. For example, the cement sector's main emission source for HAPs, CAPs and greenhouse gases (GHGs) is the cement kiln. While other emissions occur at a typical cement facility (i.e., mobile source emissions, emission from the limestone quarry, and storage), the combustion and calcination processes in the kiln produce the primary source of multi-pollutant emissions. For this type of sector the multi-pollutant sector-based approach streamlines emission source definitions, regulatory timelines, and regulated pollutants based on the primary emission point identified. See Appendix C for more discussion on the cement sector.

A **second type of sector** may take the form of a set of activities or emission sources involved in the production of a product or a group of products, where not all of the activities involved are necessarily co-located (i.e., located within a facility fence-line). The iron and steel sector is an example of a sector that integrates multiple processes to produce one product. This sector can be characterized as an integrated system of mainly three processes (i.e. coke ovens, integrated iron and steel facilities, and electric arc furnaces at mini-mills) that together make one product—steel. A simplified schematic of the iron and steel production process is shown in Figure D1.

Figure D1. Simplified Schematic of the Iron and Steel Production Process



As shown in Table D1 below, these three main processes are currently regulated under many different Clean Air Act rulemakings.

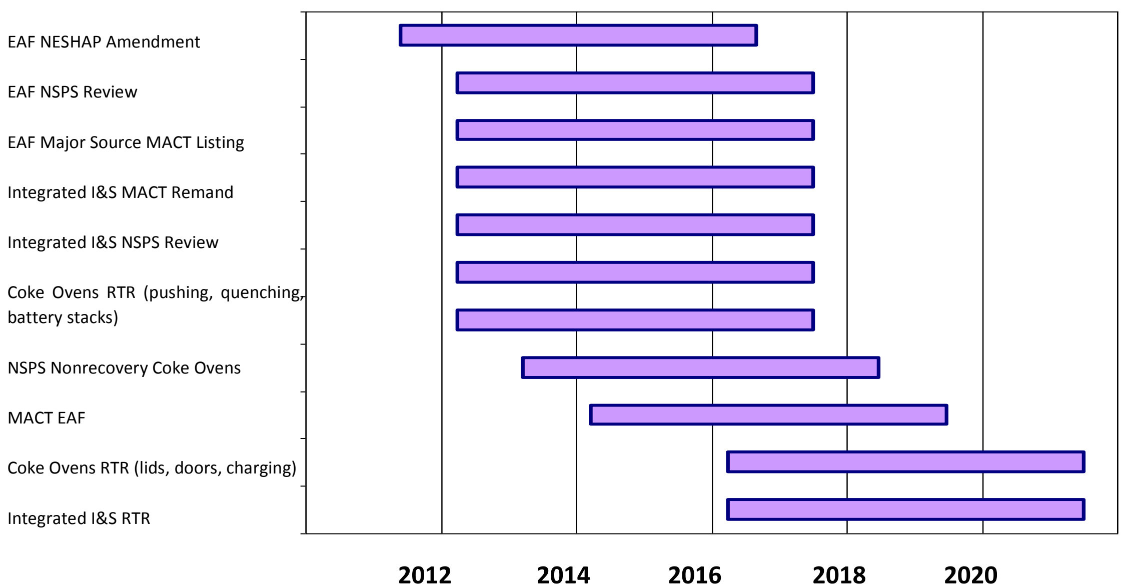
Table D1. Major Clean Air Regulations for the Iron and Steel Sector

Rule	Rule Type	CFR Citation	Year
Iron and Steel, NOx ACT	ACT/CTG		1994
Basic Oxygen Process Furnaces	NSPS	Part 60, Subpart N	1974
Steel Plants: Arc Furnaces (AA)	NSPS	Part 60, Subpart AA	1975
Steel Plants: Arc Furnaces (AAa)	NSPS	Part 60, Subpart AAa	1975
Ferroalloy Production Facilities	NSPS	Part 60, Subpart Z	1976
Basic Process Steelmaking Facilities	NSPS	Part 60, Subpart Na	1986
Coke Oven By-product plants	Pre-1990 NESHAP	Part 61, Subpart L	1989
Coke Ovens: Charging, Topside, Door Leaks	MACT	Part 63, Subpart L	1993
Ferroalloys Production	MACT	Part 63, Subpart XXX	1999
Steel Pickling	MACT	Part 63, Subpart CCC	1999
Coke Ovens: Pushing, Quenching & Battery Stacks	MACT	Part 63, Subpart CCCCC	2003
Integrated Iron and Steel (I&S)	MACT	Part 63, Subpart FFFFF	2003
Stainless & Non-stainless Steel Manufacturing: Electric Arc Furnaces (EAF)	Area Source	Part 63, Subpart YYYYY	2007

To advance an integrated approach to air pollution regulation in this type of industry sector, the EPA could focus on distinct parts of the production processes (e.g. materials handling and processing, coke production, and metal productions) and identify a strategy that will significantly cut criteria air pollutants (CAPs), hazardous air pollutants (HAPs), and health risks while encouraging pollution prevention, energy efficiency, and technology innovation. Opportunities may exist for regulatory actions in this type of sector to possibly be structured to maximize the interactions of control technologies and pollutants across the sector. For example, in the iron and steel sector there is a direct relationship between emissions of particulate matter (PM), regulated under the various NSPS, and the emissions of metal HAP, regulated under the various NESHAPs. The primary pollutants emitted by the iron and steel industry are PM and metal HAPs (primarily manganese). Fortunately, the application of air pollution control devices to reduce PM emissions (for example, to achieve compliance with ambient air standards for $PM_{2.5}$) also reduces emissions of HAP metals (other than mercury) and reduces the adverse health effects of HAPs, which is relevant to the review of NESHAP and for residual risk. This interaction is especially important for the two types of steelmaking furnaces (i.e. basic oxygen furnaces [BOF] and electric arc furnaces [EAF]), both sources of PM and metal HAPs and both subject to NSPS and NESHAP. Another example is coke ovens, where emission standards that reduce leaks from the coke ovens during coking also reduce emissions of a variety of pollutants, including PM, metal HAP, volatile organic compounds, and organic HAP.

For this type of sector, the impact of a regulatory action on one element of the industry could possibly cause a reaction in other parts of the integrated system of technologies. Therefore, bundling the review of emissions and technologies across industries operating in this type of sector could possibly maximize air quality benefits while minimizing economic impacts. Figure D2 provides one illustration of how regulatory obligations could possibly be bundled for data collection, analysis, and review for the iron and steel industry.

Figure D2. Illustrative Ferrous Metal Sector Timeline



A **third type of sector** is one characterized by the grouping of similar sources in facilities that are co-located. An example of this third type of sector would be the Petroleum Refining sector and Chemical Manufacturing sector. Refineries and chemical plants are complex facilities that contain hundreds of emission points of HAPs and CAPs. These emission sources include combustion sources such as boilers and process heaters, flares, and miscellaneous catalyst activities that require catalyst regeneration via combustion (e.g., cracking units), as well as evaporative loss sources such as storage tanks, leaking equipment (e.g., heat exchangers, piping components), wastewater treatment units, miscellaneous atmospheric venting operations, and transfer and loading sources. A typical refinery or chemical plant can have hundreds of separate emission sources emitting HAPs, CAPs, and other pollutants (e.g., reduced sulfur compounds). Additionally, facilities are often co-located in heavily industrialized areas such that emissions from these sources impact ambient air quality for large portions of the population and contribute to levels of air toxic emissions in surrounding communities that may cause significant health effects. Numerous NESHAP, MACT, and NSPS regulations have been developed over the years to address these emission points. While significant reductions have occurred through implementation of these requirements, there are still gaps in our understanding of emission sources and the magnitude of emissions.

One potential plan for comprehensively addressing the refining and chemical sector relies on increasing our knowledge base, coordinating and completing actions relating to the risk and technology reviews required under MACT and under NSPS, and then developing generic standards that consolidate, clarify, and simplify compliance requirements and facilitate the increased use of advanced emission control technologies and practices.

Recent experience in developing and later withdrawing a residual risk standard for refineries highlights the need to have accurate and complete emission information.[31] Many refining and chemical emission points are well understood because they can be readily captured and measured or they can be characterized through chemical engineering principles. However, some sources, such as leaks from process piping, flaring, wastewater, and other sources are more difficult to characterize and are thought to make up a significant percentage of the emissions footprint for refinery and chemical complexes. In addition, there are sudden, unplanned events that can occur during routine processing operations that result in significant emissions. Recent advances in source measurements and monitoring have made it possible to measure emissions or otherwise quantify the impacts of what have, up to now, been sources difficult to characterize. OAQPS has been and continues to work with states and other EPA offices to deploy monitoring and measurement projects to produce better emissions information. OAQPS also plans on issuing industry-wide information collection requests to gather comprehensive emissions and process data. And we are developing source category-specific multi-pollutant inventories and multi-pollutant control strategy economic and performance assessments. Together these efforts will inform our refinery and chemical sector residual risk analysis and rule development phase.

Because most refining and chemical sector operations have similar sources and are often co-located, OAQPS will develop a limited number of rules that are consistent and that can be applied to numerous sources: vent controls, tank controls, heat exchanger controls, wastewater controls, and leaking equipment controls. These generic standards would consider cost effectiveness and technical feasibility of control of both CAPs and HAPs. Given their multi-pollutant aspect, these generic standards could also address both NSPS and MACT technology review requirements at the same time, therefore consolidating the 8-year obligation under both programs. Further, the standards could be applied to many more sources in the refining and chemical sector.

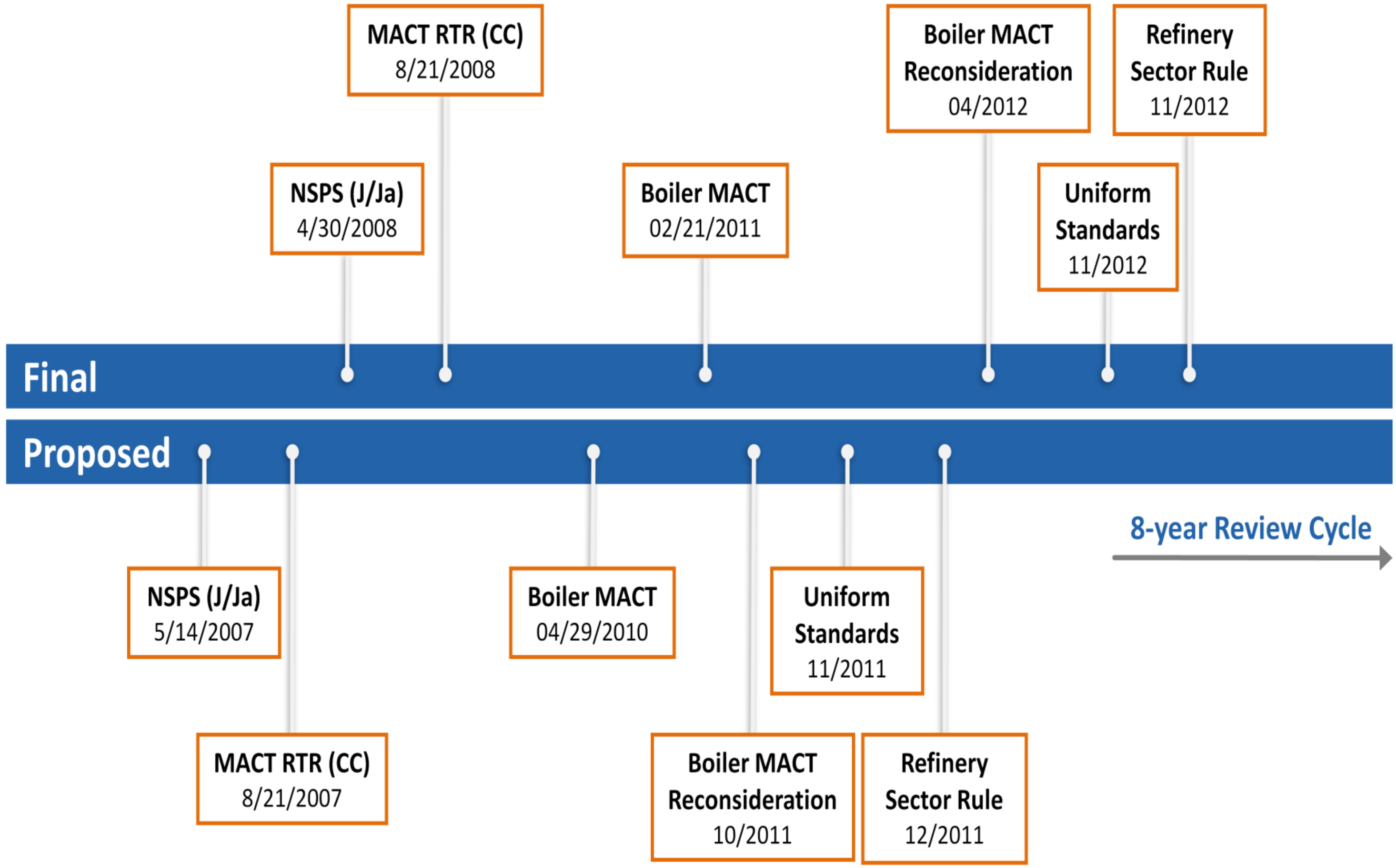
[31] 74 FR 55505 (October 28, 2009)

Appendix E:
Petroleum Refinery Sector Regulatory Summary

Petroleum Refinery Sector Regulatory Summary

Emission Point	Current Regulations	Actions
Boilers	NSPS: Db	NSPS Db tech review
Process Heaters	NSPS: J, Ja	NSPS tech review GHG NSPS UUU Residual Risk Rule and Technology Review
FCCU, Reg, SRP	NSPS: J, Ja MACT: UUU	
Process Vents	MACT: CC	CC Residual Risk Rule and Technology Review NSPS tech reviews Uniform Standards
Wastewater	MACT: CC Part 61: FF NSPS QQQ	
Storage	NSPS: Ka, Kb MACT: CC, EEE NESHAP	
Loading	MACT: CC, EEE NESHAP	
Equipment Leaks	MACT CC, UU, TT NSPS GGG, VV NESHAP	

Petroleum Refinery Sector Regulatory Timeline



How Relevant NAAQS Compare to the Petroleum Refinery Sector Regulatory Timeline