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

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

Revised Draft – June 1, 2011

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Executive Summary

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I. Introduction

Since the passage by Congress of the Clean Air Act Amendments of 1990, the U.S. Environmental Protection Agency (EPA) and the U.S. business community have invested significant resources in creating a world-class system of clean air protection. The results of these investments have been nothing less than impressive. The air is cleaner and public health has improved dramatically.[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, tribal, 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 national 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 (MACT) standards and 6 criteria air pollutant (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 be subject to different regulations controlling different forms of air pollution and each

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[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 full discussion of the costs and benefits of the Clean Air Act.

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 recordkeeping and 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 8 years. Likewise, the new source performance standards (NSPS) rules controlling criteria pollutants for industry must also have a review of technology every 8 years.

In this complex era of air pollution control, optimizing our nation's clean air investments requires a simultaneous consideration of all of our air quality goals. Reductions in criteria air pollution emissions such as fine particulate matter must be considered side-by-side with reductions in air toxics emissions such as benzene. Clean air investments must also be implemented in a manner that enhances and supports energy efficiency.

To meet this challenge, EPA is investing resources in developing approaches that consider more than one type of air pollution at a time. These "multi-pollutant" approaches have been recognized as a key approach for the next generation of clean air strategies. 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. This report presents a discussion of these benefits and challenges, a *Framework* for evaluating new approaches, and a set of recommendations for moving forward.

II. Work Group Approach

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

Early Work Group Discussions

At its May, 2010 meeting, the CAAAC's Subcommittee on Economic Incentives and Regulatory Innovation discussed EPA's initial developments of sector-based approaches to air pollution control. Matthew Witosky of OAQPS's Sector Policies and Programs Division (SPPD) addressed efforts to coordinate the development of air toxics (MACT) and new source performance standards (NSPS) in industrial sectors.[2] Brenda Shine then presented the multi-pollutant sector-based work of their SPPD for the petroleum

[2] EPA. "Sector-Based Multipollutant Approaches for Stationary Sources," presented to CAAAC Subcommittee Meeting, May 26, 2010.

refinery sector.[3] 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?
- What are the market-based mechanisms that EPA should be investigating for sector-based approaches that would help the sector to be more efficient?
- How can 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 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 needs associated with implementing source-wide multi-pollutant strategies[4]:

- 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

[3] EPA. "Petroleum Refinery Sector Update," presented to CAAAC Subcommittee Meeting, May 26, 2010.

[4] 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.

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 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.

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.[5]

Each roundtable discussion included presentations from industry trade associations and representatives from individual companies, and utilized 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 environment and economic opportunities. 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.

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[5] 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.

III. Background

Current air pollution control policies and practices have resulted in significant emissions reductions of air pollutants and their concentration in the atmosphere. To obtain these reductions, 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 now face the task of developing and installing equally comprehensive air pollution control and compliance systems. Future progress depends on increased coordination between these clean air programs. This necessity was recognized by the National Academy of Sciences' 2004 report recommending that EPA take an integrated, multi-pollutant approach to air quality management.[6]

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

Over the past decade, EPA has transitioned to a more integrated multi-pollutant approach called the "multi-pollutant sector-based approach." By using a more holistic approach, EPA hopes to achieve better environmental benefits in a more efficient manner. To maximize potential environmental benefits, this new regulatory framework challenges 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, EPA expects to achieve the following results:

- Maximize the co-benefits from air pollution control investments.
- Expand integration of multi-pollutant reduction strategies, such as energy efficiency and pollution prevention considerations into air pollution control investments and management.
- Promote additional source-wide emission reductions beyond minimum statutory requirements.
- Accelerate the 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.

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[6] 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.

EPA's new analytic capacity includes developments in integrated emissions inventories, integrated air modeling and monitoring capacity, and advancements in multipollutant technology and cost assessment tools.[7]

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. 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 multipollutant emission inventories and reduction projections together with information about the cost of the technologies applied.[8] CoST facilitates a level of collaboration between control strategy development and emission inventory modeling that was not previously possible.

Utilizing this new analytic capacity, 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, non-attainment area emissions and GHG emissions), EPA developed several different ranking exercises of these sectors. In general, ten to fifteen 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. These prioritization exercises are taken into account, together with legal and court-ordered timetables, to determine EPA's regulatory agenda for stationary sources of air pollution. Table 1 shows a resultant list of priority sectors.

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[7] 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

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

Table 1. Summary of 2005 National Emission Inventory Emissions for Industrial Sectors (tons/year)[9]

Industrial Sector	Criteria Pollutants				HAPs	
	$PM_{2.5}$	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

To date, work on the rule prioritization, data integration, and tool development has led to the advance of more integrated approaches for industrial sectors. 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, EPA's utility sectors strategy will allow a coordinated approach to 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). And, as demonstrated by the recent cement sector rulemaking, the sector-based approach reduced conflicting and redundant requirements by setting the same particulate matter requirement for both the NESHAP and the NSPS (see Appendix B).[10]

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[9] Elineth Torres, US EPA. *Integrated Multi-pollutant Sector-based Approach for the Cement Manufacturing Industry*. Working Paper, 2011.

[10] US 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

In addition to improved coordination within sectors, EPA has been able to coordinate across sectors when considering standards for industrial boilers, commercial and industrial solid waste incinerators and utilities. EPA also coordinated listening sessions for the integration of GHGs in the sector-based approach for utilities and petroleum refineries.

To carry out these approaches, OAQPS is taking these steps.

1. Determine which activities would benefit from such approach and group those activities in the corresponding sector.
2. Review the sector's current and pending regulatory requirements and actions across multiple clean air programs in a coordinated manner.
3. Perform integrated, multi-pollutant analyses for the sector.
4. Consolidate regulatory requirements across pollutants and programs for the sector, where possible.
5. Identify programmatic incentives and other non-regulatory cross program benefits.
6. Improve emission inventories and data systems.
7. Coordinate overlapping CAA mandated compliance timelines and review cycles.

The Clean Air Act Requirements and Opportunities of 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, 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 2 shows the CAA requirements for direct federal stationary source regulation and guidance.

Table 2. 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 (11 rules)	Every 8 years
	MACT technology review (96 rules)	Every 8 years
	MACT residual risk review (96 rules)	8 years after promulgation
	Area source rules (47 area source & 12 MACT rules cover 70 source categories)	Varies
	Area source rules review (70 technology, 12 residual risk)	Every 8 years
Section 129 **Solid Waste Incineration**	Technology reviews (5 rules)	Every 5 years
	Residual risk reviews	8 years after promulgation
Section 111 **NSPS** New Source Performance Standards to address criteria pollutants	NSPS technology review (68 rules)	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
Title 1 Parts C & D **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 (BART) reviews	Every 8 years

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

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, 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, EPA can identify control technologies that would best achieve multi-pollutant emission reductions while minimizing costs. In an integrated, multi-pollutant approach, EPA also assesses the applicable and necessary monitoring requirements to reduce administrative and compliance complexities associated with complying with multiple regulations. Within a rulemaking, 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," EPA must promulgate standards for that source category. In addition, 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, EPA must determine how the NESHAP and/or NSPS under consideration relate to RTR requirements applicable to the sector. In developing a rulemaking, 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 EPA regulates six 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, 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 impairment 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, EPA would consider whether a non-BART-related rulemaking controlling emissions which may affect visibility would have an impact on regional haze.

Many Types of Industry Sectors

The U.S. economy is comprised of, and 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 HAPs, CAPs and greenhouse 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, 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 B for a full discussion.

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 C presents a more lengthy consideration of sector types by further describing 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 presence 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 for 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 various air pollutant regulatory programs relevant to a particular industry sector. These potential opportunity areas are listed in Figure 2.

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 a series of questions that could be asked within each of these seven areas to determine the specific types of opportunities that may be relevant to consider within a specific industry sector. These questions are listed in Figure 3.

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 emissions 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 trade-offs with regard to air emissions or multi-media environmental impacts (e.g., air, water, hazardous waste) that arise from pursuing one technology versus another?
    - Are there steps that can be taken to support more rapid technology adoption and equipment 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, including 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 them. The Work Group identified several categories of benefits and/or challenges that are useful to assess. In some cases, measures may be available to counter or 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, greenhouse gas emissions)?
   - 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 affect disproportionally-disadvantaged or vulnerable populations or environmental justice considerations?
   - How transparent would the approach and its outcomes, when implemented, be to the interested public and local communities?

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

6. **Legal feasibility**
   - Can the Clean Air Act be reasonably interpreted to accommodate the proposed approach?
   - What is the likelihood that the approach will face and pass legal challenge?

V. Observations

This section provides expanded discussion on 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.

First Steps: Opportunities Before Multi-Pollutant Approaches

Discussions during the two industry roundtables revealed that substantial opportunities remain in some sectors to improve implementation of current regulatory approaches. Many roundtable participants emphasized that it is important to pursue such improvement opportunities in parallel with current efforts to advance innovative multi-pollutant approaches in specific industry sectors. The Work Group identified specific areas of opportunity outside of multi-pollutant approaches, including:

- *Timely and clear guidance*. Participants encouraged EPA to place a high priority on efforts to ensure that guidance on rule implementation and related information such as test methods are available simultaneously with the release of new or revised standards.
- *Permitting*. 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. For example, EPA's Clean Air Act Title V (permitting) whitepapers 1 and 2 address a variety of approaches for streamlining and improving the design of permits.[11] Plantwide applicability limits (PALs), made available through EPA's December 2002 New Source Review (NSR) rulemaking, can give facilities the opportunity to make operational changes under a plantwide emissions limit without triggering the applicability of NSR.[12] 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).[13] 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 opportunities to consider

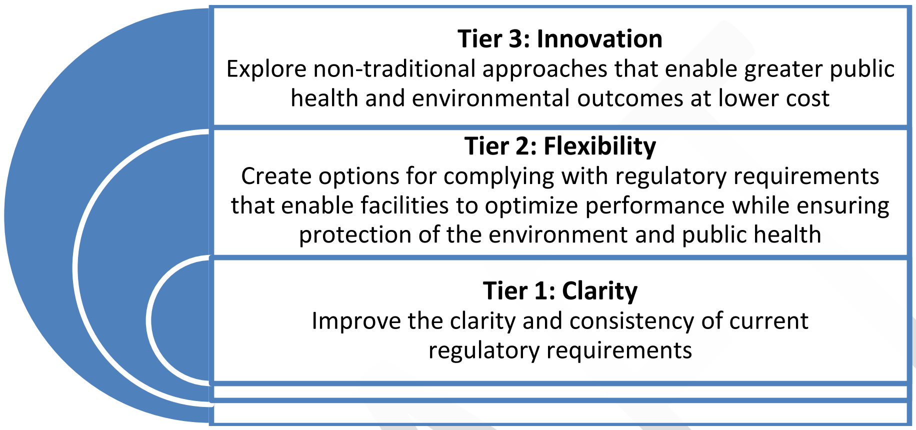
[11] See Title V White Paper 1 (http://www.epa.gov/ttn/oarpg/t5/memoranda/fnlwtppr.pdf) and White Paper 2 (http://www.epa.gov/ttncaaa1/t5/memoranda/wtppr-2.pdf).

[12] http://www.epa.gov/NSR/fr/20021231_80186.pdf

[13] http://www.epa.gov/NSR/documents/FinalRule2009.pdf

appropriate strategies for tailoring these approaches for use 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 that enables EPA to advance toward expanded multi-pollutant approaches as opportunities and trust among stakeholders grows.



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 recordkeeping 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 8 year cycle. Efforts to coordinate or align the timing and sequencing of air regulations within a sector may present opportunities to optimize investments in pollution controls and compliance systems, while utilizing 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.
- Coordinating 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.

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.
- 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 NESHAP 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 8 year cycle of NSPS and MACT review could fit well with business capital investment horizons.

In this context, participants discussed the value in aligning the timing and/or coordination of technology reviews and revisions to the NSPS and MACT standards that 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 utilize common pollution control equipment or compliance management systems. For example, Appendix D 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 standards (NAAQS).

Failure to align the timing of revisions of NESHAPs 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 opportunity to identify areas where such alignment among sector-focused air regulations could be improved.[14] 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.

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 NESHAPs 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 NESHAPs and NSPS standards.[15] Other participants noted that direct coordination and alignment

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

[15] 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

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 NESHAPs or NSPS standards, a few participants indicated that plantwide 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 BACT or LAER" determinations that might align with new NESHAP and/or NSPS standards for some period of time.

Strategies to consider

- Intensify efforts to coordinate 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, utilizing a "checklist" of questions (similar to those presented in the Framework section) to guide consideration of alignment opportunities.
- Consider how anticipated revisions to the NAAQS may affect SIP requirements addressing emissions controls for the sector and take into 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 area of opportunity to pursue multi-pollutant approaches. Aligning how sources are defined across regulatory programs affecting

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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) similar operations within a sector, such as the NESHAP and NSPS programs, may enhance the clarity and simplicity of regulatory approaches addressing multiple pollutions. 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. [Is there an example of a successful redefinition of source category that could be added here?]

Potential benefits

- Combining regulations that address similar operations can create a simpler regulatory system that reduces redundancy across regulations in ways that makes 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 see and address multi-pollutant opportunities 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.
- 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 look for opportunities 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. [What specific examples can we provide to highlight this point?] Participants also indicated that there may also be opportunities to reduce the number of regulations addressing storage tanks 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) 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."[16] [What additional discussion with specific examples or opportunities would be helpful to add? To what extent is this already done? Where are source definitions aligned and about the right scope? Where are they not aligned and too narrow in their scope?]

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 plantwide applicability limit or PAL concept promulgated by 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.[17] 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. Efforts to adjust source definitions and the 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

- Identify and pursue opportunities within the NSPS and NESHAP programs to reduce the number of unit-specific regulations that may be relevant to sources

[16] Traylor (August 2010), p. 20.

[17] For a discussion of experiences with PALs and other types of plantwide emissions limits, see US 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

within particular sectors, while looking for opportunities to align source definitions and scope across the NSPS and NESHAP programs.
- Work with permitting authorities and regulated sources to explore opportunities 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. In cases where there are trade-offs 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 appropriate 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.
- 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.

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 opportunities to align the frequency of monitoring, averaging times, data compilation formats, QA/QC approaches, or other aspects of monitoring and data requirements. [Are there any specific examples that highlight these types or opportunities or that point to where this is being done well? Are there experiences from the cement sector rulemakings that could be discussed here?]

New monitoring technologies and approaches, including continuous emissions monitors (CEMS) and fence line ambient concentration monitors, can 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 in which there may be trade-offs among different pollutant emissions depending on the control technology or approach used. Similarly, new monitoring approaches may be useful to increase stakeholders' comfort with the use of facility-wide approaches which 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 can 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 Petrochemicals) operates a chemical plant in the 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 TCEQ's 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 reduced by more than 75 percent, or almost 70 tons per year.

TPC's emission reductions of 1,3-butadiene were due to the installation of a flare gas recovery system and other process improvements[18], 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 a "hit" of the fence-line system at 15 ppb 1,3-butadiene. Facility shift supervisory personnel receive email alerts for a "hit", 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 (ppbRAE) 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.

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.

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 often overpredict 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 PSD, but monitoring was showing they were well below levels. The expanded use of emissions and ambient air quality monitoring should improve understanding of multi-pollutant emissions levels and modeling approaches. [How can we enhance the multi-pollutant aspects of monitoring approaches that complement modeling?]

Strategies to consider

- When developing or revising rules, EPA should examine the specific monitoring and data collection requirements included in other regulations and guidance

[18] 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.

relevant to the process or emission unit to see if there are opportunities to align or coordinate approaches.

- [Are there steps that permitting authorities or regulated sources could take to ensure that permit requirements incorporate a well-aligned approach to monitoring and data collection for specific emissions units or process areas?]
- Document and share case studies of creative approaches for using new monitoring approaches to enable multi-pollutant approaches.

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.

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.

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;
- NSPS, MACT, and hazardous organic NESHAP (HON) standards relevant to storage tanks; and
- [What other specific opportunity areas could be added here?]

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. [What information could be added to improve the detail and accuracy of this example?]

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. [Is there a good example that would illustrate this need?]

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. [Are there other examples? How might these discrepancies between state and federal rules be addressed?]

Strategies to consider

- When developing or revising rules, EPA should examine the specific record keeping and reporting requirements included in other regulations and guidance relevant to the process or emission unit to see if there are opportunities to align or coordinate approaches.
- Investigate opportunities to 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 explore opportunities to simplify 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 typically interested to ensure (with reasonable certainty) 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.

EPA has supported research efforts to identify viable multi-pollutant emission control options relevant to some industry sectors. For example, 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.[19] 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. [Are there other sectors for which analyses of multi-pollutant benefits of alternative control options have been conducted? What experiences from the EGU and the cement sectors can be summarized here—for example, what did the analyses in these sectors reveal and how has this information been used in the context of rulemaking?]

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. [Are there any specific examples we can reference aside from the DOE Industries of the Future program that is mentioned in the next section?] 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 other tested pollution control equipment, even if the novel system performs optimally from a multi-pollutant perspective.

Participants indicated that there may be steps EPA and state, tribal, and local 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 "create space" for innovation that can have major multi-pollutant emissions reduction benefits. [What additional information could we add on this pilot project (involving International Paper)?]

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 Best Available Control Technology (BACT) and the same as those identified as

[19] US 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

satisfying MACT standards. However, over time, divergence can emerge with BACT and MACT requiring different types of emission controls. [What additional information would be useful to discuss here? Are there any examples of where this has occurred? Are there steps that should be taken to enhance alignment between BACT/LAER and MACT and NSPS control technology requirements?]

[What can we say about the role of work practice standards relevant to multi-pollutant strategies?]

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. [What additional detail can we add on specific technologies that illustrate the trade-offs? What technologies may provide a non-GHG-emitting alternative to thermal oxidizers? It would be helpful to include an example that highlights an "energy penalty" associated with air toxics controls (e.g., the energy related increases in NOx emissions).] 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. For example, some pollution control systems are effective at removing contaminants from the air, but these same captured contaminants may pose water quality or waste challenges.

Strategies to consider

- When developing or revising rules, EPA should consider opportunities to align or coordinate emissions control requirements and approaches across various regulatory programs.
- 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

Opportunities to reduce energy use are 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 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 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.[20]

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 Programme, active research is underway to research and develop “breakthrough technologies” that could dramatically reduce the environmental footprint, including air emissions, or the iron and steel sector.[21] 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.

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[20] 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.

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

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 need to develop creative approaches to address these types of opportunities.

Strategies to consider

- When developing or revising rules, EPA should consider opportunities to align or coordinate emissions control requirements and approaches across various regulatory programs with energy efficiency opportunities.
- Explore creative opportunities to 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 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. The combination of new monitoring and collaborative approaches may spur opportunities to drive substantial reductions in local public health risks and impacts—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.
- 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.

Potential challenges

- Effective development of community-focused strategies that engage local community members in meaningful ways can take substantial time and effort to build.

- 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 and may be impeded where scientific understanding is less certain.

Observations and examples

CAAAC Work Group members discussed the importance of pursuing community-focused strategies that can enable flexibility and innovation, resulting in lower emissions and human and ecosystem health impacts at lower cost. Participants observed that community-focused strategies often begin with regular and meaningful opportunities for interested community members to meet with representatives from the regulated facility and permitting authority to share and discuss information, concerns, approaches, and action plans. Increasingly, the use of innovative monitoring technologies and approaches can enhance understanding of ambient air quality or even estimates of exposure and health risks or impacts. Monitoring, when paired with an effective collaborative process that builds trust and understanding, can produce emission control strategies that reduce health risks and impacts from multi-pollutant emissions more rapidly and at lower cost than otherwise might be possible.

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. Environmental justice (EJ) initiatives typically seek to address and mitigate these types of situations where communities experience disproportionate impacts to health and well-being.[22] 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."[23] Multi-pollutant approaches may create

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[22] 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

[23] 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

opportunities to focus 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 discuss 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. 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.

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 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.[24] To this end, EPA plans to work closely with program and regional offices, states, tribes, and community stakeholders and develop a common mapping platform and nationally consistent screening and targeting tool to enhance EJ analysis and decision-making.

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 of the role interested members in the community can play in decision-making processes and what specific involvement opportunities exist (e.g., public comment);
- Understanding of unique characteristics of each community affected (e.g., demographics, socioeconomic status, other polluting facilities in the area, previous history/experience with EPA and industry, etc.); and
- Lessons learned from past projects.

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

Strategies to consider

- Develop case studies of model community-focused approaches (including those involving innovative monitoring technologies and collaborative processes) that have sought to advance multi-pollutant emission control strategies that optimize reductions in health risks and impacts. Share these case studies with permitting authorities and industry sector organizations to encourage broader consideration, use, and experimentation involving community-focused strategies.
- Provide input to environmental justice initiatives and activities EPA is involved with to highlight opportunities and challenges associated with multi-pollutant considerations.
- [What other strategies should be considered?]

VI. Conclusions

The Work Group identified several conclusions from its discussions.

First, the time is right to look at ways to advance multi-pollutant approaches within sectors. We have more than 20 years of experience with developing unit-specific air standards related to criteria and hazardous air pollutants. We are now able to conduct more sophisticated sector-wide assessments of air emissions. 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 is ripe to take a more rigorous look at opportunities to align and optimize the various air regulations affecting individual 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 EPA, industry, and other stakeholders to overcome. The primary benefits anticipated include better environmental and public health outcomes at lower cost to business and government. Sector-based multi-pollutant approaches also promise a regulatory system that reduces redundancy across regulations, enhances compliance with applicable requirements, and improves trust and communication between regulated facilities and local community members. The challenges of moving to multi-pollutant approaches are real and will 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 opportunity to advance multi-pollutant approaches will vary substantially between industries. Sector-specific approaches are needed. While some learning can be transferred across sectors, progress will require careful, sector-specific exploration and initiative. A variety of policy innovations will be required.

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. As discussed in this report, EPA has begun to explore and develop multi-pollutant approaches within several priority sectors. The following section summarizes the Work Group's recommendations to EPA for evolving and expanding these efforts.

VII. Recommendations

The Work Group identified several recommendations to EPA which the Work Group believes 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. EPA should expand efforts to advance multi-pollutant clean air approaches within sectors. Each multi-pollutant sector-based effort should include consideration of criteria pollutant, hazardous pollutant, and greenhouse gas emissions. EPA should:
    a. Build on current efforts by EPA OAQPS to pursue sector-based, multi-pollutant opportunities within identified high-priority sectors; and
    b. Use the information developed in multi-pollutant approaches to develop innovative policies and emission control strategies that will maximize improvements to public health and the environment.

2. 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. EPA should:
    a. Consider the *Framework* in this report to identify and assess the 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 timeline or roadmap for each sector that clarifies the "state of play" with regard to regulatory development within each major industrial sector; and
    d. Seek public comment on multi-pollutant, sector-based approaches prior to, as well as during, regulatory development opportunities.

3. EPA should expand engagement with environmental justice communities and companies in specific sectors to develop and demonstrate innovative multi-pollutant approaches that seek to reduce facility-specific, as well as cumulative, risks and impacts. EPA should:
    a. Consider the implications of multipollutant, sector-based approaches in its *EJ 2014* initiative; and

   b. Document case studies of innovative approaches to community monitoring and efforts to address trade-offs and reduce multi-pollutant risks.

4. EPA should work to identify and quantify air pollution co-benefits and trade-offs associated with multi-pollutant regulatory approaches. EPA should:
   a. Develop strategies for expanding co-benefit opportunities and strategies for reducing negative trade-offs associated with multi-pollutant approaches; and
   b. EPA should develop principles that could guide community input into decisions regarding trade-offs and co-benefits.

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

6. 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. EPA should:
   a. Develop approaches that could enable facilities to adopt alternative monitoring approaches that could address the needs of multiple regulations (including state or tribal regulations); and
   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.

7. EPA should intensify its efforts to improve basic implementation of industrial sector clean air regulatory programs at the federal, state, tribal and local levels, while pursuing multi-pollutant approaches. 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 that could improve environmental benefits and lowers compliance costs; and
   c. Ensure that implementation guidance is provided simultaneously with new rules.