Chapter 1: Introduction and Background

Synopsis

This document estimates the incremental costs and monetized human health benefits of attaining a revised primary sulfur dioxide (SO_2) National Ambient Air Quality Standard (NAAQS) nationwide. This document contains illustrative analyses that consider limited emission control scenarios that states, tribes and regional planning organizations might implement to achieve a revised SO_2 NAAQS. EPA weighed the available empirical data and photochemical modeling to make judgments regarding the proposed attainment status of certain urban areas in the future. According to the Clean Air Act, EPA must use health-based criteria in setting the NAAQS and cannot consider estimates of compliance cost. This Regulatory Impact Analysis (RIA) is intended to provide the public a sense of the benefits and costs of meeting new alternative SO_2 NAAQS, and to meet the requirements of Executive Order 12866 and OMB Circular A-4 (described below in Section 1.2.2).

This RIA provides illustrative estimates of the incremental costs and monetized human health benefits of attaining a revised primary SO_2 National Ambient Air Quality Standard (NAAQS) in 2020 within the current monitoring network[1]. This proposal would add a new short-term (1-hour exposure) standard, in addition to the current annual average standard.

This analysis does not estimate the projected attainment status of areas of the country other than those counties currently served by one of the approximately 488 monitors in the current network. It is important to note that the final rule requires a monitoring network comprised of monitors sited at locations of expected maximum hourly concentrations, and also provides for nonattainment designations using air quality modeling near large stationary sources. Only about one third of the existing SO_2 network may be source-oriented and/or in the locations of maximum concentration required by the final rule because the current network is focused on population areas and community-wide ambient levels of SO_2. Actual monitored levels using the new monitoring network and/or air quality modeling results near large stationary sources may be higher than levels measured using the existing network. We recognize that once the new requirements are put in place, more areas could find themselves exceeding the new SO_2 NAAQS. However for this RIA analysis, we lack sufficient data to predict which counties might exceed the new NAAQS after implementation of the new monitoring network and modeling requirements. Therefore we lack a credible analytic path to estimating costs and benefits for such a future scenario.

[1] There are 488 monitors. Currently xx monitors (representing xx counties) exceed the final NAAQS in this analysis (75 ppb, 99th percentile daily 1-hour maximum SO_2 concentration).

1.1 Background

Two sections of the Clean Air Act ("Act") govern the establishment and revision of NAAQS. Section 108 (42 U.S.C. 7408) directs the Administrator to identify pollutants which "may reasonably be anticipated to endanger public health or welfare," and to issue air quality criteria for them. These air quality criteria are intended to "accurately reflect the latest scientific knowledge useful in indicating the kind and extent of all identifiable effects on public health or welfare which may be expected from the presence of [a] pollutant in the ambient air." SO_2 is one of six pollutants for which EPA has developed air quality criteria.

Section 109 (42 U.S.C. 7409) directs the Administrator to propose and promulgate "primary" and "secondary" NAAQS for pollutants identified under section 108. Section 109(b)(1) defines a primary standard as "the attainment and maintenance of which in the judgment of the Administrator, based on [the] criteria and allowing an adequate margin of safety, [are] requisite to protect the public health." A secondary standard, as defined in section 109(b)(2), must "specify a level of air quality the attainment and maintenance of which in the judgment of the Administrator, based on [the] criteria, [are] requisite to protect the public welfare from any known or anticipated adverse effects associated with the presence of [the] pollutant in the ambient air." Welfare effects as defined in section 302(h) [42 U.S.C. 7602(h)] include but are not limited to "effects on soils, water, crops, vegetation, manmade materials, animals, wildlife, weather, visibility and climate, damage to and deterioration of property, and hazards to transportation, as well as effects on economic values and on personal comfort and well-being."

Section 109(d) of the Act directs the Administrator to review existing criteria and standards at 5-year intervals. When warranted by such review, the Administrator is to retain or revise the NAAQS. After promulgation or revision of the NAAQS, the standards are implemented by the States.

1.2 Role of the Regulatory Impact Analysis in the NAAQS Setting Process

1.2.1 Legislative Roles

In setting primary ambient air quality standards, EPA's responsibility under the law is to establish standards that protect public health, regardless of the costs of implementing a new standard. The Clean Air Act requires EPA, for each criteria pollutant, to set a standard that protects public health with "an adequate margin of safety." As interpreted by the Agency and the courts, the Act requires EPA to create standards based on health considerations only.

The prohibition against the consideration of cost in the setting of the primary air quality standard, however, does not mean that costs or other economic considerations are unimportant or should be ignored. The Agency believes that consideration of costs and benefits are essential to making efficient, cost effective decisions for implementation of these standards. The impact of cost and efficiency are considered by states during this process, as they decide what timelines, strategies, and policies make the most sense. This RIA is intended to inform the public about the potential costs and benefits that may result when a new SO_2 standard is implemented, but is not relevant to establishing the standards themselves.

1.2.2 Role of Statutory and Executive Orders

There are several statutory and executive orders that dictate the manner in which EPA considers rulemaking and public documents. This document is separate from the NAAQS decision making process, but there are several statutes and executive orders that still apply to any public documentation. The analysis required by these statutes and executive orders is presented in Chapter 8.

EPA presents this RIA pursuant to Executive Order 12866 and the guidelines of OMB Circular A-4.[2] These documents present guidelines for EPA to assess the benefits and costs of the selected regulatory option, as well as one less stringent and one more stringent option. OMB circular A-4 also requires both a benefit-cost, and a cost-effectiveness analysis for rules where health is the primary effect. Within this RIA we provide a benefit-cost analysis. Methodological and data limitations prevent us from performing a cost-effectiveness analysis and a meaningful more formal uncertainty analysis for this RIA.

The proposal would set a new short-term SO_2 standard based on the 3-year average of the 99th percentile of 1-hour daily maximum concentrations, establishing a new standard within the range of 75 parts per billion (ppb). This RIA analyzes alternative primary standards of 50 ppb, and 100 ppb.

1.2.3 Market Failure or Other Social Purpose

OMB Circular A-4 indicates that one of the reasons a regulation such as the NAAQS may be issued is to address market failure. The major types of market failure include: externality, market power, and inadequate or asymmetric information. Correcting market failures is one reason for regulation, but it is not the only reason. Other possible justifications include

[2] U.S. Office of Management and Budget. Circular A-4, September 17, 2003, available at <http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf>.

improving the function of government, removing distributional unfairness, or promoting privacy and personal freedom.

An externality occurs when one party's actions impose uncompensated benefits or costs on another party. Environmental problems are a classic case of externality. For example, the smoke from a factory may adversely affect the health of local residents while soiling the property in nearby neighborhoods. If bargaining was costless and all property rights were well defined, people would eliminate externalities through bargaining without the need for government regulation. From this perspective, externalities arise from high transaction costs and/or poorly defined property rights that prevent people from reaching efficient outcomes through market transactions.

Firms exercise market power when they reduce output below what would be offered in a competitive industry in order to obtain higher prices. They may exercise market power collectively or unilaterally. Government action can be a source of market power, such as when regulatory actions exclude low-cost imports. Generally, regulations that increase market power for selected entities should be avoided. However, there are some circumstances in which government may choose to validate a monopoly. If a market can be served at lowest cost only when production is limited to a single producer of local gas and electricity distribution services, a natural monopoly is said to exist. In such cases, the government may choose to approve the monopoly and to regulate its prices and/or production decisions. Nevertheless, it should be noted that technological advances often affect economies of scale. This can, in turn, transform what was once considered a natural monopoly into a market where competition can flourish.

Market failures may also result from inadequate or asymmetric information. Because information, like other goods, is costly to produce and disseminate, an evaluation will need to do more than demonstrate the possible existence of incomplete or asymmetric information. Even though the market may supply less than the full amount of information, the amount it does supply may be reasonably adequate and therefore not require government regulation. Sellers have an incentive to provide information through advertising that can increase sales by highlighting distinctive characteristics of their products. Buyers may also obtain reasonably adequate information about product characteristics through other channels, such as a seller offering a warranty or a third party providing information.

There are justifications for regulations in addition to correcting market failures. A regulation may be appropriate when there are clearly identified measures that can make government operate more efficiently. In addition, Congress establishes some regulatory programs to redistribute resources to select groups. Such regulations should be examined to ensure that they are both effective and cost-effective. Congress also authorizes some

regulations to prohibit discrimination that conflicts with generally accepted norms within our society. Rulemaking may also be appropriate to protect privacy, permit more personal freedom or promote other democratic aspirations.

From an economics perspective, setting an air quality standard is a straightforward case of addressing an externality, in this case where entities are emitting pollutants, which cause health and environmental problems without compensation for those suffering the problems. Setting a standard with a reasonable margin of safety attempts to place the cost of control on those who emit the pollutants and lessens the impact on those who suffer the health and environmental problems from higher levels of pollution.

1.2.4 Illustrative Nature of the Analysis

This SO_2 NAAQS RIA is an illustrative analysis that provides useful insights into a limited number of emissions control scenarios that states might implement to achieve a revised SO_2 NAAQS. Because states are ultimately responsible for implementing strategies to meet any revised standard, the control scenarios in this RIA are necessarily hypothetical in nature. They are not forecasts of expected future outcomes. Important uncertainties and limitations are documented in the relevant portions of the analysis.

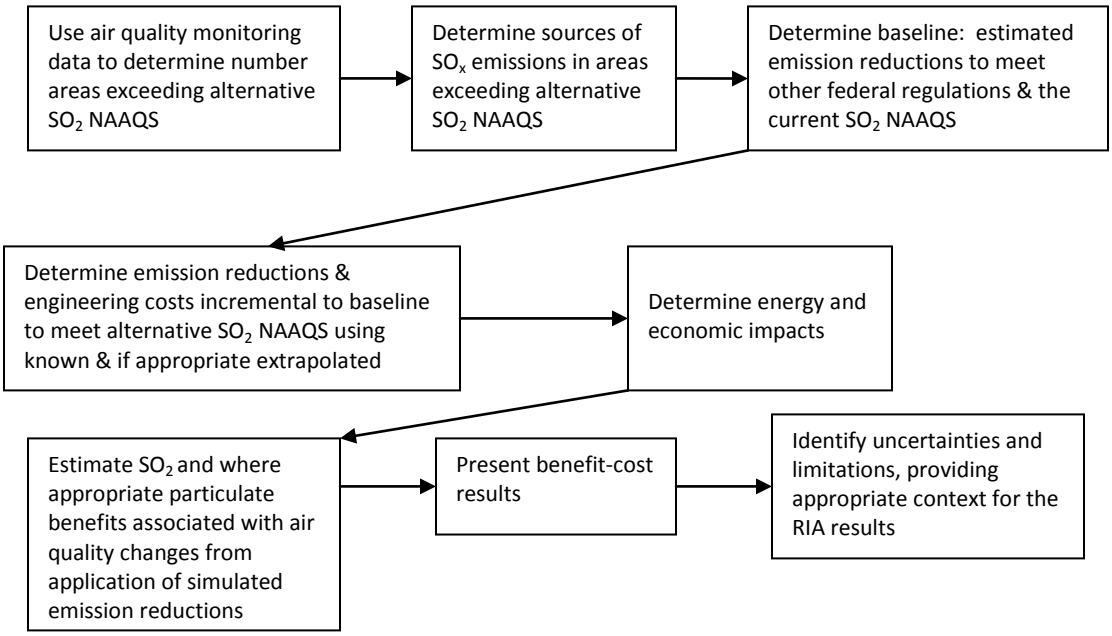
The illustrative goals of this RIA are somewhat different from other EPA analyses of national rules, or the implementation plans states develop, and the distinctions are worth brief mention. This RIA does not assess the regulatory impact of an EPA-prescribed national or regional rule, nor does it attempt to model the specific actions that any state would take to implement a revised SO_2 standard. This analysis attempts to estimate the costs and human and welfare benefits of cost-effective implementation strategies which might be undertaken to achieve national attainment of new standards. These hypothetical strategies represent a scenario where states use one set of cost-effective controls to attain a revised SO2 NAAQS. Because states—not EPA—will implement any revised NAAQS, they will ultimately determine appropriate emissions control scenarios. State implementation plans would likely vary from EPA's estimates due to differences in the data and assumptions that states use to develop these plans.

The illustrative attainment scenarios presented in this RIA were constructed with the understanding that there are inherent uncertainties in projecting emissions and controls. Furthermore, certain emissions inventory, control, modeling and monitoring limitations and uncertainties inhibit EPA's ability to model full attainment in all areas. Despite these limitations, EPA has used the best available data and methods to produce this RIA.

1.3 Overview and Design of the RIA

This Regulatory Impact Analysis evaluates the costs and benefits of hypothetical national strategies to attain several potential revised primary SO_2 standards. The document is intended to be straightforward and written for the lay person with a minimal background in chemistry, economics, and/or epidemiology. Figure 1-1 provides an illustration of the process used to create this RIA.

Figure 1-1: The Process Used to Create this RIA



1.3.1 Baseline and Years of Analysis

The analysis year for this regulatory impact analysis is 2020, which approximates the required attainment year under the Clean Air Act. Many areas will reach attainment of any alternative SO_2 standard before 2020. For purposes of this analysis, we assess attainment by 2020 for all areas. Some areas for which we assume 2020 attainment may in fact need more time to meet one or more of the analyzed standards, while others will need less time. This analysis does not prejudge the attainment dates that will ultimately be assigned to individual areas under the Clean Air Act.

The methodology first estimates what baseline SO_2 levels might look like in 2020 with existing Clean Air Act programs, including application of controls to meet the current SO_2 NAAQS, various maximum achievable control technology (MACT) standards, and then predicts

the change in SO_2 levels following the application of additional controls to reach tighter alternative standards. This allows for an analysis of the incremental change between the current standard and alternative standards.

1.3.2 Control Scenarios Considered in this RIA

In this RIA we analyzed the final NAAQS of 75 ppb, as well as hypothetical target NAAQS levels of 50 and 100 ppb. Hypothetical control strategies were developed for each NAAQS level. First, we used outputs from CMAQ model runs to estimate air quality changes that would result from the application of emissions control options that are known to be available to different types of sources in areas with monitoring levels currently exceeding the alternative standards. However, given and the amount of improvement in air quality needed to reach the some standards in some areas, as well as circumstances specific to those areas, it was also expected that applying these known controls would not reduce SO_2 concentrations sufficiently to allow these two areas to reach some standards. In order to bring these monitor areas into attainment, we calculated the cost of unspecified emission reductions by extrapolating from a range of fixed costs per ton of emission control that are generally identified nationally.

1.3.3 Evaluating Costs and Benefits

We applied a two step methodology for estimating emission reductions needed to reach full attainment. First, we quantified the costs associated with applying known controls. Second, we estimated costs of the additional tons of extrapolated emission reductions estimated which were needed to reach full attainment. This methodology enabled us to evaluate nationwide costs and benefits of attaining a tighter SO_2 standard using hypothetical strategies, albeit with substantial additional uncertainty regarding the second step estimates. [3]

To streamline this RIA, this document refers to several previously published documents, including two technical documents EPA produced to prepare for promulgation of the SO_2 NAAQS. The first was the Integrated Science Assessment (ISA) created by EPA's Office of Research and Development (U.S. EPA, 2008), which presented the latest available pertinent information on atmospheric science, air quality, exposure, health effects, and environmental effects of SO_2. The second was the Risk and Exposure Assessment (REA) (U.S. EPA, 2009) for various standard levels. The REA also includes staff conclusions and recommendations to the Administrator regarding potential revisions to the standards.

[3] Because the secondary SO_2 NAAQS is under development in a separate regulatory process, no additional costs and benefits were calculated in this RIA.

1.4 SO_2 Standard Alternatives Considered

EPA has performed an illustrative analysis of the potential costs and human health and visibility benefits of nationally attaining SO_2 NAAQS of 50, 75, and 100 ppb, assuming a baseline of no additional control beyond the controls expected from rules that are already in place (including the current $PM_{2.5}$ NAAQS), and solely within the bounds of the existing monitoring network. The benefit and cost estimates below are calculated incremental to a 2020 baseline that incorporates air quality improvements achieved through the projected implementation of existing regulations and attainment of the existing PM National Ambient Air Quality Standards (NAAQS). The baseline also includes the MACT program, the clean air interstate rule (CAIR), and implementation of current consent decrees, all of which would help many areas move toward attainment of the SO_2 standard.

1.5 References

U.S. Environmental Protection Agency (U.S. EPA). 1970. Clean Air Act. 40 CFR 50.

U.S. Environmental Protection Agency (U.S. EPA). 2008. Integrated Science Assessment for Sulfur Oxides - Health Criteria (Final Report). National Center for Environmental Assessment, Research Triangle Park, NC. September. Available on the Internet at < http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=198843>.

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