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Public Interest Comment on

Notice of Proposed Rulemaking to Set National Emission Standards for Hazardous Air Pollutants for Area Sources: Industrial, Commercial, and Institutional Boilers[1]

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EPA Docket No. 0790.

The Regulatory Studies Program (RSP) of the Mercatus Center at George Mason University is dedicated to advancing knowledge of the impact of regulation on society. As part of its mission, RSP conducts careful and independent analyses employing contemporary economic scholarship to assess rulemaking proposals from the perspective of the public interest. Thus, this comment on the Environmental Protection Agency's (EPA) Notice of Proposed Rulemaking does not represent the views of any particular affected party or special interest group, but is designed to assist EPA in improving the quality of the Regulatory Impact Analysis used for decision making.

1. Introduction

The Environmental Protection Agency (EPA) has proposed new regulations setting emissions standards for boilers for some 30 hazardous air pollutants. While the Regulatory Impact Analysis submitted by the agency finds an overall benefit to the proposed rule, the agency does not use the analysis to maximize net benefits. Only 5 of the 30 pollutants EPA expects to reduce will be regulated, and EPA only presents quantified benefits for one pollutant which is not

[1] Prepared by Mark Adams, research fellow, Mercatus Center at George Mason University. This comment is one in a series of Public Interest Comments from the Mercatus Center's Regulatory Studies Program and does not represent an official position of George Mason University. The author would like to thank Jerry Ellig and John Morrall for helpful comments.

directly regulated. The analysis performed by the agency does not identify the benefits associated with reductions in individual pollutants or the changes in benefits and costs associated with varying levels of stringency. As a result, the economic analysis for this rule cannot serve its purpose of presenting policy makers with a menu of alternatives.

EPA has proposed new emissions standards for boilers operated by businesses and institutions such as schools and churches as part of a series of actions setting emissions standards for heating and incineration devices. The proposed rule will establish separate measures for new and existing boilers, including mandating technology to capture airborne pollutants released by boilers and setting operating standards aimed at improving energy efficiency and reducing the emissions of pollutants. The rule establishes existing technologies as a benchmark for performance, but other technologies which are equally effective at reducing emissions may also be used.

Although the rule is aimed at reducing levels of some 30 Hazardous Air Pollutants (HAP), the proposed regulation will set emissions standards for only five pollutants: particulate matter, carbon monoxide, mercury, hydrogen chloride and dioxins/furans. The predicted benefits are expected to come from reducing emissions of only one narrow groups of pollutants which are not directly regulated (fine-grained particulate matter). To achieve the benefits predicted, EPA is assuming that reductions in the regulated pollutants will lead to reductions in other pollutants. For this reason, the agency may have overestimated net benefits.

EPA was unable quantify the direct benefits associated with reducing carbon monoxide emissions or mercury emissions. All of the calculated benefits of the proposed rule will come from expected reductions in fine-grained airborne particulate matter known collectively as $PM_{2.5}$ (2.5 refers to the size of the emitted particles). The regulation only addresses emissions of $PM_{2.5}$ indirectly, assuming that emission of $PM_{2.5}$ will be reduced by reductions in overall particulate matter and by reductions in other pollutants.

Current scientific literature used by EPA finds that the benefits of reducing particulate matter emissions vary greatly depending upon the type of particulate matter and also on the location of

the reductions. In the Regulatory Impact Analysis prepared by the agency, emissions are assumed to be reduced by a constant amount, across emissions types and location. This reduces the ability of the agency to make accurate determinations about the scale of benefits generated and may lead to an overestimation of total benefits.

If benefits have been overestimated then an alternative approach may be justified, but EPA does not consider a full range of alternatives. Rather than using benefit-cost analysis to justify the proposed rule, as the agency has done, the analysis should weigh various alternatives, allowing policy makers to determine which of these alternatives should become the rule. The analysis should consider the benefits of regulating each type of pollutant separately and show policy makers the costs and benefits of a range of options, including options which may require actions by Congress or by the states. By following best practices in this way, the agency may be able to increase total net benefits.

2. Benefit per Ton

To calculate the expected benefits of reducing emissions of the fine-grained particulate matter known as $PM_{2.5}$, EPA uses a "benefit per ton" approach, meaning the agency assumes that each ton of pollution has the same health effects. The best practice in regulatory analysis is to use marginal benefit analysis: each ton of pollution is treated separately.[2] For example, a person drinking a bottle of wine a day will benefit more from cutting back to half a bottle than a person who drinks half a bottle will benefit from becoming teetotal. For many pollutants and other hazardous substances, the health effects from a small amount of exposure are not proportional to those from a larger exposure.[3] In some cases, a small amount of exposure have the reverse effect of a larger exposure.[4] This effect, known as hormesis, is the reason a glass of wine a day can be

[2] See OMB Circular A-4 (2003), available at http://www.whitehouse.gov/sites/default/files/omb/assets/omb/circulars/a004/a-4.pdf. See also Susan Dudley, *A Primer on Regulation*, Mercatus Policy Series (2005), available at http://mercatus.org/sites/default/files/publication/Primer%20on%20Regulation.pdf.

[3] See e.g. Werner Lutz, "Dose-response relationship and low dose extrapolation in chemical carcinogenesis," *Carcinogenesis* 11, no. 8 (1990): 1243–1247.

[4] See e.g. Edward Calabrese and Linda Baldwin, "U-shaped dose—responses in biology, toxicology, and public health," *Annual Review of Public Health* 22 (2001):15 –33.

healthy but a bottle is not, and has been observed for a number of toxic substances and even for radiation.[5] Dr Robert Phalen, a professor of environmental medicine and a member of EPA's scientific advisory board, has published a book on particulate air pollution in which he notes that small amounts of exposure to particulate matter may have positive health benefits.[6]

EPA cites evidence that there is no safe threshold for $PM_{2.5}$ (i.e. exposure to any amount has negative health effects) and that the health effects of exposure to $PM_{2.5}$ are directly proportional to the amount of exposure. These studies did not prove a linear relationship exists but found that there was insufficient data to disprove either the assumption of a linear relationship or the non-existence of a threshold. Thus, many relationships which were not tested may be equally valid. Only one study looked at whether other relationships might better explain the health effects over different levels of exposure—finding a non-linear relationship. However, national $PM_{2.5}$ levels have only been measured since 1999 and most counties have levels so low that measurement is not possible.[7]

To estimate total health effects, EPA used mortality data from two studies looking at the effects of $PM_{2.5}$ on urban populations.[8] The first was published in the *Journal of the American Medical Association* by a team led by Arden Pope, using data from the American Cancer Association. The second was published in the American *Journal of Respiratory and Critical Care Medicine* by a team led by Francine Laden and funded by EPA. There are substantial differences between the results of the two studies: premature mortality would be reduced by the proposed rule from 300 incidences according to Laden's study but by only 110 incidences according to Pope's study.[9] In addition to substantial differences between the two studies, there were also substantial differences within each study for different cities. An earlier study by an EPA team which

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[5] Ludwig Feinendegen, "Evidence for beneficial low level radiation effects and radiation hormesis," *British Journal of Radiology* 78 (2005): 3–7.

[6] Robert F. Phalen, *The Particulate Air Pollution Controversy: A Case Study and Lessons Learned*, Kluwer Academic Publishers (2002).

[7] Tom Walton, *Regulatory Impact Analysis: National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters Draft Report,* EPA (2010).

[8] Francine Laden, Joel Schwartz, Frank E. Speizer, and Douglas W. Dockery, "Reduction in Fine Particulate Air Pollution and Mortality: Extended Follow-up of the Harvard Six Cities Study," *American Journal Of Respiratory And Critical Care Medicine* 173 (2006); C. Arden Pope III, Richard T. Burnett, and Michael J. Thun et al. "Lung Cancer, Cardiopulmonary Mortality, and Long-term Exposure to Fine Particulate Air Pollution," *Journal of the American Medical Association* 287, no.9 (2002):1132–1141.

[9] *Supra* note 7, Exhibit 16.

devised the methodology used to calculate benefits used for this rule, found that a one ton reduction in area source carbon (using Laden's methodology) would generate $2.5 million in benefits in Phoenix but only $280,000 in Denver. The study's authors hypothesize that the differences result not only from different population density but also from environmental factors such as wind and temperature, and from differences in the underlying health of residents of different regions.

EPA's method only identifies costs for nine separate cities and merges the remainder of the country into a single national region. For the national region, benefits per ton from reducing area source carbon were estimated at $720,000, more than small urban areas like Salt Lake City ($140,000) but also more than Atlanta ($610,000), Chicago ($510,000), and New York and Philadelphia ($570,000).[10] This figure is almost certainly high for rural areas with low populations, but this may be masked in the averages by many larger urban areas which are included in the national region. The team who originally devised the methodology also cautioned against attempting to apply their research to urban areas other than those already studied.[11]

The original EPA study identifies several factors that may explain large differences in the benefits from reducing $PM_{2.5}$. First, even among fine-grained particulate matter, there are different types which have different effects on mortality. Reducing area source carbon by one ton in Atlanta creates $670,000 while removing a ton of volatile organic compounds (VOC) creates only $1,200 in benefits. Reducing a ton of area source ammonia is harmful, creating a negative benefit (or social cost) of $4,100.[12]

Different sources may emit the same type of particulate matter but differences in the height of the exhaust stack or the velocity at which particles leave the stack may affect how many people are exposed.[13] For example, reducing area source carbon creates greater benefits than reducing

[10] Neal Fann, Charles M. Fulcher and Bryan J. Hubbell, "The influence of location, source, and emission type in estimates of the human health benefits of reducing a ton of air pollution," *Air Quality, Atmosphere and Health* 2 (2009):169–176.
[11] Id.
[12] Id.
[13] Id.

mobile source carbon.[14] Additionally, different locations have different mortality rates, which the authors theorize may be due to different population densities and the initial health of people living in different locations.

EPA combines all the regional benefit per ton statistics to create an average benefit per ton for the entire country for each regulated source. This would be the benefit per ton if emissions levels fell equally across the country. The analysis does not consider how benefits would vary if emissions are not reduced equally across the country, or how different regulations might differently affect different regions. The proposed rule indicates that EPA preferred more stringent regulations if the source was more likely to be found in urban areas, but because the economic analysis uses a national benefit per ton and only addresses the rule as a whole, the agency has no information to indicate whether this decision improved the quality of the rulemaking. As the evidence presented by EPA demonstrates, it not only matters whether a source is urban but in which urban area it is sited. By looking at benefits by region and separating out individual regulatory actions the analysis could show how each alternative affects each region, thus guiding policy makers to the best outcome rather than justifying the regulation after the fact.

The analysis should also address any uncertainty over where reductions are likely to occur. The agency addresses uncertainty over how much benefits a reduction in emissions would create by reporting benefits using the mortality estimates from both studies. However, EPA does not estimate any uncertainty about the location or type of pollution to be reduced. Overall, the agency likely underestimates uncertainty surrounding benefits. This does not necessarily mean the agency has overestimated or underestimated benefits, but accurately measuring uncertainty can help policy makers improve the quality of decision making. For example, EPA might consider phasing in new regulations more gradually (starting in areas where net benefits are likely to be highest or are most certain) and measure how accurate initial estimates were. This information can then inform policy going forward.

Calculating the additional benefits and costs from each ton of each pollutant reduced also helps the agency to improve the quality of rulemaking. The current regulatory impact analysis only

[14] Id.

tells policy makers whether the rule is likely to generate net benefits. A marginal benefit analysis would allow policy makers to decide if a more or less stringent rule would increase net benefits, or if an alternative approach would be better.

3. Use of Surrogates

The goal of the regulation is to reduce some 30 Hazardous Air Pollutants (HAP), EPA will not regulate each of these pollutants, rather:

> [EPA] used surrogates because … it was not practical to establish individual standards for each specific HAP. We grouped the … pollutants … into three common groupings: mercury, non-mercury metallic HAP …, and organic HAP … In general, the pollutants within each group have similar characteristics and can be controlled with the same techniques.
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> EPA (2010)[15]

All the quantified benefits of this regulation will come from reductions in $PM_{2.5}$ levels, even though $PM_{2.5}$ is not specifically regulated. Rather, reductions are expected because "technologies installed to meet … multiple limits" on particulate matter (a broader group of airborne particles which includes $PM_{2.5}$) as well as, carbon monoxide, mercury, hydrogen chloride, and dioxins/flurans will also reduce emissions of $PM_{2.5}$.[16]

EPA asserts that technologies reducing emissions of one pollutant have typically reduced emissions of other pollutants. The agency therefore assumes that requiring reductions in emissions of that pollutant will result in reduced emissions of the other pollutants. However, the existence of an emissions standard can reduce the strength of the correlation between emissions of the regulated pollutants and other pollutants. When cars ran on leaded gasoline, a more efficient engine would have reduced emissions of lead and other pollutants similarly. When the federal government began to phase out leaded gasoline, emissions of lead dropped to zero but

[15] *Notice of Proposed Rulemaking to Set National Emission Standards for Hazardous Air Pollutants for Area Sources: Industrial, Commercial, and Institutional Boilers*, EPA (2010).
[16] *Supra* note 7, (6-1).

while emissions of some other pollutants dropped too, they did not fall to zero. Emissions of some pollutants increased, either as some drivers switched to lower octane fuel, reducing fuel efficiency, or used alternatives to lead such as benzene.[17] Likewise, if a firm buys a more fuel-efficient boiler, emissions of all pollutants would likely drop. If a firm is specifically seeking to reduce emissions of a regulated pollutant, emissions of other pollutants may not drop proportionally.

The phasing out of leaded gasoline has been a successful environmental policy because the elimination of lead from fuel was the goal. Reductions in other pollutants were made possible by the change as unleaded vehicles could be equipped with catalytic convertors, but these pollutants were also regulated. EPA's regulatory analysis needs to take into account how the behavior of firms and institutions will change in response to the proposed rule. As well as responding to mandates by specifically focusing on technologies that only reduce the regulated pollutant, organizations might respond to the energy efficiency standards by using more heat. Fuel economy standards, requiring a drivers to buy a more fuel efficient car, also made it cheaper to drive with the result that the owners of more efficient cars started driving more. [18] In the same way, regulations improving the efficiency of their boilers may encourage firms to turn up the thermostat or run the boiler more often now that it is cheaper to do so. Again, this would result in a smaller reduction in pollution than EPA predicts.

The benefits from this rule are expected to come from reducing a group of fine-grained airborne pollutants which are not specifically regulated. Particulate matter, which includes $PM_{2.5}$, is regulated but this does not necessarily mean that the total benefits will be achieved. As was described above, different types of $PM_{2.5}$ have substantially different health effects. There is also considerable uncertainty about whether or not there are health benefits from reducing larger particulate matter. The study led by Arden Pope—previously mentioned as one of the studies used by EPA to calculate benefits—reports that "[m]easures of coarse particle fraction and total

[17] See Robert M. Heavenrich, "Light-Duty Automotive Technology and Fuel Economy Trends: 1975 Through 2005" *EPA* (2005); and Patrice H.Avogbe, Lucie Ayi-Fanou, Herman Autrup, Steffen Loft, Benjamin Fayomi, Ambaliou Sanni, Peter Vinzents and Peter Møller, "Ultrafine particulate matter and high-level benzene urban air pollution in relation to oxidative DNA damage," *Carcinogenesis* 26, no. 3 (2005): 613–620.

[18] DL Greene, JR Kahn, RC Gibson, "Fuel economy rebound effect for US household vehicles," *The Energy Journal* (1999).

suspended particles were not consistently associated with mortality."[19] In other words, only fine-grained particulate matter ($PM_{2.5}$) is known to increase mortality.

In order to generate the predicted benefits, EPA is relying on reductions in particulate matter not only being even across geography but also even across types of particulate matter (although the agency also predicts that reducing emissions of other pollutants will also reduce levels of $PM_{2.5}$). Any variation over the type of pollutant reduced increases the uncertainty associated with benefits. As before, this does not necessarily mean that EPA has overestimated or underestimated benefits, but measuring this uncertainty can help improve policy outcomes.

By contrast, changes in behavior resulting from the rule—such as using more heat or finding technologies that only reduce the regulated pollutant—would reduce overall benefits. EPA predicts that much of the reduction in $PM_{2.5}$ (the only quantified benefit of the rule) will come from limitations of emissions on other pollutants. Consequently, the overall quantified benefits of the rule are likely to be overstated.

4. Alternative Solutions

A Regulatory Impact Analysis can help an agency determine whether or not to proceed with a rule. A part of this determination should be whether or not the rule generates net benefits but the analysis should also help the agency decide how to structure the rule to maximize net benefits. The White House's Office of Management and Budget (OMB) advises agencies:

> It is not adequate simply to report a comparison of the agency's preferred option to the chosen baseline. Whenever you report the benefits and costs of alternative options, you should present both total and incremental benefits and costs. You should present incremental benefits and costs as differences from the corresponding estimates associated with the next less-stringent alternative. It is important to emphasize that incremental effects are simply differences between successively more

[19] C. Arden Pope III, Richard T. Burnett, and Michael J. Thun et al. "Lung Cancer, Cardiopulmonary Mortality, and Long-term Exposure to Fine Particulate Air Pollution," *Journal of the American Medical Association* 287, no. 9 (2002):1132–1141.

> stringent alternatives. Results involving a comparison to a next best alternative may be especially useful.
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> OMB Circular A-4 (2003) p. 16[20]

The goal of the agency should not just be to seek a positive outcome, but to seek the best possible outcome. A Regulatory Impact Analysis can help achieve the best possible outcome by weighing the costs and benefits of a range of outcomes, by identifying the marginal effects of more or less stringent rules, and by identifying where uncertainty exists.

Some alternatives might require legislation by congress or by the states. However, best practices outlined by OMB advise agency heads to consider options which are not within their current statutory authority:

> You should also discuss the statutory requirements that affect the selection of regulatory approaches. If legal constraints prevent the selection of a regulatory action that best satisfies the philosophy and principles of Executive Order 12866, you should identify these constraints and estimate their opportunity cost. Such information may be useful to Congress under the Regulatory Right-to-Know Act.
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> OMB Circular A-4 (2003) p. 17[21]

By considering options that do not fall within EPA's current statutory authority, the agency can help advise legislators on how to improve policy outcomes in the long run. States, which may not have the resources available to the federal government for conducting in-depth research, can also benefit from information. States action can serve either as an alternative to federal regulation or can augment the regulator's efforts.

This section proposes some alternatives which EPA might consider. It is not an exhaustive list but an indication of the type of alternatives EPA should consider in a full regulatory impact analysis.

Urban Emissions Standards

[20] Available at http://www.whitehouse.gov/sites/default/files/omb/assets/omb/circulars/a004/a-4.pdf.
[21] Id.

The evidence presented by EPA suggests that the greatest benefits from reducing emissions will come from reducing emissions in urban areas where higher population density is greatest means a larger number of people would be affected by the pollution.[22] Further, there is more evidence of the benefits from urban areas than from rural areas where particulate matter levels are frequently too low to measure.[23] There is thus less uncertainty about the benefits from reducing emissions around cities. Establishing an emissions standard for metropolitan areas would be less costly because fewer emitters would be affected and because some emitters would be able to choose to locate in areas where the standard did not apply. This could potentially increase benefits if moving emissions away from the urban areas reduces human exposure to $PM_{2.5,}$ even if total emissions fell by less.

Regional Emissions Standards

Even among cities, the benefits from reducing $PM_{2.5}$ vary greatly. Establishing separate standards depending on location could increase benefits by making standards more stringent where the benefits are highest and less stringent where benefits are lowest. As with urban standards, emitters could locate in areas where the social costs of pollution are less, to avoid the most stringent regulations, reducing costs and increasing benefits from the regulation.

Consider Each Pollutant Separately

Instead of treating the regulation as a whole, EPA could consider standards for each pollutant (or combinations of standards where the effect overlaps). For each pollutant, EPA should consider varying levels of stringency and produce a benefit-cost analysis identifying the marginal effect of increasing or decreasing the stringency of the regulation.

Pollution Charge

Under the proposed rule EPA would require boiler tune-ups and energy reviews for existing boilers. If instead boiler operators were charged a fee based on the social cost of their pollution, then businesses and institutions would have a profit motive to reduce their pollution. Organizations would be able to consider a wider range of options than are available to regulators.

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[22] *Supra* note 10.
[23] *Supra* note 7.

In some cases, a new boiler might bring greater benefits than a tune-up. Turning down the thermostat might be as effective. A pollution charge also avoids problems such as when a company is forced to invest in greater energy efficiency and responds to reduction in the cost of heating by using more.

Adopt a Graduated Approach

EPA might approach the uncertainty surrounding benefits by phasing in standards slowly. The portions of the rule expected to generate the greatest or most certain benefits should be phased in first, allowing the EPA to collect data on the performance of the rule and structure future rulemakings accordingly.

5. Conclusions

The boiler rule proposed by EPA is expected to generate net benefits, but the Regulatory Impact Analysis prepared by the agency fails to identify the benefits attributable to individual portions of the rule or how a more or less stringent rule would change costs and benefits. The agency has the option of passing some or all of the measures proposed in this rulemaking or of varying the stringency of the rule in a number of ways but presents no evidence as to why the chosen option is best. EPA cannot quantify the benefits for four of the five regulated pollutants and all of the quantified benefits will come from indirect reductions in $PM_{2.5}$. While there are unquantified benefits of an unknown magnitude, the quantified benefits are uncertain and likely overstated.

EPA uses the same benefit-per-ton approach used in many rulemakings by this agency, but the methodology is flawed and provides the agency with only limited information to select the best option. By measuring the benefits of each additional ton separately, the agency would be better able to select a rule which maximizes net benefits. The analysis should also consider a broader range of possible actions, including actions which might require federal or state legislation.

In proceeding, the agency should be advised to tread carefully, passing a rule in multiple parts while continuing to gather information. Evidence presented by the agency suggests that the best

approach would be to set local standards, setting the highest standards where the benefits of doing so are greatest, and lower standards elsewhere.