

---

# THE GEORGE WASHINGTON UNIVERSITY

---

WASHINGTON, DC

Public Interest Comment<sup>1</sup> on

The Environmental Protection Agency's Proposed Rule

Standards of Performance for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces, and New Residential Masonry Heaters

Docket ID No. EPA-HQ-OAR-2009-0734

RIN: 2060-AP93

May 5, 2014

Susan E. Dudley, Director<sup>2</sup>

## The George Washington University Regulatory Studies Center

The George Washington University Regulatory Studies Center works to improve regulatory policy through research, education, and outreach. As part of its mission, the Center conducts careful and independent analyses to assess rulemaking proposals from the perspective of the public interest. This comment on the Environmental Protection Agency's proposed "Standards of Performance for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces, and New Residential Masonry Heaters" does not represent the views of any particular affected party or special interest, but is designed to evaluate whether EPA has adequately analyzed the impacts of the proposal and incorporated plans for retrospective review, pursuant to Executive Order 13563.

### Introduction

EPA proposes to amend the New Source Performance Standards (NSPS) for residential wood heaters and expand them to include types of wood-burning appliances not covered by the existing standards, which were set in 1988. According to the preamble to the proposed rule, the updated emission limits would reflect the current best systems of emission reduction (BSER),

---

<sup>1</sup> This comment reflects the views of the author, and does not represent an official position of the GW Regulatory Studies Center or the George Washington University. The Center's policy on research integrity is available at <http://regulatorystudies.columbian.gwu.edu/policy-research-integrity>.

<sup>2</sup> Susan Dudley is director of the GW Regulatory Studies Center and research professor in the Trachtenberg School of Public Policy and Public Administration at the George Washington University.

eliminate exemptions for several residential wood combustion devices, strengthen test methods, and streamline the certification process.

Pursuant to Section 111 of the Clean Air Act, EPA must establish federal standards of performance for new sources which, in the judgment of the Administrator, “cause, or contribute significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare.” The standards should “reflect the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated.”

EPA projects that the new standards would significantly reduce emissions of fine particulate matter (PM<sub>2.5</sub>), as well as carbon monoxide (CO), volatile organic compounds (VOC), and hazardous air pollutants (HAP), and “result in substantial reductions in exposure and improved public health.”<sup>3</sup> By assigning dollar values to modeled reductions in PM<sub>2.5</sub> emissions between 2014 and 2022, EPA estimates benefits over that period ranging from \$1.7 billion to \$4.1 billion (2010 dollars).<sup>4</sup> EPA was not able to monetize the value of reductions in emissions of the other pollutants, “reduced climate effects due to reduced black carbon emissions; reduced ecosystem effects; [or] reduced visibility impairments,” nor did it monetize benefits for one category of covered appliances – masonry heaters. EPA estimates compliance costs, annualized over the 2014 – 2022 period, of \$15.7 million per year.

EPA’s analysis suggests that the benefits of the proposal, once implemented, would outweigh the costs by a factor of more than 100. These estimates depend on numerous questionable assumptions, however, and the regulatory impact analysis developed to support the proposal is flawed in important ways.

This comment reviews these flaws, suggests ways to improve EPA’s ex ante analysis, and also recommends steps EPA should commit to now so that it can evaluate whether the rule achieves the projected outcomes once implemented.

## **Deficiencies in EPA’s Analysis**

The majority (98%) of EPA’s estimated benefits of the proposal derive from avoided premature mortality that studies have associated with reductions in fine particles. These figures depend on projections of 1) emission reductions achieved by the regulation, 2) number of statistical lives attributed to those emissions, and 3) dollar values assigned to a statistical life.

---

<sup>3</sup> Preamble, 79 FR 6330.

<sup>4</sup> Preamble, 79 FR 6349.

## Reductions in emissions

EPA developed emission factors for each appliance type (before and after compliance with the proposed standards) and then applied those emission factors to projected shipment data for each of the covered appliance types. While the RIA recognizes that increases in heater prices will affect consumer demand for new wood heaters, it was “not able to prepare a full economic analysis of the impacts of this proposal on supply and demand, or the effects of such impacts on emissions (e.g. feedback effect on emissions).” Instead, EPA’s shipment estimates, and its estimated emission reductions, are based on the assumption that higher heater prices will not affect demand, nor lead consumers to keep their old units longer.<sup>5</sup> EPA forecasts that annual shipments for all covered product types will increase a rate of 2% per year, including forced-air furnaces for which it projects consumer prices will more than quadruple to over \$4,000 per unit, and hydronic heating systems, for which it projects price increases of over \$6,000 per unit.<sup>6</sup>

TABLE 11—COST EFFECTIVENESS OF PM<sub>2.5</sub> EMISSION REDUCTIONS OF PROPOSED STANDARDS AND EMISSION COREDUCTIONS BASED ON CUMULATIVE ANALYSIS [2013–2057]<sup>7</sup>

Appliance type	Nationwide cumulative cost (2010\$)	PM <sub>2.5</sub> reductions		VOC Co-Reductions		CO Co-Reductions	
		Cumulative emission reduction (tons)	Cost per ton (2010\$)	Cumulative emission reduction (tons)	Cost per ton (2010\$)	Cumulative emission reduction (tons)	Cost per ton (2010\$)
Cord Wood Stoves	\$45,492,874	96,523	\$471	136,293	\$334	1,426,240	\$32
Single Burn Rate Stoves	11,864,204	236,254	50	416,828	28	1,602,218	7
Pellet Stoves	44,272,694	29,269	1,513	392	112,894	152,082	291
Furnaces	30,451,763	823,770	37	349,207	87	5,491,797	6
Hydronic Heaters	57,760,316	360,587	160	152,858	378	2,403,916	24
Total	89,841,851	1,546,403	123	1,055,578	180	11,076,253	17

**NOTE:** Masonry Heaters are not included in this analysis because representative emission tons per appliance could not be determined.

Table 11 of the preamble, reproduced here, shows that the bulk of EPA’s forecast cumulative emissions reductions (77%) will result from controls on forced-air furnaces and hydronic heaters,

<sup>5</sup> Preamble, 79 FR 6351

<sup>6</sup> Preamble, 79 FR 6352

<sup>7</sup> Preamble, 79 FR 6354

the appliance types for which EPA estimates the largest price increases. The costs of compliance for these two heaters comprise 45% of EPA's estimated cumulative costs.<sup>8</sup>

It is unrealistic to assume that a doubling or tripling of the price of these units will not affect consumer demand, and some sensitivity analysis is warranted here. If consumers respond to these large price increases by keeping their old forced-air furnaces and hydronic heaters longer, EPA's emissions reductions and associated health benefits will clearly be overstated. If consumers respond by replacing existing heaters with other appliance types, that substitution may result in emissions reductions, but they will likely be different from those projected by EPA's RIA. It is even possible that EPA's proposed rule will cause emissions to increase instead of decrease, but we cannot know unless EPA uses more realistic assumptions in its RIA.

These unrealistic assumptions about the consumer and producer response to price increases will also affect EPA's cost estimates, and perhaps its determination of what technologies constitute BSER.

### **Health effects attributable to emissions reductions from wood heater NSPS**

Rather than relying on air quality modeling to estimate the health effects of the proposal (as EPA has done elsewhere), EPA estimates total benefits by multiplying a benefit-per-ton value to estimated emissions reductions. This "benefits transfer" approach relies on modeling conducted for other purposes to estimate the value of human health benefits associated with reducing one ton of PM<sub>2.5</sub>.<sup>9</sup> The RIA supporting the proposal recognizes the limitations of this approach:

Specifically, all national-average benefit-per-ton estimates reflect the geographic distribution of the modeled emissions, which may not exactly match the emission reductions in this rulemaking, and they may not reflect local variability in population density, meteorology, exposure, baseline health incidence rates, or other local factors for any specific location.<sup>10</sup>

It is very likely that population density in the more remote areas where wood heaters are a common source of heat is significantly less than that of the cities on which the benefit-per-ton estimates are derived. If significantly fewer people are exposed to the emissions, this "benefits transfer" approach is likely to overstate benefits by a considerable amount. If EPA is unable to apply its air quality modeling to the regions affected by the proposed rule, it should, at a minimum, make adjustments to account for the differences in population exposed.

---

<sup>8</sup> Calculated from data in Table 10 of the preamble, 6352.

<sup>9</sup> EPA relies on epidemiology studies that examined two large population cohorts: the American Cancer Society cohort and the Harvard Six Cities cohort.

<sup>10</sup> Regulatory Impact Analysis Section 7.2.3.

The generic benefit-per-ton figures are also likely to overstate benefits in areas that meet air quality standards. Both theory and data suggest that thresholds exist below which further reductions in exposure to PM<sub>2.5</sub> do not yield changes in mortality response, and that one should expect diminishing returns as exposures are reduced to lower and lower levels.<sup>11</sup> Yet, the models underlying EPA's benefit-per-ton estimates do not distinguish between exposures to PM<sub>2.5</sub> concentrations that are very low and those that are very high. The RIA states:

the health impact function for fine particles is log-linear without a threshold in this analysis. Thus, the estimates include health benefits from reducing fine particles in areas with varied concentrations of PM<sub>2.5</sub>, including both areas that do not meet the fine particle standard and those areas that are in attainment, down to the lowest modeled concentrations.<sup>12</sup>

EPA's assumption of a constant relationship between emission reductions and health effects, regardless of baseline concentrations, may be particularly important to explore in the case of wood heaters, which tend to be used in remote areas where concentrations are often below the national ambient air quality standards (NAAQS). The docket for this proposal contains a spreadsheet that suggests that the areas in which wood heaters are more prevalent are more likely to be in compliance with the PM<sub>2.5</sub> NAAQS than more urban areas.<sup>13</sup> The spreadsheet contains state and county level data from EPA's 2011 National Emissions Inventory on 1) PM<sub>2.5</sub> emissions from residential wood combustion, 2) the percent of total PM<sub>2.5</sub> emissions contributed by wood combustion emissions, and 3) a proxy of the area's attainment status with the PM NAAQS.<sup>14</sup> The fraction of PM<sub>2.5</sub> contributed by wood combustion is negatively correlated with degree of non-attainment, with correlation coefficients of -0.46 using annual measures of attainment and -0.28 using daily measures.

Since EPA admits to being less confident in the risk estimated from simulated PM<sub>2.5</sub> concentrations that fall below the bulk of the observed data in its studies, it should present these uncertainties more clearly to decision makers and the public, and adjust its benefit-per-ton estimates appropriately.

### **General problems with health effects analysis**

In addition to the problems specific to the application of health benefits to this rule, experts recognize the "significant uncertainty" associated with both "the reduction of premature deaths

---

<sup>11</sup> Smith, Anne. "An Evaluation of the Pm2.5 Health Benefits Estimates in Regulatory Impact Analyses for Recent Air Regulations," NERA Economic Consulting, December 2011

<sup>12</sup> RIA Section 7.

<sup>13</sup> Air Quality and Emissions Data; Supporting Information for the Residential Wood Heater New Source Performance Standard. August 14, 2013. EPA-HQ-OAR-2009-0734-0176

<sup>14</sup> EPA computes design values (DVs) using Federal Reference Method or equivalent data reported by states, tribes, and local agencies to approximate compliance status.

associated with reduction in particulate matter and ... the monetary value of reducing mortality risk.”<sup>15</sup>

One key source of uncertainty relates to EPA’s assumption that inhalation of fine particles is causally associated with premature death.<sup>16</sup> EPA bases this assumption on epidemiological evidence of an association between particulate matter concentrations and mortality; however, risk assessment expert Louis Anthony Cox raises questions as to whether the correlation EPA claims is real. His statistical review of EPA’s methodology concludes, with a greater than 95 percent probability, that no association exists, and that EPA’s results are a product of its choice of models and selected data rather than a real, measured correlation.<sup>17</sup> Furthermore, correlation does not necessarily indicate causation (*cum hoc non propter hoc*), and EPA has not identified a biological mechanism that explains the observed correlation.

Another source of uncertainty relates to the dollar value attributable to mortality risk reduction (value per statistical life, or VSL) when monetizing economic benefits. As the Office of Management and Budget notes, “the value of mortality risk reduction is taken largely from studies of the willingness to accept risk in the labor market [where the relevant population is healthy and has a long remaining life expectancy] and might not necessarily apply to people in different stages of life or health status.”<sup>18</sup> This caveat is particularly important in the case of PM<sub>2.5</sub> because, as EPA’s 2011 report, “The Benefits and Costs of the Clean Air Act, 1990-2020,” shows, the median age of the beneficiaries of reductions in fine particles is around 80 years old, and the average extension in life expectancy attributable to lower PM<sub>2.5</sub> levels is less than six months.<sup>19</sup>

In other analyses, EPA has reported benefits based on the value of statistical life-years (VSLY) extended, as well as lives saved, and in this proposal EPA should present alternative benefit-per-ton estimates derived from a VSLY. As OMB’s Circular A-4 Primer observes, particularly “when there are significant differences between the effect on life expectancy for the population affected by a particular health risk and the populations studied in the labor market studies,” it may be “appropriate to consider providing estimates of both VSL and VSLY, while recognizing the developing state of knowledge in this area.”<sup>20</sup>

---

<sup>15</sup> [Draft 2013 Report to Congress on the Benefits and Costs of Federal Regulations and Unfunded Mandates on State, Local, and Tribal Entities](#) (April 2013)

<sup>16</sup> RIA Section 7

<sup>17</sup> Cox, Louis Anthony, Jr. “Reassessing the Human Health Benefits from Cleaner Air,” *Risk Analysis*, Vol. 32, No. 5, (May) 2012.

<sup>18</sup> [Draft 2013 Report to Congress on the Benefits and Costs of Federal Regulations and Unfunded Mandates on State, Local, and Tribal Entities](#) (April 2013)

<sup>19</sup> Table 5-8 of U.S. EPA “The Benefits and Costs of the Clean Air Act, 1990-2020,” March 2011 presents the age cohorts and life expectancy of the beneficiaries of reduced PM<sub>2.5</sub> exposure. Available at: <http://www.epa.gov/air/sect812/feb11/fullreport.pdf>.

<sup>20</sup> Circular A-4 Primer, available at: [http://www.whitehouse.gov/sites/default/files/omb/inforeg/regpol/circular-a-4\\_regulatory-impact-analysis-a-primer.pdf](http://www.whitehouse.gov/sites/default/files/omb/inforeg/regpol/circular-a-4_regulatory-impact-analysis-a-primer.pdf)

## **EPA should develop a more plausible range of health benefits**

These uncertainties have a significant effect on the benefit estimates EPA's presents in this rule. If EPA's assumptions about the future sales of more expensive, lower-emitting appliances (particularly forced furnace and hydronic heaters) are unrealistic, benefits are likely significantly overstated. If the benefit-per-ton estimates are overstated because they don't reflect the air quality conditions and populations relevant for the wood heater market, benefits are likely significantly overstated. If EPA's assumptions of a causal, linear, no-threshold relationship between PM<sub>2.5</sub> exposure and premature mortality are inaccurate (in other words, if no association exists, if the relationship is not causal, or if the concentration-response relationship is not linear at low doses), the avoided premature mortality attributable to reducing PM<sub>2.5</sub> would be less than estimated, and possibly as low as zero. EPA should do sensitivity analysis on these assumptions and generate a plausible range of effects before proceeding with this rule. Further, as discussed below, it should commit to measuring actual outcomes.

## **Precision in cost estimates is not warranted**

EPA estimates total average annualized costs between 2014 and 2022 at \$15,688,471.<sup>21</sup> Given the number of assumptions and degree of uncertainty involved in this estimate,<sup>22</sup> the level of precision presented is misleading. The regulatory impact analysis supporting the proposal outlines the various assumptions relied on to derive these estimates. In particular, EPA notes that "the estimates of the cost of R&D are crucial to our estimates of overall costs and economic impacts and greatly influence our decisions on BSER, implementation lead times and small volume provisions."<sup>23</sup> Yet EPA assumes \$356,250 in R&D costs per manufacturer, with minor adjustments for type of heater, without exploring a range.

As noted above, EPA's projection that sales of each appliance type will grow at 2% per year, despite large price increases for some models and modest price increases for others, seems unlikely. Manufacturers of forced-air furnaces and hydraulic heaters in particular may not have the confidence that future sales will recoup their R&D and design costs, and they may choose to go out of business rather than comply. This is particularly important given that the Clean Air Act requires NSPS determinations of what constitutes BSER to consider costs. Section 111(a)(1) of the Act states that NSPS are to "reflect the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated."

---

<sup>21</sup> Preamble, 79 FR 6351

<sup>22</sup> Regulatory Impact Analysis Section 5.

<sup>23</sup> Preamble, 79 FR 6350

As noted above, EPA's shipment estimates by appliance type are another source of significant uncertainty which could affect costs as well as benefits, yet EPA's projections all rely on a single projection (growth rate in units sold of 2% per year). At a minimum, pursuant to OMB guidelines, EPA should conduct sensitivity analysis on these figures, particularly the assumptions underpinning the R&D cost estimates and projected shipments of different heater types, and present a range of plausible estimates. OMB observes:

Regulatory analysis requires predictions about the future. What the future holds, both in the baseline and under the regulatory alternative under consideration, is rarely certain. The important uncertainties connected with the regulatory decision should be analyzed and presented as part of the regulatory impact analysis. It is common practice for an agency's uncertainty analysis to present a central "best estimate," which reflects the expected value of the benefits and costs of the rule, as well as a description of the ranges of plausible values for benefits, costs, and net benefits. This description informs the decision-makers and the public of the degree of uncertainty associated with the regulatory decision.

In general, you should also include a sensitivity analysis that shows how results of your analysis vary with plausible changes in assumptions, choices of input data, and alternative analytical approaches. The level of detail in the analysis can vary with the expected effects of the rule; you should use more rigorous analytical approaches, and more comprehensive sensitivity analysis, for rules with especially large consequences.<sup>24</sup>

### **EPA should consider alternatives to its proposed standards**

OMB guidance states:

Executive Order 12866 requires an assessment, including the underlying analysis, of costs and benefits of potentially effective and reasonably feasible alternatives to the planned regulation and an explanation why the planned regulatory action is preferable to the identified potential alternatives. [Agencies] should ordinarily consider analyzing at least three options: the preferred option; a more stringent option; and a less stringent one.<sup>25</sup>

Yet, EPA provides no alternatives to its proposed BSER. A presentation of the incremental costs and health effects associated with achieving EPA's proposed standard and alternative (more and less stringent) emission limits could be very informative.

---

<sup>24</sup> Office of Management and Budget, [Circular A-4, "Regulatory Analysis" Frequently Asked Questions \(FAQs\)](#) February 7, 2011

<sup>25</sup> *Ibid.*



Table 11 of the preamble, reproduced above, reveals a wide range in cost-effectiveness across appliance types. The total cost per ton of PM<sub>2.5</sub> emissions reduced ranges from \$37 for forced air furnaces to \$1,513 for pellet stoves. Without some incremental analysis at different emission limits, decision makers and the public cannot judge the marginal cost-effectiveness of the different standards in the rule. Yet, sound public policy would argue for setting the marginal cost per ton equal for the different standards, not only within the wood combustion source category, but across emissions sources.

EPA does seek comment on a longer 3-step phase-in alternative to the proposed 2-step schedule, but it estimates that approach would increase costs without increasing benefits, and thus does not appear to be a realistic alternative.

### Plan for retrospective review

Through a series of Executive Orders, President Obama has encouraged federal regulatory agencies to review existing regulations “that may be outmoded, ineffective, insufficient, or excessively burdensome, and to modify, streamline, expand, or repeal them in accordance with what has been learned.”<sup>26</sup> In his implementing memo on retrospective review, former Administrator of the Office of Information and Regulatory Affairs, Cass Sunstein, emphasized the importance of designing regulations to facilitate their evaluation:

With its emphasis on “periodic review of existing significant regulations,” Executive Order 13563 recognizes the importance of maintaining a consistent culture of retrospective review and analysis throughout the executive branch. To promote that culture, *future regulations should be designed and written in ways that facilitate evaluation of their consequences* and thus promote retrospective analyses and measurement of “actual results.” To the extent permitted by law, agencies should therefore give careful consideration to how best to promote empirical testing of the effects of rules both in advance and retrospectively.<sup>27</sup>  
[Emphasis added]

EPA’s preamble makes no mention of this EO 13563 requirement, nor does it offer a plan for retrospective review or commit to gathering information to determine how effective the revised NSPS are at achieving the stated objectives.

Ideally, to evaluate whether an agency’s proposal was “designed and written in ways that facilitate evaluation of [its] consequences,” it should be measured against five criteria:

---

<sup>26</sup> Exec. Order No. 13563, *Improving Regulation and Regulatory Review*, 76 FR 3821 (2011).

<sup>27</sup> United States. Office of Management and Budget. Office of Information and Regulatory Affairs. *MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES: Retrospective Analysis of Existing Significant Regulations*. By Cass Sunstein. April 25, 2011.

- Did the agency clearly identify the problem that its proposed rule is intended to solve?
- Did the agency provide clear, measurable metrics that reviewers can use to evaluate whether the regulation achieves its policy goals?
- Did the agency commit to collecting information to assess whether its measurable metrics are being reached?
- Did the agency provide a clear timeframe for the accomplishment of its stated metrics and the collection of information to support its findings?
- Did the agency write its proposal to allow measurement of linkages between actions required by regulation, outputs and outcomes to enable review of whether the standards directly result in the outcomes that the agency intends?

**Identifying the Problem.** EPA asserts that the revised NSPS “will help reduce the health impacts of fine particle pollution, of which wood smoke is a contributing factor in many areas.” Further, the preamble states:

Nationally, residential wood combustion accounts for 44 percent of total stationary and mobile polycyclic organic matter (POM) emissions, nearly 25 percent of all area source air toxics cancer risks and 15 percent of noncancer respiratory effects. Residential wood smoke causes many counties in the U.S. to either exceed the EPA’s health-based national ambient air quality standards (NAAQS) for fine particles or places them on the cusp of exceeding those standards. To the degree that older, higher emitting, less efficient wood heaters are replaced by newer heaters that meet the requirements of this rule, or better, the emissions would be reduced, the efficiencies would be increased and fewer health impacts should occur.

As with any policy, success in this case will depend upon whether the identified problem is addressed—and, to some extent, solved—by implementation of the rule. Therefore, to build a successful plan for retrospective review into this rule, we must measure how effective this rule is at reducing health impacts of fine particle pollution from wood smoke.

**Clear evaluation metrics.** EPA has not identified clear evaluation metrics, and its projections of \$1.7 billion to \$4.1 billion in benefits will not be measurable. These estimates are based on a national benefit-per-ton of PM<sub>2.5</sub> reduced, which relies on a benefits transfer method that in turn relies on estimated willingness-to-pay for statistical reductions in premature mortality. More rigorous statistical analysis could help evaluate the merits of these approaches and their projections.<sup>28</sup> EPA’s estimated costs will be more conducive to measurement, however EPA has not committed to monitoring them.

---

<sup>28</sup> Louis Anthony (Tony) Cox Jr., “Improving Causal Inferences in Risk Analysis,” *Risk Analysis* [Volume 33, Issue 10](#), pages 1762–1771, October 2013

To further retrospective review of this rule, EPA should commit to measuring the costs of implementing its rule, along with any anticipated health effects (such as reductions in premature mortality). If these outcomes differ from EPA's estimates, the agency should attempt to identify why, and should apply the lessons learned to estimating similar costs and health effects in future analyses.

**Information for evaluation.** To facilitate retrospective review of the wood heater NSPS, and also to improve the analysis supporting future regulations, EPA should commit to evaluating the elements it estimates will lead to the estimated regulatory outcomes, benefits and costs, including:

1. Emission reductions in areas where wood heating is prevalent, in order to evaluate whether predicted emission reductions were accurate.
2. Concentrations of PM<sub>2.5</sub>, particularly in winter months, in those areas, to evaluate whether modeled relationships between emissions and air quality were accurate.
3. Population health endpoints identified with PM<sub>2.5</sub> exposure in the areas affected by the rule.
4. Sales of covered products, by category, to evaluate projected replacement of existing units and market penetration of lower-emitting units.
5. Unit prices of covered wood heaters, to evaluate the accuracy of cost estimates.

**Timeframe for accomplishing objectives.** EPA proposes a 2-step compliance schedule, wherein interim standards take effect on the effective date of the final rule, and tighter standards take effect five years later. EPA's rationale for this phased schedule is to allow manufacturers time to develop, certify, and produce compliant units, however, EPA's analysis does not consider the effect of this 2-step schedule on consumer and producer behavior. Particularly for the models projected to become much more expensive upon full compliance, it may encourage consumers to purchase wood heaters during the first five years, before prices increase.

After these standards take effect, EPA should commit to measuring annually the outcomes it expects from its rule.

**Effects of intermediate actions on outcomes.** As noted in the discussion above of the deficiencies in the regulatory analysis supporting the rule, EPA relies on numerous assumptions and models of what the market for wood heaters and the emissions they generate would be absent the regulation, and how responses to regulatory requirements will alter those conditions. Despite the reliance on these same assumptions and models in numerous regulations, they have not been tested, and are, in essence, hypotheses of the effects of regulatory actions.

Better retrospective review would allow EPA and others to test those hypotheses against actual outcomes. However, ex post analysis also poses challenges. Once a regulation is in place, it is not always obvious what the world would have looked like without it. Would air emissions have

continued to increase directly with economic and population growth, or would technological change and citizen preferences have constrained that growth? Measuring opportunity costs (what activities or innovations were foregone to achieve regulatory goals?) is not easy, and measuring regulatory benefits is often harder. In its Clean Air Act retrospective analysis, EPA relied on the same ex ante models to estimate ex post benefits, rather than measuring observed outcomes.

The President has placed a “large priority [on] the development of methods (perhaps including not merely before-and-after accounts but also randomized trials, to the extent feasible and consistent with law) to obtain a clear sense of the effects of rules.”<sup>29</sup> In this case, EPA has the benefit of natural experiments, since it has entered into voluntary agreements with manufacturers, and individual states have tried different regulatory approaches to addressing concerns over wood heater emissions.<sup>30</sup> Issuing a national standard cannot take into account the different heater usage patterns, population characteristics, meteorological conditions, background pollution levels, etc., but perhaps equally important, it removes the information that these different state approaches provide. For example, some states are experimenting with buy-back programs, which would encourage residents with older, more-polluting units to trade them in for newer more environmentally-friendly units.

Before embarking on a new set of national standards based on a new speculative analysis, EPA should seriously examine the results of these natural experiments.

## Recommendations

The analysis supporting EPA’s proposed NSPS for residential wood heaters is seriously flawed, and as a result, the standards may not meet the Clean Air Act requirement that it set emissions limits based on “the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated.” The complete lack of analysis of alternative emission limits not only conflicts with Presidential directives but makes EPA’s determination of BSER unreliable. Further, sensitivity analysis of key assumptions, including those underlying health effects, consumer and producer response to the standards, and R&D costs, could alter EPA’s determination of BSER.

Particularly given all the assumptions and uncertainties in the ex-ante analysis, if EPA proceeds to issue these NSPS, it should commit to gathering information on actual outcomes, including emission reductions, air quality concentrations, population health, sales and prices of new residential wood heaters by type, and turnover of old units.

---

<sup>29</sup> [Draft 2013 Report to Congress on the Benefits and Costs of Federal Regulations and Unfunded Mandates on State, Local, and Tribal Entities](#) (April 2013)

<sup>30</sup> For a discussion of the value of quasi-experimental evidence for understanding PM effects, see Dominici, Greenstone, and Sunstein, “Particulate Matter Matters,” *SCIENCE* VOL 344 18 APRIL 2014