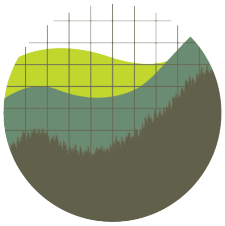

Institute *for*
Policy Integrity
NEW YORK UNIVERSITY SCHOOL OF LAW

May 16, 2022

To: Environmental Protection Agency

Subject: Comment on "Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards," 87 Fed. Reg. 17,414 (proposed March 28, 2022)

Docket ID: EPA–HQ–OAR–2019–0055

The Institute for Policy Integrity at New York University School of Law ("Policy Integrity")[1] respectfully submits the following comment to the Environmental Protection Agency ("EPA") on its proposed rule, Control of Air Pollution From New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards ("Proposed Rule").[2] Policy Integrity is a non-partisan think tank dedicated to improving the quality of government decisionmaking through advocacy and scholarship in the fields of administrative law, economics, and public policy.

In the Proposed Rule, EPA presents two regulatory options, as well as one more stringent alternative. Because EPA is statutorily required to set standards for heavy-duty vehicles reflecting the "greatest degree of emission reduction achievable," at a minimum it should select Option 1 in the Final Rule, as this regulatory proposal is feasible, net beneficial, and would produce the largest emission reduction of the options considered in the Proposed Rule. However, given the numerous overly conservative economic assumptions outlined below, EPA should also revise its cost-benefit and distributional analyses to better reflect the considerable benefits to society from strong emission standards for heavy-duty trucks. This revised analysis may show that even more stringent alternatives beyond Option 1 are feasible and net beneficial. EPA should presumptively select the alternative that maximizes net benefits, and, if it does not select that policy, should offer an adequate justification for rejecting the alternative that is most economically efficient. We make the following specific recommendations:

- **EPA should fully evaluate the costs and benefits of all regulatory options presented and should strongly consider including at least one more stringent alternative than proposed.** In order to fulfill its statutory duty, EPA should compare the costs and benefits of all regulatory alternatives under consideration in order to ensure that it selects the net-beneficial alternative that will generate the greatest emission reduction. It should also consider whether more stringent alternatives would also be cost-justified and generate greater emission reductions than the options in the Proposed Rule.
- **EPA should revise and expand its distributional analysis to better reflect the impacts of the Proposed Rule on vulnerable subpopulations.** EPA should conduct a more geographically granular analysis and reconfigure its subpopulation analysis. In addition, EPA should conduct a distributional analysis of all regulatory alternatives under consideration in order to evaluate incremental distributional benefits among alternatives.

[1] This document does not purport to represent the views, if any, of New York University School of Law.
[2] 87 Fed. Reg. 17,414 (proposed March 28, 2022) (EPA–HQ–OAR–2019–0055).

- **EPA should clarify its economic assumptions to better explain its choices in its methodology.** In particular, EPA should provide additional discussion regarding how the agency incorporates income changes into the value of a statistical life, considers the cost of illness, and accounts for learning-by-doing in calculating compliance costs.
- **EPA should consider revising its estimation of sales impacts and fleet turnover.** EPA should consider discussing sales impacts and fleet turnover qualitatively, or, in the alternative, identifying and discussing the assumptions baked into its quantitative model that may result in an overestimate of sales impacts.
- **EPA should clarify that any employment impacts from the Proposed Rule are likely small and short-lived.** EPA should quantify upstream and downstream employment effects, and if it cannot, the agency should at a minimum identify the direction and magnitude of total net employment effects.
- **EPA should quantify the benefits of reducing greenhouse gases.** EPA should quantify any expected reductions in greenhouse gas emissions from the Proposed Rule and monetize the benefits of such reduction using the social cost of greenhouse gases.

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I. EPA Should Finalize the Regulatory Option that Maximizes Net Benefits And Should Consider More Stringent Alternatives Than Proposed.

A. The Clean Air Act requires EPA to adopt stringent standards for heavy-duty vehicles reflecting the "greatest degree of emission reduction achievable"

In the Proposed Rule, EPA acts under the authority of the Clean Air Act section 202.[3] Unlike the open-ended discretion provided to EPA in setting standards for light-duty vehicles, EPA is required to set standards for heavy-duty vehicles that "**reflect the greatest degree of emission reduction achievable**" for the model year, with "appropriate considerations to cost, energy, and safety factors associated with the application of such technology."[4] Also in contrast to its discretion with respect to lead time in setting standards for light-duty vehicles, EPA is required to provide at least 4 years of lead time when it sets new standards for heavy-duty vehicles.[5] This extended lead time evidences Congress' intent that EPA set stringent, technology-forcing standards to reduce emissions from heavy-duty vehicles.[6]

Congress has prioritized the dangers of heavy-duty truck pollution since it amended the Clean Air Act in 1977, recognizing that EPA needed to "require rigorous control of heavy-duty vehicles… which have become an increasing pollution problem."[7] While the 1970 Clean Air Act required a 90% reduction in light-duty vehicle emissions, it did not set a comparable target for heavy-duty vehicles.[8] Congress addressed this shortcoming in 1977 when it required EPA to set initial heavy-duty vehicle standards reflecting the "best available control technology" that were designed to achieve a 90% reduction in hydrocarbons and carbon monoxide, and a 75% reduction in nitrogen oxides by 1981.[9] EPA failed to act as Congress directed until March 1985, when it promulgated heavy-duty regulations for the 1991 and 1994 model years—a decade later than Congress intended, and only upon court order.[10] Thus, Congress once again intervened, amending the Clean Air Act's heavy-duty provisions in 1990 to limit the sulfur content of diesel fuels after significant testimony regarding the dangers of diesel exhaust and other pollution from heavy-duty vehicles.[11] The Proposed Rule is the first time EPA has acted to reduce heavy-duty vehicle emission in more than two decades, since it last issued standards in 2000. This history of intermittent agency action, continually pushed by Congress and the courts to go further, shows the necessity for EPA to act now by issuing strong, protective standards.

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[3] 85 Fed. Reg. at 17,420.

[4] Clean Air Act § 202(a)(3); 42 U.S.C. § 7521(a)(3).

[5] *Compare* Clean Air Act § 202(a)(2) (standards "shall take effect after such period as the Administrator finds necessary to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance") *with* § 202(a)(3)(B) (heavy-duty vehicle standards "shall apply… beginning no earlier than the model year commencing 4 years after such revised standard is promulgated").

[6] *See Nat. Res. Def. Council v. EPA*, 655 F.2d 318, 328 (D.C. Cir. 1981) ("The legislative history of both the 1970 and the 1977 amendments demonstrates that Congress intended the agency to project future advances in pollution control capability. It was 'expected to press for the development and application of improved technology rather than be limited by that which exists today.'") (quoting S.Rep.No.1196, 91st Cong., 2d Sess. 24 (1970)).

[7] S.Rep.No.127, 95th Cong., 1st Sess. (1977) at 15.

[8] *Id.* at 65.

[9] *Id.* at 66.

[10] S.Rep.228, 101st Cong., 1st Sess. (1989) at 111.

[11] *Id.*

Instead, even the most stringent of the two options EPA has proposed can hardly be said to be the "greatest emission reduction achievable" when California has already issued similar heavy-duty vehicle standards that are being implemented three years earlier.[12]

EPA has "co-proposed" two regulatory options, along with one more stringent alternative for which EPA was unable to determine feasibility.[13] Option 2 is the "less stringent" of the two co-proposals.[14] EPA found that the more stringent emission standards in Option 1 are "achievable" and "feasible."[15] And EPA acknowledges that proposed Option 1 will result in greater emission benefits,[16] lower costs,[17] and higher net benefits.[18] Thus, as EPA acknowledges, Option 1 is the "more appropriate level of stringency as it would result in a greater level of achievable emission reduction for the model years proposed, which is consistent with EPA's statutory authority[.]"[19] Yet EPA "co-proposes" both options as "potentially appropriate."[20] This cannot be true. Finalizing standards equivalent to Option 2—when at least one other regulatory option produces greater emission benefits, has higher net benefits, and is feasible—would be inconsistent with EPA's statutory duty under the Clean Air Act. **At a minimum, EPA must finalize standards that are at least as stringent as Option 1.**

B. EPA Must Fully Evaluate the Feasibility, Costs, and Benefits for All Alternatives Under Consideration

It is well established that agencies should consider a range of regulatory alternatives in order to properly evaluate the costs and benefits of a regulatory proposal. Executive Order 12,866 explains that "agencies should select those approaches that maximize net benefits" when "choosing among alternative regulatory approaches."[21] Accomplishing such a goal of maximizing net benefits is impossible without first considering a broad range of alternatives at different levels of stringency.[22] The Office of Management and Budget ("OMB") Circular A-4 directs agencies to "describe the alternatives available to [the agency] and the reasons for choosing one alternative over another."[23] When, as here, there is a continuum of possible alternatives based on the level of stringency, agencies "generally should analyze at least three options: the preferred option; a more stringent option that achieves additional benefits (and

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[12] *See* Cal. Air Res. Bd., *Comparison of CARB Heavy-Duty Omnibus Regulation (Omnibus) and U.S. Environmental Protection Agency (U.S. EPA) Clean Trucks Plan (CTP) Proposed Options*, ("Option 1 includes many elements of CARB's Omnibus program and is approximately as stringent, although it takes effect about three years later… Option 1 is significantly weaker and the standards do not reflect the performance of demonstrated emission control technologies."), https://perma.cc/9PNB-JNPY.

[13] 85 Fed. Reg. at 17,420.

[14] *Id.* at 17,421.

[15] *Id.* at 17,438–39.

[16] *Id.* at 17,438 (projecting that Option 1 would reduce NOx emissions by 44% by 2040, while Option 2 would reduce NOx emissions by 55% over the same period).

[17] *Id.* at 17,589 (annualized costs at 3% discount rate of $1.9 billion for Option 1 versus $2.1 billion for Option 2).

[18] *Id.* (net present benefits at 3% discount rate of $61-220 billion for Option 1 versus $41-170 billion for Option 2).

[19] *Id.* at 17,440

[20] *Id.*

[21] 58 Fed. Reg. 51,735 §1(a) (Oct. 4, 1993).

[22] *See* Richard L. Revesz & Samantha P. Yi, *Distributional Consequences and Regulatory Analysis*, 52 ENV'T L. 53, 91–92.

[23] OFFICE OF MGMT. & BUDGET, CIRCULAR A-4: REGULATORY ANALYSIS 16 (2003).

presumably costs more) beyond those realized by the preferred option; and a less stringent option that costs less (and presumably generates fewer benefits) than the preferred option."[24] Circular A-4 makes clear that an analysis that, as here, does not discuss the incremental costs and benefits of alternatives is not adequate.[25]

Since the Supreme Court held in *State Farm* that the National Highway Traffic Administration ("NHTSA") had acted arbitrarily and capriciously by refusing to consider a "technological alternative within the ambit of [its] existing standards,"[26] the U.S. Court of Appeals for the D.C. Circuit has repeatedly held that rational decisionmaking by administrative agencies requires consideration of "significant alternatives to the course it ultimately chooses."[27] Agencies must consider "obvious" alternatives and provide an explanation when alternatives are rejected.[28] And in explaining why alternatives are rejected, agencies may not "put a thumb on the scale by undervaluing the benefits and overvaluing the costs of more stringent standards."[29] EPA's failure to fully evaluate alternatives is particularly egregious here, where proposing and evaluating alternative performance standards with varying levels of stringency is such a "familiar tool in [EPA]'s tool kit."[30]

With a full analysis of only Option 1,[31] and only a limited analysis of the less-stringent Option 2[32] and the more stringent alternative, EPA cannot rationally determine which of its proposed regulatory options is the most reasonable approach. **At a minimum, EPA should fully evaluate the costs and benefits of Option 2 and the more stringent alternative described in the Proposed Rule, as Circular A-4 recommends.**[33] The agency should presumptively select the alternative that maximizes net benefits,[34] and, if it does not select that policy, should offer an adequate justification for rejecting the alternative that is most economically efficient.[35]

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[24] *Id.*

[25] *Id.*

[26] *Motor Vehicle Mfrs. Ass'n of U.S., Inc. v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 51 (1983).

[27] *Allied Local & Reg'l Mfrs. Caucus v. EPA*, 215 F.3d 61, 80 (D.C. Cir. 2000).

[28] *Int'l Ladies' Garment Workers' Union v. Donovan*, 722 F.2d 795, 816 n.41 (D.C. Cir. 1983).

[29] *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1198 (9th Cir. 2008).

[30] *See Chamber of Com. of U.S. v. Sec. & Exch. Comm'n*, 412 F.3d 133, 144 (D.C. Cir. 2005).

[31] Even EPA's analysis of Option 1 is oddly incomplete, as it acknowledges that there are differences between the scenario modeled in the DRIA and the standards presented in the rule. *See* 85 Fed. Reg. at 17,589 n.781("As noted in draft RIA Chapter 5.4, **there are differences between the standards, emission warranty, and useful life provisions of proposed Option 1 presented in Sections III and IV and those included in our control case scenario modeled for the air quality analysis** (as noted in Section VII, **due to resource constraints we only conducted air quality modeling for the proposed Option 1**). As detailed in draft RIA Chapter 8, estimates of health benefits are based on our air quality analysis, and thus differences between proposed Option 1 and modeling are not reflected in the benefits analysis.") (emphasis added).

[32] *See id.*

[33] CIRCULAR A-4, *supra* note 23, at 16.

[34] Exec. Order 12,866, *supra* note 21, §1(a) ("[A]gencies should select those approaches that maximize net benefits…, unless a statute requires another regulatory approach.").

[35] EPA, Guidelines for Preparing Economic Analyses 1-4 (2010) ("The policy that maximizes net benefits is considered the most efficient").

C. EPA should strongly consider adding more stringent regulatory alternatives to its analysis

EPA's draft regulatory impact analysis ("RIA" or "DRIA") indicates the strong potential that more stringent regulations would produce additional social benefits.[36] It is important that EPA consider more stringent alternatives than Option 1 in order to identify whether the agency is leaving incremental net benefits on the table.[37] In the Proposed Rule, EPA introduces one more stringent alternative, but cannot determine whether it is technologically feasible and therefore does not analyze its costs and benefits.[38] Instead of ending its analysis there, EPA should consider other options in between Option 1 and the more stringent alternative. Showing whether a more stringent alternative would, or would not, produce higher net benefits would improve the overall transparency of the rulemaking process. Further, consideration of more than three alternatives would be consistent with past regulatory practice, such as the SAFE Rule's contemplation of eight different regulatory options.[39]

EPA's distributional and employment analyses of the regulation further support the consideration of strong alternatives. Specifically, EPA's current analysis demonstrates that strong regulation as represented by Option 1 improves the air quality faced by disadvantaged groups in the most polluted areas. A wider distributional analysis as recommended in Section II, *infra*, combined with a wider set of alternatives would allow EPA to analyze the extent to which stronger regulations could benefit disadvantaged communities already suffering from high levels of air pollution. Moreover, since the current analysis finds little to no negative impact on sales or employment from Option 1,[40] the additional benefits of further reducing air pollution could substantially increase the incremental net benefits of more stringent regulation. Indeed, the effect of building and installing the necessary technologies for vehicle improvements required by more stringent standards could even lead to higher levels of employment at the manufacturing level and overall. Ideally, EPA should quantify the overall employment impacts along with the wider set of alternatives to determine the direction and magnitude of these employment effects, though EPA could consider making these points qualitatively at a minimum.

II. EPA Should Expand Its Distributional Analysis to Better Account for the Effects of the Proposed Rule on Different Subpopulations

While EPA takes the important step of conducting a distributional analysis for the baseline and Proposed Option 1, EPA should go further in its distributional analysis. In the RIA, EPA finds that the largest air quality improvements are expected to occur in areas with the worst baseline air quality, where a substantially larger number of people of color are expected to live compared

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[36] *See, e.g.*, 85 Fed. Reg. at 17,438 (a more stringent alternative will reduce NOx emissions by 44% by 2040, as compared to 55% over the same period for a less stringent alternative); *Id.* at 17,589 (net present benefits at a 3% discount rate of $61-220 billion for more stringent alternative versus $41-170 billion for less stringent alternative).

[37] *See* CIRCULAR A-4, *supra* note 23, at 16.

[38] 85 Fed. Reg. at 17,589 n.782.

[39] 83 Fed. Reg. 42,986, 42,990 (Aug. 24, 2018) (proposing 8 different regulatory alternatives).

[40] *See* sections V & VI, *infra*.

with non-Hispanic White populations.[41] EPA analyzes these changes by sorting the baseline concentrations of ozone and $PM_{2.5}$ and comparing the 12 kilometers by 12 kilometers grid cells in the highest 5 percent of the distribution of the baseline air quality concentrations with those in the remaining 95 percent.[42] We applaud the demographic analysis conducted by the Agency, which aids in answering the important question of who would benefit from the proposed regulation. However, this analysis appears to fall short of informing EPA and the public of the full distributional analysis of air pollution reductions, in which EPA is called upon to provide under executive guidance.[43]

There are several ways EPA can improve its distributional analysis:

- *First*, EPA should use a more granular geographic scale. In the RIA, EPA uses a geographic unit of analysis that is too coarse to capture intra-city disparities.
- *Second*, EPA should consider revising its subpopulation analyses, which currently focuses on those exposed to the most severe air pollution (top 5 percent) and considers the demographic breakdown from that starting point.
- *Third*, EPA should re-estimate benefits for renters, who are more likely to be non-White and have lower income, in order to capture any possibility that these groups will be priced out of their neighborhoods if air quality improves.
- *Fourth*, EPA should improve its statistical analysis in order to support the conclusions it draws. The current analysis lacks statistical power to conclude significant reductions in air pollutants due to the proposed rule.

EPA should aim to address these issues in its analysis for the final rule or qualitatively discuss any elements for which it needs additional time and resources to develop the appropriate analytical techniques.

A. EPA should use a more granular geographic scale for its analysis

EPA should conduct its distributional analysis at a more granular geographic level to capture the heterogeneous air quality impacts within a given area. EPA's current unit of analysis, 12 kilometers x 12 kilometers cells across the contiguous U.S.,[44] is roughly equivalent to the size of a medium-sized city such as Pittsburgh, Pennsylvania.[45] Thus, the current aggregation level of EPA's analysis misses all distributional impacts within the area of a medium-sized city, despite the potential for significant disparities at this scale.

EPA should improve the granularity to a finer scale, ideally 1 kilometer by 1 kilometer for dense urban areas. EPA can use existing tools, like InMAP, which allows for this level of finer spatial

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[41] EPA, Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards Draft Regulatory Impact Analysis [hereinafter "DRIA"] (March 2022) at 305–6, https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10144K0.pdf.

[42] *Id.* at 306.

[43] *See* CIRCULAR A-4, *supra* note 23; Exec. Order 12,866, *supra* note 21; Exec. Order 13,990, 86 Fed. Reg. 7037 (Jan. 25, 2021); Exec. Order No. 14,008, § 219, 86 Fed. Reg. 7619 (Feb. 1, 2021).

[44] DRIA, *supra* note 41, at 306.

[45] Pittsburgh is 151 square kilometers.

resolution. At this scale, EPA could better determine the impact of its regulation on the populations of interests, particularly within large urban areas where the majority of the U.S. population live,[46] which can have significant variations in air quality.[47] For example, using InMAP's more granular scale, the Agency could analyze the distributional impacts within neighborhoods rather than at a city level.[48] For more information on the importance of using a granular spatial scale in environmental justice and distributional analyses, see Policy Integrity's report, *Making Regulations Fair: How Cost-Benefit Analysis Can Promote Equity and Advance Environmental Justice*.[49]

B. EPA should consider reconfiguring its subpopulation analysis

By focusing its analysis only on those exposed to the most severe air pollution (top 5 percent), EPA effectively presupposes that reducing air pollution exposure to the top 5 percent results in a distributionally desirable outcome. However, EPA may find that looking at additional demographic subpopulations in addition to race-based groups and low-income groups could provide important information for its distributional analysis that the current approach excludes. EPA may also be missing effects on those employed by the trucking industry whose households are outside of the top 5 percent of affected areas but may still face significant impacts from truck pollution. If EPA cannot change its overall approach to the subpopulation analysis, it should at least explain why a critical level of 5 percent is relevant and at a minimum, qualitatively discuss how other groups may be affected by the proposal. As currently constructed, while EPA's analysis indicates that the proposed regulation would benefit people in the top 5th percentile, it remains unclear whether it would benefit or hurt at-risk groups in the top 10th or 25th percentiles, which should also be the subject of the Agency's concern.

EPA should consider analyzing the distributional effects of the proposed rule by racial/ethnic composition, income, age, baseline exposure to air pollution, and potential ability to adapt. Although executive guidance counsels EPA to consider the way the effects of the proposed rule accrue to specific types of demographic groups (e.g., "minorities" and "low income"),[50] EPA is not precluded from considering other subpopulations of interest. Not exploring the effects on these other possible subgroups leaves EPA with insufficient information to reach a conclusion

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[46] Urban Areas Facts, U.S. Census Bureau, https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural/ua-facts.html (last access May 10, 2022).

[47] *See, e.g.,* Jonah Lipsitt, et al., *Spatial Analysis of COVID-19 and Traffic-Related Air Pollution in Los Angeles*, 153 ENV'T INT'L 106531 (2021) (applying high-resolution exposure model to neighborhoods of Los Angeles County to allow for more accurate pollution exposure); *see also*, Gerard Hoek et al., *A Review of Land-Use Regression Models to Assess Spatial Variation of Outdoor Air Pollution,* 42 Atmospheric Env't 7561–78 (2008) (a review of models and approaches for assessing intra-urban air pollution differences).

[48] *See, e.g.,* DANIELLE SPIEGEL-FELD ET AL., GUARINI CTR. ON ENV'T, ENERGY, AND LAND USE L. ET AL., CARBON TRADING FOR NEW YORK CITY'S BUILDING SECTOR at 33 (June 2021), https://policyintegrity.org/files/publications/2021-11-15_Guarini_-_Carbon_Trading_For_New_York_Citys_Building_Sector.pdf.

[49] JACK LIENKE ET AL., INST. FOR POL'Y INTEGRITY, MAKING REGULATIONS FAIR: HOW COST-BENEFIT ANALYSIS CAN PROMOTE EQUITY AND ADVANCE ENVIRONMENTAL RACISM at 6–10 (Aug. 2021), https://policyintegrity.org/publications/detail/making-regulations-fair.

[50] *See* Exec. Order 12,898, 59 Fed. Reg. 7,629 (Feb. 16, 1994).

about the distributional effects of the rule. For example, EPA places little emphasis on income-based groups,[51] which could mask the effects of adaptation to air pollution. Higher-income groups are capable of taking more defensive actions on both the extensive and intensive margins to protect themselves from air pollution, including buying air purifiers, cleaners, or filters and running them more frequently, as well as taking other actions such as wearing face masks and staying indoors.[52] Lower-income households have fewer resources to direct toward adaptation efforts, leaving them more vulnerable to air pollution.[53] And omitting age-based subpopulations also obscures important disparities by age. Specifically, children and the elderly are more vulnerable to air pollution for biological reasons.[54] Therefore, it is critical that EPA calculates the distributional effects for a variety of at-risk groups, in addition to minority populations.[55]

In addition, EPA focuses its distributional analysis on households directly exposed to air pollution while possibly overlooking the effects on individuals working in trucking-related sectors who would also be impacted by the regulation. Truckers may be exposed to much higher levels of harmful pollutants than the rest of the population, including those residing in areas with poor air quality.[56] For the purpose of presenting a complete accounting of costs and benefits, EPA should discuss the distributional effects in trucking-related sectors. For example, minority workers, older workers, and/or low-income workers in the trucking sector may gain more from

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[51] *See, e.g.*, DRIA, *supra* note 41, at 307 (describing the analysis as including a breakdown of population based on the poverty line).

[52] *See, e.g.,* Austin M. Williams, *Understanding the Micro-Determinants of Defensive Behaviors Against Pollution*, 163 ECOLOGICAL ECON. 42, 43 (2019).

[53] Gary Adamkiewicz et al., *Moving Environmental Justice Indoors: Understanding Structural Influences on Residual Exposure Patterns in Low-Income Communities*, 101 Am. J. Pub. Health S238–45 (2011); Terry Brown et al., *Relationships Between Socioeconomic and Lifestyle Factors and Indoor Air Quality in French Dwellings*, 140 Envt'l Rsch. 385–96 (2015); Anna Rosofsky et al., *Temporal Trends in Air Pollution Exposure Inequality in Massachusetts*, 161 Env't Rsch. 76–86 (2018); Prateek M. Shrestha et al., *Impact of Outdoor Air Pollution on Indoor Air Quality in Low-Income Homes During Wildfire Seasons*, 16 INT'L J. ENV'T RSCH. & PUB. HEALTH 3535 (2019).

[54] Early-life exposure to air pollution adversely affects lung development and mental health in children. *See* W. James Gauderman et al., *The Effect of Air Pollution on Lung Development from 10 to 18 Years of Age*, 351 N.E. J. Med. 1057–67 (2004); *see also* Kimberly Yolton et al., *Lifetime Exposure to Traffic-Related Air Pollution and Symptoms of Depression and Anxiety at Age 12 Years*, 173 ENV'T RSCH. 199–206 (2019). Short-term variations in air pollutants are positively correlated with respiratory health in the elderly. *See* Anil Namdeo et al., *Estimation of Age-Related Vulnerability to Air Pollution: Assessment of Respiratory Health at Local Scale*, 37 ENV'T INT'L 829–37 (2011).

[55] Engineering and environmental studies both show associations between air pollution concentrations and race and ethnicity. *See, e.g.,* Simone C. Gray et al., *Race, Socioeconomic Status, and Air Pollution Exposure in North Carolina*, 126 ENV'T RSCH. 152–58 (2013); *see also* Maninder PS Thind et al., *Fine Particulate Air Pollution from Electricity Generation in the US: Health Impacts by Race, Income and Geography*, 53 ENV'T SCI. & TECH. 14010–19 (2019).

[56] *See, e.g.*, Lee et al., *Exposure of Trucking Company Workers to Particulate Matter During the Winter*, 61 CHEMOSPHERE 1677 (2005); DIANE BAILEY ET AL., NAT. RES. DEF. COUNCIL & COAL. FOR CLEAN & SAFE PORTS, TRUCK DRIVERS FACE ELEVATED HEALTH RISKS FROM DIESEL POLLUTION (2007), https://www.nrdc.org/sites/default/files/driving.pdf.

the regulation due to high occupational exposure to air pollution,[57] but meanwhile may lose more due to decreased labor demand after the regulation. Analyzing the air quality effects on workers in the transportation sector would enable EPA to examine whether the worst-off face greater costs than those who are better off or vice versa of the policy.[58] Understanding the effects on workers would reveal the balance between the benefits and the costs of the policy borne by historically marginalized and overburdened groups, and could even inform other regulatory policies to offset the potential distributional imbalance.

Rather than focusing on the subpopulations already exposed to the highest levels of ozone and $PM_{2.5}$ pollution, EPA should examine the air quality concentrations at each decile or quantile of exposure for the total population, as well as for each relevant demographic group, both before (baseline) and after the Proposed Rule (including the preferred option and all alternatives).[59] A distributional analysis that looks beyond the top 5 percent versus the bottom 95 percent breakdown of pollution exposure would allow the Agency to avoid arbitrary cutoffs. Doing so would also help EPA and the public understand whether low-income or minority groups across the full population have borne the environmental costs of heavy-duty truck emissions disproportionally. The analysis would further help EPA to uncover whether the Proposed Rule would result in a redistribution of welfare toward these disadvantaged groups. If EPA chooses to keep the current 5th and 95th percentile buckets, the agency must justify its choice to break down air quality effects in this way.

C. EPA should re-examine the potential effects on renters who may be priced out of their neighborhoods due to improved air quality

While EPA does not explicitly consider housing impacts, the agency should reassess potentially overestimated health effects on renters who might be priced out of neighborhoods in the medium- to long-run due to increased rents associated with improved air quality. The current analysis focuses on initial incidence, which represents a short-run analysis where housing prices and individuals are held constant. However, the general equilibrium impacts of an air quality change will result in property price increases in areas with air quality improvements relative to other areas.[60] If the populations of interest do not own property and instead rent, then the resulting property price increases will diminish the benefits that these disadvantaged populations

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[57] Occupational drivers are exposed to a higher level of traffic-related air pollution. *See, e.g.,* Natalia Brucker et al., *Biomarkers of Occupational Exposure to Air Pollution, Inflammation and Oxidative Damage in Taxi Drivers*, 463 SCI. TOTAL ENV'T 884–93 (2013); *see also* Shanon Lim et al., *Characterising Professional Drivers' Exposure to Traffic-Related Air Pollution: Evidence for Reduction Strategies from In-Vehicle Personal Exposure Monitoring*, 153 ENV'T INT'L 106532 (2021).

[58] *See, e.g.,* H.D. Robison, *Who Pays for Industrial Pollution Abatement?*, 67 REV. ECON. & STATISTICS 702–06 (1985) (showing that the lowest income class paid 0.218 percent of income indirectly for industrial pollution abatement in contrast to 0.218 percent for the highest income groups).

[59] Given the EPA's interest in the top fifth percentile, it will likely be interested in the decile calculation.

[60] *See, e, g.*, K. Y. Chay & M. Greenstone, *Does Air Quality Matter? Evidence from the Housing Market*, 113 J. POL. ECON. 376–424 (2005) (finding that housing values increased by 0.2-0.4 percent given a 1 $\mu g/m^3$ reduction in total suspended particulates).

receive from the policy as their rental rates will likely increase.[61] Some individuals who cannot afford the increased rents may be pushed out of the neighborhood, as households spatially resort due to the policy.[62] This could lead renters to move into areas with air quality that will not be improved by the proposed rule. Property owners, though they too might be priced out of a given neighborhood, could still reap the benefits of improved air quality by way of increased property value in a way renters would not.[63] EPA should take the potential adverse effects on renters into account.

D. EPA should provide stronger statistical evidence to conclude that the proposed rule will significantly improve the air quality of minority groups

Finally, EPA calculates changes in ozone and $PM_{2.5}$ concentrations resulting from proposed Option 1 for each racial group,[64] but fails to conduct statistical tests that show whether the reductions in air pollutants are statistically significant from zero. In other words, based solely on the information in the RIA and technical support document, it is not possible to tell whether proposed Option 1 would statistically significantly provide greater reductions in air pollution for the top 5 percent most polluted areas versus the bottom 95 percent. In tables 6-7 through 6-10 of the RIA, it is not clear whether the range of numbers reported in the parenthesis below the pollutants concentrations in each cell represent standard deviations.[65] Whether the issue is a lack of clear labeling or failure to complete the needed statistical analysis, the current information in the RIA lacks sufficient data on statistical power, which is critical to EPA concluding that proposed Option 1 would lead to significant improvements in the air quality at all. This information is also necessary for EPA's analysis of which groups would benefit most from the Proposed Rule.

III. EPA Should Conduct a Distributional Analysis for All Alternatives and Treat Distributional Effects as an Unquantified Benefit or Cost Consistent with Executive Guidance

EPA should analyze the distributional consequences of all regulatory alternatives in its efforts to maximize net benefits, including to overburdened communities.[66] Even though EPA has taken the important step of conducting some distributional analysis of both baseline conditions and projected implementation of Option 1, it still overlooks important information. Absent

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[61] Empirical studies show that the elasticity of rents with respect to air quality is smaller than that for owner-occupied housing values. *See, e.g.*, C. A. Grainger, *The Distributional Effects of Pollution Regulations: Do Renters Fully Pay for Cleaner Air?*, 96 J. PUBLIC ECON., 840–852 (2012); *see also* C. Hitaj et al., *The Value of Ozone Air Quality Improvements to Renters: Evidence from Apartment Building Transactions in Los Angeles County*, 146 ECOLOGICAL ECON. 706–21 (2018).

[62] *See* D. Fullerton, *Distributional Effects of Environmental and Energy Policy: An Introduction* (Nat'l Bureau of Econ. Rsch, Working Paper No. 14241, 2008).

[63] *See* N.V. Kuminoff, *The New Economics of Equilibrium Sorting and Policy Evaluation Using Housing Markets*, 51 J. ECON. LITERATURE, 1007–62 (2013).

[64] DRIA, *supra* note 41, at 308–11

[65] *Id*.

[66] *See,* e.g., Erin T. Mansur & Glenn Sheriff, (2021). *On the Measurement of Environmental Inequality: Ranking Emissions Distributions Generated by Different Policy Instruments*, 8 J. ASS'N ENV'T & RES. ECON. 721–58 (2021) (comparing the equity of distributions of environmental outcomes of different policy alternatives).

distributional analysis for each alternative considered, it is impossible for EPA to determine when the better distributional consequences of one alternative are sufficient to overcome another alternative's higher net benefits. Without a clear understanding of how the costs and benefits of different regulatory alternatives are distributed among different groups,[67] agencies cannot reliably ensure that their programs do not "perpetuate systemic barriers to opportunities and benefits for people of color and other underserved groups," as identified as a priority of the Biden administration in Executive Order 13,985.[68]

In the Proposed Rule, EPA improves upon past distributional analyses for other air quality regulations by looking at both the baseline *and* the expected impacts of the Proposed Rule. In the past, EPA has often looked at only the baseline distribution of risks to determine whether a rule would have distributionally desirable outcomes, concluding that if a proposal was expected to reduce pollution, it would necessarily improve air quality for groups of concern.[69] In this proposal, EPA takes the additional step of modeling the air quality benefits of Proposed Option 1 in different areas and connecting those benefits to the demographic breakdown of those areas.[70] However, EPA conducts this analysis only for the baseline and Option 1, which obscures potentially important information by not evaluating the distributional impacts of co-proposed Option 2 or the more stringent alternative under consideration. EPA should conduct the same distributional analysis for all alternatives considered and compare the incremental benefits.

Despite initial guidance on conducting such analysis being decades old, and despite newer guidance on environmental justice and distributional analysis, agencies rarely, if ever, conduct a distributional analysis for each alternative being considered.[71] An assessment of major Obama-era EPA rules found that EPA provided no analysis of whether existing disparities that would remain even with the regulation were significant and harmful, whether a more stringent standard could reduce those disparities, and whether such an alternative could be a more desirable outcome.[72] Moreover, the failure to meaningfully examine the distributional impacts of alternatives goes against Circular A-4, which identifies "an examination of alternative approaches" as a key element of "a good regulatory analysis."[73]

Circular A-4 provides that "[w]here distributive effects are thought to be important, the effects of various regulatory alternatives should be described quantitatively to the extent possible, including the magnitude, likelihood, and severity of impacts on particular groups."[74] Without consideration of alternatives, it would be impossible to identify an outcome with the greatest net

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[67] See LIENKE ET AL., *supra* note 49, for more details on disaggregating costs and benefits by group.

[68] *See* LIENKE ET AL., *supra* note 49, at i; Revesz & Yi, *supra* note 22, at 64.

[69] *See* Revesz & Yi, *supra* note 22, at 64–65; *see also, e.g.*, EPA, *Preliminary Regulatory Impact Analysis for the Proposed Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review*, at 4-43 (2021), https://perma.cc/STW8-NN9K.

[70] DRIA, *supra* note 41, at 308–11.

[71] Revesz & Yi, *supra* note 22, at 61–68.

[72] *Id*. at 63.

[73] *Id*. at 61 (quoting Circular A-4); *See also id.* at 68 ("The important missing element in the analysis is the consideration of alternatives."); *id*. at 90–92.

[74] CIRCULAR A-4, *supra* note 23, at 14.

benefits under a traditional cost-benefit analysis. For example, without the consideration of alternatives, the agency may consider an Alternative A that is net beneficial and simply stop there without considering whether a more stringent Alternative B or less stringent Alternative C would deliver greater net benefits.

This comparison of alternatives is no less essential for distributional analysis. In order to document how a superior distribution of benefits may be preferable to another alternative with greater net benefits, an agency must compare incremental distributional benefits between alternatives. Circular A-4 does not demand consideration of an infinite number of alternatives, but it is customary to consider at least one alternative that is more stringent than the selected alternative and one that is less stringent,[75] as discussed above. Nothing in Circular A-4 suggests that this practice does not extend to the consideration of distributional effects.

Both in the comparison of alternatives and within the justification for the selection of an alternative over others, EPA should treat distributional outcomes as it would an unquantified or nonmonetized effect. Executive Order 12,866 instructs agencies to incorporate equity consideration into their cost-benefit analyses and regulatory decisions,[76] specifically recognizing that "distributional impacts" and equity" are relevant to assessing net benefits.[77] Circular A-4 instructs agencies to "provide a separate description of distributional effects (i.e., how both benefits and costs are distributed among sub-populations of particular concern) so that decision makers can properly consider them along with the effects on economic efficiency," and to describe distributional effects "quantitatively to the extent possible."[78] In 2011, President Obama issued Executive Order 13,563, which reaffirmed Executive Order 12,866 and stated that agencies conducting cost-benefit analysis "may consider (and discuss qualitatively) values that are difficult or impossible to quantify, including equity, human dignity, fairness, and distributional impacts."[79] Separate from these directives on cost-benefit analysis, EPA and other agencies have been further instructed to consider environmental justice considerations in their decisionmaking.[80] As already noted, President Biden has further reaffirmed commitments to

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[75] *See, e.g.*, Michael A. Livermore & Richard L. Revesz, *Rethinking Health-Based Environmental Standards*, 89 N.Y.U. L. REV. 1184, 1239–46 (2014).

[76] Exec. Order No. 12,866, *supra* note 21, § 1(a) ("Further, in choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.").

[77] *Id.* § 1(b)(5).

[78] CIRCULAR A-4, *supra* note 23, at 14.

[79] Exec. Order No. 13,563, *supra* note 43, § 1(c).

[80] Exec. Order No. 12,898, *supra* note 50, § 1-101 ("To the greatest extent practicable and permitted by law, . . . each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations . . . .").

prioritize environmental justice and the development of procedures to improve consideration of the distributional impacts of regulations.[81]

Consistent with these directives, EPA should treat any desirable (or undesirable) distributional effects as an unquantified benefit (or cost) that it compares alongside other costs and benefits.[82] EPA can draw upon its extensive expertise and experience in analyzing other direct unquantified benefits to inform its consideration of distributional effects.

As a concrete example of how a qualitative discussion of distributional benefits could be incorporated into EPA's cost-benefit analysis, consider policy A and alternative B which generate five billion dollars and five billion plus one dollars, respectively. In policy A, the five billion dollars are distributed equally across all individuals in society. In alternative B, the five billion plus one dollars are distributed to one already-rich individual. The costs to implement each policy are equal. From a pure efficiency perspective, alternative B maximizes net benefits. However, policy A results in a wider distribution of benefits, and a qualitative discussion emphasizing these distributional benefits could justify EPA's decision to proceed with policy A over alternative B.[83]

IV. EPA Should Clarify Some of Its Economic Assumptions to Better Support Its Cost-Benefit Analysis

For a few key components in its cost-benefit analysis, EPA has not provided a sufficient explanation of its methodology. The following recommendations are intended to ensure EPA's analysis is clear, defensible, and accurately presents the costs and benefits of the Proposed Rule.

A. EPA should explain how it adjusts the value of a statistical life over time

In the Proposed Rule, EPA has adjusted the value of statistical life ("VSL") over time for an increase in GDP per capita[84] consistent with its own most recent guidelines.[85] We applaud the agency for taking this theoretically and empirically correct choice.[86] **However, to strengthen the Final Rule, EPA should further clarify its reasoning and process in adjusting VSL over time.**

Currently, the RIA states that it discusses how "evidence and theory suggest that one's willingness-to-pay (WTP) for health and environmental improvements should increase as real income increases" in the accompanying Technical Support Document ("TSD").[87] However,

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[81] *See* Exec. Order No. 13,990, *supra* note 43, § 1; Exec. Order No. 14,008, *supra* note 43, § 219; Modernizing Regulatory Review: Memorandum for the Heads of Executive Departments and Agencies § 2(b)(ii), 86 Fed. Reg. at 7223.

[82] Revesz & Yi, *supra* note 22, at 96–97 (discussing why this approach should be preferred).

[83] *See* Revesz & Yi, *supra* note 22, at 96-97.

[84] DRIA, *supra* note 41, at 379.

[85] EPA Guidelines, *supra* note 35, at App'x B.

[86] *See* W. K. Viscusi & C. J. Masterman, *Income Elasticities and Global Values of a Statistical Life*, 8 J. BENEFIT-COST ANALYSIS 226–50 (2017); C. J. Masterman & W. K. Viscusi, *The Income Elasticity of Global Values of a Statistical Life: Stated Preference Evidence*, 9 J. BENEFIT-COST ANALYSIS 407–34 (2018).

[87] DRIA, *supra* note 41, at 379 (referencing Sections 5.4 and 6.4.3 of the TSD)

Policy Integrity was unable to identify this discussion in the TSD. Critically, as the quantity of life is limited (i.e., individuals have only one life) in comparison to most consumption goods, the relative value of a statistical life increases over time as GDP rises over time. In other words, as consumption goods become less scarce relative to non-market goods such as the environment and health goods and services, the relative price of these non-market goods and services rises in contrast to the more abundant market goods.[88]

EPA should also discuss more clearly its calculation of the VSL in the RIA. EPA lays out the source for income (i.e., GDP per capita) growth calculations and extends "income growth adjustment factors out to 2045" as growth is expected to increase into the future leading to a rise in the VSL.[89] However, EPA does not introduce the magnitude of the income elasticity and its corresponding source. Presumably, it uses the central value of 0.4 given in Appendix B of *EPA's Guidelines for Preparing Economic Analyses*.[90] However, recent research finds a higher value for the United States between 0.5 to 0.7 with a best estimate of 0.55.[91] Accordingly, EPA should clarify why it selected its current value of 0.4, particularly given that it has previously used a value of 0.55.[92] EPA should conduct a literature review to determine the most appropriate value. It should also explain its reasoning for not including sensitivity analysis with respect to this parameter given that EPA's guidelines specify a wide range between 0.08 to 1.0.[93] This empirical question is important because a higher income elasticity will increase the benefits of reducing air pollution. [94]

EPA should also consider addressing the impact of the rising relative value of statistical life on household decisions. Specifically, a rise in the real value of a statistical life should lead the household to take more protective action for air quality. In other words, as households become richer and place more value on reducing risk, we should see more defensive behavior on the extensive and intensive margins. For example, households should buy more air purifiers, cleaners, or filters and run them more frequently, as well as take other actions such as wearing face masks and staying indoors until their marginal benefit equals their marginal cost.[95] Ideally, the agency would quantitively calculate the impact of rising income on the baseline and alternative scenarios, as well as the cost of this defensive behavior. As the cost differences

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[88] M. Hoel & T. Sterner, *Discounting and Relative Prices*, 84 CLIMATIC CHANGE 265–80 (2007); T. Sterner & U. M. Persson, *An Even Sterner Review: Introducing Relative Prices into the Discounting Debate*, 2 REV. ENV'T ECON. & POL'Y 61 (2008).

[89] DRIA, *supra* note 41, at 379.

[90] EPA Guidelines, *supra* note 35, at B-4.

[91] Viscusi & Masterman (2017), *supra* note 86; Masterman & Viscusi (2018), *supra* note 86.

[92] 85 Fed. Reg. 24,174, 24,827 (April 30, 2020).

[93] EPA Guidelines, *supra* note 35, at B-4.

[94] EPA correctly adjusted VSL for rising GDP per capita, but *not* individuals or sub-populations within the United States. This is consistent with Appendix B of EPA's Guidelines for Preparing Economic Analyses, *supra* note 35. It is also consistent with the United States's use of a uniform VSL applied to all individuals equally within the United States.

[95] Ruth Dittrich & Stuart McCallum, *How to Measure the Economic Health Cost of Wildfires—A Systematic Review of the Literature for Northern America*, 29 INT'L J. WILDLAND FIRE 961–73 (2020).

between these scenarios are likely to be small, this could reasonably be addressed with a qualitative discussion.

B. EPA should explain how it estimates the cost of illness and consider whether its approach undervalues the benefits of the Proposed Rule

EPA underestimates the true economic value of air pollution reduction as it uses the cost of illness approach ("COI") instead of society's willingness-to-pay for changes in risk of a given health effect. EPA should discuss the type of impacts omitted from valuing morbidity impacts using this approach and the potential magnitude of these omissions.

For example, a COI approach omits many important impacts of illness, including the lower quality of life that individuals experience from illness. Beyond the suffering associated with morbidity, which the EPA briefly mentions,[96] the COI approach also excludes lost productivity from workers facing higher air pollution. At a minimum EPA should address this qualitatively, ideally in conjunction with a sensitivity analysis using willingness-to-pay estimates from the existing literature.[97]

In using the COI approach, the EPA does not clearly state whether its estimates include opportunity costs such as income losses due to absence from work, which a willingness-to-pay approach is more likely to reflect. This is critical, as the COI approach "only looks at direct costs from morbidity: it sums the resource and opportunity costs from being sick – the treatment cost and lost wages – without considering the disutility associated with pain, discomfort, and lower quality of life... The cost of the preventative action taken to avoid becoming sick is also not taken into account (e.g. the cost of buying an air cleaner)."[98]

EPA states in the RIA that its cost estimates account only for direct treatment costs[99]—excluding the lost wages recommended in the literature. If EPA's COI approach does not go beyond direct treatment costs, the agency is underestimating morbidity costs in its COI calculations. As the COI approach is already an underestimate as compared to the willingness-to-pay approach, only accounting for direct treatment costs would represent a significant underestimation of the morbidity impacts. This is concerning and should be addressed qualitatively at a minimum.

Regardless, the EPA's use of the COI approach and its potential underestimation implies that the net benefits of regulation are potentially significantly higher. EPA should explicitly take this into account when selecting between alternatives.

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[96] *See* DRIA, *supra* note 41, at 387 ("These cost-of-illness (COI) estimates are typically a lower bound estimate of the true value of reducing the risk of a health effect because they reflect the direct expenditures related to treatment, but not the value of avoided pain and suffering.")

[97] Dittrich & McCallum (2020), *supra* note 95.

[98] *Id.*

[99] DRIA, *supra* note 41, at 398 ("cost-of-illness (COI) estimates…reflect the direct expenditures related to treatment").

C. *EPA should clarify how its calculation of technology costs incorporates learning-by-doing*

EPA should more clearly explain its calculation of technology costs considering learning-by-doing, and, in particular, ensure that it is accounting for the impact of pre-2027 learning on the direct-cost estimate during the first year of implementation.

Consistent with the economic literature,[100] EPA accounts for learning-by-doing when calculating the technological costs of compliance.[101] We applaud the agency for taking this step, as well as adjusting its learning-by-doing calculation for the "number of years of sales of a technology leading to learning prior to the year for which the technology's cost estimate is intended."[102]

However, it is unclear how EPA calculated the cost of implementation *in the first year*. In particular, it is unclear how EPA adjusted baseline costs for learning-by-doing pre-2027. EPA is calculating the direct costs in year *t as*

$$y_t = \left(\frac{x_t + (Sales_{t=0} \times SVF)}{Sales_{t=0} + (Sales_{t=0} \times SVF)} \right)^b y_{t=0}$$

where *b* is the learning rate, y_t is the technology cost in year *t*, x_t is the cumulative production of the technology in year *t*, $Sales_t$ is the number of sales, SVF is the seed volume factor, and *t=0* is first year of implementation (MY2027 and MY2030).[103] To calculate the technology costs in the baseline, EPA relied on a recent study from the International Council on Clean Technology ("ICCT").[104] However, as EPA acknowledges,[105] the ICCT study looked at technology costs to meet standards set in 1998, 2004, 2007, and 2010 and explicitly did *not* consider learning effects.[106] EPA explains the ICCT cost estimates were adjusted for stricter compliance in 2027 relative to the earlier regulation considered by ICCT, and that differences in costs between the baseline and the alternative scenarios *post*-2027 were captured due to learning-by-doing. However, EPA did not discuss how they accounted for learning-by-doing *pre*-2027 in technology costs for the first year of implementation (i.e., whether EPA adjusted ICCT's cost estimates to account for pre-2027 learning). As it currently reads, the RIA implies that EPA correctly adjusted the *post*-2027 learning curve for pre-2027 learning, but it appears to *not* have

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[100] O. Castrejon-Campos et al., *Effects of Learning Curve Models on Onshore Wind and Solar PV Cost Developments in the USA*, 160 RENEWABLE & SUSTAINABLE ENERGY REV. 112278 (2022) ("Learning curve theory has been adopted as a common framework for exploring the relationship between endogenous technological learning and technology cost developments."); A. Grübler, et al., *Modeling Technological Change: Implications for the Global Environment*, 24 ANN. REV. ENERGY & ENV'T 545–569 (1999).

[101] DRIA, *supra* note 41, at 320.

[102] *Id.* at 320–22.

[103] *Id.* at 321.

[104] *Id.* at 315.

[105] *Id.*

[106] Francisco Posada et al., *Costs of Emission Reduction Technologies for Heavy-Duty Diesel Vehicles* v (ICCT White Paper, Feb. 2016) ("[T]his analysis does not incorporate discounts for process learning or volume sales; thus, cost estimates presented should be considered conservative."), https://theicct.org/wp-content/uploads/2021/06/ICCT_costs-emission-reduction-tech-HDV_20160229.pdf.

adjusted the cost estimates *in 2027* for pre-2027 learning. If the agency did make this necessary adjustment, then the agency should more clearly explain their methodology and how the cost estimate $y_{t=0}$ accounts for learning-by-doing pre-2027. If they did not make this necessary adjustment, it is critical that the adjustment is made to avoid overestimation of the cost of compliance.

V. EPA Should Consider Revising Its Estimation of Fleet Turnover

EPA lays out three effects of regulation on heavy trucks in its fleet turnover analysis. First, there is a *pre-buy* effect, whereby the Proposed Rule encourages companies and individuals to buy vehicles before the implementation date to avoid the (potential) increased (net) cost of their vehicle. Second, there is a *low-buy* effect whereby the (potential) pre-buy behavior displaces purchases that would have occurred in the absence of regulation from after the implementation date to before the implementation date and out of the new truck market altogether (either through not buying a truck or shifting to purchase a used truck). The net effect of this pre-buy and low-buy effect on overall demand for new heavy-duty vehicles captures the elasticity of demand to the regulation.[107] Finally the *Gruenspecht effect*, also known as the *scrappage effect*, whereby substitution from new vehicles to used vehicles increases used vehicle price and the longevity of these vehicles by making it more economical to fix them. These three impacts jointly determine the impact of the regulation on fleet size and thereby emissions, as vehicles sold before the implementation date emit relatively more air pollutants than those sold after the regulations take effect.

A. EPA should improve the reduced-form identification of the sales effects, consider a structural-form model, or qualitatively discuss the implications and limitations of the current estimates.

EPA uses a new methodology to forecast the sales impacts of the proposed regulation. Specifically, EPA estimates changes in truck sales across the months before and after the compliance deadline of previous EPA standards. It then calculates the demand elasticities based on the estimated sales effects of the 2007 and 2010 standards. Based on its estimated compliance costs, EPA further uses the elasticities to forecast changes in truck sales due to the proposed regulation. As we explain in detail below, this methodology could be improved by strengthening the key assumption of 100% cost pass-through and correcting the econometric errors that could bias the forecast.

1. The sales coefficients capture more than the direct effects of increased compliance costs.

EPA fails to recognize that the reduced-form identification effects capture both the increased price due to the regulation and the improved vehicle quality such as longer warranties and

[107] We use "net" here to note that there are also improvements in the quality of the vehicle, including a longer warranty and improved durability, which has the opposing effect on pre-buy behavior than price. Theoretically, these quality improvements could reverse the impact of an increase in price leading to an elasticity of zero or even a shift in sales from before to after the rule implementation. In the final SAFE rule (see "Equation 3 – Calculation of Change in Sales"), NHTSA and EPA folded fuel efficiency savings into the vehicle price to construct a measurement of the net price change. In this context, this is also possible with decreased maintenance and repair costs.

improved durability. The *pre-buy* effects estimated by the agencies capture the anticipation effects, i.e., the increased pre-regulation purchases in anticipation of higher new-truck prices along with improved vehicle attributes (i.e., the cross-price elasticity over time), whereas the *low-buy* effects capture both systematic post-regulation sales slump due to this shift in demand over time and the direct effects of policy (i.e., the own-price elasticity of demand).[108] In particular, the own-price elasticity implied by EPA captures the net change in sales due to higher purchase vehicle prices, which are passed through to buyers from sellers with higher compliance costs, and improved vehicle attributes. EPA is thus essentially jointly estimating the two elasticities without isolating the direct effects of policy, which are the most relevant estimates for the forecast of the sales impacts of the new rule in its methodology.

2. Time-varying unobservable confounders may lead to substantial forecasting biases.

In the sales effects estimation, the agencies have omitted and/or failed to address a number of confounding factors that may bias the effects of the proposed regulation on truck sales, including:

- The adverse fuel consumption effects, i.e., excessive fuel consumption due to improved fuel efficiency with the new emission standards, and buyers' concerns about the reliability of untested control technology;[109]
- Rule stringency, e.g., the required emission reductions level, technology requirement, and compliance costs;
- Vehicle attributes, e.g., improved efficiency, increased longevity and warranty, and decreased repair costs;[110]
- Endogenous vehicle purchase prices;[111] and
- Previous truck sales.[112]

These omissions are critical because they may be effects from these elements that EPA is observing, rather than effects from the factors EPA is explicitly considering. Unlike the two papers that EPA cites,[113] EPA uses these estimates to make forecasts about the impact of the

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[108] The anticipation effects led to 31,164 more truck sales before the implementation of the 2007 heavy-duty emission standards. *See* Katherine Rittenhouse & Matthew Zaragoza-Watkins, *Anticipation and Environmental Regulation*, 89 J. ENV'T ECON. & MGMT. 255–77, 266 (2018).

[109] DRIA, *supra* note 41, at 412.

[110] *Id.* at 226.

[111] The pre-buy effects may be confounded by higher pre-regulation vehicle prices due to sellers' anticipation of an increased demand shock. The endogenous vehicle price is particularly the case in a non-competitive freight market. An instrumental variable approach is called for to address this supply-side confounder if the vehicle purchase price is to be controlled for in the model. *See* Rittenhouse & Zaragoza-Watkins (2018), *supra* note 108, at 262; *see also* Terence Lam & Charles Bausell, *Strategic Behaviors Toward Environmental Regulation: A Case of Trucking Industry*, 25 CONTEMP. ECON. POL'Y 3–13, 11 (2007).

[112] *See* Lam & Bausell (2007), *supra* note 111 at 10-11.

[113] Rittenhouse & Zaragoza-Watkins (2018), *supra* note 108; Lam & Bausell (2007), *supra* note 111.

proposed regulation on future vehicle sales over time. Failure to address the omission of the above unobservable time-varying variables raises serious questions about the accuracy of the agencies' forecast of the sales impacts of the proposed regulation.

These forecasting issues are unsurprising, as the published studies upon which the agency relies were not peer reviewed for the express purpose of forecasting the future impact of a proposed regulation. Instead, these studies focused solely on identifying the existence of pre-buy and low-buy effects. With this more limited goal in mind, these papers only have limited success, as their estimates of these effects were only statistically significant for a subset of the truck regulations only providing mixed evidence of their existence; EPA has similarly mixed results with respect to statistical significance.[114] Policy Integrity has previously commented on similar identification and forecasting problems in the light-duty context when EPA and NHTSA advanced their modeling of the scrappage effect beyond the peer-reviewed literature.[115]

EPA has three options to address the potential forecasting errors. First, EPA could improve its current reduced-form estimation by exploiting available data to account for the impact of these confounding changes on truck sales and testing the sensitivity of the estimation to alternative model specifications. Alternatively, EPA could consider estimating a structural model, as it has indicated it may do for future regulations in the light-duty context.[116] **As a final alternative—that Policy Integrity recommends—EPA could qualitatively discuss the potential impact of the pre-buy and low-buy effect in a similar manner as its current discussion of the Gruenspecht effect.**[117] In this discussion, the agency could discuss the identification problems above as limiting factors on their analysis, along with the non-existence of literature using these estimates to forecast sales effects.

3. EPA's current sales forecasting model may not adequately capture the extent to which reduced repair costs for the trucking industry will limit pre-buy and no-buy effects.

In response to the rule, EPA assumes that the required extended warranties and increased truck durability will reduce repair costs, which will be a benefit for the trucking industry that partially or fully offsets increased sale prices.[118] The impact on repair costs for the trucking industry is to extend the period of low maintenance costs—which are covered by the manufacturer under the Proposed Rule's longer warranties—thereby lowering their repair costs in the medium run until increased technology costs result in higher long-run per-mile maintenance costs after roughly 7 years of operation.[119] These benefits should in turn increase demand for trucks holding price constant. Therefore, the overall impact of the regulation on sales could theoretically be positive

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[114] DRIA, *supra* note 41, at 410, tbl. 10-1.

[115] *See, e.g.*, Inst. for Pol'y Integrity, Comments on The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks at 56–78 (Oct. 26, 2018).

[116] *See* Jacobsen et al., *The Effects of New-Vehicle Price Changes on New- and Used- Vehicle Markets and Scrappage* (EPA, Aug. 2021), https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=352754&Lab=OTAQ.

[117] DRIA, *supra* note 41, at 416.

[118] *Id.* at 342 & n.370.

[119] *Id.* at 348, fig. 7-4.

or negative, just as the sign of the pre-buy effect is theoretically unclear.[120] At a minimum, this improvement in truck quality will lower the overall impact of the regulation on fleet-turnover, including pre-buy and no-buy behavior. However, EPA's current methodology for estimating fleet size impacts is unable to capture the opposing price and quality effects separately, and so is unable to determine if trucking companies will be better off after the Proposed Rule.

Currently, the EPA implicitly captures quality changes, including longer warranties and increased durability, along with other "unobserved factors, such as concerns over vehicle reliability and control technology uncertainty," in the price coefficient of their pre-buy and no-buy analyses. However, it is unclear if truck manufacturers and trucking companies will respond to the Proposed Rule in the same manner as they did to the past rules. In fact, based on the mixed results with respect to statistical significance and coefficient magnitudes in RIA Table 10-1 of the pre-buy and low-buy effects, it is even unclear if truck manufacturers and truck companies responded to past regulations in 2002, 2007, 2010, and 2014 in the same manner. Moreover, as the price increases stem from the cost of implementing a specific set of production processes and technology changes in the truck manufacturing assumed by EPA, it is unclear if the past estimates are consistent with the assumed quality changes that EPA forecasts. Therefore, it is unclear the extent to which EPA captures the offsetting effect of lower repair costs on fleet turnover in its analysis of the pre-buy and low-buy effects. **To accurately capture the impact of EPA's projected quality changes, consistent with its assumed price increases, EPA needs to identify the price and quality effects on sales separately.**

There may be long-run impacts not captured in EPA's simple short-run estimates comparison. Specifically, as the demand for capital goods, like heavy-duty trucks, becomes more inelastic over time, we should expect any negative sales effect to be small and temporary (as discussed above). This is particularly true given that EPA predicts minimal to no fleet turnover, transportation mode shifting, or changes in site locations.

4. The 100% cost pass-through assumption is theoretically and empirically unwarranted.

The result of EPA's analysis is strongly dependent on the assumption that manufacturers can fully pass along the additional compliance cost to consumers (i.e., the trucking companies purchasing heavy-duty vehicles) through higher prices for new vehicles. However, EPA does not adequately discuss its reasoning for this assumption. Theoretically,[121] in a perfectly competitive market, increased marginal costs are expected to be passed onto consumers as price equals the marginal cost of production. However, the degree to which the costs would be borne by producers and consumers depends on the sensitivity of consumers to prices. Consumers would not fully bear the costs unless they were completely insensitive to price changes. In other words, if consumers choose not to buy or buy fewer units because of price increases, then manufacturers are not able to pass on 100% of the additional costs. Moreover, the pass-through rate varies with

[120] Assuming perfect information and no information shocks after the implementation date (a potentially reasonable assumption for trucking companies making long-run fleet size decisions), a trucking company would only move up their planned purchase of a new truck if the expected post-implementation increase in sales price exceeds the decrease in maintenance and repair costs.

[121] *See* SYLWIA BIALEK & MAX SARINSKY, INST. FOR POL'Y INTEGRITY, OVERINFLATED: THE SAFE RULE'S OVERSTATED ESTIMATES OF VEHICLE-PRICE IMPACTS 9-12 (2020).

the share of fixed costs within total compliance costs, i.e., costs that would occur regardless of the quantity of the product sold and do not affect the price in competitive markets. In an imperfectly competitive market, the validity of the 100% pass-through assumption also relies on producers' market power. Empirically, the agencies' estimates of the demand elasticities indicate some change in overall demand, which is not consistent with perfectly inelastic demand and thus does not support the 100% cost pass-through assumption.[122]

B. EPA should clearly explain why estimating a scrappage model for heavy-duty vehicles is more difficult than for light-duty vehicles

EPA implicitly discusses the scrappage effect in the context of pre-buy and low-buy impacts. Specifically, EPA states that "potential buyers decid[e] not to purchase at all. In this case, the vehicle miles traveled (VMT) of older vehicles may increase to make up for the VMT otherwise expected of the newer ('missing') vehicles. To the extent that the older vehicles emit more than the missing vehicles, emissions may increase. However, because the VMT is likely to be shifted to the newer [heavy-duty] vehicles among the existing fleet, and most of those vehicles are expected to be in compliance with the existing [heavy-duty] vehicle standards, this effect is expected to be small."[123] EPA then goes on to argue against the scrappage effect due to the absence of a robust methodology.[124]

We agree that modeling the scrappage effect is potentially unnecessary in this instance, but recommend that EPA provide a fuller explanation of why this is the case. EPA cannot simply claim it lacks the methodology given the use of such methodology by NHTSA and EPA in the light-duty vehicle context. In the 2020 SAFE rulemaking, EPA and NHTSA estimated the scrappage effect using a reduced-form model. More recently, EPA issued a report outlining a structural-form methodology for estimating the scrappage effect.[125] While Policy Integrity has previously submitted comments critical of EPA and NHTSA's methods of estimating the scrappage effect for light-duty vehicles,[126] EPA cannot now ignore its prior methodologies without a fuller explanation.

We recommend that EPA briefly discuss the scrappage estimates in the light-duty vehicle context. The agency should explain why this estimate lacks robustness (i.e., is challenging or flawed) in the heavy-duty vehicle context relative to the light-duty vehicle context. Alternatively, EPA could discuss why NHTSA and EPA's current estimation strategies are weak more generally (i.e., in both light and heavy-duty contexts). Part of this justification should also include EPA's expectation that the scrappage effect will be "small" in the heavy truck context.

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[122] DRIA, *supra* note 41, at 412.

[123] DRIA, *supra* note 41, at 416.

[124] *Id.* EPA explicitly states that "Quantifying these effects would require a robust method to estimate the effects of the standards on pre-buy and low-buy, as well as a method to estimate shifts in VMT among vehicle vintages in the case of an expected change in the net sales of newer vehicles. In the absence of robust methods to estimate these effects, EPA is not quantifying the fleet turnover or emissions impacts in this proposed rule, though, as with pre-buy and low-buy, we acknowledge these potential impacts."

[125] *See generally* Jacobsen et al, *supra* note 116.

[126] *See, e.g.*, Inst. for Pol'y Integrity Comments, *supra* note 115.

This suggestion should not be read as a recommendation to include the scrappage effect. Instead, we recommend that EPA provide a more comprehensive explanation for its modeling decisions, particularly where it is inconsistent with past EPA modeling practices in the vehicle market more generally. If EPA now believes its prior methodologies for estimating scrappage are flawed more generally—even in the light-duty vehicle context—this should be explained. We believe a similar consideration and discussion may be warranted for EPA's estimates of the pre-buy elasticities.

C. EPA should clearly state in its quantitative analysis that the net effect on sales is currently indistinguishable from zero and any potential impacts are likely to be small and short-lived.

EPA makes clear that the sales effect of the regulation should be small due to the competing effects of increased capital costs and decreased operating costs. However, as EPA notes, the evidence is unclear and mixed as to whether the net effect of sales is zero[127] or negative.[128] In fact, this is consistent with EPA's finding that the sales impacts of regulations in 2002 and 2014 are insignificant, while it finds significant low-buy effect in 2007 and 2010.[129] But even in 2007 and 2010, EPA notes that the "observed effects are short-lived, on the order of months rather than years."[130]

The net effect of the proposed regulation on sales is unclear based on EPA's illustrative examples using the 2007 and 2010 estimates.[131] Despite the estimation problems discussed above, it is clear that EPA's analysis indicates that the net sales effect should be interpreted as zero based on the above evidence, including the likely small and temporary effect on sales. This interpretation is consistent with EPA's prediction of low turnover effects and no mode shifting due to the Proposed Rule. **EPA should be explicit about the near-zero impact on sales based on previous studies and their own estimates.**

VI. EPA Should Clarify That Any Employment Effects Are Likely Small and Short-Lived

Ideally, EPA should quantitatively measure employment effects. Currently, EPA addresses employment effects qualitatively except for the cost effect, as discussed below. If EPA continues to address employment qualitatively, it should at least attempt to give an idea of the direction of the employment impacts and its relative size.

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[127] Rittenhouse & Zaragoza-Watkins (2018), *supra* note 108.

[128] D. Harrison, Jr., & M. LeBel, *Customer Behavior in Response to the 2007 Heavy-Duty Engine Emission Standards: Implications for the 2010 NOX Standard*, NERA Economic Consulting (2008) [Docket ID EPA-HQ-OAR-2019-0055-0576].

[129] DRIA, *supra* note 41, at 410.

[130] *Id.*

[131] *Id.* at 412–15 (showing pre-buy effects that are statistically insignificant using the 2007 estimates and slightly positive effects using the 2010 estimates and small, negative low-buy effects using both the 2007 and 2010 estimates).

EPA discusses total employment impacts in the manufacturing sector qualitatively, indicating that the impact of the regulation on employment could be positive or negative.[132]

But EPA does conduct a quantitative analysis of the *cost effect*, i.e., the increased employment analysis necessary to adopt technologies needed for trucks to meet the standards.[133] For these employment effects, it uses the ratio of workers to production cost for all vehicle manufacturing to imprecisely infer the specific ratio for production processes related to emission reductions compliance activities in the heavy-duty sector.[134]

Qualitatively, EPA accounts for two additional impacts on employment in the manufacturing sector: the *demand effect*, i.e., changes in demand for labor in the manufacturing sector due to changes in sales, and the *factor-shift effects*, i.e., the employment changes due to changes in labor intensity of production resulting from changes in the production process and compliance activities.[135] EPA predicts the demand effect to be negative, but since EPA also predicts that the sales impact will be small and indistinguishable from zero,[136] this employment effect should also be small and indistinguishable from zero.[137] In contrast, EPA cannot even determine the direction of the factor-shift effect on manufacturing employment.[138]

Overall, the direction of overall employment effect on manufacturing is unclear. Even so, EPA should attempt to qualitatively determine whether the overall net effect on employment is likely to be small or large, as the former seems more likely due to the small sales effect and the overall unclear direction on manufacturing employment.

In addition, EPA also needs to qualitatively assess the impact of the Proposed Rule on downstream employment. For consumers of heavy-duty trucks (i.e., truckers and trucking companies), the impact is again unclear due to the opposing effects of the cost increase and the presumptive improvement in vehicle quality that leads to the small and essentially zero sales effect.[139] A similar logic applies to middlemen, such as dealers and service providers, because the sales effect is likely to be small and indistinguishable from zero. Furthermore, the counter-veiling impacts on competing sources of transportation such as rail and air that would result from any negative impact is a further reason that employment impacts downstream should be small and indistinguishable from zero. We again recommend that EPA discuss the potential magnitude

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[132] *Id.* at 420.

[133] *Id.* at 425.

[134] *Id.* at 421–22.

[135] *Id.* at 420.

[136] *See* section V.C, *supra*.

[137] EPA misleadingly states that "a demand effect caused by higher production costs raising market prices. Higher prices reduce consumption (and production) reducing demand for labor within the regulated industry." DRIA at 419. However, this statement ignores the opposing effect of quality improvements later recognized in Section 10.2.2.1. In fact, based on EPA's own analysis, the net impact on sales is unclear and currently indistinguishable from zero.

[138] DRIA, *supra* note 41, at 420.

[139] *Id.* at 426.

of this impact, particularly given its statement that the agency does not expect transportation mode shifts, again clarifying that the evidence does not support an impact different than zero.[140]

Finally, EPA's analysis fails to discuss the upstream employment impacts of the Proposed Rule. Specifically, it should discuss the impact on the upstream sectors, such as steel or electronic producers.[141] As with downstream employment impacts, because the overall impact of vehicle sales is potentially small and close to zero, the impact on upstream employment is again likely small.

Given the interest in employment effects, EPA should attempt to measure the employment effects quantitively. However, if this is not possible, EPA should at least attempt to qualitatively assess the direction and magnitude of the employment effects. Based on the above assessment, the direction of the employment effect is unclear and likely to be relatively small, though the existing evidence points to a small impact that is either zero or slightly positive.

VII. EPA Should Quantify the Benefits of Reducing Greenhouse Gas Emissions

While the Proposed Rule is focused on reducing the emissions of particulate matter and nitrogen oxides from the heavy-duty trucks, the necessary vehicle improvements may also reduce greenhouse gas emissions. However, EPA does not quantify greenhouse gas emission reductions for any of the alternatives considered. EPA has expertise in estimating greenhouse gas emissions from changes in vehicle standards and should apply that expertise here. If EPA believes the greenhouse gas effects are too small to warrant quantification, it should explain that.

EPA should not only quantify greenhouse gas emissions (or emission reductions) in the Proposed Rule, but also monetize the climate effects of those changes in greenhouse gases. EPA has used the social cost of greenhouse gases many times in the past to monetize the climate effects of its proposed regulations, and so should have no problem applying the tool here.[142] The social cost of greenhouse gases can be applied to any volume of emissions and is useful for comparing climate impacts to other monetized costs and benefits.[143]

Policy Integrity and several other groups submitted joint comments to EPA on its light- and medium-duty vehicle emissions that focus on the social cost of greenhouse gases.[144] These comments (attached) highlight the appropriate methodology and rationale that EPA should use in the Final Rule.

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[140] *Id.* at 416.

[141] *Id.* at 421.

[142] *See, e.g.*, 86 Fed. Reg. 74,434, 74,444 tbl.4, n.b (Dec. 30, 2021) (explaining how the agency monetized the benefits of reducing greenhouse gas emissions in its final light-duty vehicle greenhouse gas emission standards for MY 2023-26).

[143] *See generally* Inst. for Pol'y Integrity et al., Joint Comments on the Consideration of the Social Cost of Greenhouse Gases in Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards (Sept. 27, 2021), https://policyintegrity.org/documents/Joint_SCC_Comments_on_EPA_Cars_Rule.pdf.

[144] *Id.*

Respectfully,

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Enc.

Inst. for Pol'y Integrity et al., Joint Comments on the Consideration of the Social Cost of Greenhouse Gases in Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards (Sept. 27, 2021).