Institute for Policy Integrity
NEW YORK UNIVERSITY SCHOOL OF LAW

October 31, 2018

VIA ELECTRONIC SUBMISSION

Environmental Protection Agency

Attn: Mr. Nicholas Swanson, Sector Policies and Programs Division (D205–01), Office of Air Quality Planning and Standards

Re: Emission Guidelines for Greenhouse Gas Emissions from Existing Electric Utility Generating Units; Revisions to Emission Guideline Implementing Regulations; Revisions to New Source Review Program, 83 Fed. Reg. 44,746 (proposed Aug. 31, 2018)

Docket ID: EPA-HQ-OAR-2017-0355

The Institute for Policy Integrity at New York University School of Law[1] ("Policy Integrity") respectfully submits the following comments to the Environmental Protection Agency ("EPA") on the agency's proposed replacement for the Clean Power Plan, proposed revisions to implementing regulations for Section 111(d) of the Clean Air Act, and proposed revisions to the New Source Review program (collectively, the "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.

We write to make the following comments:

- The Clean Air Act does not require EPA to repeal the Clean Power Plan.
- Replacing the Clean Power Plan with the Proposed Rule is not a reasonable exercise of EPA's discretion under the Clean Air Act, because the agency's own analysis shows that the new policy's costs will greatly outweigh its benefits.
- EPA's treatment of forgone climate benefits is unreasonable.
- EPA's treatment of forgone health benefits from particulate matter reductions is legally and scientifically indefensible.
- EPA irrationally ignores the costs of its proposed changes to New Source Review permitting requirements.

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[1] No part of this document purports to present New York University School of Law's views, if any.

[2] Emission Guidelines for Greenhouse Gas Emissions from Existing Electric Utility Generating Units; Revisions to Emission Guideline Implementing Regulations; Revisions to New Source Review Program, 83 Fed. Reg. 44,746 (proposed Aug. 31, 2018) [hereinafter "Proposed Rule"].

I. The Clean Air Act Does Not Require EPA to Repeal the Clean Power Plan

In the Clean Power Plan, EPA found that the "best system of emission reduction" for carbon dioxide emissions from existing power plants was the combination of emission rate improvements and limitations on overall emissions that affected plants can accomplish through the following three pollution control measures, or "building blocks": (1) improving heat rate at coal-fired steam plants; (2) substituting generation from lower-emitting existing natural gas combined cycle plants for generation from higher-emitting steam plants, which are primarily coal-fired; and (3) substituting generation from new zero-emitting renewable generating capacity for generation from fossil fuel-fired plants, which are primarily coal- and gas-fired.[3] The agency determined that these reduction techniques were available to all power plants affected by the Clean Power Plan, "either through direct investment or operational shifts or through emissions trading."[4]

EPA now asserts, however, that the Clean Power Plan was "not within Congress's grant of authority to the Agency under the governing statute,"[5] because a BSER must consist of "measures that can be applied to or at an individual stationary source,"[6] as opposed to "measures the source's owner or operator can implement at another location."[7] EPA thus appears to contend that the Clean Air Act *unambiguously precludes* the incorporation of flexible emission reduction techniques, like the generation shifting contemplated by the Clean Power Plan, into a BSER. This is false.

EPA claims to draw support for its unnecessarily narrow reading of Section 111 from "statutory text, context and legislative history, and . . . historical practice."[8] In reality, statutory text, legislative history, and regulatory precedent all support an interpretation of "best system of emission reduction" that encompasses flexible reduction measures like generation shifting. Because the Clean Air Act does not compel EPA to repeal and replace the Clean Power Plan, the agency's claims to the contrary render the Proposed Rule arbitrary and capricious.[9]

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[3] EPA, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Final Rule, 80 Fed. Reg. 64,662, 64,667 (Oct. 23, 2015) [hereinafter "CPP"].

[4] *Id.*

[5] Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 82 Fed. Reg. 48,035, 48,038 (proposed Oct. 16, 2017) [hereinafter "Proposed CPP Repeal"]; Proposed Rule, 83 Fed. Reg. at 44,752 (incorporating the statutory interpretation described in the Proposed CPP Repeal by reference).

[6] Proposed Rule, 83 Fed. Reg. at 44,752.

[7] *Id.*

[8] *Id.*

[9] *Massachusetts v. EPA*, 549 U.S. 497, 532-34 (2007) (setting aside EPA decision premised on misinterpretation of its legal authority); *Safe Air for Everyone v. EPA*, 488 F.3d 1088, 1101 (9th Cir. 2007) (agency action based on "legally erroneous" conclusion is "arbitrary, capricious, or otherwise not in accordance with law"); *see also* Bethany A. Davis Noll & Denise A. Grab, *Deregulation: Process and Procedures that Govern Agency Decisionmaking in an Era of Rollbacks*, 38 ENERGY L.J. 269, 289–90 (2017), *available at* https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3073416.

A. The Text of Section 111 Does Not Bar EPA from Including Generation Shifting in a BSER

As Policy Integrity explains in detail in its report *Bounded Regulation: How the Clean Power Plan Conforms to Statutory Limits on EPA's Authority* (attached to this letter as **Exhibit A)**, the text of the Clean Air Act contains eight significant constraints on EPA's authority to craft emission guidelines under Section 111(d).[10] Most are found in the definition of "standard of performance" in Section 111(a), which reads as follows:

> The term "standard of performance" means a standard for emissions of air pollutants which reflects 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.[11]

Additional requirements can be found in the text of Section 111(d) itself, which reads, in relevant part:

> The Administrator shall prescribe regulations which shall establish a procedure . . . under which each State shall submit to the Administrator a plan which . . . establishes standards of performance for any existing source . . . . Regulations of the Administrator under this paragraph shall permit the State in applying a standard of performance to any particular source under a plan submitted under this paragraph to take into consideration, among other factors, the remaining useful life of the existing source to which such standard applies.[12]

Breaking these two passages into their component parts reveals the following criteria for any emission guidelines issued by EPA:

1. **EPA must identify the "best system of emission reduction" and calculate the "degree of emission limitation achievable through the application" of that system.** Thus, the agency cannot arbitrarily declare that existing sources in the relevant category must reduce their emissions by a particular amount. Instead, it must survey available systems for reducing emissions and calculate the level of reduction achievable using what it considers the best of those systems.

2. **In identifying the best system, EPA must consider the amount of emission reductions it will yield.** It goes without saying that a system of emission reduction is

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[10] *See* RICHARD L. REVESZ, DENISE A. GRAB & JACK LIENKE, BOUNDED REGULATION: HOW THE CLEAN POWER PLAN CONFORMS TO STATUTORY LIMITS ON EPA'S AUTHORITY (2016), http://policyintegrity.org/files/publications/Bounded_Regulation_Policy_Brief.pdf.

[11] 42 U.S.C. § 7411(a)

[12] *Id.* § 7411(d)(1).

unlikely to be "best" if it does a poor job reducing emissions. Thus, when comparing available systems, EPA must consider their relative abilities to decrease the amount of pollution generated by regulated sources.[13]

3. **In identifying the best system, EPA must consider the system's cost.** A system is not necessarily "best" simply because it can achieve the deepest emission reductions. EPA must also take into account the costs of achieving those reductions and cannot adopt standards that can be achieved only at "excessive," "exorbitant," or "unreasonable" expense.[14] That said, courts have consistently granted EPA "a great degree of discretion" when assessing the reasonableness of a system's costs.[15]

4. **In identifying the best system, EPA must consider "nonair quality health and environmental impacts."** For example, the use of a "scrubber" to remove sulfur dioxide emissions from a power plant's smokestack produces coal ash, which can, if improperly stored, contaminate groundwater.[16] EPA must consider this type of indirect environmental effect—whether positive or negative—when weighing systems of emission reduction. Ultimately, EPA has explained, "a system cannot be 'best' if it does more harm than good due to cross-media environmental impacts."[17]

5. **In identifying the best system, EPA must consider "energy requirements."** This factor could encompass the system's impacts on the regulated sources' own energy needs (e.g., because additional power is needed to operate the system identified by EPA), as well as its impacts on the energy needs of a region or the nation as a whole (e.g., because application of the system affects the power sector's output of electricity or the refining sector's output of gasoline).[18] Thus, a system cannot be "best" if it imperils access to reliable energy sources.

6. **EPA must find that its preferred method of emission reduction has been "adequately demonstrated."** The U.S. Court of Appeals for the D.C. Circuit has interpreted this requirement to bar EPA from identifying a "purely theoretical or experimental means of preventing or controlling air pollution" as the best system of

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[13] See *Sierra Club v. Costle*, 657 F.2d 298, 326 (D.C. Cir. 1981) ("[W]e can think of no sensible interpretation of the statutory words ''best . . . system'' which would not incorporate the amount of air pollution as a relevant factor to be weighed when determining the optimal standard for controlling . . . emissions.").

[14] CPP, 80 Fed. Reg. at 64,720 (quoting several court decisions on the treatment of costs under Section 111).

[15] *Lignite Energy Council v. EPA*, 198 F.3d 930, 933 (D.C. Cir. 1999); see also CPP, 80 Fed. Reg. at 64,720–21 (discussing additional decisions on EPA's discretion to weigh cost against other Section 111 factors).

[16] *See generally* Charles Duhigg, *Cleansing the Air at the Expense of Waterways*, N.Y. TIMES (Oct. 12, 2009), http://www.nytimes.com/2009/10/13/us/13water.html.

[17] CPP, 80 Fed. Reg. at 64,721.

[18] See *id.* (explaining that "EPA may consider energy requirements on both a source-specific basis and a sector-wide, region-wide, or nationwide basis").

emission reduction.[19] This does not mean, however, that the system must be "in actual routine use somewhere."[20] Instead, the agency can make reasonable projections based on existing technology.[21]

7. **EPA's guidelines must be translatable into "standards of performance" for individual sources.** Ultimately, the standards promulgated by states in response to EPA's guidelines (or by EPA itself in states that decline to develop standards) must be applicable to—and enforceable against—"any existing source" of pollution in the relevant category. The standards, in other words, must take the form of independent compliance obligations for individual sources. The fact that each source is subject to its own standard, however, does not mean that the source must meet its standard solely through actions taken within the walls of its own facility.[22]

8. **EPA's guidelines must give states flexibility to account for the "remaining useful life" of their existing sources.** The application of certain systems of emission reduction might make less economic sense for facilities on the verge of retirement. In particular, requiring sources that are nearing the end of their useful lives to install pollution-control equipment might be needlessly costly.[23] EPA's emission guidelines must allow states some means of taking variations in sources' remaining useful lives into consideration when setting standards.

As *Bounded Regulation* makes clear, EPA rigorously observed each of these constraints in designing the Clean Power Plan.[24] None precluded the adoption of a "best system of emission reduction" that incorporated generation shifting.

Finally, although Section 111 does not define "system," other, analogous provisions of the Clean Air Act illustrate the term's expansive nature. Section 183, for example, authorizes EPA to specify "best available control measures" for volatile organic compound emissions from certain consumer or commercial products.[25] These control measures must reflect "the degree of emissions reduction . . . achievable through the application of the most effective equipment,

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[19] *Portland Cement Ass'n v. Ruckelshaus*, 486 F.2d 375, 391 (D.C. Cir. 1973) (quoting H. Rep. No. 91-1146, 91st Cong., 2d Sess. 10 (1970)).

[20] *Id.* (quoting S. Rep. No. 9-1196, 91st Cong., 2d Sess. 16 (1970)).

[21] *Id.*; see also CPP, 80 Fed. Reg. at 64,720 (discussing other cases that address the "adequately demonstrated" factor).

[22] CPP, 80 Fed. Reg. at 64,779 (explaining that Section 111(d)(1) and (a)(1) "require by their terms that 'any existing source' must have a 'standard of performance,' but nothing in these provisions requires a particular amount—or, for that matter, any amount—of emission reductions from each and every existing source").

[23] *Id.* at 64,872; see also EPA, Legal Memorandum Accompanying Clean Power Plan for Certain Issues 30-36 (2015) (discussing legislative and regulatory history of the "remaining useful life" provision in Section 111(d)).

[24] BOUNDED REGULATION, *supra* note 10, at 5-9.

[25] 42 U.S.C. § 7511b(e)(3)(A)

measures, processes, methods, *systems*, or techniques."[26] Section 183 further provides that "systems of regulation" adopted under the provision can include, but are not limited to, "requirements for registration and labeling, self-monitoring and reporting, prohibitions, limitations, or economic incentives (including marketable permits and auctions of emissions rights)."[27]

Like "systems" in Section 183, "system" in Section 111 is capacious enough to encompass a broad range of regulatory approaches, including the generation shifting contemplated by the Clean Power Plan. Thus, the plain text of the Clean Air Act cannot support any claim by EPA that the agency is legally obligated to repeal the Clean Power Plan.

B. Section 111's Legislative History Does Not Suggest that Congress Intended to Preclude the Consideration of Flexible Reduction Measures

The legislative history of Section 111 also supports a broad reading of "best system of emission reduction." While the version of the Clean Air Act originally passed by the House took a purely technological approach to stationary source regulation,[28] the Senate's bill contemplated a variety of reduction techniques, providing for standards that reflected "the greatest degree of emission control . . . achievable through application of the latest available control technology, processes, operating methods, *or other alternatives*."[29] The final conference bill and statute reflected the Senate's broader approach.[30]

Congress amended Section 111 in 1977, requiring that standards for new sources reflect the "best technological system of continuous emission reduction," but maintaining greater flexibility for EPA with regard to existing source standards, which could be based on the "best system of continuous emission reduction."[31] Thus, for existing sources, legislators recognized that the best system was "not necessarily technological."[32]

Finally, in 1990, Congress revised Section 111 once again, returning to a broad "best system of emission reduction" formulation for both new and existing sources, without any requirement that the system be "technological" or "continuous."[33]

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[26] *Id.* § 7511b(e)(1)(A) (emphasis added).

[27] *Id.* § 7511b(e)(4); *see also Sierra Club v. Johnson*, 444 F. Supp. 2d 46, 50 (D.D.C. 2006).

[28] CPP, 80 Fed. Reg. at 64,764 (citing H.R. 17,255, 91st Cong. § 5 (1970)).

[29] CPP, 80 Fed. Reg. at 64,764 (quoting S. Rep. No. 91–1196, at 15–16 (1970)). Clean Air Act Amendments of 1977, § 109, 91 Stat. at 700; see also 42 U.S.C. § 7411(a)(7); Clean Air Act Amendments of 1977, § 109, 91 Stat. at 700.

[30] CPP, 80 Fed. Reg. at 64,764 (citing Senate exhibit summarizing conference agreement).

[31] *Id*. at 64,764-65.

[32] *See id.* at 64,765 (quoting H.R. Rep. No. 95–294 (1977)); Clean Air Act Amendments of 1990, Pub. L. 101-549, § 403, 104 Stat. 2399, 2631 (Nov. 15, 1990).

[33] CPP, 80 Fed. Reg. at 64,765.

Taken together, this history suggests that Section 111's framers intended to grant EPA wide latitude in determining a best system of emission reduction, particularly with respect to existing sources. The history does *not* support a contention that EPA is unambiguously barred from incorporating flexible reduction measures like generation shifting into a BSER.

C. Regulatory Precedent Supports the Use of Flexible Systems of Emission Reduction, Including Generation Shifting

Finally, there is ample regulatory precedent for taking the availability of flexible emission reduction techniques, including generation shifting, into account when determining how much abatement to require from polluting entities. As described in the article *Familiar Territory*: *A Survey of Legal Precedents for the Clean Power Plan* (attached to this letter as **Exhibit B)**, EPA has, for decades and under administrations of both parties, gone beyond considering individual sources in isolation when setting emission limits under the Clean Air Act.[34]

1. Clean Air Mercury Rule

The Clean Air Mercury Rule ("Mercury Rule") is a prior Section 111(d) rule that explicitly factored emission trading into its BSER, finding that "a cap-and-trade program based on control technology available in the relevant timeframe is the best system for reducing [mercury] emissions from existing coal-fired [power plants]."[35] In promulgating the Mercury Rule, EPA also explained why trading was a permissible component of state plans under Section 111(d), noting that "'standard of performance' is not explicitly defined to include or exclude an emissions cap and allowance trading program" and that no other part of Section 111(d) "indicate[s] that the term 'standard of performance' may not be defined to include a cap-and-trade program."[36] Though the D.C. Circuit ultimately vacated the Mercury Rule, the reversal was on grounds unrelated to the agency's choice of BSER.[37]

EPA acknowledges that the Mercury Rule is an "exception" to its claim that prior Section 111 rules "limited their BSER to physical or operational measures taken at and applicable to individual sources."[38] The agency implies, however, the rule is of minimal precedential value because it was vacated by the D.C. Circuit.[39] This is untrue. Notwithstanding its vacatur—which again, had nothing to do with the agency's choice of BSER—the Mercury Rule demonstrates that, a full decade prior to the Clean Power Plan's promulgation, EPA understood flexible

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[34] *See* Richard L. Revesz, Denise A. Grab & Jack Lienke, *Familiar Territory: A Survey of Legal Precedents for the Clean Power Plan*, 46 ENVTL. L. REP. 10,190, 10,190 (2016).

[35] Standards of Performance for New and Existing Stationary Sources: Electric Utility Steam Generating Units, 70 Fed. Reg. 28,606, 28,617 (May 18, 2015).

[36] 70 Fed. Reg. at 28,616–17.

[37] *New Jersey v. EPA*, 517 F.3d 574, 577-78 (D.C. Cir. 2008).

[38] Proposed CPP Repeal, 82 Fed. Reg. at 48,041.

[39] *Id.* at 48,041.

measures that harnessed the collective emission reduction potential of regulated sources to be a permissible component of BSER.

Nor does EPA persuasively distinguish the Mercury Rule by claiming that it "was still ultimately predicated on measures taken at the level of individual sources."[40] As discussed above, trading was expressly included as part of the "best system of emission reduction" for the Mercury Rule. And in justifying the trading program's national emission budget, EPA took into account the likelihood that some plants would reduce emissions not by installing technological controls, but through "switching fuels" or "making dispatch changes."[41] In other words, generation shifting was a recognized component of the Mercury Rule's trading-based BSER.

2. *Good Neighbor Provision*

EPA also incorporated emission trading into three rules issued under Section 110(a)(2)(D), commonly known as the Good Neighbor Provision, which prohibits "any source" in an upwind state from emitting pollution that "contribute[s] significantly" to downwind states' failure to meet national ambient air quality standards.[42] In designing the most recent of these rules, the Transport Rule, EPA considered a "direct control" approach that would have set emission limits on individual sources without allowing trading, but ultimately concluded "that the direct control alternative would result in fewer emission reductions and higher costs compared to [a trading-based approach]."[43] Furthermore, EPA explicitly took the possibility of generation shifting into account when setting state emission budgets under the rule.[44] In other words, generation shifting was not only allowed as a compliance mechanism but also affected the stringency of the rule's emission limits. In upholding the Transport Rule in 2014, the Supreme Court found that "EPA's

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[40] *Id.* at 48,041 n.14.

[41] 70 Fed. Reg. at 28,619; *see also* EPA, Regulatory Impact Analysis for the Final Clean Air Mercury Rule 7-2 (2015) ("EPA analysis has found that the most efficient method to achieve the emissions reduction targets is through a cap-and-trade system that States have the option of adopting. States, in fact, can choose not to participate in the optional cap-and-trade program. However, EPA believes that a cap-and-trade system for the power sector is the best approach for reducing Hg emissions. As a result, EPA modeling has focused on the cap-and-trade approach for meeting the CAMR requirements.").

[42] Finding of Significant Contribution and Rulemaking for Certain States in the Ozone Transport Assessment Group Region for Purposes of Reducing Regional Transport of Ozone, 63 Fed. Reg. 57,356, 57,358, 57,456 (Oct. 27, 1998); Rule to Reduce Interstate Transport of Fine Particulate Matter and Ozone (Clean Air Interstate Rule); Revisions to Acid Rain Program; Revisions to the NOx SIP Call, 70 Fed. Reg. 25,162, 25,162, 25,229 (May 12, 2005); Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals, 76 Fed. Reg. 48,208, 48,210 (Aug. 8, 2011). These rules were issued, respectively, under the Clinton, George W. Bush, and Obama administrations and made revisions to the prior administrations' approaches.

[43] 76 Fed. Reg. at 48,272-73.

[44] 76 Fed. Reg. at 48,261 (taking into account states' ability to "increase[ ] natural gas generation" as part of the budget-setting process").

cost-effective allocation of emission reductions among upwind States . . . [was] a permissible, workable, and equitable interpretation of the Good Neighbor Provision."[45]

As with the Mercury Rule, EPA denies that the Transport Rule is a relevant precedent, noting that, unlike Section 111, Section 110 "expressly authorize[s] the use of 'marketable permits' to implement ambient air quality standards."[46] Accordingly, EPA deems it "unlikely that Congress would have silently authorized" the agency to consider trading as part of a Section 111 BSER determination.[47] But this argument is unpersuasive for at least two reasons. First, Section 111(d) directs EPA to follow "a procedure similar to that provided by [Section 110]" when working with states to set standards for existing sources, which suggests that regulatory approaches adopted under Section 110 are particularly instructive precedents for Section 111(d) proceedings.[37] Second, it is inappropriate to draw a negative inference about the EPA's ability to consider flexible pollution control mechanisms in Section 111 from the fact that such mechanisms are explicitly authorized in Section 110.[48] As explained in Jason Schwartz's report to the Administrative Conference of the United States, *Marketable Permits: Recommendations on Applications and Management* (attached to this letter as **Exhibit C**), "a court will not apply the canon of negative inference unless it is confident that Congress likely considered and intended to preclude the unmentioned options in that specific context."[49] Indeed, as discussed below, courts have repeatedly upheld Clean Air Act trading programs under provisions of the Act that do not expressly authorize the use of marketable permits.[50]
Here, there is no evidence in the text or legislative history of Section 111 that Congress intended to prohibit flexible reduction techniques like trading and generation shifting. Thus, no negative inference as to the scope of EPA's authority under Section 111 should be drawn from the express authorization of trading in Section 110.

3. *Regional Haze Trading Program*

In 2012, EPA approved a trading program proposed by a group of western states and municipalities to address their collective contributions to haze in the Colorado Plateau.[51] As a

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[45] *EPA v. EME Homer City Generation, L.P.*, 134 S. Ct. 1584, 1610 (2014).

[46] Proposed CPP Repeal, 82 Fed. Reg. at 48,042.

[47] *Id.*

[48] *Id.* at 20 (and citations therein) ("[A] court will not apply the canon of negative inference unless it is 'confident' that Congress likely considered and intended to preclude the unmentioned options in that specific context.").

[49] See JASON A. SCHWARTZ, ADMINISTRATIVE CONFERENCE OF THE UNITED STATES, MARKETABLE PERMITS: RECOMMENDATIONS ON APPLICATIONS AND MANAGEMENT 20 (2017), https://www.acus.gov/sites/default/files/documents/Marketable%20Permits%20Report-final.pdf (internal quotation marks omitted).

[50] *See infra* discussion of regional haze and mobile source trading programs.

[51] Approval and Promulgation of State Implementation Plans; State of Wyoming; Regional Haze Rule Requirements for Mandatory Class I Areas Under 40 CFR 51.309, 77 Fed. Reg. 73,926, 73,927 (Dec. 12, 2012); Approval, Disapproval and Promulgation of State Implementation Plans; State of Utah; Regional Haze Rule Requirements for Mandatory Class I Areas Under 40 CFR 51.309, 77 Fed. Reg. 74,355,

prerequisite to approving the program, EPA required the states to show that trading would achieve greater overall reductions than the installation of "best available retrofit technology" at individual sources.[52] As in previous examples, then, the incorporation of trading enabled a more stringent reduction target.[53] Notably, Section 169A, the visibility provision under which EPA approved the trading program, did not expressly authorize the use of marketable permits or other flexible regulatory mechanisms.[54] The U.S. Court of Appeals for the Tenth Circuit nevertheless upheld the regional haze trading program in 2014.[55]

4. Trading and Averaging Under Mobile Source Provisions

EPA has also, for decades, looked beyond individual sources' independent reduction capabilities when regulating vehicles and fuels under Title II of the Clean Air Act. For example, under the Reagan Administration in 1982, EPA promulgated a Section 211 standard for the lead content of gasoline that some refineries could satisfy only by obtaining blending components or "lead credits" from other refineries.[56] The U.S. Court of Appeals for the D.C. Circuit upheld this aggregate approach to lead reduction and found that "[a]lthough lead-credit trading was a new idea, EPA had sufficient reason to believe that a market for lead credits would develop" given the nature of refining industry and agency's experience with similar programs.[57]

Since the 1980s, EPA has taken a similarly flexible approach to motor vehicle emission standards under Section 202.[58] Rather than requiring each new vehicle to achieve the same degree of emission control, EPA sets standards that a manufacturer's fleet can meet on average.[59]

74,357 (Dec. 14, 2012); Approval and Promulgation of State Implementation Plans; State of New Mexico; Regional Haze Rule Requirements for Mandatory Class I Areas, 77 Fed. Reg. 70,693, 70,694-95 (Nov. 27, 2012); Approval and Promulgation of State Implementation Plans; City of Albuquerque-Bernalillo County, New Mexico; Interstate Transport Affecting Visibility and Regional Haze Rule Requirements for Mandatory Class I Areas, 77 Fed. Reg. 71,119, 71,121 (Nov. 29, 2012).

[52] *WildEarth Guardians v. EPA*, 770 F.3d 919, 923 (10th Cir. 2014).

[53] *See Familiar Territory*, *supra* note 34, at 10,192.

[54] *See* 42 U.S. Code § 7491 Regional Haze Regulations, 64 Fed. Reg. 35,714, 35,739 (July 1, 1999) (explaining why agency believed the approval of trading plans was within its statutory discretion).

[55] *WildEarth Guardians*, 770 F.3d at 923.

[56] 47 Fed. Reg. 49,322 (Oct. 29, 1982).

[57] *Small Refiner Lead Phase-Down Task Force v. EPA*, 705 F.2d 506, 534-36 (D.C. Cir. 1983).

[58] 42 U.S.C. § 7521(a)(1).

[59] *See, e.g.*, Control of Air Pollution from New Motion Vehicles and New Motor Vehicle Engines; Gaseous Emission Regulations for 1987 and Later Model Year Light-Duty Vehicles, and for 1988 and Later Model Year Light-Duty Trucks and Heavy-Duty Engines; Particulate Emission Regulations for 1988 and Later Model Year Heavy-Duty Diesel Engines, 50 Fed. Reg. 10,606, 10,607-08 (Mar. 15, 1985).

As in previous examples, the flexibility provided by averaging has directly affected the stringency of vehicle rules.[60]

The U.S. Court of Appeals for the D.C. Circuit upheld this fleet-wide approach to section 202, finding that, absent "any clear congressional prohibition of averaging," EPA's effort to "allow manufacturers more flexibility in cost allocation while ensuring that a manufacturer's overall fleet still meets the emissions reduction standards makes sense."[61] This decision makes clear that the absence of explicit authorization for flexible compliance measures should not be read to preclude the use of such measures.

For all of the reasons discussed above, the text and legislative history of Section 111, as well as relevant regulatory precedents under a variety of Clean Air Act provisions, support a reading of "best system of emission reduction" that encompasses the generation shifting included in the BSER for the Clean Power Plan."[62] Any claim by EPA that it is statutorily *required* to repeal the Clean Power Plan is thus false, and finalizing the Proposed Rule in reliance on this false claim would alone be sufficient to render the Proposed Rule arbitrary and capricious.

II. Replacing the Clean Power Plan with the Proposed Rule Is Not a Reasonable Exercise of EPA's Statutory Discretion

EPA does, of course, have some *discretion* to interpret the ambiguous phrase "best system of emission reduction" and to weigh relevant statutory factors when choosing a BSER for a particular pollutant and source category. But that discretion must be exercised in a reasonable manner.[63] In the Proposed Rule, EPA's choice of BSER is manifestly *un*reasonable, because the agency's own analysis shows that, relative to the Clean Power Plan, implementation of the

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[60] *See id*. at 10,634-45.

[61] *Natural Res. Def. Council v. Thomas*, 805 F.2d 410, 425 (D.C. Cir. 1986).

[62] As others have pointed out, even if EPA were correct that BSER must be limited to "measures that can be applied to or at an individual stationary source," Proposed Rule, 83 Fed. Reg. at 44,752, the Clean Power Plan satisfies this requirement. *See, e.g.,* Comments of Environmental Defense Fund on EPA's Advance Notice of Proposed Rulemaking on State Guidelines for Greenhouse Gas Emissions from Existing Sources, at 48-60 (Feb 26, 2018), https://www.edf.org/sites/default/files/content/Comments%20of%20Environmental%20Defense%20Fund.pdf.

[63] *Chevron v. NRDC*, 467 U.S. 837, 844 (1984) ("a court may not substitute its own construction of a statutory [provision] *for a reasonable interpretation* made by the administrator of an agency") (emphasis added); *Util. Air Regulatory Grp. v. EPA*, 134 S. Ct. 2427, 2442 (2014) ("Even under Chevron's deferential framework, agencies must operate within the bounds of reasonable interpretation." (internal quotation marks omitted)); see also *North Carolina v. EPA*, 531 F.3d 896, 906 (D.C. Cir. 2008) (evaluating the reasonableness of an agency's discretionary interpretation under the familiar "arbitrary and capricious" framework of *Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983), including that the agency "relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise").

Proposed Rule will be net costly to society. In other words, EPA is voluntarily interpreting the Clean Air Act in a manner that the agency concedes will do substantially more harm than good.[64] Such an arbitrary exercise of regulatory authority merits no judicial deference.[65]

Under each of three illustrative compliance scenarios considered by EPA in its Regulatory Impact Analysis for the Proposed Rule, forgone climate and health benefits (from emission reductions that would be achieved under the Clean Power Plan but not under the Proposed Rule) outweigh avoided compliance costs.[66] This is true even though EPA (1) unreasonably inflates the projected costs of achieving the Clean Power Plan's emission guidelines by assuming that no states would opt to comply through use of cost-lowering interstate trading,[67] and (2) unreasonably excludes damages from climate impacts occurring outside U.S. borders.[68] Remarkably, even in a version of its analysis that excludes not just extraterritorial climate impacts but also *all* benefits from reductions in non-greenhouse gas pollutants—which, as discussed below, is legally indefensible and economically irrational—the Proposed Rule remains net costly under two of the three illustrative compliance scenarios.[69]

EPA's choice to forgo the emissions reductions and net benefits that would have resulted from the Clean Power Plan is particularly unreasonable in light of Section 111's overriding purpose, which, the D.C. Circuit observed in 1973, is to ensure that sources are "controlled to the greatest

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[64] Proposed Rule, 83 Fed. Reg. at 44,795 (showing net costs relative to CPP in all modeled compliance years, under all discount rates, and all compliance scenarios).

[65] *Michigan v. EPA*, 135 S. Ct. 2699, 2707 (2015) ("No regulation is 'appropriate' if it does significantly more harm than good."); *Allentown Mack Sales & Service, Inc. v. NLRB*, 522 U.S. 359, 374 (1998) ("Not only must an agency's decreed result be within the scope of its lawful authority, but the process by which it reaches that result must be logical and rational.")

[66] Proposed Rule, 83 Fed. Reg. at 44,794 tbl.18 (showing annualized net costs of between $1.4 and 6 billion, depending on compliance scenario and discount rate).

[67] EPA, Regulatory Impact Analysis for the Proposed Emission Guidelines for Greenhouse Gas Emissions from Existing Electric Utility Generating Units; Revisions to Emission Guideline Implementing Regulations; Revisions to New Source Review Program, EPA-452/R-18-006, at ES-2 (2018) [hereinafter "Proposed Rule RIA"] ("This RIA assumes a mass-based implementation of the CPP for existing affected sources, and does not assume interstate trading."). The Clean Power Plan allowed states to comply through interstate trading, and EPA developed—but never finalized—a model trading rule that would have facilitated this mode of compliance. *See* EPA, DRAFT MODEL TRADING RULES FOR GREENHOUSE GAS EMISSIONS FROM ELECTRIC UTILITY GENERATING UNITS CONSTRUCTED ON OR BEFORE JANUARY 8, 2014, at 11 (2016), https://blog.epa.gov/2016/12/19/update-on-epas-clean-power-plan-model-rules/ (noting that states "expressed a desire for guidance from EPA on consistent language states could use to be approved for interstate trading). Ignoring the compliance cost reductions that would flow from interstate trading is inconsistent with longstanding White House guidance on cost-benefit analysis, which instructs agencies to "take into account cost-saving innovations that result from a shift to . . . incentive based policies." Office of Mgmt. & Budget, Circular A-4, at 37 (2003).

[68] Proposed Rule, 83 Fed. Reg. at 44,794 tbl.18 ("Climate benefits reflect the value of domestic impacts from CO_2 emissions changes."); *see also* Proposed Rule RIA at 7-7 to 7-8 (providing estimates of forgone *global* climate benefits for illustrative scenarios).

[69] Proposed Rule, 83 Fed. Reg. at 44,794 tbl.17.

degree practicable"[70] The court reiterated the point in 1978, noting that an "essential purpose" of Section 111 standards is to "reduc[e] emissions as much as practicable."[71]

While those D.C .Circuit cases involved the issuance of new source performance standards under Section 111*(b)*, EPA itself has long maintained that the same statutory purpose should inform the issuance of *existing* source emission guidelines under Section 111*(d)*. As the agency explained in 1975 when promulgating implementing regulations for Section 111(d), this position is supported by the legislative history of Section 111:

> The Committee of Conference chose to rewrite the Senate provision [on emissions standards for existing sources of non-"criteria, non-"hazardous" pollutants] as part of section 111, which in effect requires maximum feasible control of pollutants from new stationary sources . . . . EPA believes this choice reflected a decision in conference that a similar approach (making allowances for the costs of controlling existing sources) was appropriate for the pollutants to be controlled under section 111(d)."[72]

Thus, a fundamental purpose of emission guidelines issued under Section 111(d) is to control emissions from existing sources to the maximum degree feasible. Because EPA has exercised its discretion to select a BSER in a way that undermines this fundamental purpose, the Proposed Rule is arbitrary and capricious.[73]

III. EPA's Treatment of Forgone Climate Benefits Is Unreasonable

For criticisms of the Proposed Rule's treatment of forgone climate benefits, see Policy Integrity's separate comments on the social cost of greenhouse gases, filed jointly with Environmental Defense Fund, the Montana Environmental Information Center, the Natural Resources Defense Council, the Sierra Club, the Union of Concerned Scientists, the Western Environmental Law Center, and WildEarth Guardians.[74]

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[70] *Essex Chem. Corp.*, 486 F.2d 427, 434 n.14 (1973). While this case considers New Source Performance Standards under section 111(b), it interpreted the term "standard of performance," the same provision under which EPA establishes BSER for section 111(d) emission guidelines.

[71] *Sierra Club v. Costle*, 657 F.2nd 298, 325-26 (D.C. Cir. 1981).

[72] State Plans for the Control of Certain Pollutants from Existing Facilities, 40 Fed. Reg. 53,340, 53,342 (Nov. 17, 1975).

[73] *Ctr. for Biological Diversity v. NHTSA*, 538 F.3d 1172, 1195 (9th Cir. 2008) (agency has "discretion to decide how to balance the statutory factors" as long as that "balancing does not undermine the fundamental purpose" of the statute); *Util. Air Regulatory Grp. v. EPA*, 134 S. Ct. 2427, 2442 (2014) ("[A]n agency interpretation that is inconsistent with the design and structure of the statute as a whole does not merit deference." (internal quotation marks and citation omitted)).

[74] Environmental Defense Fund et al., Comments on Flawed Estimates of the Social Cost of Carbon in the Proposed Emission Guidelines for Greenhouse Gas Emissions from Existing Electric Utility Generating Units (Oct. 31, 2018).

IV. EPA's Treatment of Forgone Benefits from Particulate Matter Reductions Is Legally and Scientifically Indefensible

In the Regulatory Impact Analysis for the Proposed Rule, EPA takes multiple approaches to calculating forgone health benefits from reductions in particulate matter pollution that would have accompanied the Clean Power Plan's CO_2 reductions. In one set of calculations, EPA appropriately assumes that health benefits accrue from all reductions in particulate matter exposure, as it did in the original analysis for the Clean Power Plan.[75] In a second set of calculations, EPA assumes that particulate matter reductions have zero benefit if they occur in areas where the ambient concentration of particulate matter is below a particular threshold—either the lowest measured level ("LML") of the two epidemiological studies that the agency uses to quantify particulate matter-related risk or the average annual National Ambient Air Quality Standard ("NAAQS") for particulate matter. [76] Finally, in a third set of calculations, EPA ignores particulate matter benefits (and benefits from reductions of all other non-greenhouse gas pollutants) entirely.[77] Neither of these latter two approaches is legally, scientifically, or economically defensible.

A. Assuming Zero Health Benefits from Particulate Matter Reductions Below Either the LML or NAAQS Is Inconsistent with the Scientific Record and Longstanding EPA Practice

In several of its calculations, EPA attributes zero benefits to particulate matter reductions in areas where the ambient concentration of particulate matter is below either (1) the LML or (2) the NAAQS. In other words, these analyses treat particulate matter as a threshold pollutant that poses no health risks below a certain concentration. Assuming the existence of a risk-free level of particulate matter exposure, however, runs contrary to the best available science and to decades of EPA statements and practice, as discussed in Richard Revesz and Kimberly Castle's forthcoming article *Environmental Standards, Thresholds, and the Next Battleground of Climate Change Regulations* (attached to this letter as **Exhibit D)**.[78]

1. Scientists Have Found No Evidence of a Threshold for Negative Health Effects from Particulate Matter Exposure

Scientists have rejected the existence of a threshold below which particulate matter poses no risk to public health. In 2006, EPA solicited judgments from twelve peer-nominated experts on the

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[75] *See. e.g.,* Proposed Rule RIA, *supra* note 67, at4-42 tbl.4-13.

[76] *See, e.g., id.* at 4-43 tbl.4-14 & 4-44 tbl.4-15.

[77] Proposed Rule RIA, *supra* note 67, at ES-14 tbl.ES-10.

[78] Kimberly M. Castle & Richard L. Revesz, *Environmental Standards, Thresholds, and the Next Battleground of Climate Change Regulations*, 103 MINN. L. REV. (forthcoming 2019), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3154669.

concentration-response relationship between particulate matter exposure and mortality.[79] Eleven of the twelve rejected the notion of a population-wide threshold for mortality effects.[80] This finding was echoed in a 2010 report from the American Heart Association, which undertook a comprehensive review of studies on the relationship between particulate matter and cardiovascular health and found that "the evidence reviewed supports that there is no safe threshold for [particulate matter]."[81] A 2016 report from the World Health Organization, too, concluded that particulate matter "has health impacts even at very low concentrations" and that "no threshold has been identified below which no damage to health is observed."[82] Finally, a 2017 study from the Harvard School of Public Health, which examined health outcomes for approximately 60 million Medicare beneficiaries, "found no evidence of a threshold value" for particulate matter's mortality effects.[83]

2. *For Decades, EPA Has Disclaimed, Based on the Best Available Science, the Existence of a Threshold for Health Effects from Particulate Matter Exposure*

For three decades, and under administrations of both parties, EPA has consistently disclaimed the existence of a population-wide threshold for health effects from particulate matter. In 1984, under the Reagan Administration, EPA explained in the RIA for a proposed update to the particulate matter NAAQS that "the data do not . . . show evidence of a clear threshold in exposed populations" and instead "suggest a continuum of response."[84] In a 1997 update to the NAAQS, the Clinton EPA similarly cautioned that "the level or even existence of population thresholds below which no effects [from particulate matter exposure] occur cannot be reliably determined."[85]

Under the George W. Bush Administration in 2006, the EPA once again updated the particulate matter NAAQS and once again found that "effect thresholds can neither be discerned nor

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[79] See INDUSTRIAL ECONOMICS, INC., EXPANDED EXPERT JUDGMENT ASSESSMENT OF THE CONCENTRATION-RESPONSE RELATIONSHIP BETWEEN PM2.5 EXPOSURE AND MORTALITY, at i-ii (Sept. 21, 2006), https://www3.epa.gov/ttnecas1/regdata/Uncertainty/pm_ee_report.pdf.

[80] *Id.* at 3-25. Even the single expert who did believe such a threshold existed conceded that it was not detectable based on currently available studies. *Id.* at 3-25, 3-26.

[81] Robert D. Brook et al., *Particulate Matter Air Pollution and Cardiovascular Disease: An Update to the Scientific Statement from the American Heart Association*, 121 CIRCULATION 2331, 2332, 2365 (2010).

[82] WORLD HEALTH ORGANIZATION, AMBIENT AIR POLLUTION: A GLOBAL ASSESSMENT OF EXPOSURE AND BURDEN OF DISEASE 11 (2016), http://apps.who.int/iris/bitstream/10665/250141/1/9789241511353-eng.pdf?ua=1.

[83] *See* Quan Di, et al., *Air Pollution and Mortality in the Medicare Population*, 376 NEW ENG. J. MED. 2513, 2514 (2017).

[84] See EPA, Regulatory Impact Analysis on the National Ambient Air Quality Standards for Particulate Matter, at VI-15 to VI-17, (Feb. 21, 1984), http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=9101HEPX.TXT.

[85] National Ambient Air Quality Standards for Particulate Matter, 62 Fed. Reg. 38,652, 38,670 (July 18, 1997).

determined to exist."[86] Finally, in the most recent update to the NAAQS, under the Obama Administration, EPA explained that there was "no discernible population-level threshold below which effects would not occur."[87]

In the absence of any new scientific evidence that would justify departing from these prior findings, it is patently unreasonable for EPA to treat particulate matter as a threshold pollutant in the Proposed Rule and accompanying Regulatory Impact Analysis. EPA characterizes its use of thresholds as "sensitivity analysis" that is "designed to increase transparency rather than imply a specific lower bound on the size of ancillary health co-benefits."[88] But, as explained in Circular A-4, a guidance document on regulatory analysis issued by the Office of Management and Budget under President George W. Bush, a proper sensitivity analysis should "reveal whether, and to what extent, the results of the [agency's primary] analysis are sensitive to *plausible* changes in the main assumptions and numeric inputs."[89] Given the available science, EPA cannot plausibly assume that particulate matter exposure poses no health risk below the LML or below the NAAQS. Accordingly, calculations based on such assumptions are unreasonable, including for purposes of sensitivity analysis. Rather than increasing transparency, as EPA claims, they cause unnecessary confusion by presenting estimates with absolutely no grounding in available empirical evidence.

B. Ignoring Benefits from Reductions in "Non-Targeted" Pollutants Is Inconsistent with Case Law, Executive Guidance, and Established Administrative Practice

In some calculations, EPA ignores particulate matter benefits altogether, claiming that "in the decision-making process, it is useful to consider the change in benefits due to the *targeted* pollutant relative to the costs."[90] But the agency offers no coherent explanation as to *wh*y such an artificially constrained analysis is useful—or even permissible. In reality, ignoring indirect regulatory effects—like reductions in "non-targeted" pollutants—is inconsistent with case law, longstanding executive guidance on cost-benefit analysis, and basic economic rationality.

1. Case Law Requires Agencies to Consider Indirect Costs, and There Is No Logical Reason Agencies Should Treat Indirect Benefits Differently than Indirect Costs

Courts have repeatedly required agencies to take indirect costs into account when making regulatory decisions. For example, the U.S. Court of Appeals for the D.C. Circuit required EPA

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[86] National Ambient Air Quality Standards for Particulate Matter, 71 Fed. Reg. 61,144, 61,152 (Oct. 17, 2006) (to be codified at 40 C.F.R. pt. 50, 51, 52, 53 and 58).

[87] National Ambient Air Quality Standards for Particulate Matter, 78 Fed. Reg. 3,086, 3,148 (Jan. 15, 2013) (to be codified at 40 C.F.R. pts. 50, 51, 52, 53 and 58).

[88] Proposed Rule RIA, *supra* note 67, at 6-15.

[89] Office of Mgmt. & Budget, Exec. Office of the President, Circular A-4, Regulatory Analysis at 3 (2003), https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A4/a-4.pdf [hereinafter "Circular A-4"].

[90] Proposed Rule RIA, *supra* note 67, at ES-13 (emphasis added).

to consider indirect costs when setting ambient standards for ozone under the Clean Air Act.[91] That court also struck down a National Highway Traffic Safety Administration rule for failing to consider indirect costs in the form of safety risks associated with the smaller size of more fuel-efficient cars.[92] Similarly, when EPA attempted to ban asbestos-based brakes under the Toxic Substances Control Act, the U.S. Court of Appeals for the Fifth Circuit held that the agency had to consider the indirect safety harm that would accompany forcing cars to use substitute, non-asbestos brakes.[93]

Although these precedents focus on the consideration of indirect costs rather than indirect benefits, the logic of the cases dictates that agencies cannot lawfully treat indirect benefits differently than indirect costs. Indirect benefits "are simply mirror images" of indirect costs.[94] The terms "benefit" and "cost" are merely convenient labels for positive effects versus negative effects and do not reflect any distinction warranting different analytical treatment. In fact, agencies are required to treat costs and benefits alike and consider each equivalently, with comparable analysis, to offer a full accounting of a rule.[95]

2. *Ignoring Indirect Effects of Rulemaking Is Inconsistent with Established Administrative Practice, Including Executive Guidance on Regulatory Review and Three Decades of EPA Practice Under the Clean Air Act*

The executive orders on cost-benefit analysis governing regulatory review call for agencies to accurately measure the "actual results of regulatory requirements," thereby implicitly requiring analysis of both direct and indirect costs and benefits.[96] Additionally, Circular A-4 explicitly requires the consideration of indirect benefits.[97] In particular, the Circular instructs agencies to consider important indirect benefits, which include any "favorable impact . . . secondary to the

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[91] *See Am. Trucking Ass'ns v. EPA*, 175 F.3d 1027, 1051–52 (D.C. Cir. 1999) (holding that EPA must consider the indirect health costs of reducing a pollutant rather than only "half of a substance's health effects"), *rev'd on other grounds sub nom. Whitman v. Am. Trucking Ass'ns*, 531 U.S. 457 (2001).

[92] *See Competitive Enter. Inst. v. Nat'l Highway Traffic Safety Admin.*, 956 F.2d 321, 326–27 (D.C. Cir. 1992); *see also U.S. Telecom Ass'n v. Fed. Commc'ns Comm'n*, 290 F.3d 415, 424–25 (D.C. Cir. 2002) (remanding a rule for failure to consider indirect costs).

[93] *See Corrosion Proof Fittings v. EPA*, 947 F.2d 1201, 1225 (5th Cir. 1991).

[94] Samuel J. Rascoff & Richard L. Revesz, *The Biases of Risk Tradeoff Analysis: Towards Parity in Environmental and Health-and-Safety Regulation*, 69 U. CHI. L. REV. 1763, 1793 (2002).

[95] See *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1198 (9th Cir. 2008) (warning agencies not to "put a thumb on the scale by undervaluing the benefits and overvaluing the costs"); *Bus. Roundtable v. SEC*, 647 F.3d 1144, 1148–49 (D.C. Cir. 2011) (agency cannot "inconsistently and opportunistically frame[] the costs and benefits of the rule"); *Sierra Club v. Sigler*, 695 F.2d 957, 979 (5th Cir. 1983) (if agency "trumpet[s]" economic benefits, it must also disclose costs).

[96] Exec. Order No. 13,563 § 1, 76 Fed. Reg. 3821, 3821 (Jan. 21, 2011) (affirming Exec. Order No. 12,866); *accord* Exec. Order No. 12,866 § 6(a)(3)(C), 58 Fed. Reg. 51,735, 51,741 (Oct. 4, 1993) (detailing the requirements for cost-benefit analysis).

[97] Circular A-4, *supra* note 89, at 26.

statutory purpose of the rulemaking."[98] The Circular also stresses that "[t]he same standards of information and analysis quality that apply to direct benefits and costs should be applied to ancillary benefits and countervailing risks."[99]

EPA's own cost-benefit guidelines, adopted after extensive peer review, likewise instruct the agency to assess "all identifiable costs and benefits," including direct effects "as well as ancillary [indirect] benefits and costs."[100] The assessment of both direct and indirect effects is needed "to inform decision making" and allow meaningful comparisons between policy alternatives.[101]

Moreover, EPA—under presidents of both parties and across three decades—has consistently taken indirect benefits into account when evaluating Clean Air Act regulations. For example, in 1987, EPA under President Reagan discussed the importance of considering the indirect benefits that would result from its regulation of toxic emissions from municipal waste combustors.[102] And in 1991, EPA under President George H.W. Bush justified performance standards for landfill gases partly by reference to "the ancillary benefit of reducing global loadings of methane."[103] Later, when establishing standards to address hazardous air pollutant emissions from pulp and paper producers, EPA under President Clinton analyzed indirect benefits from reductions in co-pollutants like volatile organic compounds, particulate matter, and carbon monoxide.[104] EPA under President George W. Bush acknowledged that its Clean Air Interstate Rule, though designed to control particulate matter and ozone, would also reduce mercury emissions,[105] and included these indirect health and welfare benefits in its cost-benefit analysis justifying the rule.[106] In addition, in promulgating a rule on mobile source air toxics, EPA noted that "[a]lthough ozone and [fine particulate matter] are considered criteria pollutants rather than 'air toxics,' reductions in ozone and [fine particulate matter] are nevertheless important co-benefits of this proposal."[107] Finally, EPA under President Obama considered the indirect benefits from

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[98] *Id.*

[99] *Id.*

[100] EPA, Guidelines for Preparing Economic Analyses at 11-2 (2010), *available at* https://yosemite.epa.gov/ee/epa/eerm.nsf/vwAN/EE-0568-50.pdf/$file/EE-0568-50.pdf.

[101] *Id.* at 7-1.

[102] *See* Assessment of Municipal Waste Combustor Emissions Under the Clean Air Act, 52 Fed. Reg. 25,399, 25,406 (proposed July 7, 1987).

[103] Standards of Performance for New Stationary Sources and Guidelines for Control of Existing Sources: Municipal Solid Waste Landfills, 56 Fed. Reg. 24,468, 24,469 (proposed May 30, 1991).

[104] *See* National Emission Standards for Hazardous Air Pollutants for Source Category: Pulp and Paper Production; Effluent Limitations Guidelines, Pretreatment Standards, and New Source Performance Standards: Pulp, Paper, and Paperboard Category, 63 Fed. Reg. 18,504, 18,585–86 (Apr. 15, 1998).

[105] *See* Rule to Reduce Interstate Transport of Fine Particulate Matter and Ozone (Clean Air Interstate Rule); Revisions to Acid Rain Program; Revisions to the NO_X SIP Call, 70 Fed. Reg. 25,162, 25,170 (May 12, 2005).

[106] *See* EPA, Regulatory Impact Analysis for the Final Clean Air Interstate Rule at 1-10 (2005), *available at* https://www.epa.gov/sites/production/files/2015-09/documents/finaltech08.pdf.

[107] Control of Hazardous Air Pollutants from Mobile Sources, 72 Fed. Reg. 8428, 8430 (Feb. 26, 2007).

reducing carbon monoxide, volatile organic compounds, and nitrogen oxides in its analysis of regulating hazardous air pollutant emissions from combustion engines.[108]

Ultimately, the purpose of regulatory cost-benefit analysis is to ensure that a proposed action will do "more harm than good."[109] An agency cannot accurately make this determination if it limits the scope of its analysis to direct or "target" effects. Instead, it must look to the "actual results" of its decision.[110] Accordingly, EPA should abandon any estimates of the Proposed Rule's costs and benefits that do not include health effects from particulate matter reductions.

V. EPA Irrationally Ignores the Costs of Its Proposed Changes to New Source Review Permitting Requirements

In justifying proposed changes to the New Source Review ("NSR") permitting program, EPA repeatedly emphasizes benefits (in the form of avoided regulatory costs) without acknowledging costs (in the form of forgone emission reductions). This one-sided treatment renders the proposed changes arbitrary and capricious.[111]

For example, EPA cites a 2014 report finding that "80 percent of non-retiring coal-fired units have emissions rates for NO_x and SO_2 at levels that exceed those typically required under NSR" and thus "would have to install additional controls" if heat rate improvement projects taken in response to the Proposed Rule "triggered the applicability of NSR."[112] EPA cites the "substantial time, effort, and money" that such plants would expend to satisfy NSR requirements, as well as the "burden for permit agencies" of processing additional NSR applications from such units.[113] But the agency makes absolutely no mention of the fact that, in addition to incremental compliance costs, application of NSR to these sources would also yield incremental *benefits*, in the form of reduced NO_x and SO_2 emissions.

Similarly, EPA notes that "the prospect of a protracted permitting process and possible requirement to install pollution control equipment at the emissions unit can create a disincentive for sources to voluntarily make energy efficiency improvement."[114] But EPA makes no effort to assess whether enabling such energy-efficiency improvement at the expense of requiring

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[108] *See* National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines, 75 Fed. Reg. 51,570, 51,578 (Aug. 20, 2010).

[109] *Michigan v. EPA,* 135 S. Ct. 2699, 2707 (2015).

[110] Exec. Order No. 13,563 § 1.

[111] See *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1198 (9th Cir. 2008) (warning agencies not to "put a thumb on the scale by undervaluing the benefits and overvaluing the costs"); *Sierra Club v. Sigler*, 695 F.2d 957, 979 (5th Cir. 1983) (if agency "trumpet[s]" economic benefits, it must also disclose costs); *Nat'l Ass'n of Home Builders v. EPA*, 682 F.3d 1032, 1040 (D.C. Cir. 2012) ("And when an agency decides to rely on a cost-benefit analysis as part of its rulemaking, a serious flaw undermining that analysis can render the rule unreasonable.").

[112] Proposed Rule, 83 Fed. Reg. at 44,775.

[113] *Id.* at 44,776.

[114] *Id.* at 44,776.

installation of the best available pollution controls when a source undergoes an emissions-increasing physical or operational change will be net beneficial for society. Specifically, the agency fails to (1) discuss whether and to what extent allowing coal plants to make efficiency improvements *without* triggering NSR permitting will increase aggregate emissions relative to a scenario without NSR reform, and (2) weigh the climate and health costs of any such emissions increases against the benefit of avoided permitting-related expenditures.

Legal and economic scholars have long recognized that stringently regulating new sources of pollution while exempting existing sources—a regulatory practice commonly known as "grandfathering"—can perversely encourage those existing sources to stay in operation longer than they otherwise would and lead to adverse environmental consequences.[115] Academics call this distortion of retirement decisions the "old plant effect," and the Clean Air Act's approach to federal performance standards for stationary sources' NO_x and SO_2 emissions—with tight controls for new sources and none for existing ones—is a classic example of the type of bifurcated policy that causes it.[116]

The NSR permitting program, however, acts as a de facto limit on the duration of this grandfathering by requiring existing sources to install pollution controls as soon as they undergo "modification." [117] Unfortunately, coal-fired power plants have a long history of exploiting ambiguities in NSR regulations— undertaking comprehensive, life-extending renovations but claiming (with varying degrees of success) that the upgrades do not qualify as "modifications" within the meaning of relevant Clean Air Act provisions and rules.[118] By amending the NSR program in ways that make coal plant upgrades even *less* likely to trigger additional pollution-control obligations, the Proposed Rule will, in effect, expand the grandfathering of old coal plants. As a result, it might also extend the economically useful lives of these highly polluting facilities.

Indeed, EPA's Regulatory Impact Analysis shows that, relative to a scenario in which low-cost heat rate improvements are adopted but NSR triggers are not changed, a scenario in which low-cost heat rate improvements are adopted and NSR triggers *are* changed leads to increases in total coal generation capacity *and* total coal-fired electric generation in years 2025, 2030, and 2035 (suggesting decreased coal plants retirements and increased coal-plant utilization relative to the scenario without NSR reform).[119] The analysis also finds that, as of 2035, the low-cost scenario

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[115] *See* RICHARD L. REVESZ & JACK LIENKE, STRUGGLING FOR AIR: POWER PLANTS AND THE "WAR ON COAL" 30-35 (2016); *see also* Richard L. Revesz & Allison L. Westfahl Kong, *Regulatory Change and Optimal Transition Relief,* 105 NW. U. L. REV. 1581 (2011); Jonathan Remy Nash & Richard L. Revesz, *Grandfathering and Environmental Regulation: The Law and Economics of New Source Review*, 101 NW. U. L. REV. 1677 (2007).

[116] Nash & Revesz, *supra* note 115, at 1708.

[117] REVESZ & LIENKE, *supra* note 115, at 63-66.

[118] *Id.* at 66-79.

[119] Proposed Rule RIA, *supra* note 67, at 3-25 tbl.3-19, 3-28 tbl.3-21

with NSR reforms leads to higher aggregate CO_2, SO_2, *and* NO_X emissions from the electric sector as a whole.[120]

However, EPA makes no mention of these increased emissions when justifying its proposed changes to NSR permitting triggers. Instead, the agency asserts the following:

> [T]he analysis conducted for the [Proposed Rule] . . . reflects that, for scenarios that include varying levels and costs of efficiency improvements (reflecting, in part, the proposed changes to NSR in this action), total national emissions of CO2 and other pollutants will essentially stay the same or be slightly reduced *when compared with a CPP repeal*."[121]

But this claim is misleading, because it elides the relevant comparison for purposes of evaluating the economic rationality of potential NSR reforms. The appropriate comparison is not between all Proposed Rule compliance scenarios and a full repeal of the CPP, but between Proposed Rule compliance scenarios that *include* NSR reform and Proposed Rule compliance scenarios that *do* not include NSR reform. Only this comparison would isolate the incremental effects of proposed changes to NSR permitting requirements.

Because EPA justifies its proposed changes to NSR permitting requirements by "inconsistently and opportunistically fram[ing]" their costs and benefits, those proposed changes are arbitrary and capricious.[122]

Respectfully,

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Attachments

Exhibit A: RICHARD L. REVESZ, DENISE A. GRAB & JACK LIENKE, BOUNDED REGULATION: HOW THE CLEAN POWER PLAN CONFORMS TO STATUTORY LIMITS ON EPA'S AUTHORITY (2016).

Exhibit B: Richard L. Revesz Denise A. Grab & Jack Lienke, *Familiar Territory: A Survey of Legal Precedents for the Clean Power Plan*, 46 ENVTL. L. REP. 10,190 (2016).

Exhibit C: JASON A. SCHWARTZ, ADMINISTRATIVE CONFERENCE OF THE UNITED STATES, MARKETABLE PERMITS: RECOMMENDATIONS ON APPLICATIONS AND MANAGEMENT (2017).

Exhibit D: Kimberly M. Castle & Richard L. Revesz, *Environmental Standards, Thresholds, and the Next Battleground of Climate Change Regulations*, 103 MINN. L. REV. __ (2019) (forthcoming).

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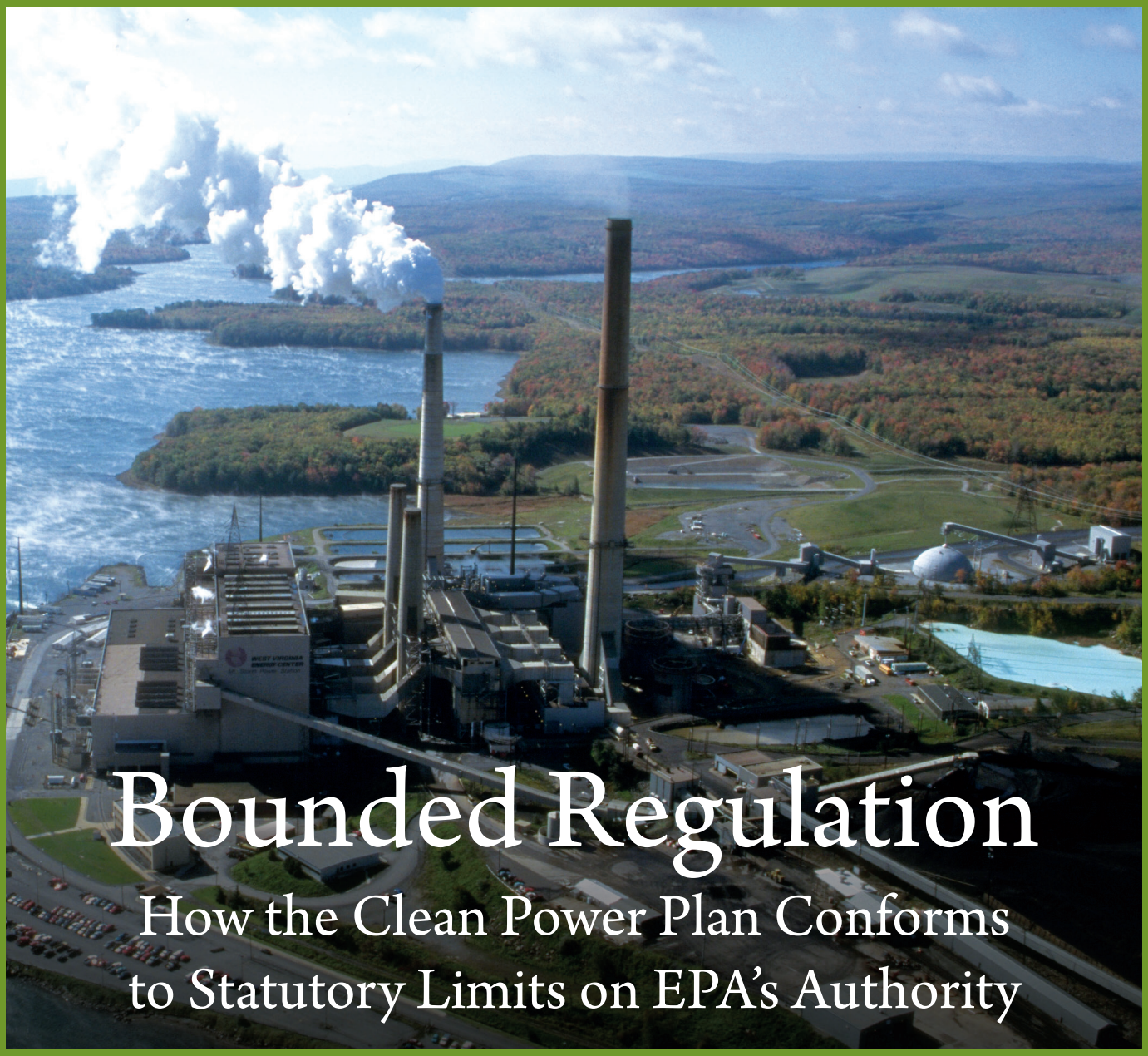
[120] *Id*. at 3-19 tbl.3-13, 3-20 tbls.3-14 & 3-15.

[121] Proposed Rule, 83 Fed. Reg. at 44,781 (emphasis added).

[122] *Bus. Roundtable v. SEC*, 647 F.3d 1144, 1148–49 (D.C. Cir. 2011).

Exhibit A:

RICHARD L. REVESZ, DENISE A. GRAB & JACK LIENKE, BOUNDED REGULATION: HOW THE CLEAN POWER PLAN CONFORMS TO STATUTORY LIMITS ON EPA'S AUTHORITY (2016).



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Bounded Regulation

How the Clean Power Plan Conforms to Statutory Limits on EPA's Authority

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I. Introduction

The Clean Power Plan is the first federal regulation aimed at reducing carbon dioxide (CO_2) emissions from existing power plants, the nation's largest source of greenhouse gas pollution.[1] Expected to reduce the power sector's annual CO_2 output to 32% below 2005 levels by 2030,[2] the Plan is widely viewed as a significant, but eminently achievable, step to address the United States' contribution to global climate change.[3]

Critics of the Plan, however, argue that, in its pursuit of substantial emission reductions, the Environmental Protection Agency (EPA) "dramatically overstepped its authority" under the Clean Air Act[4] and invaded regulatory arenas—intrastate electricity markets—that have traditionally been managed by the states.[5] They accuse the agency of attempting to "fundamentally restructure the nation's electricity industry" and position itself as "the nation's energy czar."[6]

It is certainly true that EPA's regulatory authority over existing power plants is not boundless. Indeed, Section 111 of the Clean Air Act places several important limits on the agency's discretion to craft emission guidelines for such facilities, such as forbidding the agency from imposing excessive costs, requiring it to consider how its guidelines might affect the nation's energy supply, and requiring it to base guidelines on reduction techniques that have been "adequately demonstrated."[7] But critics are wrong to suggest that the Clean Power Plan represents a "dramatic overstepping" of these statutory boundaries.[8] Instead, as this policy brief will discuss, the Plan explicitly acknowledges and respects each of Section 111's constraints on EPA's regulatory authority.

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[1] EPA, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Final Rule, 80 Fed. Reg. 64,662, 64,663 (Oct. 23, 2015); *see also* EPA, Learn About Carbon Pollution From Power Plants, https://www.epa.gov/cleanpowerplan/learn-about-carbon-pollution-power-plants (last visited Sept. 1, 2016) (noting that the electric power sector was the largest source of U.S. greenhouse gas emissions as of 2012).

[2] 80 Fed. Reg. at 64,665.

[3] *See, e.g.*, President Barack Obama, Remarks by the President in Announcing the Clean Power Plan (Aug. 3, 2015), https://www.whitehouse.gov/the-press-office/2015/08/03/remarks-president-announcing-clean-power-plan (calling the Clean Power Plan "the single most important step America has ever taken in the fight against global climate change"); Envtl. Def. Fund, A New National Clean Power Plan, https://www.edf.org/climate/a-new-federal-clean-power-plan (last visited Sept. 1, 2016) (referring to Plan as the "most significant step in U.S. history toward reducing the pollution that causes climate change"); M.J. Bradley & Associates, EPA's Clean Power Plan: Summary of IPM Modeling Results with ITC/PTC Extension 3 (June 1, 2016) (finding that Plan's "targets are achievable under a range of scenarios and assumptions"); Brief of Amici Curiae Former State Envtl. & Energy Officials in Supp. of Resp'ts 1, West Virginia v. EPA, No. 15-1363, Doc. No. 1606746 (D.C. Cir. Apr. 1, 2016) (explaining that Plan's "targets are quite modest given strong positive trends in the power sector").

[4] George Russell, *Business, States Open Legal Fire on EPA's Clean Power Plan Rule*, FoxNews.com (Oct. 26, 2015), http://www.foxnews.com/politics/2015/10/26/business-states-open-legal-fire-on-epas-clean-power-plan-rule.html (quoting executive director of the National Federation of Independent Business's Small Business Legal Center).

[5] *See* Opening Br. of Pet'rs on Core Legal Issues 36–41, West Virginia v. EPA, No. 15-1363, Doc. No. 1610010 (D.C. Cir. Apr. 22, 2016).

[6] William S. Scherman, *EPA Has Designed Its Clean Power Plan to Evade Court Review*, Forbes (Aug. 3, 2015), http://www.forbes.com/sites/beltway/2015/08/03/epa-has-designed-its-clean-power-plan-to-evade-court-review.

[7] *See infra* pp. 3-4.

[8] Alan Neuhauser, *EPA to Issue Carbon Rules by Summer*, U.S. News & World Rep. (Jan. 7, 2015), http://www.usnews.com/news/articles/2015/01/07/epa-to-complete-clean-power-plan-carbon-rules-by-summer (quoting CEO of the Pennsylvania Coal Alliance).

II. Regulating Existing Stationary Sources of Pollution Under Section 111(d)

Section 111 requires EPA to establish "standards of performance" for stationary source categories that "contribute[] significantly to . . . air pollution which may reasonably be anticipated to endanger public health or welfare."[9] Frequently, EPA promulgates such standards only for new sources, under Section 111(b). However, when the pollutant in question is neither a so-called "criteria" pollutant, like particulate matter, nor a "hazardous" pollutant, like mercury, standards must also be established for existing sources, under Section 111(d).[10] Greenhouse gases like CO_2 fall into the narrow category of non-criteria, non-toxic pollutants subject to Section 111(d) regulation.

While Section 111 standards for new sources are established directly by EPA, existing-source standards are established by states, subject to minimum guidelines and oversight from EPA. More specifically, Section 111(d) instructs the agency to "establish a procedure . . . under which each State shall submit to the [EPA] Administrator a plan which . . . establishes standards of performance for any existing source."[11] These state-established standards must reflect "the degree of emission limitation achievable through the application of the best system of emission reduction which . . . *the [EPA] Administrator* determines has been adequately demonstrated."[12] In other words, even though EPA is not, in the first instance, charged with implementing existing-source standards, it is responsible for determining their minimum stringency.[13]

Accordingly, EPA begins the process of standard-setting under Section 111(d) by issuing "emission guidelines" for states, which identify: (1) what the agency considers the best system of emission reduction for the given pollutant and source category, (2) the level of emission reduction achievable using that system, and (3) the time necessary to achieve that reduction.[14] Each state then has the opportunity to design an individual plan to impose standards consistent with EPA's guidelines.[15] Importantly, a state is not required to adopt the particular system of reduction identified by EPA in its guidelines, so long as the state's own approach will achieve an equivalent or superior level of abatement.[16] If a state declines to submit a plan or submits an inadequate plan, EPA must design and imposes federal standards for the existing sources in that state.[17]

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[9] 42 U.S.C. § 7411(b)(1)(A).

[10] *Id.* § 7411(d)(1); 80 Fed. Reg. at 64,701 (explaining that Section 111(d) applies to "certain existing sources of air pollutants that were not otherwise regulated as criteria pollutants or hazardous air pollutants").

[11] 42 U.S.C. § 7411(d)(1).

[12] *Id.* § 7411(a)(1) (emphasis added).

[13] As discussed below, if a state declines to implement its own standards, or proposes unsatisfactory standards, EPA must impose federal standards. 42 U.S.C. § 7411(d)(2).

[14] 40 C.F.R. § 60.22(b)(5).

[15] *Id.* § 60.23.

[16] *Id.* § 60.24(c).

[17] *Id.* § 60.27(c); *see also* 42 U.S.C. § 7411(d)(2).

III. Constraints on EPA's Section 111(d) Authority

The text of Section 111 contains eight significant constraints on EPA's authority to craft emission guidelines. Most are found in the definition of "standard of performance" in Section 111(a), which reads as follows:

> The term "standard of performance" means a standard for emissions of air pollutants which reflects 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.[18]

Additional requirements can be found in the text of Section 111(d) itself, which reads, in relevant part:

> The Administrator shall prescribe regulations which shall establish a procedure . . . under which each State shall submit to the Administrator a plan which . . . establishes standards of performance for any existing source . . . . Regulations of the Administrator under this paragraph shall permit the State in applying a standard of performance to any particular source under a plan submitted under this paragraph to take into consideration, among other factors, the remaining useful life of the existing source to which such standard applies.[19]

Breaking these two passages into their component parts reveals the following criteria for any emission guidelines issued by EPA:

1. **EPA must identify the "best system of emission reduction" and calculate the "degree of emission limitation achievable through the application" of that system.** Thus, the agency cannot arbitrarily declare that existing sources in the relevant category must reduce their emissions by a particular amount. Instead, it must survey available *systems* for reducing emissions and calculate the level of reduction achievable using what it considers the *best* of those systems.

2. **In identifying the best system, EPA must consider the amount of emission reductions it will yield.** It goes without saying that a system of emission reduction is unlikely to be "best" if it does a poor job reducing emissions. Thus, when comparing available systems, EPA must consider their relative abilities to decrease the amount of pollution generated by regulated sources.[20]

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[18] 42 U.S.C. § 7411(a).

[19] *Id.* § 7411(d)(1).

[20] *See* Sierra Club v. Costle, 657 F.2d 298, 326 (D.C. Cir. 1981) ("[W]e can think of no sensible interpretation of the statutory words "best . . . system" which would not incorporate the amount of air pollution as a relevant factor to be weighed when determining the optimal standard for controlling . . . emissions.").

3. **In identifying the best system, EPA must consider the system's cost.** A system is not necessarily "best" simply because it can achieve the deepest emission reductions. EPA must also take into account the costs of achieving those reductions and cannot adopt standards that can only be achieved at "excessive," "exorbitant," or "unreasonable" expense.[21] That said, courts have consistently granted EPA "a great degree of discretion" when assessing the reasonableness of a system's costs.[22]

4. **In identifying the best system, EPA must consider "nonair quality health and environmental impacts."** For example, the use of a "scrubber" to remove sulfur dioxide emissions from a power plant's smokestack produces coal ash, which can, if improperly stored, contaminate groundwater.[23] EPA must consider this type of indirect environmental effect—whether positive or negative—when weighing systems of emission reduction. Ultimately, EPA has explained, "a system cannot be 'best' if it does more harm than good due to cross-media environmental impacts."[24]

5. **In identifying the best system, EPA must consider "energy requirements."** This factor could encompass the system's impacts on the regulated sources' *own* energy needs (e.g., because additional power is needed to operate the system identified by EPA), as well as its impacts on the energy needs of a region or the nation as a whole (e.g., because application of the system affects the power sector's output of electricity or the refining sector's output of gasoline).[25] Thus, a system cannot be "best" if it imperils access to reliable energy sources.

6. **EPA must find that its preferred method of emission reduction has been "adequately demonstrated."** Under D.C. Circuit case law, EPA cannot identify a "purely theoretical or experimental means of preventing or controlling air pollution" as the best system of emission reduction.[26] This does not mean, however, that the system must be "in actual routine use somewhere."[27] Instead, the agency can make reasonable projections based on existing technology.[28]

7. **EPA's guidelines must be translatable into "standards of performance" for individual sources.** Ultimately, the standards promulgated by states in response to EPA's guidelines (or by EPA itself in states that decline to develop standards) must be applicable to—and enforceable against—"any existing source" of pollution in the relevant category. The standards, in other words, must take the form of independent compliance obligations for individual sources. The fact that each source is subject to its own standard, however, does not mean that the source must meet its standard solely through actions taken within the walls of its own facility.[29]

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[21] 80 Fed. Reg. at 64,720 (quoting several court decisions on the treatment of costs under Section 111).

[22] Lignite Energy Council v. EPA, 198 F.3d 930, 933 (D.C. Cir. 1999); *see also* 80 Fed. Reg. at 64,720–21 (discussing additional decisions on EPA's discretion to weigh cost against other Section 111 factors).

[23] *See generally* Charles Duhigg, *Cleansing the Air at the Expense of Waterways*, N.Y. Times (Oct. 12, 2009), http://www.nytimes.com/2009/10/13/us/13water.html.

[24] 80 Fed. Reg. at 64,721.

[25] *See id.* (explaining that "EPA may consider energy requirements on both a source-specific basis and a sector-wide, region-wide, or nationwide basis").

[26] Portland Cement Ass'n v. Ruckelshaus, 486 F.2d 375, 391 (D.C. Cir. 1973) (quoting H. Rep. No. 91-1146, 91st Cong., 2d Sess. 10 (1970)).

[27] *Id.* (quoting S. Rep. No. 9-1196, 91st Cong., 2d Sess. 16 (1970)).

[28] *Id.*; *see also* 80 Fed. Reg. at 64,720 (discussing other cases that address the "adequately demonstrated" factor).

[29] 80 Fed. Reg. at 64,779 (explaining that Section 111(d)(1) and (a)(1) "require by their terms that 'any existing source' must have a 'standard of performance,' but nothing in these provisions requires a particular amount—or, for that matter, any amount—of emission reductions from each and every existing source").

8. **EPA's guidelines must give states flexibility to account for the "remaining useful life" of their existing sources.** The application of certain systems of emission reduction might make less economic sense for facilities on the verge of retirement. In particular, requiring sources that are nearing the end of their useful lives to install pollution-control equipment might be needlessly costly.[30] EPA's emission guidelines must allow states some means of taking variations in sources' remaining useful lives into consideration when setting standards.

IV. The Clean Power Plan's Observance of Section 111(d)'s Constraints

In issuing the Clean Power Plan, EPA acknowledged and abided by each of the constraints discussed above.

1. **EPA identified a "best system of emission reduction" and calculated the "degree of emission reduction achievable" using that system.**

According to the Clean Power Plan, the "best system of emission reduction" for CO_2 emissions from existing power plants is the combination of emission rate improvements and limitations on overall emissions that affected plants can accomplish through the following three pollution control measures, or "building blocks":

1. Improving heat rate at coal-fired steam plants;
2. Substituting generation from lower-emitting existing natural gas combined cycle plants ("gas plants") for generation from higher-emitting steam plants, which are primarily coal-fired; and
3. Substituting generation from new zero-emitting renewable generating capacity for generation from fossil fuel-fired plants, which are primarily coal- and gas-fired.[31]

EPA determined that these reduction techniques are available to all power plants affected by the Clean Power Plan, "either through direct investment or operational shifts or through emissions trading."[32]

EPA chose these building blocks after surveying "the types of strategies that states and owner and operators of [power plants] are already employing" to reduce CO_2 from the electric sector, including both technological solutions and "the full range of

Requirements for Section 111(d) Emission Guidelines

- ☑ Best system of emission reduction?
- ☑ Magnitude of reductions?
- ☑ Reasonable cost?
- ☑ Nonair effects?
- ☑ Impacts on energy requirements?
- ☑ Adequately demonstrated?
- ☑ Translatable into standards of performance for sources?
- ☑ Flexibility to consider remaining useful life?

[30] *Id.* at 64,872; *see also* EPA, Legal Memorandum Accompanying Clean Power Plan for Certain Issues 30-36 (2015) (discussing legislative and regulatory history of the "remaining useful life" provision in section 111(d)).
[31] 80 Fed. Reg. at 64,667.
[32] *Id.*

operational practices, limitations, constraints and opportunities that bear upon [power plants'] emission performance."[33] In identifying the "best" of the available strategies, EPA considered not only the statutory factors discussed below—like cost and energy requirements—but also the global nature of CO_2 pollution (which renders the location of emissions unimportant) and the interconnected nature of the electric grid (which allows one plant to substitute generation for another).[34]

EPA then used its building blocks to calculate nationally uniform emission performance rates—expressed in pounds of CO_2 per megawatt hour—for two categories of plant: steam plants and gas plants.[35] The agency also calculated state-specific performance rates based on each state's mix of the two plant types.[36] Finally, EPA translated each state's rate-based target into an alternative mass-based target (i.e., an annual limit on *aggregate* emissions from regulated sources rather than a limit on their average *rate* of emissions).[37]

States have broad flexibility in designing plans to comply with these guidelines and are not required to implement the "best system" as determined by EPA. They simply must ensure that regulated plants "individually, in aggregate, or in combination with other measures taken by the state" achieve the equivalent of the performance rates calculated by EPA.[38]

2. EPA took into account the magnitude of expected emission reductions.

In choosing among available systems of emission reduction, EPA explicitly took into account the volume of emission reduction that each option could be expected to achieve.[39] The agency noted that, outside of its chosen building blocks, it had found no "other measures available under section 111 that are less costly and would achieve emission reductions that are commensurate with the scope of the problem [of global climate change] and [power plants'] contribution to it."[40]

3. EPA took into account costs.

EPA determined the stringency of each building block (e.g., the percentage by which it assumed coal-fired steam plants could improve their heat rate) "based on what is achievable at reasonable cost rather than the maximum achievable amount."[41] It projected that emission reductions could be achieved under building block 1 at an average cost of $23 per ton, under building block 2 at $24 per ton, and under building block 3 at $37 per ton.[42] The agency further estimated that, implemented together, the three building blocks would achieve CO_2 reductions at an average cost of $30 per ton.[43]

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[33] *Id.*
[34] *Id.* at 64,717.
[35] *Id.* at 64,667. EPA first applied the blocks at a regional level and then set the national rates based on the region where the blocks yielded the least stringent result. *Id.* at 64,744 & n.418.
[36] *Id.* at 64,667.
[37] *Id.*
[38] *Id.*
[39] *Id.* at 64,745 (describing, for building block 1, EPA's analysis of the "technical feasibility, costs, and *magnitude of CO_2 emission reductions* achievable through heat rate improvements at coal-fired steam EGUs" (emphasis added)); *id.* at 64,746 (same for building block 2); *id.* at 64,747 (same for building block 3).
[40] *Id.* at 64,751.
[41] *Id.* at 64,748.
[42] *Id.* at 64,749.
[43] *Id.*

EPA assessed the reasonableness of these costs in four ways:

- It compared the building blocks' costs to the costs of controls that power plants had implemented to reduce other air pollutants, such as sulfur dioxide and nitrogen oxides.[44]

- It compared the building blocks' costs to assumptions about the cost of future CO_2 regulations that utilities had used for planning purposes in their Integrated Resource Plans.[45]

- It compared the building blocks' costs to the costs of other means of achieving substantial cuts in power plants' carbon emissions, such as retrofitting plants with carbon capture and storage technology or implementing natural gas co-firing at steam plants.[46]

- It observed that building blocks' costs, both individually and combined, were well below the central estimate of the Social Cost of Carbon, which estimates the monetary value of an avoided ton of carbon emissions in a given year.[47]

Ultimately, EPA concluded that the costs of its "best system of emission reduction" were reasonable when assessed against any of these benchmarks.[48]

4. EPA took into account nonair quality health and environmental impacts.

EPA saw "no reason to expect an adverse non-air environmental . . . impact from deployment of the combination of the three building blocks."[49] Instead, the agency projected that implementation of the building blocks would result in *beneficial* cross-media impacts, in the form of reduced water usage and solid waste production.[50]

5. EPA took into account energy requirements.

EPA took the nation's energy requirements into account by designing guidelines that could be satisfied "without reducing overall electricity generation."[51] To ensure that the Clean Power Plan "reflect[ed] the paramount importance of ensuring electric system reliability,"[52] the agency engaged in "extensive consultation" with the Federal Energy Regulatory Commission, the Department of Energy, and other relevant authorities,[53] and also prepared a detailed technical support document describing the "resource adequacy and reliability impacts" of the rule.[54] Finally, EPA included in the Clean Power Plan a "reliability safety valve" that allows individual sources to temporarily violate emission standards set for

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[44] *Id.* at 64,750.
[45] *Id.*
[46] *Id.* at 64,751.
[47] *Id.*
[48] *Id.* at 64,750-51.
[49] *Id.* at 64,751.
[50] *Id.*
[51] *Id.* at 64,778.
[52] *Id.* at 64,671.
[53] *Id.*
[54] EPA, Technical Support Document: Resource Adequacy and Reliability Analysis (2015), https://www.epa.gov/sites/production/files/2015-11/documents/tsd-cpp-adequacy-reliability.pdf.

them under states' plans where complying with the standards would conflict with "the maintenance of electric system reliability in the face of an extraordinary and unanticipated event that presents substantial reliability concerns."[55]

6. EPA found that its "best system" was adequately demonstrated.

For building block 1, EPA found that "taking action to improve heat rates is a common and well-established practice within the [electric utility] industry."[56]

For building block 2, EPA noted that "the utility power sector has recognized that generation shifts are a means of controlling air pollutants" since the Clean Air Act was passed in 1970.[57] Furthermore, "[s]ince at least 2000, fossil fuel-fired generation has been shifting from coal- and oil-fired [plants] to [gas plants], both as a result of construction of additional [gas plants], and also as a result of dispatch of pre-existing [gas plants] at higher capacity factors."[58] This led to an 83% increase in gas generation between 2005 and 2012, a *higher* growth rate than EPA expects to occur under the Clean Power Plan between 2015 and 2022.[59] In addition to discussing industry trends, EPA noted that past Clean Air Act programs have relied on generation shifting as a means of emission reduction.[60]

Finally, for building block 3, EPA noted that renewable generation "has been relied on since the 1970s to provide energy security by replacing some fossil fuel-fired generation."[61] As with gas-fired generation, the agency found that recent industry trends have led to "rapid growth" in renewable generation that is "projected to continue as costs of [renewable] generation fall relative to the costs of other generation technologies."[62] Finally, EPA noted that "[b]oth Congress and the EPA have previously established frameworks under which [renewable] generation could be used as a means of achieving emission reductions from the utility power sector."[63]

7. EPA ensured that its guidelines are translatable into standards of performance that can be applied to "any existing source."

The Clean Power Plan presents states with a variety of options for imposing standards of performance on individual existing sources. Most obviously, "states may establish emission standards for their affected [plants] that mirror the uniform emission performance rates for the two subcategories of sources" identified by EPA.[64] But a state may also "pursue alternative approaches that adopt emission standards that . . . meet either the [blended] rate-based goal promulgated for the state or the alternative mass-based goal promulgated for the state."[65] For example, the standard of performance in a state adopting a mass-based trading program could simply be that each source must obtain an allowance for each ton of

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[55] 80 Fed. Reg. at 64,671.
[56] *Id.* at 64,745.
[57] *Id.* at 64,746.
[58] *Id.* at 64,795.
[59] *Id.* at 64,800.
[60] *Id.* at 64,746 (noting that generation shifts "have been recognized as a means of reducing emissions under trading programs established by the EPA to implement the [Clean Air] Act's provisions"). Prior EPA programs that relied on generation shifting are discussed in Richard L. Revesz, Denise A. Grab & Jack Lienke, *Familiar Territory: A Survey of Legal Precedents for the Clean Power Plan*, 46 Envtl. L. Rep. 10190, 10193 (2016).
[61] 80 Fed. Reg. at 64,747.
[62] *Id.*
[63] *Id.*
[64] *Id.* at 64,667.
[65] *Id.* at 64,667-68.

carbon it emits over the course of a year. So long as the total pool of allowances available in the state was equal to the mass-based goal set by EPA, this would satisfy the guidelines.[66]

8. EPA gave states sufficient flexibility to account for their sources' remaining useful lives.

EPA found that states have ample discretion to account for their sources' remaining useful lives, because the emission guidelines "do[] not specify presumptive performance rates" that any particular generator must "achieve in the absence of trading."[67] Instead its guidelines "provide collective performance rates for two classes of [generating units] and give states the alternative of developing plans to achieve a state emission goal for the collective group of all affected [units] in a state."[68] By buying emission allowances (in a mass-based trading system) or emission rate credits (in a rate-based trading system), a source approaching the end of its useful life could "avoid excessive up-front capital expenditures that might be unreasonable for a facility with a short remaining useful life."[69] In addition or as an alternative to allowing sources the flexibility of trading, a state could specifically design laxer standards for older sources, so long as it ensured that its overall emission reductions would be consistent with EPA's guidelines.[70]

V. Conclusion

The Clean Power Plan rigorously observes the many constraints on EPA's discretion to craft emission guidelines under Section 111(d). It is not the reckless power grab that opponents describe, but a straightforward application of EPA's longstanding Clean Air Act authority to regulate dangerous emissions from stationary sources of pollution.

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[66] In litigation over the Clean Power Plan, opponents have argued that standards of performance cannot involve individual sources curtailing generation because that would be a standard of "non-performance." Opening Br. of Pet'rs on Core Legal Issues 51, West Virginia v. EPA, No. 15-1363, Doc. No. 1610010 (D.C. Cir. Apr. 22, 2016). However, as EPA has pointed out, "the word 'performance' [in Section 111] refers to *emissions* performance, not *production* performance." Respondent EPA's Final Br. 65, West Virginia v. EPA, No. 15-1363, Doc. No. 1609995 (D.C. Cir. Apr. 22, 2016).

[67] *Id.* at 64,870.

[68] *Id.*

[69] *Id.* at 64,871.

[70] *Id.*

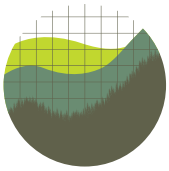

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Exhibit B:

Richard L. Revesz, Denise A. Grab & Jack Lienke, *Familiar Territory: A Survey of Legal Precedents for the Clean Power Plan*, 46 ENVTL. L. REP. 10,190 (2016).

COMMENTS

Familiar Territory: A Survey of Legal Precedents for the Clean Power Plan

Richard L. Revesz, Denise A. Grab, and Jack Lienke

Richard Revesz is Dean Emeritus and Lawrence King Professor of Law at New York University School of Law, and Director of the Institute for Policy Integrity. Denise Grab and Jack Lienke are Senior Attorneys at the Institute for Policy Integrity.

A coalition of states, utilities, energy producers, and other industry groups has brought a challenge[1] in the U.S. Court of Appeals for the District of Columbia (D.C.) Circuit against the U.S. Environmental Protection Agency's (EPA's) Clean Power Plan (CPP), which limits carbon dioxide (CO_2) emissions from the nation's existing power plants pursuant to §111(d) of the Clean Air Act (CAA).[2] (A competing cohort of states, municipalities, companies, and environmental organizations has intervened in support of the rule.) As of this writing, merits briefing has yet to begin, but the petitioners offered a preview of their arguments in a set of motions to stay the CPP pending resolution of their suit.[3] In support of the stay requests, the petitioners filed dozens of declarations from state government officials and industry representatives, many of which made exaggerated claims regarding the "unprecedented" nature of the CPP. In this Comment, we highlight a wide variety of regulations from the CAA's 45-year history that provide substantial precedent for the flexible design of the CPP.

I. Precedents for the CPP's Inclusion of Beyond-the-Fenceline Pollution Reduction Measures

In order to calculate emission guidelines for existing sources of pollution under §111(d), EPA must first identify the "best system of emission reduction which . . . has been adequately demonstrated" (BSER) for the relevant pollutant and source category.[4] For CO_2 emissions from existing power plants, EPA has determined that the BSER includes a combination of three building blocks: (1) improving the heat rate—that is, the efficiency with which fuel is converted to electricity—of coal-fired steam plants; (2) substituting increased generation from lower-emitting existing natural gas-fired "combined cycle" plants for generation from higher-emitting existing steam plants (which are mostly coal-fired); and (3) substituting increased generation from zero-emitting new renewable capacity—such as wind and solar facilities—for generation from both existing coal-fired plants *and* existing gas-fired plants.[5]

Several declarations filed by opponents of the CPP assert that the rule's reliance on "beyond-the-fenceline" measures for reducing pollution (building blocks 2 and 3), as opposed to just technological or operational requirements imposed on individual sources (building block 1), has no precedent under CAA §111. For example, one New Jersey official claims that the "requirement that [New Jersey] regulate 'outside the fence' of affected [electric generating units] is an unprecedented regulatory approach under Section 111 of the Clean Air Act."[6] Similarly, the president of an energy institute affiliated with the U.S. Chamber of Commerce insists that "EPA has never asserted the authority under Clean Air Act [§]111 to set standards that look beyond the boundaries of individual regulated facilities to mandate systemic changes."[7]

Other declarants suggest that beyond-the-fenceline regulation is unprecedented not just under §111, but under the CAA as a whole. A Wyoming official, for example, claims that the CPP's "'outside the fence' control measures . . . are unlike any other Clean Air Act requirements [the state's Department of Environmental Quality] implements."[8] Likewise, a West Virginia declarant asserts

Note: The authors will be filing an amicus brief in support of the U.S. Environmental Protection Agency in West Virginia v. EPA, *No. 15-1363 (D.C. Cir.).*

1. West Virginia v. EPA, No. 15-1363 (D.C. Cir. Oct. 23, 2015).
2. 42 U.S.C. §§7401-7671q, ELR Stat. CAA §§101-618.
3. After the U.S. Court of Appeals for the D.C. Circuit denied motions to stay, Order, West Virginia v. EPA, No. 15-1363, Doc. No. 1594951 (D.C. Cir. Jan. 21, 2016), petitioners successfully sought a stay from the U.S. Supreme Court. Order, West Virginia v. EPA, Doc. No. 15A773 (U.S. Feb. 9, 2016).
4. Carbon Pollution Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64662, 64707 (Oct. 23, 2015); *see also* 42 U.S.C. §7411(a)(1), (d).
5. 80 Fed. Reg. at 64707.
6. State Petitioners' Motion for Stay and for Expedited Consideration of Petition for Review, Addendum pt. II, ex. C, Declaration of Bob Martin, at C000134 ¶ 8, West Virginia v. EPA, No. 15-1363, Doc. No. 1579999 (D.C. Cir. Oct. 23, 2015) [hereinafter State Petitioners' Motion to Stay].
7. Chamber of Commerce et al., Motion for Stay of EPA's Final Rule, ex. 7-A, Declaration of Karen Alderman, ¶ 10, West Virginia v. EPA, No. 15-1363, Doc. No. 1580020 (D.C. Cir. Oct. 23, 2015).
8. State Petitioners' Motion to Stay, Addendum pt. II, ex. C, Declaration of Todd Parfitt, at C000173, ¶ 7.

that the CPP's "reliance on measures outside the affected facilities' boundaries (fence-line) . . . are entirely unprecedented for any state."[9]

The declarants' claims echo an earlier, somewhat narrower argument made by other opponents of the CAA, who acknowledge that EPA has previously allowed beyond-the-fenceline reduction techniques as a means of *complying* with emission limits, but maintain that the availability of such techniques has never before been taken into account when determining the *stringency* of those limits.[10]

In fact, EPA previously promulgated several rules—under both §111 and other provisions of the CAA—that incorporate beyond-the-fenceline strategies for reducing emissions. In a number of these rulemakings, beyond-the-fenceline reduction techniques were used not only as a compliance mechanism, but also to determine the stringency of the relevant emission limits, sometimes justifying more stringent restrictions than would otherwise have been imposed.

Regulations for which stringency was informed by beyond-the-fenceline reduction techniques include the Clean Air Mercury Rule, issued under §111; emission guidelines for municipal waste combustors and medical waste incinerators, issued jointly under §111 and §129; the Cross-State Air Pollution Rule and its predecessors, issued pursuant to the Good Neighbor Provision of §110; the regional haze trading program, approved under §169A; lead standards for gasoline, issued under §211; and emission standards for motor vehicles, issued under §202. We discuss each of these precedents in more detail below.

A. Beyond-the-Fenceline Rulemaking Under §111

1. Clean Air Mercury Rule

Under the George W. Bush Administration in 2005, EPA issued the Clean Air Mercury Rule (CAMR), which set statewide targets for mercury emissions from power plants and allowed for intersource and interstate trading of emission allowances.[11] By its very nature, an emission trading scheme reaches beyond the fencelines of individual plants, allowing a group of regulated sources to apportion a collective reduction burden among themselves based on their relative costs of abatement. Notably, emission trading was not merely a permissible means of complying with CAMR, but was also identified by EPA as a component of the "best system of emission reduction" for mercury from power plants.[12] In other words, EPA took the availability of trading into account when determining the appropriate stringency of the rule's emission budgets.

In proposing and enacting CAMR, EPA explained why emission trading is justified under §111(d). Among other things, the Agency noted that "the term 'standard of performance' is not explicitly defined [in §111] to include or exclude an emissions cap and allowance trading program."[13] "Nor," EPA pointed out, "do any other provisions of [§]111(d) indicate that the term 'standard of performance' may not be defined to include a cap-and-trade program."[14] Accordingly, EPA amended the §111 implementing regulations to provide that a state's "[e]mission standards shall either be based on an allowance system or prescribe allowable rates of emissions except when it is clearly impracticable."[15]

Though CAMR was ultimately vacated by the D.C. Circuit, the reversal was on grounds unrelated to trading or the stringency of the rule's emission budgets, and the language regarding allowance systems in §111's implementing regulations remains in place.[16]

2. Emission Guidelines for Large Municipal Waste Combustors

CAMR was not the first §111(d) rule to look beyond the fencelines of individual sources. Under the Clinton Administration in 1995, EPA incorporated beyond-the-fenceline reduction strategies into its emission guidelines for large municipal waste combustors, issued jointly under §§111(d) and 129.[17] The guidelines allowed regulated entities both to average the nitrogen oxides (NO_x) emission rates of multiple units within a single large plant and to trade emission credits with other plants.[18] Further, plants that chose to take advantage of emission averaging were subject to tighter emission guidelines than those that did not.[19] Thus, as in CAMR, the availability of beyond-the-fenceline reduction techniques affected the stringency of the municipal waste combustors rule.

9. *Id.* at Addendum pt. II, ex. C, Declaration of William F. Durham, at C000014 ¶ 2.
10. *See, e.g.*, *EPA's CO_2 Regulations for New and Existing Power Plants, Legal Perspectives: Hearing Before the Subcomm. on Energy & Power of the H. Comm. on Energy & Commerce*, 114th Cong. 19-20 (Oct. 22, 2015) (statement of Allison Wood, Partner, Hunton & Williams LLP), *available at* http://docs.house.gov/meetings/IF/IF03/20151022/104065/HHRG-114-IF03-Wstate-WoodA-20151022.pdf.
11. Standards of Performance for New and Existing Stationary Sources: Electric Utility Steam Generating Units, 70 Fed. Reg. 28606, 28606 (May 18, 2005).
12. *Id.* at 28617 ("EPA has determined that a cap-and-trade program based on control technology available in the relevant timeframe is the best system for reducing [mercury] emissions from existing coal-fired Utility Units.").
13. *Id.* at 28616.
14. *Id.* at 28617.
15. *Id.* at 28649.
16. New Jersey v. EPA, 517 F.3d 574, 577-78, 38 ELR 20046 (D.C. Cir. 2008); 40 C.F.R. §60.24(b)(1).
17. Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources; Municipal Waste Combustors, 60 Fed. Reg. 65387 (Dec. 19, 1995).
18. *Id.* at 65402.
19. *Id.*

3. Emission Guidelines for Medical Waste Incinerators

In 1997, also under the Clinton Administration, EPA issued another set of joint §§111(d) and 129 emission guidelines aimed at medical waste incinerators.[20] These guidelines also looked beyond the fencelines of individual sources, requiring owners of regulated incinerators to develop waste management programs that could include "paper, cardboard, plastics, glass, battery, or metal recycling," and were designed to "reduce the volume of waste to be incinerated, and thereby reduce the amount of air pollution emissions associated with that waste."[21] Implementing such programs necessarily involved actions outside the walls of individual incinerators. As in the previous examples, then, the medical waste incinerator rule's stringency was affected by beyond-the-fenceline reduction techniques.

B. Beyond the Fenceline Rulemaking Under Other CAA Sections

EPA has also employed beyond-the-fenceline reduction techniques in regulations issued under CAA provisions *other* than §111, even where those provisions do not expressly authorize such an approach. As with the §111 precedents, in these rulemakings, EPA not only allowed beyond-the-fenceline reduction techniques as a compliance mechanism, but also took such techniques into account when determining the stringency of emission limits.

1. Trading Under the Good Neighbor Provision

EPA incorporated emission trading into a series of rules issued under §110(a)(2)(D), commonly known as the Good Neighbor Provision, which prohibits "sources" in upwind states from emitting pollution in amounts that "significantly contribute" to a downwind state's failure to attain or maintain the national ambient air quality standards.[22] In the 1998 NO_x SIP Call, promulgated during the Clinton Administration[23]; the 2005 Clean Air Interstate Rule, promulgated during the George W. Bush Administration[24]; and the 2011 Cross-State Air Pollution Rule (CSAPR), promulgated during the Obama Administration,[25] EPA established statewide emission budgets for the power sector and crafted trading mechanisms that states could opt into as a flexible, cost-effective means of meeting their budgets. EPA's previous actions under §110(a)(2)(D) are especially instructive because §111(d) directs the EPA Administrator to follow "a procedure similar to that provided by section [110]" when working with states to set standards of performance for existing sources.[26]

In setting state budgets for CSAPR, EPA explicitly took into account emission reductions that could be achieved *only* by going outside the fenceline of an individual plant, such as those associated with "increased dispatch of lower-emitting generation."[27] Thus, CSAPR's stringency was directly linked to the availability of beyond-the-fenceline reduction techniques. The U.S. Supreme Court upheld CSAPR in 2014, ruling that "EPA's cost-effective allocation of emission reductions among upwind States . . . [was] a permissible, workable, and equitable interpretation of the Good Neighbor Provision."[28]

2. Regional Haze Trading Program

EPA also used emission trading to address regional haze under CAA §169A.[29] Under the Obama Administration in 2012, the Agency approved a regional trading program proposed by a group of western states and municipalities to address their collective contributions to haze in the Colorado Plateau.[30] In approving the trading program, EPA found that it would achieve *greater* overall reductions than the installation of "Best Available Retrofit Technology" at individual sources.[31] In other words, as in previous examples, the incorporation of beyond-the-fenceline techniques enabled a more stringent reduction target. The U.S. Court of Appeals for the Tenth Circuit upheld the regional haze trading program in 2014.[32]

3. Trading and Averaging Under Mobile Source Provisions

EPA has also, for decades, taken a beyond-the-source approach to its regulation of mobile sources of pollution under Title II of the CAA. For example, under the Reagan Administration in 1982, EPA promulgated a §211 standard

20. Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources: Hospital/Medical/Infectious Waste Incinerators, 62 Fed. Reg. 48348, 48348 (Sept. 15, 1997).
21. *Id.* at 48348, 48359. The waste management plans under this rule were not challenged and remained in place despite a remand of the rule following a suit that challenged other parts of the regulation. *See* 72 Fed. Reg. 5510 (Feb. 6, 2007).
22. 42 U.S.C. §7410(a)(2)(D)(i)(I).
23. Finding of Significant Contribution and Rulemaking for Certain States in the Ozone Transport Assessment Group Region for Purposes of Reducing Regional Transport of Ozone, 63 Fed. Reg. 57356, 57358, 57456 (Oct. 27, 1998).
24. Rule to Reduce Interstate Transport of Fine Particulate Matter and Ozone (Clean Air Interstate Rule); Revisions to Acid Rain Program; Revisions to the NO_x SIP Call, 70 Fed. Reg. 25162, 25162, 25229 (May 12, 2005).
25. Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals, 76 Fed. Reg. 48208, 48210 (Aug. 8, 2011).
26. 42 U.S.C. §7411(d)(1).
27. 76 Fed. Reg. 48252.
28. EPA v. EME Homer City Generation, LP, 134 S. Ct. 1584, 161044 ELR 20094 (2014).
29. 42 U.S.C. §7491.
30. Final Rule, Approval and Promulgation of State Implementation Plans; Wyoming, 77 Fed. Reg. 73926, 73927 (Dec. 12, 2012); Final Rule, Approval, Disapproval and Promulgation of State Implementation Plans; Utah, 77 Fed. Reg. 74355, 74357 (Dec. 14, 2012); Final Rule, Approval and Promulgation of State Implementation Plans; New Mexico, 77 Fed. Reg. 70693, 70695 (Nov. 27, 2012); Final Rule, Approval and Promulgation of State Implementation Plans; City of Albuquerque-Bernalillo County, 77 Fed. Reg. 71119, 71121 (Nov. 29, 2012).
31. *Id.*
32. WildEarth Guardians v. EPA, 770 F.3d 919, 923, 44 ELR 20229 (10th Cir. 2014).

for the lead content of gasoline that some refineries could satisfy only by obtaining blending components or "lead credits" from other refineries.[33] This aggregate approach to lead reduction was upheld by the D.C. Circuit.[34]

EPA has taken a similarly flexible approach to emission standards for motor vehicles under CAA §202.[35] Rather than requiring each new vehicle to achieve the same degree of emission control, EPA has set standards that a manufacturer's fleet can meet on average.[36] In some cases, a manufacturer's "over-compliance" with its fleetwide standard generates credits that can be traded with other manufacturers.[37] The D.C. Circuit upheld this fleetwide approach to §202 in 1986, finding that, in the absence of "any clear congressional prohibition of averaging," EPA's effort to "allow manufacturers more flexibility in cost allocation while ensuring that a manufacturer's overall fleet still meets the emissions reduction standards makes sense."[38]

II. Precedents for the CPP's Shifting of Generation From One Energy Source to Another

In addition to asserting that the use of beyond-the-fenceline strategies is unprecedented under the CAA, some declarants claim that the CPP is the first CAA regulation to shift generation from relatively dirtier sources of energy to relatively cleaner sources. For example, an Ohio official states that the CPP's "reliance on the reduction of demand from a particular source of energy . . . is entirely unprecedented."[39] This statement is echoed almost verbatim by at least three other declarants.[40] In reality, substantial precedent exists for programs under the CAA that influence the type of fuel used for the production of electricity. Indeed, implementation of the CAA has repeatedly, over more than four decades, resulted in fundamental shifts in the fuel balance used in the power sector throughout the United States. We provide a representative (not comprehensive) set of examples below.

A. *Programs That Shifted Demand to Low-Sulfur Coal*

Some programs have shifted demand from high- to low-sulfur coal. For example, EPA's first-ever sulfur dioxide performance standard for new power plants, promulgated under the Nixon Administration in 1971, was set at a level that could be satisfied either by installing scrubbers on plants using high-sulfur eastern coal *or* by burning low-sulfur western coal.[41] EPA expected the standard to encourage plants in some states to shift from high-sulfur coal to low-sulfur coal.[42]

The Title IV acid rain trading program, established as part of the CAA Amendments of 1990, further encouraged the substitution of low-sulfur coal for high-sulfur coal. More than one-half of the plants regulated during the first phase of that program complied by increasing their use of low-sulfur coal rather than employing scrubbers.[43]

B. *Programs That Shifted Demand to Natural Gas*

Other EPA regulations have, like the CPP, encouraged a shift from coal to natural gas. In 2011, for example, EPA predicted that its Mercury and Air Toxics Standards (MATS) would result in a 1.3% decrease in coal generation and a 3.1% increase in natural gas generation between 2009 and 2015.[44]

Also in 2011, EPA estimated that CSAPR would result in a 1.9% decrease in coal generation and a 4.1% increase in natural gas generation between 2009 and 2014.[45]

III. Conclusion

As the above examples demonstrate, there is ample precedent under the CAA both for the issuance of regulations that rely on beyond-the-fenceline pollution reduction techniques, such as emission trading, and for the issuance of regulations that influence the type of fuel used in the production of electricity.

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33. Small Refiner Lead Phase-Down Task Force v. EPA, 705 F.2d 506, 534-35, 13 ELR 20391 (D.C. Cir. 1983).
34. *Id.* at 536.
35. 42 U.S.C. §7521(a)(1).
36. *See, e.g.*, 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards, 77 Fed. Reg. 62624, 62627-28 (Oct. 15, 2012).
37. *Id.* at 62628.
38. Natural Res. Def. Council v. Thomas, 805 F.2d 410, 425, 17 ELR 20269 (D.C. Cir. 1986).
39. State Petitioners' Motion to Stay, Addendum pt. II, ex. C, Declaration of Robert Hodanbosi, at C000052 ¶ 2.
40. *Id.* at Addendum pt. II, ex. C, Declaration of Brian Gustafson, at C000040 ¶ 6; *id.* at Addendum pt. II, ex. C, Declaration of Jim Macy, at C000129 ¶ 3; *id.* at Addendum pt. II, ex. C, Declaration of Stuart Spencer, at C000188 ¶ 2.
41. *See* Bruce Ackerman & William T. Hassler, Clean Coal/Dirty Air: or How the Clean Air Act Became a Multibillion-Dollar Bail-Out for High-Sulfur Coal Producers 19 (1981). Scrubbers rely on a chemical reaction to remove sulfur from exhaust gases as they pass through a smokestack. Richard L. Revesz & Jack Lienke, Struggling for Air: Power Plants and the "War on Coal" 32 (2016).
42. Ackerman & Hassler, *supra* note 41, at 19 (noting that EPA "recognized that utilities might respond to [its 1971 standard of performance] the natural way, by burning [low-sulfur] coal"); *see also id.* at 34 (describing a 1976 EPA report that predicted a 15% decline in high-sulfur coal production in Illinois, Indiana, and western Kentucky by 1990 under EPA's 1971 standard of performance).
43. *See* Richard Schmalensee & Robert N. Stavins, *The SO_2 Allowance Trading System: The Ironic History of a Grand Policy Experiment*, 27 J. Econ. Persp. 103, 111 (2013) (noting that 59% of the sulfur dioxide reductions achieved during the first phase of the Acid Rain Trading Program were a result of fuel switching or blending rather than emission scrubbing).
44. *See* U.S. EPA, Regulatory Impact Analysis for the Final Mercury and Air Toxics Standards 3-16 tbl. 3-6 (2011). In 2015, the Supreme Court remanded MATS to the D.C. Circuit for further review, after finding that the *timing* of EPA's consideration of the rule's costs was improper. Michigan v. EPA, 135 S. Ct. 2699, 2711, 45 ELR 20124 (2015). The Court specifically declined, however, to comment on the *content* of that cost analysis, which included EPA's estimate of the rule's effects on the national generation mix. *Id.*
45. U.S. EPA, Regulatory Impact Analysis for the Federal Implementation Plans to Reduce Interstate Transport of Fine Particulate Matter and Ozone in 27 States; Correction of SIP Approvals for 22 States 261 tbl. 7-13 (2011).

Exhibit C:

JASON A. SCHWARTZ, ADMINISTRATIVE CONFERENCE OF THE UNITED STATES, MARKETABLE PERMITS: RECOMMENDATIONS ON APPLICATIONS AND MANAGEMENT (2017).

Administrative Conference of the United States

MARKETABLE PERMITS:

RECOMMENDATIONS ON APPLICATIONS AND MANAGEMENT

Final Report: December 11, 2017

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Executive Summary

Marketable permits are regulatory tools designed to allocate privileges or obligations more efficiently by harnessing the market's decision-making powers. Evidence suggests that marketable permits lower compliance costs, incentivize innovation, and may ease administrative burdens more than traditional regulation. Historically, marketable permits have enjoyed bipartisan support. The administrations of Presidents Reagan, Bush (41), Clinton, Bush (43), and Obama all used marketable permits. President Clinton's Executive Order 12,866 calls for agencies to assess the advantages of regulating through "economic incentives to encourage the desired behavior, such as user fees or marketable permits."

Regulators have often applied marketable permits to environmental policies. Multiple markets exist for air pollution, including most famously the acid rain market, as well as for global pollutants like greenhouse gases. Other environmental markets include water quality trading, tradable fish catch shares, and habitat banks that sell credits to project developers who need to offset their impacts to wetlands or endangered species. Tradable obligations also exist for renewable energy production and energy efficiency, like markets for vehicle efficiency standards and renewable fuel credits.

Non-environmental marketable permit programs include the auctions and secondary trading of electromagnetic spectrum licenses, the trading (and proposed, but currently defunct, auction) of airport landing slots, and—at the state and local levels—transferable development rights, liquor license markets, and taxi medallion auctions. Other ideas for marketable permit programs considered by federal agencies or proposed by academics include transferrable permits for aircraft noise levels, auctions for satellite congestion in space, and tradable limits to control the over-prescription of antibiotics.

Marketable permits are *permits*: they are government-created licenses or obligations for a specific level of a particular activity. Many kinds of permits can be transferred together with the sale of a business or underlying assets. What distinguishes *marketable* permits is that they can be bought or sold independently of any real property or other interest. The primary and secondary markets for these permit exchanges are often regulatory creations as well and require oversight.

Marketable permits depart from the prescriptive, inflexible, or highly particularized approaches often seen in traditional regulation. Traditional environmental regulation, for example, may require each individual polluter to comply with a specific standard and may even prescribe exactly which technological or operational changes sources must make to comply. Traditional licensing of access to the electromagnetic spectrum was similarly particularized and inflexible: individual applicants had to navigate complex administrative hearings, and once spectrum was assigned it was difficult to reassign. By contrast, marketable permits rely on the market to identify the most cost-efficient way to allocate regulatory privileges or obligations. For example, under a cap-and-trade system for greenhouse gases, a regulator sets an overall maximum budget of permitted emissions per time period, but individual regulated sources decide for themselves, based on their own abatement costs, what emissions reductions to make and how: they can choose to emit as many tons as they can afford to buy additional permits for, or they can reduce emissions and sell any unused permits for profit. Similarly, instead of forcing regulators to divine how to allocate electromagnetic spectrum to the highest value uses, auctioning licenses and allowing re-sale entrusts the market to identify the most valuable uses.

Two main categories of marketable permits are cap-and-trade programs and credit trading programs. Though political debates often associate the term "cap-and-trade" with pollution reduction, the cap-and-trade framework applies to a range of marketable permit schemes, including allocation of a capped number of tradable electromagnetic spectrum licenses. In cap-and-trade programs, regulators set an absolute budget of pollutant tons or allowable fish catch or number of airport landing slots. In credit trading, regulators set a relative goal, like no net emissions increases or no net loss of wetlands, and

then any new entrants seeking to increase emissions or develop over wetlands must purchase offsetting credits that are sold by third parties and verified by regulators. Cap-and-trade and credit systems can be combined. For example, in a greenhouse gas cap-and-trade program, unregulated sources may be allowed to voluntarily reduce their emissions and sell verified credits into the market.

Evidence confirms that, in many regulatory applications, marketable permits allocate privileges and obligations more efficiently than traditional regulation, by allowing the market to identify and prioritize the lowest-cost abatement opportunities or the highest value use of scarce resources. For example, the acid rain market reduced costs by as much as 90% versus alternatives without tradable permits, with savings estimated at up to $1 billion annually. Marketable permit programs also likely incentivize innovation better than traditional regulation. For example, the trading and leasing of electromagnetic spectrum licenses has helped users develop novel arrangements, such as sharing channels and voluntarily accepting more interference than FCC typically allowed in its direct licensing. Finally, marketable permits may lower long-term administrative costs compared to traditional regulation. For example, the acid rain market famously achieved nearly 100% compliance with only about 100 EPA staff.

Like traditional regulation, marketable permits may create some positive or negative distributional consequences in certain applications. For example, small, rural providers have had trouble accessing electromagnetic spectrum licenses on secondary markets, and under a program of catch shares, Alaska's halibut and sablefish fisheries endured layoffs, with small fishers and communities hit hardest. At the same time, some features and options of marketable permits can remedy distributional problems: open auctions of permits help put all firms—large, small, new, existing—on relatively equal footing, and revenue generated by auctions can, in some cases, be returned to consumers or taxpayers as dividends.

Many marketable permit programs have achieved policy goals as well as or better than prescriptive regulation. Markets' cost savings have enabled regulators to set more stringent caps than they could under prescriptive regulation, or even break a political logjam blocking any regulation. For example, many credit the acid rain market's cost savings as making dramatic cuts to sulfur dioxide pollution politically feasible. Other evidence includes that annual harvest limits in fish catch share programs are rarely exceed, while quota overruns were common before catch share programs. Many regulators believe in the benefits of marketable permits. For example, 80% of Fish and Wildlife Service staff feel that habitat banks are as or more effective at aiding species recovery than other regulatory options.

Marketable permits are more advantageous in some regulatory contexts than others. Factors to consider in deciding whether a marketable permit approach is appropriate include:

- Marketable permits work best when regulators care more about overall activity levels than the identity of actors.
    - For example, global pollutants like greenhouse gases are ideal for marketable permits because they have no localized effects. Consequently, it does not matter which individual sources or regions reduce their emissions; what matters is the aggregate reductions.
    - This is not an absolute precondition. Marketable permit programs can be effective while requiring minimum standards to prevent trades between activities with dissimilar or unintended consequences. For example, habitat banks can operate efficiently without allowing land developers to offset the impacts of paving over 10 acres of ecologically rich wetlands just by paying to create a 10-acre "two-snake mud puddle" in a completely different state. However, if too many trade restrictions or review requirements become necessary, the market loses its efficiency. Some permit categories, like occupational licenses, that require individualized regulatory approvals should not be marketable.

  - Some experts disfavor the application of marketable permits to highly localized problems, as trading might inadvertently authorize spatially concentrated activity levels with undesirable consequences, such as pollution "hot spots." However, the hot spots much feared in existing air pollution markets largely did not materialize, and several strategies exist to prevent transfers that would create disproportionate hot spots.
  - Regulators should consider whether distributional concerns, such as effects on small entities, new entrants, or hot spots, counsel against use of marketable permit programs. At the same time, marketable permit structures can help remedy distributional issues in certain contexts. For example, when auctions of permits are available and feasible, that choice may help protect the interests of small and new firms better than traditional regulation.
- Marketable permits work best when sufficient variation exists between permittees' compliance costs or their utilities in the resources traded.
  - For example, if it costs each regulated source of pollution the exact same to reduce a ton of emissions, there is nothing to gain from trading emissions permits. However, if one source can reduce its emissions at $1 per ton while another faces $1000 per ton costs, and if the environmental consequences are comparable regardless of which source reduces the emissions, allowing the second source to pay the first to make extra reductions achieves the same emissions level at lower overall cost than prescribing the same standard for both sources (i.e., about $2 instead of $1001 for the first two tons).
  - When the regulator has less information than the regulated entities have about compliance costs and utility differentials, marketable permit approaches may be advantageous. In the above example, if the regulator lacks information on which sources face either $1 or $1000 per ton costs, the regulator would do a poor job of prescribing individualized emissions standards. The market can more easily identify the best opportunities.
  - The case for markets initially rises with increasing stringency, because the potential for large cost savings increase as compliance becomes more expensive. However, at the point when increased stringency demands every source to comply maximally, there will be little room left for efficient trades. With low abatement costs and very high monitoring costs, prescriptive regulation may be more efficient than market-based regulation.
- Compared to prescriptive regulation, marketable permit approaches may be better able to handle regulating a large number of heterogeneous or small sources. Marketable permits may also be appropriate when regulating more sophisticated actors, like large power plants.
  - Ideally, permittees should be sufficiently sophisticated and knowledgeable about their choices to make efficient decisions in the market. If a market contains small sources that will trade infrequently, regulators may need to provide training and technical assistance.
  - Regulators should be reasonably confident that enough regulated entities will want to participate in a market. A "build and they will come" assumption has not worked well in water quality trading, for example. Sufficient supply and demand must exist to create a competitive and efficient market.
  - Marketable permit programs may work better when covered entities do not compete directly in product markets, or at least are unlikely to be tempted to use the permit market to influence the product market in anti-competitive ways.
- Regulators need at least implicit regulatory authority from broad statutory language, or else explicit authority, to create a marketable permit program.
  - Regulators should also have sufficient legal authority to monitor permit markets for fraud, manipulation, and other abuses.

Even when marketable permit programs are legally authorized and are advantageous compared to traditional regulation, following some best practices for market design and oversight will increase the benefits of marketable permits.

- Clear and consistent legal standards will reduce uncertainty for market participants.
    - Several marketable permit programs do not have explicit statutory authority, including water quality trading under the Clean Water Act. Courts have expressed some concern about the lack of explicit authority. Though agencies may successfully rely on their discretion to interpret broad statutory language, **if marketable permit programs exist without explicit statutory authority, Congress should consider endorsing those programs. Agencies should communicate to Congress any legal barriers to marketable permits.**
    - Courts have also at times struggled to distinguish permissible regulatory fees from unconstitutional regulatory taxes. To preemptively protect the legal status of permit auctions in future litigation, **agencies should emphasize the market management and distributional reasons for choosing auctions besides raising revenue, to avoid potential categorization of the permit auction as an impermissible tax.**
    - Referring to marketable permits as "property rights" may create misleading perceptions about permits' permanence or compensation for takings. At various points the Clean Air Act refers to the auctioning of "emissions rights." **Congress and agencies should avoid creating misperceptions by calling marketable permits "rights," and should instead use the language of marketable licenses or obligations.**
    - While requiring agencies always to adopt codified regulations to establish marketable permit programs would limit flexibility, lack of clear guidance from federal agencies has at times confused federal field officers, state implementers, and market participants. **Guidance on marketable permit programs should minimally go through public notice and comment, and agencies should consider codifying regulations to resolve lingering uncertainty or inconsistencies.**
- Some design features will enhance the natural cost-efficiencies or distributional benefits of marketable permits.
    - In cap-and-trade programs, regulators typically allocate permits either by auction or free allocation to historical users of the resource (a.k.a., "grandfathering"). Grandfathering can be inequitable, as it awards the regulated industry a windfall enrichment and creates barriers to new entry. **Federal agencies should opt for auctions over grandfathering to prevent windfalls and barriers to entry, and should encourage states to use an auction-and-dividend approach to return revenue to consumers and taxpayers. If auctions are not feasible, agencies should consider alternate allocation techniques.** Alternate techniques include setting aside a reserve pool of permits for new entrants; allocating pollution permits based not on historical emissions but on electricity output, to reward renewable energy generators; and community-based allocations, like the 40% of fish catch shares that New Zealand awards to the Maori, so the community can protect its own interests.
    - To better guarantee achieving the desired level of activity, **agencies should cap the total activity level, rather than just capping the rate of activity.** (For example, in a hypothetical market to control the issuance of antibiotic prescriptions, cap total prescriptions, not just the number of prescriptions a doctor can write per patient.) Similarly, **to facilitate adjusting the cap over time, agencies should consider allocating percentages of a cap, rather than allocating absolute subunits of a cap.**
    - To use the market's advantages to enhance policy effectiveness, **agencies should focus on fine-tuning the cap's stringency in light of cost savings and should allow open access to the**

market so citizens can retire credits. "Retirement ratios"—such as requiring the purchase of 11 credits to offset 10 pounds of pollution, with the extra credit "retired"—undermine a program's efficiency and should be avoided unless it is impossible to tighten the cap itself.

- **Agencies should have clearly defined criteria for credit approval, to ensure credits are "real."** Credit approval systems should not reward behavior that would have happened anyway ("additionality"), should allow for predictable and repeatable calculations, should address uncertainty, and should avoid double-counting. Credit approval programs should include procedures for selecting clear baselines, developing predictable and pre-approved calculation tools, and establishing policies on "credit stacking" (i.e., allowing a single project to generate credits for multiple permit markets). Uncertainty trading ratios—requiring an extra cushion of credits to buffer against the risk of inaccurate calculations or unpredictable outcomes—should be based on science, consistently applied, and kept transparently distinct from any other trading ratios (like ratios to manage hot spot risks).
- **Agencies should establish clear rules for liability and responsibility for acts of nature.** Performance bonds and reserve pools may be useful tools.
- **Marketable permit programs need clear, adequate sanctions**, ideally including both penalties and plans for coming into compliance.
- **When possible, regulators should pursue economies of scale in management, for example by spreading the costs of credit registries over multiple species or multiple fisheries. Federal agencies should provide clear guidance on trading policy to regional and state officials, including through trainings.** Public trainings are also useful.

- Careful oversight of markets will help prevent fraud, manipulation, and other inefficiencies.
  - **If direct agency oversight is not efficient and self-verification is not effective to verify credits, agencies should set standards to ensure that third-party credit verifiers are qualified, insured, and conflict-free.**
  - In some marketable permit programs, robust secondary markets have been slow to develop without active involvement of regulators. For example, EPA's market for vehicle emissions provides no centralized setting for trading, and the agency does not disclose the prices of traded permits, which raises the costs of participating in the market and possibly explains initial low trading volumes. **Regulators should consider whether they can address barriers to efficient secondary transactions, for example by facilitating price discovery.** Without revealing proprietary or confidential business information, regulators should act as information brokers, collecting and disseminating data on trade prices and volumes. Regulators can also help minimize transaction costs and ensure adequate market participation by supporting or operating brokerages or exchanges.
  - Though the Commodity Futures Trading Commission (CFTC) has fairly comprehensive authority over derivative markets, it has not fully exercised its authority with respect to derivatives based on permit markets. **CFTC should monitor active derivative markets relating to regulatory permits and exercise its authority to prevent fraud, manipulation, and excessive speculation.** CFTC should set position limits for active permit derivatives or require permit derivatives be traded on exchanges.
  - Neither CFTC nor any other agency has comprehensive authority to oversee secondary permit markets. However, compared to relatively unregulated "over-the-counter" transactions, secondary transactions conducted on registered exchanges are subject to some CFTC oversight. **CFTC should consult with other agencies on the oversight of secondary permit markets, and should identify to Congress any need for additional statutory authorities to regulate permit markets. Agencies should presumptively limit secondary trading of allowances and credits to exchanges, as appropriate and consistent**

with their legal authority. Exceptions could be made for over-the-counter contracts that cannot be standardized, like forward contracts for the delivery of offset credits. **Permit market regulators should explore additional memoranda of understanding with related agencies.** In particular, permit market regulators should develop relationships with CFTC to coordinate investigative and enforcement activities.

- **Regulators should adopt position limits on purchasing and holding marketable permits, or employ other tools to adequately prevent monopolies, excessive speculation, and other manipulations.** Additional tools include careful auction design, reporting requirements, transparent price information, effective surveillance, and price circuit breakers. "Circuit breakers," which limit how much prices can rise or fall in a given period, can also help manage price volatility caused by reasons other than fraud. **Agencies should prevent extreme price volatility by creating broad markets, allowing the banking and borrowing of permits over time, or using circuit breakers, safety valves, or reserve pools.**
- Regulators need to thoroughly track transactions and holdings. **Marketable permit programs should assign unique serial numbers to allowances and credits. Registries should track the status of each allowance and credit in as close to real time as practical, as well as transaction prices and each account's total holdings.** That does not necessarily mean such information should be publicly disclosed in real time. **Regulators need to monitor international markets and related private markets as well.**
- To balance the public's need for transparency against confidentiality concerns, **agencies should implement a system of weekly disclosures of aggregate market information, to allow the general public to assess the marketable permit program's efficiency and effectiveness.** Agencies should release any non-confidential data that would help the public gauge a market's policy effectiveness, and should periodically assess both the policy and economic effectiveness of a program.
- **Marketable permit regulators should develop communication policies to prevent pre-publication leaks and information asymmetries.**

Overview of Research Methodology and Scope

Research for this project began with a thorough review of the legal literature on marketable permits, as well as a more targeted review of the economic literature on the advantages, disadvantages, challenges, and past successes and failures of various marketable permit programs. Existing marketable permit programs were further identified through searches of the U.S. Code and the Code of Federal Regulations, key agency websites, and case law on the legal status of marketable permit programs. Evaluations of the economic and policy effectiveness of programs, from regulatory agencies; investigative agencies like GAO, CBO, and CRS; consultants; think tanks; and advocacy groups that were available online were reviewed. Notable state and foreign marketable permit programs were also examined when relevant. The legal authorities of the Commodity Futures Trading Commission and other potential oversight agencies to supervise federal and interstate permit markets were assessed through statutory analysis and review of the relevant literature. Informal conversations with six experts on marketable permits were also conducted.

The research and recommendations focus on factors for weighing the appropriate applications of marketable permit programs and the general management of an efficient and effective permit market. Some complex and highly context-specific issues, such as the most efficient bid structure for permit auctions, are not covered.

I. What Are Marketable Permits?

A. Overview: Characteristics of a Prototypical Marketable Permit Program

Marketable permits are regulatory tools designed to allocate privileges or obligations more efficiently by harnessing the market's decision-making powers. Marketable permits are intended to lower compliance costs, ease administrative burdens, and incentivize innovation more than traditional regulatory approaches, all while (in theory) achieving policy goals with greater certainty. They have been used most prominently to advance environmental and energy policies, though they have other applications, such as in transportation policy (addressing aerospace congestion and allocating taxi medallions) and communication policy (allocating electromagnetic spectrum).

Marketable permits depart from the prescriptive, inflexible, or highly particularized approaches often seen in traditional regulation. Traditional environmental regulation, for example, may require each individual polluter to comply with a specific standard and may even prescribe exactly which technological or operational changes sources must make to comply. Such an approach might, for instance, require each individual power plant to limit greenhouse emissions to the same numerical maximum of pollution per unit of electricity generated—regardless of whether compliance may be vastly more expensive for some plants while other plants could cheaply reduce emissions even further beyond the numerical limit. As an example in a different context, traditional licensing of access to the electromagnetic spectrum was similarly particularized and inflexible: individual applicants had to navigate long, complex administrative hearings, and once spectrum was assigned it may have been difficult to reassign.

By contrast, marketable permits rely on the market to identify the most cost-efficient way to allocate regulatory privileges or obligations. For example, under a marketable permit system for greenhouse gases called "cap-and-trade," a regulator would first set an overall maximum budget of permitted emissions per time period. The regulator would then initially allocate those emission allowances to the regulated sources, and may further authorize unregulated sources to generate additional "credits" or "offsets" for sale by voluntarily undertaking verified emissions reductions not otherwise required by law. Because the allowances and credits can be traded between sources, the marketable permit system empowers individual regulated sources to decide for themselves, based on their own abatement costs, what emissions reductions to make and how: they can choose to emit as many tons as they can afford to buy additional permits for, or they can reduce emissions and sell any unused permits for profit, all without (in theory) losing any regulatory benefits. Similarly, instead of forcing regulators to divine how to allocate electromagnetic spectrum to the highest value uses, by auctioning off spectrum licenses and allowing subsequent re-sales and leases, regulators entrust the market to identify the most valuable use of the resource.[1]

Though there are many variations, a prototypical marketable permit scheme entails the following steps:

- First, a regulator determines the quantity of privileges or obligations to be allocated. This determination may take the form of a cap on tons of pollution emitted or tons of fish caught per year, a baseline level of ecosystem services from wetlands or other habitat that must be maintained, or the amount of spectrum or number of airport landing slots to be allocated.

[1] *See* Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 3 (1981) (explaining market-based regulation helps ensure that firms with highest-value use of the resource will obtain the permit).

- Second, a regulator allocates those privileges or obligations. The initial allocation may be by open auction; by lottery, either for free or with a fixed price per allocation awarded; by criteria-based rules, such as historical use of the resource, again either free or with a fixed charge; or by approving the sale of verified credits generated by unregulated sources or third parties.
- Third, the regulator determines the rules for trading permits on a secondary market.
- Finally, the regulator monitors permit transactions and holdings, and compares holdings to the use of the common resource to determine compliance. For example, under a greenhouse gas cap-and-trade system, each allowance or credit authorizes the emission of one ton of greenhouse gases, and each regulated source must hold enough permits to cover its total actual emissions over the compliance period.

B. Concepts and Definitions

1. Definition and Categorization of Marketable Permits

Marketable permits are, first and foremost, *permits*: they are government-created licenses or obligations for a specific level of a particular activity. Often they ration use of common public resources like clean air, fisheries, or electromagnetic spectrum,[2] but in addition to such marketable privileges, marketable obligations also exist, like tradable requirements to produce renewable energy.[3]

What distinguishes *marketable* permits is that they can be bought or sold independently of any real property or other interest. Independent alienability is a crucial distinction, since many permits can be transferred together with the sale of a business or underlying assets. For example, if a factory previously secured a traditional, prescriptive air pollution permit to authorize its emissions, when the factory is sold the permit may transfer, too, and the permit has its own value that contributes to the overall sale price.[4] What makes marketable permits special is that they can be exchanged by themselves on markets. Those markets are often regulatory creations as well and require careful oversight.

Marketable permits can be traded on primary markets, secondary markets, or both. Primary markets refer to the first transfer of permits and include auctions of allowances or licenses as well as sales of credits generated by approved third parties. Secondary markets include all subsequent transfers of the permits, including spot transactions and forward contracts. Some permits that are tradable on a secondary market are not allocated in the first place by a market mechanism like an auction, but rather are distributed by lottery or criteria-based rules.[5] Some permits initially allocated on a market by auction or credit sale may then have limited or no transferability on secondary markets. Some secondary permit

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[2] Tom Tietenberg, *Tradable Permits in Principle and Practice*, *in* Moving to Markets in Environmental Regulation: Lessons from Twenty Years of Experience (Jody Freeman & Charles Kolstad eds., 2006).

[3] Kirsten Engel, *Dormant Commerce Clause Threat to Market-Based Environmental Regulation: The Case of Electricity Deregulation*, 26 Eco. L. Q. 243 (1999).

[4] Jonathan Remy Nash, *Framing Effects and Regulatory Choice*, 82 Notre Dame L. Rev. 313 (2006). A few fish quota share programs typically grouped with individually transferrable quota programs may, in fact, only allow transfer of the fish catch share along with the fishing license. *See* Katrina Wyman, *Why Regulators Turn to Tradable Permits: A Canadian Case Study*, 52 U. Toronto L.J. 419 (2002); *see also* Nat'l Marine Fisheries Serv., Catch Share Spotlights (the Bering Sea Groundfish Cooperative allows transfer of quota with vessel). Such programs, even if often called marketable permit programs, would not be included under this report's definition.

[5] Hybrid structures are also possible. For example, most acid rain permits are freely allocated, but a zero-revenue secondary auction requires holders to publicly auction 2.8% of permits each year, sold at actual bid prices (rather than at a single market-clearing price), with revenue distributed pro rata back to sellers from whom the permits were withheld, rather than to government. Jonathan Nash & Richard Revesz, *Markets and Geography: Designing Marketable Permit Schemes to Control Local and Regional Pollutants*, 28 Ecol. L. Q. 569 (2002).

markets also give rise to separate derivative markets, where futures, options, and swaps based on the value of the underlying permit are traded.

Unlike commodity or property markets, in marketable permit systems the government principally controls both supply and demand.[6] For example, in a greenhouse gas cap-and-trade system, the government controls supply by determining the cap on total emissions allowances and controls demand by legally requiring regulated sources to hold enough permits to cover their emissions. The control is never absolute: a factory could always relocate to a different jurisdiction, or a fisher to state waters, to avoid being forced into the federal market. And control over demand is always mediated by outside factors like innovation: a factory that develops the techniques to mitigate its own emissions need not enter an auction for emissions allowances. Marketable permits are usually discussed separately from other types of government sales, like auctions of government-owned oil and gas deposits, where supply is even more heavily influenced by private and international sources, though perhaps the distinction is only a matter of degrees.[7]

Two main categories of marketable permits, which can exist in combination, are cap-and-trade programs and credit trading programs. Though the term "cap-and-trade" is most often associated in political debates with pollution reduction measures, the cap-and-trade framework applies to a range of marketable permit schemes, including the allocation of a capped number of tradable licenses in electromagnetic spectrum or aerospace. In cap-and-trade programs, regulators set an "absolute baseline" by capping the budget of emissions allowances or allowable fish catch or number of airport landing slots. In credit trading, regulators set a "relative baseline": for example, regulators may set a goal of no net emissions increases or no net loss of wetlands, and then any new entrants seeking to increase air emissions or destroy wetlands must purchase offsetting credits sold by third parties that voluntarily reduce their emissions or create new wetlands.[8] Regulators must set standards to determine the number of credits that may be sold and to verify that the credits represent real mitigation.[9] Cap-and-trade and credit systems can be combined. For example, in a greenhouse gas cap-and-trade program, unregulated sources may also be allowed to voluntarily reduce their own emissions and sell verified credits into the cap-and-trade market.

2. Distinction from Other Market-Based Tools: Bubbles, Banking, and Fees

Other market-based regulatory tools, such as bubbles, averaging, and netting, are often grouped together with marketable permits.[10] These tools, common in environmental policy, allow single firms or sources, or units within such sources, to trade emission reduction requirements internally across location and time, so long as the overall average or net emissions meet the regulatory requirements. Because these approaches only involve internal, intra-firm decision-making, they raise fundamentally

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[6] *See* James Salzman & J.B. Ruhl, *Currencies and the Commodification of Environmental Law*, 53 Stanford L. Rev. 607 (2000) (citing Royal C. Gardner).

[7] A marketable permit program, wherein a central regulator determines optimal amount of tradable permits for use of a common resource, is different from scheme where all of the resource is allocated to private parties who then negotiate to achieve their optimal allocation. *See* Michael Livermore, *Reviving Environmental Protection: Preference-Directed Regulation and Regulatory Ossification*, 25 Va. Envtl. L. J. 311 (2007). Federal auctions of rights to access coal, oil, gas, and mineral deposits are not discussed in this report, even though such licenses may sometimes be transferred between parties with government approval. *E.g.*, 30 U.S.C. § 1411-1428 (Deep Seabed Hard Mineral Resource licenses may be transferred with NOAA approval).

[8] Tietenberg, *Tradable Permits*, *supra* note 2.

[9] T.H. Tietenberg, Emissions Trading: Principles and Practice 18-19 (2006, 2d ed).

[10] *See* Robert Hahn & Gordon Hester, *Where Did All the Markets Go? An Analysis of EPA's Emissions Trading Program*, 6 Yale J. Reg. 109 (1989).

different management issues compared to marketable permit systems, which create new regulatory markets and require oversight of risks like market power and price manipulation.

The same is true of banking and borrowing, which allow the temporal trading of regulatory privileges or obligations over time, such as over-complying with an emissions limit this year to generate credits to offset additional emissions in future years. While banking and borrowing can play important roles in marketable permit programs, they can also be applied under more prescriptive and particularized regulatory approaches, to allow some intra-firm, temporal flexibility about compliance decisions. Banking and borrowing are only addressed in this report to the extent they present special challenges in the market context, such as how banking may contribute to the risk of hoarding permits.

Finally, regulatory fees and marketable permits share many similar features and, at least in theory, could be somewhat interchangeable. Compare, for example, a carbon tax with a cap-and-trade program for greenhouse gases. If the government sets the carbon tax accurately, firms will pollute only up to the point when paying the tax exceeds the value of the underlying activity, thus achieving a certain limit on total pollution much the same way a cap would. Conversely, if the government sets the cap and regulatory requirements accurately, supply and demand in the cap-and-trade market will balance to reach a set price for emissions allowances, which will act very similarly to a carbon tax set at that same price. Theoretically, both fees and marketable permits share the same kinds of economic advantages over traditional, prescriptive regulation.[11]

However, many similarities break down under real-world uncertainty.[12] For example, uncertainty about abatement costs may mean that actual emissions reductions cost more than the regulator anticipated. In that scenario, a cap-and-trade program can still guarantee the desired environmental outcome by virtue of the hard cap on total emissions, but the increased demand for allowances will mean the program's total compliance costs will exceed expectations. Uncertainty over abatement costs interacts with a tax in exactly the opposite way: per-unit compliance costs will still be guaranteed because firms facing costly abatement options can opt to pay the set tax, but as more firms opt to pay the tax rather than abate, total emissions will exceed expectations. The same pattern occurs with uncertainty about future economic growth: a cap-and-trade program will continue to guarantee a limit on emissions even if demand for the polluting activities rises with economic growth; a tax, on the other hand, can not stop firms from choosing to simply pay the tax to increase emissions in order to increase output.[13] Some theories predict that marketable permits will perform better than fees in the face of imperfect enforcement;[14] some theories suggest that when marketable permit prices fluctuate too much, fees are preferable for sending the kind of consistent price signals necessary for long-term capital investments.[15] Ultimately, neither marketable permits nor fees are the unambiguously superior choice.

For the most part, this report will not discuss regulatory fees further. The "in-lieu fees" allowed for wetland mitigation are best thought of not as true fees, but as a kind of advance payment on a credit, and are discussed as such in this report. Because permit auctions can strongly resemble regulatory fees,

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[11] *See* William Pizer, Dallas Burtraw et al., *Modeling Economywide vs Sectoral Climate Policies Using Combine Aggregate-Sectoral Models* 7 (RFF 05-08, 2003, republished as 27 Energy J. 135 (2006)) (explaining that, under certain conditions, marketable permits and taxes are "equivalent policies"); Gilbert Metcalf & David Weisbach, *The Design of a Carbon Tax* 3 (Univ. Chicago Public Law & Legal Theory Working Paper 254, 2009) (explaining the design issues are largely similar).
[12] OECD, Environmental-Related Taxes and Tradable Permit Systems in Practice (2008).
[13] Robert Stavins, Market-Based Environmental Policies: What Can We Learn from U.S. Experience (and Related Research)? 29, *in* Moving to Markets, *supra* note 2; Marshall J. Breger, Richard B. Stewart, E. Donald Elliott & David Hawkins, *Providing Economic Incentive in Environmental Regulation*, 6 Yale J. on Reg. 463 (1991) (tradable permits handle economic growth more automatically than taxes, because taxes are fundamentally rate-based, not mass-based).
[14] T.H. Tietenberg, Emissions Trading: Principles and Practice 176 (2006, 2d ed).
[15] Interview with Don Elliott.

and because courts could question whether permit auctions represent an unconstitutional tax, the legal status of auctions as compared to regulatory fees is discussed below. Regulatory fees are also distinct from user fees, which is a charge on a particular service to recoup the government's costs. User fees may be applied in conjunction with marketable permit programs to cover the costs of monitoring transactions and compliance.

It is notable that marketable permits and regulatory fees can be applied simultaneously and can interact both as complements and as substitutes. For example, the Environmental Protection Agency developed a cap-and-trade program for ozone-depleting substances, but in 1989 an excise tax was added to compensate for the windfall profits from the initial allowance allocation (see below for more on allocation options and windfalls). Eventually the tax increased enough that it, not the allowance cap, controlled production.[16] Permit markets can also be designed with features that approximate taxes. For example, regulators can set a ceiling on permit prices in an emissions allowance market or set a fixed penalty for any excess emissions once the market hits a certain price.[17] These kinds of "safety valves" on prices are discussed below.

3. Avoided Terminology: "Command-and-Control" and "Marketable Rights"

The literature comparing marketable permit programs with traditional regulatory approaches often refers to the latter as "command-and-control" regulation. This terminology seeks to draw the line between a system that flexibly lets the market decide how to allocate regulatory privileges and responsibilities, and a system that "commands" each individual regulated entity to "control" their actions in a highly prescriptive and inflexible manner. An environmental regulation that instructs each regulated source to install a particular technological or operational system of emissions control (often called a "design standard" or "work practice standard") is the stereotypical "command-and-control" regulation.

However, such prescriptive design and operational standards are relatively rare these days; environmental regulators today, when not applying market-based tools, typically prefers a more flexible "performance standard" that allows a source to achieve its individual emissions target however it sees fit. Even many technology-based regulations are not "uniformly prescriptive," but rather are tailored to individual sources.[18] Uniformly prescriptive design and operational standards are most often still applied to environmental problems when measuring a source's performance would be difficult or impossible, as with "fugitive" emissions that cannot be readily measured from the end of a smokestack. Because environmental market approaches require the regulator to monitor actual emissions against the number of permits held, marketable permits are, in fact, an unlikely alternative to the true "command-and-control" regulations applied to these hard-to-measure problems.[19]

Since even the staunchest advocates of market-based tools admit a continuing need for traditional regulation in certain circumstances, scholar David Driesen suggests avoiding the disparaging and misleading terminology of "command-and-control."[20] Others, such as Jody Freeman and Charles Kolstad, have copied that approach,[21] and this report will, too. Because what truly distinguishes marketable

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[16] T.H. Tietenberg, Emissions Trading: Principles and Practice 10 (2006, 2d ed).
[17] Breger, Stewart, Elliott, & Hawkins, *supra* note 13.
[18] David Driesen, *Is Emission Trading an Economic Incentive Program?*, 55 Wash. & Lee L. Rev. 289 (1998) (for example, best available control technology under the Clean Air Act, and various standards under the Clean Water Act).
[19] *Id.*
[20] *Id.*
[21] Jody Freeman & Charles Kolstad, Preface, *in* Moving to Markets, *supra* note 2.

permits from traditional regulations is the specificity and rigidity about who must comply, this reports uses the terms "traditional," "prescriptive," or "particularized" regulation instead.

This report also does not follow some of the literature in referring to "marketable rights." The word "rights" implies a permanence or property status that may not apply to marketable permits (see below on property).[22] Instead, this report uses the terms "permits" or "licenses."

C. The History and Current Applications of Marketable Permits

1. The Evolution and Future of the Idea of Marketable Permits

Expanding on Ronald Coase's influential 1960 article *The Problem of Social Cost*, Thomas Crocker and John Dales developed the idea of tradable pollution permits in the 1960s.[23] The idea steadily gained proponents in academic circles and among U.S. regulatory experts through the 1970s and 1980s, with the Environmental Protection Agency beginning to experiment with tradable permits and credits for air pollution. As Richard Revesz and Michael Livermore recount, "The concept entered the [U.S.] political arena in the 1980s, when C. Boyden Gray, then a high-ranking Reagan Administration official, promoted it as a preferable approach to the traditional method of addressing air pollution."[24]

The 1990 amendments to the Clean Air Act ushered in an age of growing bipartisan political support for the idea of marketable permits. That legislation, which authorized EPA's landmark acid rain permit market, passed by overwhelming bipartisan majorities in both chambers of Congress and was signed into law by President George H.W. Bush.[25] From there the consensus grew, as did the number and range of applications.[26] For example, Presidents Bill Clinton, George W. Bush, and Barack Obama all turned to marketable permits to deal with problems of cross-state air pollution. The year 2008 was a high watermark, with both candidates for president (Barack Obama and John McCain) supporting cap-and-trade for greenhouse gas emissions. In general, President Obama's administration embraced marketable permits, applying them to greenhouse gas and interstate air pollution controls, and issuing a presidential directive to further encourage conservation banks for the mitigation of wetlands and endangered species habitat.[27] Though both Democrats and Republicans have at times resisted applying marketable permits to particular policy contexts,[28] historically marketable permits have enjoyed bipartisan support.

The new Trump administration is expected to back away from President Obama's plans for national greenhouse gas regulation and may attempt to roll back other regulatory systems that currently rely on marketable permits. However, marketable permits were long a favorite tool of Republicans, lauded for

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[22] Breger, Stewart, Elliott, & Hawkins, *supra* note 13 (statement of Hawkins).

[23] T.H. Tietenberg, Emissions Trading: Principles and Practice 2-4 (2006, 2d ed) (Crocker first applied trading to air pollution, Dales to water pollution); Lesley McAllister, *Beyond Playing "Banker"*, 59 Admin. L. Rev. 269 (2007).

[24] Michael Livermore & Richard Revesz, *Interest Groups and Environmental Policy*, Envtl. L. 12-13 (2015).

[25] EPA, Legislative Chronology: Clean Air Act Amendments of 1990, http://www3.epa.gov/ttn/caaa/gen/chron.txt.

[26] Michael Livermore & Richard Revesz, *Interest Groups and Environmental Policy*, Envtl. L. 10-11 (2015).

[27] Presidential Memorandum, Mitigating Impacts on Natural Resources from Development, Nov. 3, 2015.

[28] For example, Congressional Republicans labeled cap-and-trade proposals for greenhouse gas emissions as "cap-and-tax" and opposed such proposals as harmful to the economy and employment. House Republicans, *A Pledge to America: A New Governing Agenda Built on the Priorities of Our Nation, the Principles We Stand for & America's Founding Values* 43 (2010). Democrats have also attacked marketable permit ideas as "taxes." A plan from George W. Bush's Federal Aviation Administration to auction off landing slots at congested New York airports, 73 Fed. Reg. 60,544 & 60.574, was labeled a "sky tax" by New York's Senator Chuck Schumer. Schumer led the Democratic charge to pass an appropriations rider temporarily blocking the auction in 2009, Omnibus Appropriations Act of 2009, and later that year the Obama administration rescinded the rule, 74 Fed. Reg. 52132 & 52134.

achieving policy goals at the lowest cost. It is possible that, under a Trump administration, marketable permits could see a resurgence, perhaps in areas where they have not yet fully flourished, like water quality trading. Regardless, marketable permit programs will continue at the state level, and federal agencies may be called upon to oversee interstate markets.

2. Overview of Existing Federal and Interstate Applications

This section provides background on the application of marketable programs to federal regulation, including marketable programs implemented by states to meet federal standards, as well as interstate applications that may necessitate some federal oversight of markets.

a) Air Pollution Markets

A number of prominent marketable permit programs exist to implement provisions of the Clean Air Act. The Clean Air Act's program to allow new sources to trade offsetting credits of "criteria"[29] pollutant reductions began in 1974.[30] Starting in 1982, EPA allowed permit trading to help phase out lead from gasoline.[31] (Technically, the lead phase-out program is no longer an "existing" program, as its goal of zero lead in gasoline has long been achieved.)

The 1990 amendments to the Clean Air Act included two significant provisions on marketable permits. First, they mandated a system of tradable sulfur dioxide emission allowances to address power plants' contributions to acid rain. For years, the acid rain program has been held up as a paradigm of market-based regulation. Despite seeing significant trading activity through much of its life, recently the acid rain market has become somewhat less important, as other regulations have partly superseded it.[32]

The 1990 amendments also explicitly authorized states to use marketable permits to implement the various federal standards they are responsible for through their "state implementation plans," or SIPs. When states fail to properly implement the Clean Air Act's standard, EPA steps in with a "federal implementation plan," or FIP. In 1994, a group of states organized a system for trading obligations to reduce nitrogen oxide emissions. EPA subsequently expanded on those efforts by proposing marketable permit solutions to problems of interstate pollution. These efforts included President Clinton's 1993 NOx SIP Call, President Bush's Clean Air Interstate Regulation, and President Obama's Cross-State Air Pollution Regulation. Various other SIPs and FIPs use marketable permit programs for visibility and other air pollution issues.[33]

The most famous (or infamous, depending on who you ask) and well-studied use of marketable permits under a SIP is the urban smog trading program administered by the South Coast Air Quality Management District as part of California's SIP. The program, known as RECLAIM, consists principally of a mandatory cap-and-trade for large sources of smog-producing pollutants, as well as related voluntary programs to generate credits from smaller "area sources" and from scraping fleets of older, heavily-polluting cars.[34]

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[29] Criteria pollutants are the six widely emitted pollutants for which EPA sets ambient air quality standards: particulate matter, sulfur dioxide, nitrogen dioxide, ground-level ozone, carbon monoxide, and lead.
[30] E.g., 42 U.S.C. § 7503(c) (allowing offsets to comply with non-attainment new source review).
[31] 47 Fed. Reg. 49,322 (Oct. 29, 1982) (called "inter-refinery averaging").
[32] Benjamin Leard & Virginia McConnell, *New Markets for Credit Trading under U.S. Automobile Greenhouse Gas and Fuel Economy Standards* (Resources for the Future Discussion Paper 15-16, 2015).
[33] 56 Fed. Reg. 5173 (1991); *see also* 70 Fed. Reg. 58,154 (2003).
[34] Nash & Revesz, *supra* note 5.

EPA has finalized various emission standards for vehicles that allow "averaging, banking, and trading" (ABT) among and between car manufacturers.[35] However, there has been very little if any trading between manufacturers under these programs,[36] at least until the recent greenhouse gas standards for motor vehicles (discussed below).[37]

b) Climate Change and Stratospheric Ozone Markets

Because global pollutants like greenhouse gases and ozone-depleting substances have few if any localized effects, total emission reductions matter much more than which source is making those reductions. As a result, global pollutants are ideal candidates for marketable permits. Compared to applications of marketable permits to local and regional pollutants like sulfur dioxide, marketable permit programs for global pollutants may encounter fewer problems with fungibility and therefore may need fewer exchange restrictions (see below on fungibility and exchange restrictions).

In 1988, EPA created a marketable permit program for ozone-depleting chlorofluorocarbons, which included both a cap on tradable production allowances and credits for certified destructions of the harmful substances.[38]

In the second term of the Obama administration, EPA issued the Clean Power Plan standards for carbon dioxide emissions from existing coal- and gas-fired power plants. The standards, to be implemented by the states, can be achieved through marketable permits, emission taxes, or any other approaches that states prefer. EPA expected most states to either opt into regional or national cap-and-trade programs, or else defer to a federal implementation plan that would use marketable permits. The Clean Power Plan is currently being litigated before the U.S. Court of Appeals for the District of Columbia, and the new Trump administration is anticipated either to not advance implementation of the standards or to attempt to repeal the standards.

Nevertheless, greenhouse gas markets will continue to operate at the state level. Several New England states have developed the Regional Greenhouse Gas Initiative for carbon pollution for their power plants, and California has begun implementing a state-wide greenhouse gas cap-and-trade program. California's program authorizes both linking permit markets with and purchasing offsets from Canada. Federal agencies may need to supervise such interstate and international markets.

Market-based programs for vehicles' greenhouse gas emissions are discussed below, since EPA issued them jointly with the Department of Transportation's vehicle efficiency standards. Energy efficiency and renewable energy programs, while contributing to greenhouse gas reductions, are focused on more than environmental benefits, including issues like national security and consumer cost savings.

c) Renewable Energy Credits and Vehicle Efficiency Trading

In 2010, EPA and the Department of Transportation's National Highway Traffic Safety Administration (NHTSA) finalized joint standards to regulate the greenhouse gas emissions from passenger motor vehicles and to increase the fuel efficiency requirements; similar joint proposals on heavy-duty trucks followed. Trading credits among vehicle manufacturers is permitted to achieve these standards, and EPA and NHTSA technically each operate separate trading programs. Though at first some researchers

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[35] Heavy-Duty Engines, 55 Fed. Reg. 30,584 (1990).
[36] EPA, Manufacturer Performance Report for 2015 MY (2015).
[37] For other programs with marketable permit elements, see also the Oxygenated Gas Credit Program, 57 Fed. Reg. 47,853 (1992), and the Clean Fuel Fleet Emission Standards, 58 Fed. Reg. 32,474 (1993).
[38] T.H. Tietenberg, Emissions Trading: Principles and Practice 9 (2006, 2d ed).

expressed concerns about the limited number of transactions on the markets and the corresponding risk of monopolies forming, in recent years the markets have been relatively "active."[39]

In the Energy Policy Act of 2005,[40] Congress mandated that EPA develop a Renewable Fuel Standards (RFS) program, to require fuel importers and refiners to blend a certain proportion of renewable fuels together with any fossil fuel-based gasoline sold. Importers and refiners may purchase and blend renewable fuels directly, or they may purchase credits (called RINs, for renewable identification numbers) from generators of renewable fuels.

Many states apply similar requirements to their electricity producers. As of August 2016, 29 states, the District of Columbia, and three U.S. territories have renewable electricity standards (often called Renewable Portfolio Standards, or RPS).[41] Because states may allow interstate or even international trading of renewable energy credits or certifications (RECs), and because individual states may lack the authority to oversee adequately such interstate and international markets, federal oversight may be desired to ensure the integrity of these markets. In 2012, states on average sourced 39% of required credits from out-of-state resources (ranging from 94% in Delaware and Missouri, to 0% in New Mexico, Iowa, and Texas); some states traded with Quebec.[42]

The Department of Energy also implements requirements for state-owned fleets of vehicles and certain other large fleets to purchase a set proportion of alternative fuel vehicles. Besides direct purchases of alternative vehicles, these requirements can also be met with marketable credits. The market for credits is small, with only 13 transactions totaling 383 credits traded for model year 2014 (out of about 20,000 credits).[43]

d) Water Quality Trading

Like the Clean Air Act, the Clean Water Act has a cooperative federalism structure, and states are often responsible for implementing federally-set water quality standards. Some Clean Water Act standards are technology-based prescriptive requirements, and EPA does not currently support the use of trading programs to comply with such technology-based limits (though EPA has expressed willingness to consider in the future how even technology-based standards might be met through marketable permits).[44] Other Clean Water Act standards apply more holistically to entire bodies of water, including setting pollution budgets, or total maximum daily loads (TMDLs), for water bodies. Some states use marketable permits to comply with TMDLs and other standards. In particular, trading may be authorized both among point sources and between point sources and non-point sources. A point source, like a factory sitting on a river, is a regulated source with a measurable flow of pollution, often emitted from the end of a pipe. A non-point source, like a farm, has more diffuse, often un-measurable discharges. Because TMDLs provide a fixed cap on pollution and because non-point sources are largely unregulated, water quality trading often takes the form of a cap-and-trade program combined with a credit program.

Compared to air pollution markets, water quality trading has developed relatively slowly. The slow development across the United States could be blamed partly on the slow development of TMDLs themselves. However, even worldwide only a few dozen active water quality trading programs exist, and

[39] EPA & NHTSA, Draft Technical Assessment Report: Midterm Evaluation, 420-D-16-900.
[40] Expanded by the Energy Independence and Security Act of 2007.
[41] Database of State Incentives for Renewables and Efficiency (DSIRE), Renewable Portfolio Standards Policies, http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2017/03/Renewable-Portfolio-Standards.pdf.
[42] NREL, Quantifying the Level of Cross-State Renewable Energy Transactions (2015).
[43] Dept. of Energy-EERE, Fleet Compliance Results for MY2014/FY2015.
[44] EPA, Water Quality Trading Policy, 68 Fed. Reg. 1609 (Jan. 13, 2003).

globally only $32 million in water quality trades took place in 2015, compared to hundred of billions of dollars in worldwide carbon markets.[45]

The first U.S. pilot water quality trading project was at Wisconsin's Fox River in the 1980s.[46] Currently about two dozen active programs exist across 16 states.[47] Because some watersheds cross state lines, some trading programs are interstate as well,[48] like the Ohio River Basin program.[49] Yet as of 2008, only 100 point sources nationwide had participated in water quality trading, and 80% of participants were under a single program in Long Island Sound.[50] More recently, significant water quality trading programs have been developed in the Chesapeake Bay.

e) Natural Resource Mitigation Banks

The Army Corps of Engineers, in consultation with EPA, issues permits for development projects affecting wetlands, streams, and other aquatic resources. Under Section 404 of the Clean Water Act and Sections 9 and 10 of the Rivers and Harbors Act of 1899, the Corps requires permittees first to avoid impacts and then to mitigate any unavoidable effects. Such mitigation can take the form of the creation, restoration, expansion, or preservation of other aquatic resources. In the 1980s, EPA and the Corps disagreed on whether mitigation should be done exclusively on-site by the individual permittees themselves, or if off-site mitigation was also permissible.[51] By 1995, EPA and the Corps issued joint guidance on the use of wetland mitigation banks, wherein permittees purchase mitigation credits from third parties that complete verified creation, restoration, or preservation projects. Approval for "in-lieu fees" soon followed: in-lieu fees are essentially mitigation banks from which credits can be purchased, for a fee, in advance of the mitigation actually being accomplished; by contrast, mitigation banks sell credits for already-completed mitigation projects. By 2014, 52% of projects requiring mitigation used either banks or in-lieu fees rather than permittee-conducted efforts, though in terms of total acres of mitigation, permittee-responsible projects continue to outpace mitigation banks.[52] Nearly 1500 banks and in-lieu instruments have been approved.[53]

Copying the model of wetlands mitigation,[54] the Fish and Wildlife Service (FWS) implemented a conservation bank program for habitat mitigation. Section 10 of the Endangered Species Act allows FWS to grant permits for incidental harms to endangered species.[55] After permittees first try to avoid impacts, they must develop a habitat conservation plan that includes mitigation for the incidental

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[45] Ecosystem Marketplace, State of Watershed Investment (2016); *see also* Ecosystem Marketplace/Forest Trends, State of Watershed Payments (2010) ($118 billion in regulated carbon markets).
[46] Willamette Partnership, *In It Together: A How-To Reference for Building Point-Nonpoint Water Quality Trading Programs* (2012).
[47] *Id.* (As of 2011, 24 active point-nonpoint trading programs across 16 states; 80% of programs focus on phosphorus).
[48] EPA, Water Quality Trading Toolkit (2009).
[49] Willamette Partnership, *In It Together: A How-To Reference Part 2* (2012). EPA noted in comments on the draft version of this report that the Ohio River program is currently voluntary and awaiting regulatory drivers in the form of nutrient or sediment NPDES limits.
[50] Willamette Partnership, *In It Together: A How-To Reference Part 2* (2012); *see also* Industrial Economics Inc. (IEc), Water Quality Trading Evaluation (2008, produced for EPA) (reported "limited practical success").
[51] U.S. Army Corps-Jacksonville District, Key Concepts of Mitigation Banking (2003).
[52] U.S. Army Corps, Institute for Water Resources, The Mitigation Rule Retrospective (2015) (stats for years 2010-2014); *see also* Corps-EPA, Final Rule: Compensating Mitigation for Losses of Aquatic Resources, 73 Fed. Reg. 19,593 (2008) (In 2005, permittee-responsible represented 60% of acres, banks 33%).
[53] U.S. Army Corps, Institute for Water Resources, The Mitigation Rule Retrospective (2015).
[54] FWS, Guidance for the Establishment, Use, and Operation of Conservation Banks (2003).
[55] Also, Section 7 of the Endangered Species Act requires mitigation for actions by federal agencies.

harms.[56] In 1995, the California Department of Fish and Game innovated the first conservation bank,[57] and FWS now allows both conservation banks and in-lieu fees for the required habitat mitigation nationwide.[58] The National Oceanic and Atmospheric Administration (NOAA) is responsible for certain endangered species permits affecting marine resources, and some regional offices of the National Marine Fisheries Service (NMFS) also allow use of conservation banks, though FWS-approved banks far outnumber NOAA-approved banks. As of January 2017, 158 conservation banks had been approved (including 23 sold-out banks and 12 banks pending approval).[59] As with wetlands, use of mitigation banks and in-lieu fees continues to lag slightly behind reliance on permittee-responsible mitigation projects for habitat conservation.[60]

Overall, the use of natural resource mitigation banks has been impressive. As of 2011, U.S. wetland, stream, and habitat conservation banking programs had $2-$3.4 billion in transactions, with 15,000 hectares traded annually.[61]

Conservation bank credits may also be used to mitigate under other programs, like the National Environmental Policy Act,[62] though few examples of such use exist.[63]

f) Tradable Fish Catch Shares

Historically, many fisheries have been overwhelmed by "derby" conditions: a race among licensed fishers to catch the allowed amount before the end of the season. Fishers were incentivized to build bigger, more expensive fleets to try to outcompete each other, and the derby conditions encouraged overfishing and unsafe conditions.[64] Catch share programs that allocate precise quotas to individual fishers can alleviate these inefficient derby conditions. Catch shares can be distributed and made tradable or can be allocated by auction (though no U.S. catch share programs currently use auctions).

The first individually transferrable quota program was established in 1990 by the Mid-Atlantic regional fishery council for catch of surfclams and ocean quahogs; today there are 16 U.S. catch share programs, with varying levels of marketability.[65] Most catch share programs are administered by regional councils; the program for highly-migratory Bluefin tuna is administered directly by the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS). Environmental Defense Fund estimates that 65% of fish caught in U.S. federal waters are under catch shares.[66]

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[56] FWS, Guidance for the Establishment, Use, and Operation of Conservation Banks (2003).
[57] *Id*.
[58] Notice of Final Compensatory Mitigation Policy, 81 Fed. Reg. 95,316 (Dec. 27, 2016).
[59] U.S. Army Corps, Regulatory In-lieu Fee and Bank Information Tracking System (RIBITS), https://ribits.usace.army.mil/ribits_apex/f?p=107:2.
[60] Ecosystem Marketplace, State of Biodiversity Markets (2011) (In 2011, 67% of mitigation was from permittee-responsible activity, 26% from mitigation banks, and 7% from in-lieu fees).
[61] *Id*.
[62] FWS, Guidance for the Establishment, Use, and Operation of Conservation Banks (2003).
[63] *See* NMFS West Coast Region, Conservation Banking Guidance (2015). Initial searches did not reveal any examples of mitigation banking in environmental impact statements under NEPA. The National Oceanic and Atmospheric Administration and the Federal Highway Administration also use RIBITS. FERC allows off-site mitigation, but is not preferred, occurs rarely, and may not be considered trading. *See* Pub. Serv. Co. of Colo., 132 FERC P 61,224, 62,261 (2010).
[64] NOAA, Catch Share Policy (2010).
[65] NOAA, Map of Catch Share Programs by Region, http://www.nmfs.noaa.gov/sfa/management/catch_shares/about/programs_by_region.html.
[66] Katrina Wyman, *The Recovery in U.S. Fisheries*, J. Land Use (forthcoming) (admitting that may be a high estimate; another estimate is 25% of species caught in U.S. fisheries are under catch shares).

g) Markets in Other Common Resources

The Federal Communications Commission (FCC) is responsible for licensing use of the electromagnetic spectrum by television and radio broadcasters, broadband and cellular providers, and other services. FCC has been conducting auctions to distribute licenses since 1994,[67] and has been working to improve the transferability of licenses since 2003.[68] The most famous FCC auction is the ongoing broadcast incentive auction, a first-of-its-kind two-step auction wherein first broadcasters propose sale of their underutilized spectrum and then broadband providers compete to purchase the freed spectrum. Secondary markets for trading spectrum licenses are somewhat constrained, since applicants for transfer must demonstrate that the transfer serves the public interest,[69] and historically FCC only rarely allowed sublease or resale.[70] Various legal[71] and technical limits, like potential interference between users of neighboring bandwidth, sometimes block the secondary transfer of spectrum to a different use than the originally approved use.[72]

Finally, landing slots at congested airports are licensed by the Federal Aviation Administration (FAA). For purposes of this report, landing slots are most relevant for the failed attempt by FAA to auction off some landing slots at New York City-area airports. Private, secondary trades of landing slots between airline operators are also permitted, subject to FAA approval.

3. Notable Local and Foreign Applications

The most important foreign marketable permit programs fall under the United Nations Framework Convention on Climate Change. To implement its collective responsibility to reduce greenhouse gas emissions, the European Union established an Emissions Trading System (EU-ETS). The Framework Convention's Kyoto Protocol also allowed countries with emissions reduction obligations to earn credits by funding mitigation in countries that do not yet have emissions reduction obligations, through a program called the Clean Development Mechanism (CDM).[73] Both EU-ETS and CDM have experienced some issues with market management and fraud, and U.S. markets may learn important lessons by studying those examples. Foreign countries also have a host of marketable trading programs in similar applications as seen in the United States, like air and water quality or fisheries,[74] as well as some additional contexts, like the U.K.'s waste management market for municipal waste.[75] Foreign programs will be referenced in subsequent sections of this report when relevant.

At the U.S. state and local level, some of the best known examples of marketable permits are transferable development rights, liquor licenses, and taxi medallions, as well as water quantity trading.[76] These applications first are notable reminders that marketable permit structures can be used to address

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[67] FCC, About Auctions, http://wireless.fcc.gov/auctions/default.htm?job=about_auctions.
[68] FCC, Secondary Market Initiative, http://wireless.fcc.gov/licensing/index.htm?job=secondary_markets.
[69] 47 C.F.R. § 20.22.
[70] Pablo Spiller & Carlo Cardilli, *Toward a Property Rights Approach to Communications Spectrum*, 16 Yale J. of Reg. 53 (1999).
[71] Jessica Elder, *Voluntary Incentive Auctions: The Benefits of a Market-Based Spectrum Policy*, 20 Comm. L. Conspectus 163 (2011).
[72] FCC, Connecting America: The National Broadband Plan 82 (2010) ("In many spectrum bands, the government issues exclusive flexible use licenses that allow licensees to choose what services to offer and to transfer, lease, or subdivide their spectrum rights. Many spectrum licensees, however, have inflexible licenses that limit the spectrum to specific uses.").
[73] There is also Joint Implementation, which allows trading between Annex I countries.
[74] In fact, Iceland, Canada, and other countries pioneered tradable fish catch shares long before they became popular in the United States.
[75] Breger, Stewart, Elliott, & Hawkins, *Providing Economic Incentive in Environmental Regulation*, *supra* note 13.
[76] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 38, 48-50 (1981).

policy goals beyond the environmental and energy contexts. Additionally, these local applications contain some unique structures that federal regulators can learn from. Take, for example, transferable development rights. Under this land management tool, "a property owner retains ownership of his land but sells his rights to further develop it to another landowner who can use the permit to exceed the density permitted on his land under the applicable zoning. . . . Development rights can be bought, stored or banked, and sold until they are actually used to develop a piece of property."[77] Puerto Rico has interestingly implemented transferrable development rights through a public, rather than private, market: "[T]he Puerto Rico Plan does not allow direct transfers of development rights among private property owners. Rather, the Puerto Rico Planning Board acts as buyer and seller in all development rights transfers."[78] With the government acting as middleman, undesirable transfers can be prevented, but perhaps at the expense of economic and administrative efficiency. Federal regulators should study local applications of marketable permits, and this report will draw from local case studies when useful.

4. Roads Not (Yet) Taken

Though some legal scholars have wondered whether all the good opportunities for regulatory permit markets have already been implemented,[79] a variety of other ideas for marketable permit programs have been proposed over the years.

First, some notable failures and false-starts:

- In the early 1990s, the Federal Aviation Administration (FAA) considered transferrable permits for phasing out noisy aircraft and replacing them with quieter fleets.[80] FAA indicated it would adopt a market-based approach unless public commenters opposed it—and commenters strongly opposed it. First, airport neighbors worried about a problem known as "additionality," which is whether the market inadvertently rewards behavior that would have happened anyway. These concerned neighbors noted that some aircraft operators were already on track to switch to quieter aircraft even without regulations, yet now FAA was proposing to reward them with credits that could be sold to other operators who will then phase-out their own noisy aircraft more slowly than otherwise. Even industry could not get together behind a marketable permit proposal: neither large and small carriers, nor owners and operators could agree on a design for the market. In the face of such lack of consensus support, FAA jettisoned the idea.
- In 2008, FAA issued rules on slot auctions for three heavily congested New York-area airports: LaGuardia, JFK, and Newark.[81] Up until that point, landing slots were allocated free of charge through a licensing procedure. Senator Schumer led the attack against this so-called "sky tax," alleging the auction will hurt customers' pocketbooks. Following a temporary congressional moratorium on the plan, the Obama administration rescinded the rule in 2009.[82] Landing slots continue to have some limited transferability between airlines.
- In 1990, the Army Corps of Engineers rejected the idea of marketable permits for managing shoreline degradation connected to civil works projects. The estimated administrative costs of such a program were cited as justification.[83]

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[77] *Id.* at 37.
[78] *Id.* at 38.
[79] James Salzman & J.B. Ruhl, *supra* note 6. (wondering whether all the "low-hanging fruit" were picked early (e.g., acid rain, lead in gas), and there might be few areas left ripe for markets).
[80] *See* 56 Fed. Reg. 48,628 (1991).
[81] 73 Fed. Reg. 60,544 & 60574.
[82] 74 Fed. Reg. 52,132 & 52,134. Amazingly, the proposal to rescind only received five sets of public comments, all against.
[83] 55 Fed. Reg. 30,690 (1990).

- The original version of the Clean Air Act Amendments of 1990, as proposed by the George H.W. Bush administration, included a national trading system between fuel refiners and automobile manufacturers. The provision was deleted in congressional committee mark-ups, following opposition from environmental groups. Environmentalists were concerned about swapping the diffuse pollution of countless individual motor vehicles for the concentrated, local effects of pollution from a small number of refineries.[84] This issue of localized effects and "hot spots" comes up repeatedly in debates over marketable permit programs.
- Finally, in 2005, the George W. Bush administration's EPA issued the Clean Air Mercury Rule, which set limits on mercury emissions from power plants to be implemented by the states. The Rule encouraged inter-plant and interstate trading of emissions allowances. The Rule was vacated by the U.S. Court of Appeals for the District of Columbia in 2008, but on grounds completely unrelated to trading. Essentially, the court found that mercury emissions needed to be controlled under a different provision of the Clean Air Act than the one EPA first picked: Section 112, instead of Section 111(d). Under the Obama administration, EPA determined that Section 112 generally, and mercury emissions in particular, were not good candidates for marketable permits, and opted for a prescriptive standard instead.

Other examples of ideas for marketable permits that were briefly considered by federal agencies include an EPA task force's recommendations for tradable recycled newsprint quantity requirements[85] and battery recycling trading, as well as recommendations from the Department of Justice that EPA use auctions for an asbestos phase-down.[86] EPA currently does not support water quality trading for bio-accumulative toxics, though has expressed openness to a future pilot project.[87]

Academics have been even more creative, proposing marketable permits for: satellite congestion in space,[88] pesticides-related risk,[89] wastewater from hydraulic fracturing,[90] environmental quality relating to dams,[91] introduction of non-indigenous species,[92] and various health risks including to control antimicrobial resistance.[93] An idea has even been floated that the right to initiate a citizen suit against polluters for violations of regulatory standards should be auctioned off.[94]

D. Legal Status

[84] Breger, Stewart, Elliott, & Hawkins, *Providing Economic Incentive in Environmental Regulation*, *supra* note 13.
[85] *Id*.
[86] OECD, Emission Permits and Competition (2010).
[87] EPA, Water Quality Trading Toolkit (2009).
[88] *See* personal.colby.edu/personal/t/thtieten/tradable_permits_other.htm (Prof. Tietenberg's personal catalog of other applications of marketable permits).
[89] Breger, Stewart, Elliott, & Hawkins, *Providing Economic Incentive in Environmental Regulation*, *supra* note 13 (Stewart's proposal, noting that the idea would first require better techniques for measuring the risk).
[90] Xochitl Torres Small, *Water Use and Recycling in Hydraulic Fracturing*, 55 Nat. Res. J. 2 (2015).
[91] Dave Owen & Colin Apse, *Trading Dams*, 48 U.C. Davis L. Rev. 1043 (2015).
[92] *See* Eric Biber, *Exploring Regulatoyr Options for Controlling the Introduction of Non-Indigenous Species to the United States*, 18 Va. Envtl. L. J. 375 (1999) (but Biber also details the potential problems with such a scheme).
[93] *See* Tietenberg's personal catalog, *supra* note 88.
[94] Michael Abramowicz, *The Law-and-Markets Movement*, 49 Am. Univ. L. Rev. 327 (1999).

1. Is Explicit Statutory Authorization Required for Markets or Auctions?

a) Marketable Permit Programs Exist Under Both Explicit and Implicit Authorities

Many, but certainly not all, existing marketable permit programs have explicit statutory authority: the acid rain program;[95] various state and federal implementation plans under the Clean Air Act, including the Cross-State Air Pollution Rule[96] and the Clean Power Plan;[97] electromagnetic spectrum auctions;[98] renewable fuel standard credits;[99] and the Department of Transportation's tradable fuel efficiency requirements for vehicles[100] (though not EPA's related greenhouse gas and emissions standards for vehicles).

Several programs currently have explicit statutory authority but once existed without it:

- In 1988, two years before the Clean Air Act Amendments of 1990 added explicit authorization for trading allowances for ozone-depleting substances,[101] EPA interpreted a broad statutory mandate to "control" such emissions as authorizing a tradable allowance system.[102] That same year, the Department of Justice concluded that EPA not only had the authority to use marketable permits, but that the agency could auction off the initial allocation as well.[103] EPA ultimately did not pursue the auction option.
- Amendments to the Magnuson-Stevens Fishery Conservation and Management Act added the term "individual fishing quota" for the first time in 1996, six years after the first system of tradable catch shares was created for surfclams and quahogs.[104] Those amendments also imposed a temporary congressional moratorium on new catch share programs, which was not lifted until 2002.[105]
- Nothing in Section 404 of the Clean Water Act explicitly gives the Army Corps of Engineers the authority to allow wetland mitigation banking and in-lieu fees; indeed, only the interplay between Sections 403 and 404 even gives the Corps the general authority to require minimizing impacts to wetlands.[106] Neither does anything in the Rivers and Harbors Act of 1899 give the Corps explicit authority to allow mitigation banking for impacts to streams and other aquatic resources. Yet since the 1990s, the Corps has allowed mitigation banking, and beginning in 2008, the Corps has expressed a strong preference for banking over other approaches to mitigation for

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[95] Clean Air Act Title IV.

[96] Clean Air Act § 110; Policy Integrity Amicus Brief in CSAPR Case 14 (2013) ("Congress Explicitly Authorized EPA and the States to Use Market Mechanisms to Address Interstate Air Pollution in Order to Achieve Environmental Goals Cost-Effectively").

[97] The authority is more indirect, through Clean Air Act § 111's reference to § 110. *See also* the non-attainment new source review program, 42 U.S.C. § 7502, and the federal ozone standards, 42 U.S.C. § 7511b.

[98] 47 U.S.C. § 309(j); FCC, About Auctions, *supra* note 67 (competitive bidding first allowed by Congress in 1993; auction authority expanded in 1997).

[99] Energy Policy Act of 2005 § 1501.

[100] *See* Energy Policy and Conservation Act, as amended by Energy Independence and Security Act.

[101] Clean Air Act title VI, § 607, as added by Pub. L. 101–549, title VI, § 602(a), Nov. 15, 1990, 104 Stat. 2660.

[102] Protection of Stratospheric Ozone, 53 Fed. Reg. 30566 (Aug. 12, 1988) (codified at 40 C.F.R. pt. 82).

[103] FTC, Comments of the Staff of the Bureau of Economics on Protection of Stratospheric Ozone (1988) (citing DOJ Comments on Proposed Rule on Protection of Stratospheric Ozone, A-87-20, Feb. 8, 1988).

[104] Nat'l Res. Council, *Sharing the Fish: Toward a National Policy on Individual Fishing Quotas* (1999). The Magnuson-Stevens Act also authorized auctions or other collection of royalties, on top of cost recovery. 16 U.S.C. § 1853a(d)-(e).

[105] Mark Fina, *Evolution of Catch Share Management*, 36 Fisheries 164 (2011).

[106] Nat'l Res. Council, *Compensating for Wetland Losses under the Clean Water Act* 64 (2001) (supplemented by § 307 of the Water Resources Development Act, which instructs the Corps to pursue "no overall net loss").

wetlands, streams, and aquatic resources.[107] In the National Defense Authorization Act of 2004, Congress implicitly acknowledged the Corps' authority for wetland mitigation banks by requiring the Corps to issue regulations "establishing performance standards and criteria for the use, consistent with section 404 of the [Clean Water Act], of on-site, off-site, and *in-lieu fee mitigation and mitigation banking as compensation for lost wetlands functions* in permits."[108] Notably, that 2004 legislation did not mention streams or other aquatic resources, even though the Corps continues to allow mitigation banks for such impacts as well.

Finally, a number of marketable permit programs have never had explicit statutory authority:

- EPA's inter-refinery trading system to help phase out lead from gasoline never had explicit statutory authority.[109] Section 211 of the Clean Air Act broadly authorizes EPA to "control or prohibit" the manufacture of fuels and fuel additives.[110]
- EPA's various "averaging, banking, and trading" programs for vehicle emissions, including for mobile source greenhouse gas emissions, has no explicit authorization in statute.[111] Section 202 of the Clean Air Act broadly authorizes EPA to develop "standards" for motor vehicle emissions.[112] (Note that the Department of Transportation's related credit trading program for fuel efficiency is specifically authorized by two energy policy statutes.[113])
- Section 169A of the Clean Air Act requires individual "sources" to install the "best available retrofit technology" to control regional haze. EPA's regulations allowed states to use marketable permits to comply with these standards if the program would achieve "greater reasonable progress" toward reducing regional haze than a prescriptive, source-specific standard would.[114] The U.S. Court of Appeals for the Tenth Circuit upheld the trading program in 2012.[115]
- Water quality trading under the Clean Water Act is not explicitly authorized, though EPA believes that the statute nonetheless provides "clear legal authority" to trade.[116] The U.S. Court of Appeals for the Ninth Circuit once strongly implied, in dicta, that the lack of either statutory or regulatory authority for water quality trading meant it was not permitted.[117] Nevertheless, water quality trading has continued. Some scholars suggest that, for cooperative federalism structures like the Clean Air Act and the Clean Water Act, explicit statutory authority is not required because states retain their plenary powers to implement the federal standards however they see fit.[118]
- There is no explicit authorization in the Endangered Species Act to allow conservation banking to achieve mitigation. Indeed, the Fish and Wildlife Service even admits that its authority to

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[107] Corps-EPA Final Rule, Compensatory Mitigation for Losses of Aquatic Resources, 73 Fed. Reg. 19,593 (2008).
[108] National Defense Authorization Act of 2004 § 314; Pub. L. 108–136, div. A, title III, §314(b), Nov. 24, 2003, 117 Stat. 1431. (and those regulations should "maximize available credits and opportunities for mitigation.")
[109] 47 Fed. Reg. 49,322.
[110] 42 U.S.C. § 7545(c).
[111] *See* 75 Fed. Reg. 25,412 (saying, without mentioning any statutory authority, that Averaging, Banking, and Trading (ABT) of emissions credits has been an important part of many mobile source programs under CAA Title II, both for fuels programs as well as for engine and vehicle programs).
[112] 42 U.S.C. § 7521.
[113] EISA and EPCA, *supra*.
[114] 40 C.F.R. § 51.309(d)(4)(i); WildEarth Guardians v. EPA, 770 F.3d 919, 925 (10th Cir. 2014).
[115] WildEarth Guardians v. EPA, 770 F. 3d 919 (10th Cir. 2014).
[116] EPA, Water Quality Trading Policy, 68 Fed. Reg. 1609 (Jan. 13, 2003) (statute and regulations together provide "clear legal authority").
[117] Friends of Pinto Creek v. EPA, 504 F.3d 1007, 1012 (9th Cir. 2007).
[118] William Buzbee, *Federalism-Facilitated Regulatory Innovation and Regression*, 28 Georgetown Envtl. L. Rev. (2016).

require permits achieve no net loss of critical habitat is "limited."[119] Nevertheless, conservation banking continues to flourish.

No federal permit auction has gone into effect without explicit authority, and some scholars have questioned whether auctioning is legal without specific statutory language.[120] However, in 1988 the Department of Justice concluded that EPA could auction off permits for ozone-depleting substances, despite the lack of specific statutory language.[121] In 2008, the Federal Aviation Administration interpreted its broad statutory powers to manage property as authorizing an auction of airport landing slots. The Obama administration rescinded the rule before the auction could go into effect (it had been stayed by the D.C. Circuit pending full judicial review), but there are some legitimate questions about relying on property management powers to authorize a marketable permit program.

b) Powers to Manage Property and Charge User Fees May Be Insufficient

While the Federal Aviation Administration's landing slot auction rule was under judicial review, and before the rule was rescinded in 2009, Congress asked the Government Accountability Office (GAO) to investigate the legal basis for the auction. In 2008, GAO concluded that FAA lacked legal authority.[122] FAA had based its auction principally on the argument that a landing slot is "property" that the agency "constructs" and may "lease" for "adequate compensation."[123] Other agencies may have similar authorities to manage property in their organic statutes.[124] GAO determined, based on statutory context, that Congress had only intended to give FAA authority to manage "traditional property," such as real property. According to GAO, FAA's argument had proven too much, as it would mean the agency had been giving away millions of dollars in federal property for free for decades.[125] Moreover, because Congress gave FAA specific regulatory authority to control airspace and landings under a particular provision, GAO determined the agency could not reach into a completely unrelated provision to claim the same regulatory authority.[126]

GAO also considered whether the auction could be approved as a user fee under the Independent Offices Appropriation Act. That statutory provision declares "It is the sense of Congress that each service or thing of value provided by an agency . . . is to be self-sustaining to the extent possible," and to that end, "each agency" may "charge" a "fair" amount "based on—the costs to the government, the value of the service or thing to the recipient, public policy or interest served, and other relevant facts."[127] A previous version of the statute had clarified that "thing of value" included "any . . . privilege, authority, use, franchise, license, permit, certificate, registration or similar thing of value or utility performed, furnished, provided, granted, prepared, or issued."[128] Based on the plain language, a permit auction

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[119] Notice of Final Compensatory Mitigation Policy, 81 Fed. Reg. 95,316 (Dec. 27, 2016).
[120] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 25 (1981)
[121] FTC, Comments of the Staff of the Bureau of Economics on Protection of Stratospheric Ozone (1988) (citing DOJ Comments on Proposed Rule on Protection of Stratospheric Ozone, A-87-20, Feb. 8, 1988).
[122] GAO, B-316796, *Federal Aviation Administration—Authority to Auction Airport Arrival and Departure Slots and to Retain and Use Auction Proceeds* (2008).
[123] 73 Fed. Reg. 60,543.
[124] *E.g.,* 20 U.S.C. § 3477 (Dept. of Education); 49 U.S.C. § 114 (TSA).
[125] *See also* Cleveland v. U.S., 531 U.S. 12 (2000). According to that case, pre-issuance, licenses have no value to the state; licenses are "purely regulatory," even if they acquire some aspects of property once owned, the state's interest "surely implicate the government's role as sovereign, not as property holder." *Id.* at 23-24.
[126] GAO, *supra* note 122.
[127] 31 U.S.C. § 9701.
[128] 31 U.S.C. § 483a. The change was to "eliminate unnecessary words," not to change the meaning.

would seem to fit within the authority to charge a "fair" amount based on "public policy" for any permit, license, or privilege.

First and foremost, GAO noted this possible statutory authority was closed to FAA because Congress annually passed appropriations riders blocking any new aviation user fees.[129] However, GAO further argued that even absent the riders, the Independent Offices Appropriation Act only authorized specific kinds of user fees: when an agency provides a service in a non-governmental capacity, it may charge market price; but when an agency acts in a regulatory capacity, the user fee can only charge government costs.[130] This interpretation of the statute is based on a pair of Supreme Court cases and their progeny. In *National Cable Association of Broadcasters v. FCC*[131] and in *FPC v. New England Power*,[132] the Supreme Court struck down agencies' use of the Independent Offices Appropriation Act to collect "fees" from regulated parties that recovered "costs for benefits inuring to the public." The Court said that reading the Act's reference to "public policy" literally would put the agency "in search of revenue," and that charging a fee to discourage activity is "in the nature of 'taxes'" that only Congress can levy.[133] Ultimately, the Court declined to rule on the "ultimate reach" of the "public policy" criterion, concluding that the only relevant factor in these cases was whether the amount charged by the agencies was consistent with the "value to the recipient" of the benefit provided.[134] The upshot of these cases, according to GAO, is that courts are "not sympathetic" to fees based on the "public policy" criterion, and a "number of lower courts," including the U.S. Court of Appeals for the D.C. Circuit, have found that the Act allows agencies to charge user fees only to recover government costs.[135] Because any revenue-raising auction would almost certainty charge more than just the administrative costs of running the auction, this interpretation of the Independent Offices Appropriation Act would not support creation of a revenue-raising auction.

However, a regulatory permit auction could be distinguished from the facts of the two Supreme Court cases. In *FPC v. New England Power*, the court found that the Independent Offices Appropriation Act could not be applied to "whole industries" including companies that had "no proceedings before the Commission during the year in question."[136] In other words, the agency was still charging every regulated entity an annual fee even though many did not receive any permits or licenses in most years. An auction of marketable permits would be distinguishable because each auction participant would receive permits for that specific year, and only be charged accordingly. In *National Cable*, the Court also distinguished an authorized fee for a permit from an impermissible tax: "A fee, however, is incident to a voluntary act, e.g., a request that a *public agency permit an applicant to* practice law or medicine or construct a house or *run a broadcast station*. The public agency performing those services normally *may exact a fee* for a grant which, presumably, bestows a benefit on the applicant, not shared by other members of society."[137] Charging an auction price for marketable permits seems analogous to this permissible scenario presented by the Court. A dissent by Justice Marshall in these cases also criticized

[129] GAO, *supra* note 122.
[130] DOJ agreed that if an auction charges market price, and not government costs, it cannot be "user fee" under IOAA, though DOJ did not ultimately issue an opinion on whether FAA's auction was legally authorized or not.
[131] 415 U.S. 336 (1974).
[132] 415 U.S. 345 (1974).
[133] *National Cable*, *supra* note 131.
[134] *Id.*
[135] Statement of Richard Hembra, GAO, before Subcomm. Hearing on EPA Ozone, 1989 (see babel/hathitrust).
[136] 415 U.S. 345.
[137] *Id.* at 340-341.

the Court for giving "undue emphasis" to the "cost to the government" factor alone without allowing the agency to weigh the other factors, such as "public policy."[138]

It is possible that, presented with an auction for regulatory permits, a future court could uphold authority under the Independent Offices Appropriations Act. However, agencies will likely have more success just relying on any broad grants of regulatory authority.

c) Authority Can Be Implicit in Broad Statutory Language

The most relevant case on finding implicit authority for market-based regulatory tools in broad statutory language is *FEA v. Algonquin SNG*.[139] The Trade Expansion Act allowed the President to "take such action . . . as he deems necessary to adjust the imports . . . [to protect] national security." In 1975, finding that a system of quotas no longer adequately controlled petroleum imports, President Ford switched to a system of license fees. A legal challenge alleged that the President only had statutory authority to adjust imports through quantitative tools like quotas, not monetary tools like fees. The Supreme Court concluded there was no reason to read the word "adjust" as limited to quotas and excluding fees.[140] The Court relied on the broad statutory language and evidence in legislative history that Congress did not intend to tie the President's hands.[141] The Court concluded with a note of warning, that its ruling would not allow the President to take any action no matter how remote the impact on imports.[142] A few years later, the U.S. District Court for the District of Columbia acted on this warning and ruled that a fee was not authorized when its purpose was not directly to control imports, but rather to raise oil prices and reduce consumption generally, with only an indirect effect on imports.[143] Together, these cases stand for the proposition that when statutory language and legislative history support a broad reading of regulatory authority, a variety of quantitative and market-based tools are implicitly authorized, so long as the tool directly targets a legitimate regulatory purpose.[144]

As one example, in 1989 Congress held hearings on whether EPA had authority to auction off emissions allowances for ozone-depleting substances under Section 157(b) of the Clean Air Act, which authorized the "control" of emissions.[145] When that section was added in 1977, Congress clearly expressed that it "does not wish to tie the Administrator's hands or confer an authority which is cumbersome or unduly difficult to use, administer, or enforce."[146] Congress further explained that "control" included any "other measures as may be necessary to assure protection for health and environment."[147] EPA interpreted "control" in 1988 to allow tradable permits for ozone-depleting substances,[148] and the agency began exploring whether an auction would also be permitted.[149] A memorandum submitted by the Department of Justice for the 1989 congressional hearing found that the scope of authority under the section was "sweeping" and further argued that Congress knew about economic incentives and

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[138] *Nat'l Cable Television Ass'n, Inc. v. United States*, 415 U.S. 352, 359–60, (1974).
[139] 426 U.S. 548 (1976).
[140] *Id.* at 561.
[141] Statement of Richard Hembra, GAO, before Subcomm. Hearing on EPA Ozone, 1989 (see babel/hathitrust).
[142] *Nat'l Cable* at 571.
[143] 492 F. Supp. 614 (D.D.C. 1980).
[144] Statement of Richard Hembra, GAO, before Subcomm. Hearing on EPA Ozone, 1989 (see babel/hathitrust) ("Regulatory fees" may be upheld by courts either if "expressly provided" in statute or if "deemed necessary to accomplish a legitimate regulatory purpose under a broad grant of statutory authority.").
[145] Section 157(b) was later replaced by Section 615.
[146] H.R. Rep. No. 101-294 (1977).
[147] I*d.*
[148] Protection of Stratospheric Ozone, 53 Fed. Reg. 30,566 (Aug. 12, 1988) (codified at 40 C.F.R. pt. 82).
[149] Advance Notice of Proposed Rulemaking, 53 Fed. Reg. 30,604 (Aug. 12, 1988).

specifically did not prohibit them.[150] At the hearing, Senator Lieberman opined that the conclusions of that memorandum seemed sound but that Congress should make sure EPA's authority was even clearer in future legislation.[151]

Finally, states may also have implicit, relevant powers. Some statutes, notably the Clean Air Act and the Clean Water Act, rely on a structure of cooperative federalism, in which states are tasked with implementing federal standards. Because these statutes include provisions on the retention of state authority,[152] arguably states retain their plenary police powers in the absence of specific preemption. Therefore state may be able to implement their obligations under federal programs however they see fit consistent with the statute and, unless specifically prohibited, implicitly may use marketable permits.[153] It so happens that the Clean Air Act explicitly gives states authority to use marketable permits to implement many obligations;[154] the Clean Water Act does not.

One concern is that, because Congress has explicitly authorized marketable permits in one provision or one statute, by negative inference marketable permits may not be allowed when Congress has not specifically authorized them. Based on case law and the legislative histories of relevant statutes, this concern should be limited.

Generally, a court will not apply the canon of negative inference unless it is "confident" that Congress likely considered and intended to preclude the unmentioned options in that specific context.[155] In 1989, the Department of Justice argued that, since marketable permits had become such an obvious regulatory strategy for the Clean Air Act, if Congress "did not prohibit them" and "instead used general language permitting a wide scope of regulatory measures," no negative inference against market-based regulations should apply.[156] Several legal experts have similarly concluded that lack of a prohibition on marketable permits is usually sufficient to authorize marketable permits.[157]

At the same time, Congress was definitely aware that referencing certain market-based regulatory tools in one provision could accidently imply a limitation of such tools in another provision, and at least once

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[150] Memorandum from Douglas Kmiec, Asst. Attorney General, Office of Legal Counsel, to Alan Raul, General Counsel, White House Office of Management and Budget (May 15, 1989) ("It is thus clear that Congress was cognizant of economic forms of regulation, did not prohibit them, but instead used general language permitting a wide scope of regulatory measures for the control of CFCs.").

[151] *Proposals to Control the Manufacture, Use, and Disposals of Ozone-Depleting Substances: Hearing Before the Subcomm. On Envtl. Pollution of the S. Comm. On Env't and Pub. Works*, 101st Cong. (May 19, 1989).

[152] 42 U.S.C. § 7416; 33 U.S.C. § 1370.

[153] William Buzbee, *Federalism-Facilitated Regulatory Innovation and Regression*, 28 Georgetown Envtl. L. Rev. (2016).

[154] 42 U.S.C. § 7410.

[155] For example, in *Shook v. District of Columbia Fin. Responsibility and Management Assistance Auth.*, 132 F.3d 775, 782 (D.C. Cir. 1998), the D.C. Circuit stated: "We have recognized, however, that [] maxim [of *expressio unius est exclusio alterius* (the mention of one thing implies the exclusion of another)] is often misused. Sometimes Congress drafts statutory provisions that appear preclusive of other unmentioned possibilities—just as it sometimes drafts provisions that appear duplicative of others—simply, in Macbeth's words, 'to make assurance double sure.' That is, Congress means to clarify what might be doubtful—that the mentioned item is covered—without meaning to exclude the unmentioned ones. The maxim's force in particular situations depends entirely on context, whether or not the draftsmen's mention of one thing, like a grant of authority, does really necessarily, or at least reasonably, imply the preclusion of alternatives. That will turn on whether, looking at the structure of the statute and perhaps its legislative history, one can be confident that a normal draftsman when he expressed "the one thing" would have likely considered the alternatives that are arguably precluded. For that reason, we think the maxim should be used as a starting point in statutory construction—not as a close-out bid."

[156] Memorandum from Douglas Kmiec, *supra* note 150.

[157] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 24 (1981); Dave Owen & Colin Apse, *Trading Dams*, *supra* note 91.

Congress modified a proposed amendments to the Clean Air Act to avoid that result.[158] Despite such over-abundance of caution occasionally exhibited by Congress, courts are unlikely to bar a marketable permit program on the grounds of a negative inference.

The Government Accountability Office (GAO) has warned that a court may be tempted to find that an auction exceeds explicit statutory authority in order to avoid thorny constitutional questions about whether auctions are taxes.[159] However, so long as auctions are directly targeted to advance legitimate regulatory purposes, they should avoid being labelled as unconstitutional taxes.

d) Auctions Are Not Unconstitutional Taxes

Courts have sometimes struggled to differentiate illegal regulatory *taxes* from permissible regulatory *fees*.[160] Under the U.S. Constitution, only Congress has the power to levy taxes,[161] which are generally defined to include payments imposed on many citizens to raise money for a public purpose. The Supreme Court cautioned in *National Cable* against so-called "fees" that are not voluntary, that are designed to discourage activity, or that put agencies "in search of revenue," for such traits are "in the nature of 'taxes'" that only Congress can levy.[162] It could be argue that auctions for marketable permits are taxes because they are mandatory, not voluntary; they discourage activity; and they raise revenue.

However, properly framed, auctions for marketable permits are distinguishable on all these grounds. First, they are not "involuntarily" assessed on a "whole" industry in the way the Court was concerned about. The Court in *National Cable* and its sister case *FEA v. Algonquin* was most troubled by an annual, universal fee charged to each regulated entity regardless of whether it had applied for a permit or license in that particular year.[163] With an auction, only regulated entities seeking permits need to participate in the auction; those that mitigate their own emissions or purchase offsetting credits from third parties need not participate. Also, the language in *National Cable* was dicta, and other courts have come to different conclusions, arguing instead that "regulatory fees" may be "imposed by an agency upon those subject to its regulation."[164]

Second, it is the cap, not the method of permit allocation, that discourages activity. The choice between an auction or a free allocation of marketable permits itself should have little or no effect on levels of

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[158] *See* 136 Cong. Rec. H12845 (daily ed. Oct. 26, 1990) (statement of Rep. Anderson, chair of the H. Comm. On Transportation and Infrastructure, regarding the Conference Report) ("The conferees also adopted the Senate version of Section 108(f), with some modifications. Among the modifications, the reference to road charges, tolls, parking surcharges, and other pricing mechanisms was deleted from (1)(A)(vii). *These economic strategies were deleted from this clause of Section 108(f) in order to avoid the implication that such strategies were available only* in downtown areas, or other areas of emission concentration, or during periods of peak use. Section 172 (c) of the bill establishes the general requirements for implementation plans in non-attainment areas. The general plan provisions include the use of economic incentives, such as fees, marketable permits, and auctions of emission rights . . . . The limited context for the use of such strategies suggested by Section 108(f)(1)(A)(vii) was potentially inconsistent with the general provision of the bill and was therefore removed.") (emphasis added).

[159] Statement of Richard Hembra, GAO, before Subcomm. Hearing on EPA Ozone, 1989 (see babel/hathitrust).

[160] *See*, *e.g.*, *Nat'l Cable Television Ass'n v. United States*, 415 U.S. 336, 340 (1974). The Supreme Court's recent ruling that the Affordable Care Act's penalty for not purchasing insurance fell under Congress's taxation power does not offer definitions relevant to the issue of marketable permits. Instead, the Court distinguished between a "tax" and a "penalty": a penalty may exact a heavy burden regardless of how small the infraction, while it may be reasonable to pay a small tax rather than purchase insurance; a penalty typically requires scienter, while a tax does not; a tax is collected by the IRS, while a penalty may be exacted by a regulatory agency. *Nat'l Fed. Of Indep. Businesses v. Sebelius*, 132 S.Ct. 2566, 2596 (2012).

[161] U.S. Const. art. I, § 8.

[162] *Nat'l Cable Television Ass'n v. United States*, 415 U.S. 336 (1974).

[163] FEA v. Algonquin, 426 U.S. 548 (1976).

[164] *San Juan Cellular Telephone Co. v. Public Serv. Comm'n of Puerto Rico,* 967 F.2d 683 (1st Cir. 1992).

activity.[165] Economic theory predicts that, whether auctioned or freely allocated, marketable permits will affect regulated entities' decisions the same way. Specifically, regulated entities will account for the opportunity cost of the marketable permit whether they paid for it or received it for free. The following analogy paints a clear picture: "A ticket scalper is going to charge the same amount—the going black-market price—whether he's selling a ticket that he found on the ground or a ticket that he bought. He's just going to turn more of a profit if he found it on the ground."[166] The reasons for choosing an auction over a free allocation relate to distributional concerns and market management, not a desire to modify behavior. Compared to free allocations, auctions lower barriers to new entry, avoid the risk of market power and strategic behavior,[167] facilitate price discovery, and prevent unjust windfalls that may create perverse incentives. All these features of auctions are discussed below. Finally, while an auction may raise revenue, that is not its primary intent. Rather, its primary intent is to achieve a regulatory goal most efficiently. Thus, whether explicitly or implicitly authorized by Congress, a permit auction poses no constitutional problems.[168]

Notably, Congress has distinguished between permit auctions and emissions fees. In the 1990 Clean Air Act Amendments, Congress made clear that state implementation plans could use "economic incentives such as fees, marketable permits, and auctions of emission rights."[169] However, for federal implementation plans, Congress deliberately left out "fees," authorizing only "economic incentives such as marketable permits or auctions of emissions allowances."[170] While Congress expressed concern about empowering EPA to charge "fees" that were actually undesirable and involuntary "taxes,"[171] it left EPA the power to auction allowances, suggesting any concerns about taxation do not apply to permit auctions.[172]

Ultimately, as GAO has advised, the fundamental question for whether an auction or regulatory fee is considered a "tax" is whether the primary purpose is to bring about legitimate regulatory objectives or to raise revenue.[173]

Recommendation: Agencies choosing permit auctions should emphasize any grounds not related to revenue, such as market performance, efficiency, and distributional considerations, in order to avoid potential categorization of the permit auction as an impermissible tax.

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[165] Note that some courts have contrasted fees with taxes saying a fee "serve[s] regulatory purposes directly by . . . deliberately discouraging particular conduct by making it more expensive." *See San Juan Cellular Telephone Co. v. Public Serv. Comm'n of Puerto Rico,* 967 F.2d 683, 685 (1st Cir. 1992) (citing *South Carolina ex rel. Tindal v. Block*, 717 F.2d 874, 887 (4th Cir. 1983), *cert. denied*, 465 U.S. 1080, (1984)).

[166] Rob Inglis, *The Power Industry's Prisoner's Dilemma*, The New Republic: The Vine, Mar. 23, 2009, available at http://blogs.tnr.com/tnr/blogs/environmentandenergy/archive/2009/03/23/the-power-industry- prisoner-s-dilemma.aspx.

[167] Such as inflating your baseline before the allocation to receive a greater share.

[168] *See* Memorandum from Douglas Kmiec, Asst. Attorney General, Office of Legal Counsel, to Alan Raul, General Counsel, White House Office of Management and Budget (May 15, 1989) (discussing constitutionality of implicit authority for an auction, including the non-delegation doctrine).

[169] 42 U.S.C. § 7410.

[170] 42 U.S.C. § 7602(y).

[171] *See* H.R. Rep. No. 101-490, pt. 2 (H. Comm. on Ways and Means) (1990) (objecting to the inclusion of emissions fees in FIPs and various other provisions, because: "The [emissions] fees described are in the nature of taxes because they are not designed solely to compensate the Federal Government . . . and the fees are designed to modify the behavior. . . . In addition, these fees are in the nature of taxes because the fees are assessed with respect to behavior that is not voluntary in nature. Businesses wishing to continue to operate must pay these fees."). Note, however, that the specific attempt in the House of Representatives to strip the word "fee" failed by a vote of 170-253. 136 Cong. Rec. H2511 (daily ed. May 21, 1990) (Roll Call No. 131). The language was removed subsequently by the Senate, at the behest of the White House.

[172] Possibly Congress only intended a zero-revenue auction; but the broad language "such as" seems to provide flexibility.

[173] Statement of Richard Hembra, GAO, before Subcomm. Hearing on EPA Ozone, 1989 (see babel/hathitrust).

e) Benefits of Explicit Authorization

Even though both marketable permits generally and auctions specifically can be based on implicit statutory authorizations, explicit authorization may be preferred. As Senator Lieberman warned, without explicit statutory language, marketable permit programs and especially auctions may be subject to legal battles.[174] In such challenges, to avoid possible constitutional issues over taxation powers, courts may be tempted to read implicit statutory authority narrowly and strike down auctions on statutory grounds.[175] Any lingering legal uncertainty could cause reluctance among agencies to implement marketable permit programs and among regulated entities to participate in them.[176] In fact, the slow development of water quality trading has been blamed partly on lack of legal certainty and clarity.[177] Without statutory language on trading in the Clean Water Act, states and regulated entities have expressed confusion about how a trading program would interact with other statutory requirements, like anti-backsliding policies.[178] The U.S. Court of Appeals for the Ninth Circuit once opined in dicta that the Clean Water Act did not allow water quality trading, because there was no mention of trading in statute or regulations.[179]

Recommendation: If active marketable permit programs exist without explicit congressional authority, Congress should consider endorsing those programs. Agencies should communicate to Congress any legal barriers to marketable permits, including the need for explicit statutory authorization.[180] The Office of Management and Budget's annual report to Congress on the costs and benefits of regulation, and the "recommendations for reform" section of those reports, may provide an appropriate vehicle for such communications.

2. Are Marketable Permits Property Rights?

Many economists argue that marketable permits should be treated as secure property rights, to raise the return on investment and incentivize long-term investment strategies.[181] For instance, unlike in the United States, New Zealand grants its fish catch share on a permanent basis,[182] and as a result of the clearer property rights, New Zealand's share prices are higher than U.S. share prices.[183] Similarly, credit buyers need some level of guarantee that the credits they purchase will remain valid for the life of the contract despite any regulatory changes.[184]

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[174] *Proposals to Control the Manufacture, Use, and Disposals of Ozone-Depleting Substances: Hearing Before the Subcomm. On Envtl. Pollution of the S. Comm. On Env't and Pub. Works*, 101st Cong. (May 19, 1989).
[175] Statement of Richard Hembra, GAO, before Subcomm. Hearing on EPA Ozone, 1989 (see babel/hathitrust).
[176] James Tripp & Daniel Dudek, *Institutional Guidelines for Designing Successful Transferable Rights Programs*, 6 Yale J. Reg. 369 (1989). EPA's § 157b rule opted not to go with auction because of legal concerns, 53 Fed. Reg. 30,579 (Aug. 12, 1988), but EPA also simultaneously issued an advance notice of proposed rulemaking to explore auction, 53 Fed. Reg. 30,604.
[177] EPA & USDA, *Report on 2015 National Workshop on Water Quality Markets* (2016); *see also* Willamette Partnership, *In It Together: A How-To Reference* (2012).
[178] EPA, Water Quality Trading Policy, 68 Fed. Reg. 1609 (Jan. 13, 2003).
[179] Friends of Pinto Creek v. EPA, 504 F.3d 1007, 1012 (9th Cir. 2007).
[180] EPA has also suggested, in comments on the draft version of this report, that agencies encourages states to adopt any laws or regulations necessary to create state-level legal certainty about the marketable permit program, as Virginia has done to promote water quality trading.
[181] Tom Tietenberg, Tradable Permits in Principle and Practice, 14 Penn St. Envtl. L. Rev. 251 (2006).
[182] *Id.*
[183] *See* Richard Newell et al., *Asset Pricing in Created Markets for Fishing Quotas* (Resources for the Future Discussion Paper 05-46, 2005).
[184] World Resources Inst., *Addressing Risk and Uncertainty in Water Quality Markets* (2014).

On the other hand, many legal experts and advocates express ideological and practical concerns with treating marketable permits as property. Ideological concerns are raised about privatizing what were previously public resources.[185] The language of "property" and "rights" may introduce a mentality of entitlement that can exacerbate some perverse incentives, such as fishers disposing of all but the largest specimens of target fish to make the most of their quota.[186] Practically, regulators may need to ratchet down a cap over time and will face intense political opposition and potentially legal challenges from existing permit holders who feel their "rights" are being taken without compensation. Government may occasionally need to "confiscate" permits either to increase regulatory stringency or to invalidate fraudulent credits, even if those invalid credits were bought in good faith.[187]

Ultimately, "property" is not a monolithic concept. Rather, individual privileges—the abilities to use something or exclude others, the abilities to divide or transfer, and the duration and legal recognition of those abilities—can be mixed and matched into various property bundles. In fact, most regulatory tools (short of complete bans) give rise to some kinds of property rights: for example, if a factory has a permit for compliance with prescriptive regulation, when factory gets sold, the permit is transferred too.[188] So long as owners of marketable permits have some of the key incidents of property, like the abilities to use, exclude, sell, dispose, and pledge to creditors,[189] some measure of security in interest can be given short of "property."[190] Permits are best seen as temporary licenses to carry out a particular activity, with a conditional promise from the government that the permit will continue to have value for purposes of compliance, unless the government exercises its right to reclaim the permit.[191] Putting a price on a temporary grant of permission by itself does not convert a permit into a "right" or "property."[192]

Most scholars think it unlikely that a court would find a Fifth Amendment constitutional claim for compensation for taking permits.[193] For example, in *Members of the Peanut Quota Holders Ass'n v. U.S.*, the U.S. Court of Appeals for the Federal Circuit found that while farmers had some property interest in their peanut production quotas, there would be no compensation for takings because agricultural quotas are wholly government creations, and as such the government retains the right to withdraw them unless the statute specifies that the interest was irrevocable.[194]

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[185] Dan Cole, Pollution & Property: Comparing Ownership Institutions for Environmental Protection (2002).
[186] Carol Rose, *The Several Futures of Property*, 83 Minn. L. Rev. 129 (1998).
[187] David Driesen, *What's Property Got to Do with It?—Review of Dan Cole's Pollution and Property*, 30 Eco. L. Q. 1003 (2003).
[188] Jonathan Nash, *supra* note 4 (arguing that even information disclosure rules and tax-based regulation give rise to certain kinds of property rights).
[189] *Id.*
[190] Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181.
[191] David Driesen, *What's Property Got to Do with It?, supra* note 187. Lee Ann Fennell has observed that permits are essentially held subject to an implicit government call option, but with an exercise price of zero and unclear terms. She recommends making the call option explicit. That way, government does not need to try to anticipate every problem, like hot spots, in ways that will inevitably erode the benefits of trading, but instead can selectively exercise call options to deal with problems if they arise. Lee Ann Fennell, *Revealing Options*, 118 Harvard L. Rev. 1399 (2005) (recommending a mechanism: permit holder states how much the permit is worth to them, pays tax based on that amount, government can recall at that valuation).
[192] Breger, Stewart, Elliott, & Hawkins, *Providing Economic Incentive in Environmental Regulation*, *supra* note 13; *see also* GAO, *supra* note 122 (arguing that the fact that a license has value does not make it "property").
[193] Mark Fina & Tyson Kade, *Legal and Policy Implications of the Perception of Property Rights in Catch Shares*, 2 Wash. J. Envtl. L. & Pol'y 283 (2012). But such takings claims are perhaps not impossible: they are most unlikely for a regulatory modification to the permit to address environmental harms, but perhaps more possible if the regulatory modification seeks, for example, to redistribute quota among different classes of fishers.
[194] *Id.* The legal analysis could be different if the government cancels a permit before the purchaser was able to take any advantage of the permit at all.

Some laws specifically disclaim any property status for marketable permits, in part to preempt any attempts to claim compensation for a takings.[195] For example, Congress explicitly stated that acid rain credits did "not constitute a property right."[196] At the same time, however, Congress also characterized acid rain credits as "quasi-property"[197] and durable, subject only to limitations or revocations by new legislation passed by Congress and signed by the President.[198] The Magnuson-Stevens Act also declares that fish catch shares are "not a right or title or interest" and may be revoked or modified at any time without compensation.[199] In fact, fish catch shares are usually defined as a percentage share of a total allowable catch, so the agency can simply change the total cap and individual permits automatically adjust without need for further legal action.[200] The FCC's statutory authority for spectrum auctions clarifies that spectrum licenses are not "ownership," and are technically only "temporary" with no presumption of renewal.[201] EPA's manual for criteria pollutant offset banks warns that if a region's environmental quality is not improving quickly enough, EPA reserves the right to place a moratorium on trades, raise the required trading ratio, or even require forfeit of all traded permits.[202]

Other laws are less precise or less consistent in characterizing the property status of marketable permits. For example, at various points the Clean Air Act refers to the auctioning of "emissions rights."[203] Courts have recognized some property-like status for landing slots in bankruptcy proceedings[204] and for fish catch shares in divorce settlements and other civil actions.[205] At the state level, this is even more common. Taxi medallions are considered personal property of the owner and, for example, are treated as part of the estate upon death.[206] Three states—Pennsylvania, Vermont, and Puerto Rico—explicitly recognize renewable energy credits as "property" in statutes or regulations, and courts in New Jersey and Connecticut have done the same.[207] Some federal courts and agencies have followed suit, with the U.S. Court of Appeals for the Second Circuit writing that "RECs are inventions of state property laws," and with EPA, the Department of Energy, and the Armed Services Board of Contract Appeals recognizing RECs as "property rights."[208]

Even if none of those legislative, judicial, or administrative bodies intended to use the word "property" in a way that would create a takings claim for compensation, terminology creates perceptions, and perceptions are important. For example, despite the specific disclaimer in the Magnuson-Stevens Act, the widespread perception among many fishers is that catch shares are their property, because shares are exclusive and transferable and because they are effectively permanent: they are renewed until

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[195] Interview with Don Elliott (Acid rain language designed largely to prevent takings claims).
[196] 42 U.S.C. § 7651b(f).
[197] H.R. Rep. No. 101-490 pt. 1, at 366 (1990) (allowances are "quasi-property" and can be reported as "utility assets").
[198] Jonathan Nash, *supra* note 4 (per Rep. Mike Oxley, 136 Cong. Rec. E360, E3672 (daily ed. Nov. 2, 1990)).
[199] 16 U.S.C. § 1853a(b)
[200] Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181.
[201] 47 U.S.C. §§ 301, 304. But arguably that leaves open anything short of fee simple. Howard Shelanski & Peter Huber, *Administrative Creation of Property Rights to Radio Spectrum*, 41 J. L. & Econ. 581 (1998).
[202] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 19 (1981)
[203] 42 U.S.C. §§ 7410, 7502 (nonattainmnet), 7511b (federal ozone).
[204] GAO, *supra* note 122.
[205] Mark Fina & Tyson Kade, *Legal and Policy Implications of the Perception of Property Rights in Catch Shares*, *supra* note 193 (citing 161 F.3d 584 (9th Cir. 1998)).
[206] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 50 (1981)
[207] Center for Resource Solutions, Legal Basis for RECs (2015).
[208] *Id.* The U.S. Armed Services Board of Contract Appeals has said that RECs are "personal property, given their exclusive nature and transferability."

revoked, in a system known as "rolling conditional permanence."[209] Auctions could strengthen the perception—and maybe even the legal claim—of property rights in marketable permits.[210]

Recommendation: Congress and agencies should avoid creating misperceptions by calling marketable permits "rights," and should instead use the language of marketable licenses or permits.

3. Do Marketable Permits Commodify Resources?

Even if marketable permits are not considered to be full "property," some critics worry that marketable permits commodify the environment, human health, and other resources in undesirable or even unethical ways. Marketable permits have even been compared to sales of indulgences in the Middle Ages.[211] Beyond vague notions of ethics, one concrete concern is that marketable permits in, for example, pollution allowances, will have negative effects on anti-pollution norms. An analogy is made to handicapped parking spaces, highlighting the difference between imposing a $100 fine for parking in a disabled space versus creating $100 permits for premium parking spaces but the physically challenged get free access. The latter, it is argued, tacitly endorses parking in handicapped spaces if you are willing to pay for it. Similarly, if marketable permits spread the conception that pollution is not "bad" but something to be bought, consequences could include reduction in anti-pollution whistle-blowing, less self-restraint, and lower compliance rates.[212]

Proponents of marketable permits argue this commodification critique overlooks that any permit with a degree of scarcity has value, whether it is marketable or not: marketability does not create value, but only makes it visible.[213] Before the introduction of markets, fishers already have the "right" to exploit by virtue of their fishing license; polluters have the "right" to pollute under some regulatory permit.[214] At least permit auctions and taxes charge something for the privilege; prescriptive regulations and allocated permits just give it away for free.[215] Perhaps regrettably, because market-based regulations is often framed by proponents as deemphasizing the role of government, and because permits are often called "allowances" rather than "restrictions," the frame plays into this commodification critique. In reality, marketable permit programs should require a substantial, active government role.[216]

4. Are the Terms Defined by Regulation, Guidance, or Case-by-Case?

A final consideration in the legal status of marketable permits is how the terms of the permits and transactions are defined: by codified legislative regulation, by interpretive rule or agency guidance, or on an ad hoc basis. Without any formality, neither regulators, regulated entities, nor the public has regulatory certainty and predictability. For permitting programs implemented by regional offices or the

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[209] Mark Fina & Tyson Kade, *Legal and Policy Implications of the Perception of Property Rights in Catch Shares*, *supra* note 193. Plus, the federal government finances loans for small fishers with terms lasting twenty years or more, further creating perception of long-term property interests.

[210] *Id.*

[211] Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181, n.3 (citing Goodin 1994).

[212] Lior Jacob Strahilevitz, *How Changes in Property Regimes Influence Social Norms: Commodifying California's Carpool Lanes*, 75 Indiana L. J. 1231 (2000).

[213] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 21, 24 (1981). Though all environmental regulation (short of a ban) could be susceptible to a "right to pollute" critique, as they all sanction some amount of pollution, the frame around market-based programs exacerbates the critiques and partly explains why some continue to prefer prescriptive regulation. Jonathan Nash, *Framing Effects and Regulatory Choice*, *supra* note 4.

[214] Katrina Wyman, *Why Regulators Turn to Tradable Permits: A Canadian Case Study*, 52 U. Toronto L.J. 419 (2002).

[215] Jonathan Nash, *Framing Effects and Regulatory Choice*, *supra* note 4.

[216] *Id.*

states, lack of formal guidance from the federal agency can lead to inconsistencies in implementation.[217] In fact, Congress instructed the Army Corps of Engineers to issue regulations on its wetlands mitigation bank program specifically to address concerns about consistency and predictability under the loose guidance documents that the Corps had issued at various points in time.[218] On the other hand, too much formality could limit a program's flexibility to adapt.

The Administrative Conference of the United States has weighed in on the formality of policy statements before. In a 1976 recommendation, the Conference advised that agencies submit even non-binding policy statements and guidance documents to public notice and comment.[219] In the preamble to a 1992 recommendation, the Conference wrote it was "concerned" about agencies issuing policy statements in lieu of regulations, as such statements may still be treated by agency staff as binding or may be "reasonably regarded by the public as binding and dispositive of the issues they address."[220] The consultant report supporting that recommendation noted that if non-legislative regulations and policy documents on standards for "approving or granting applications . . . are intended to be routinely applied, or if they are regularly applied, they of course have a practical binding effect, even though they are not legally binding."[221] Similarly, if agency interpretations and guidance are binding on the states implementing federal standards, they are in effect "binding upon private parties who must gain the states' approval of their permit applications."[222]

Ultimately, agencies adopting marketable permit programs should do so with at least a degree of formality, subject to some flexibility to facilitate adjusting the program especially in its early years.[223] Codified, legislative regulations adopted through notice-and-comment rulemaking may be most important for marketable permit programs that operate without explicit statutory language, though notably the existing programs with explicit statutory language typically also have codified regulations.[224]

Currently there is a range of formality with which agencies set up the rules for their marketable permit programs. Many of the air pollution programs were created through codified legislative regulations.[225] Fish catch share programs are designed by regional councils and codified in the Code of Federal Regulations.[226] For the wetlands mitigation bank program, the Corps and EPA originally issued joint guidance in 1995 and then, following congressional instructions, issued joint regulations in 2008, codified in the Code of Federal Regulations.[227] Numerous Corps districts developed their own regional guidance to implement the rule.[228]

On the other end of the spectrum, for years water quality trading programs operated without the certainty of any official guidance from EPA, which may partly be responsible for the slow growth of water quality trading.[229] EPA issued a water quality trading policy in 2003 and submitted the document

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[217] WRI, *Addressing Risk and Uncertainty in Water Quality Markets* (2014).
[218] Corps-EPA Final Rule, Compensatory Mitigation for Losses of Aquatic Resources, 73 Fed. Reg. 19,593 (2008).
[219] ACUS Recommendation 76-5.
[220] ACUS Recommendation 92-2.
[221] ACUS Consultant Report on Recommendation 92-2, *available at* http://scholarship.law.duke.edu/cgi/viewcontent.cgi?article=3188&context=dlj
[222] *Id.*
[223] Willamette Partnership, *In It Together: A How-To Reference* (2012).
[224] *E.g.*, acid rain, fish quotas, FCC auctions, CAFE. All programs under the Clean Air Act, whether explicitly authorized or not, have regulations.
[225] *E.g.,* acid rain, lead.
[226] *E.g.*, 50 C.F.R. § 648.74 (surf clam and quahog ITQ).
[227] 73 Fed. Reg. 19,593 (2008) (codified at 33 C.F.R. 332).
[228] Corps, Institute for Water Resources, The Mitigation Rule Retrospective (2015).
[229] Andrew Wolman, *Effluent Trading in the United States and Australia*, 8 Great Plains Nat. Res. J. 1 (2003).

for public comment,[230] but ultimately it remains an un-codified policy statement. In 2007, EPA followed up with a Water Quality Trading Toolkit, offering guidance to state permit writers on developing trading programs. Still, at a 2015 joint EPA-USDA workshop on water quality markets, participants expressed a desire for more explicit authority than EPA's 2003 policy statement, to increase market confidence and participation.[231] While some states have adopted statutes or formal guidance on water quality trading, EPA has explained that states do not necessarily have to develop their own trading rules.[232] For example, North Carolina has no official policy besides a willingness to work to develop a trading program for any interested watershed group.[233] The U.S. Court of Appeals for the Ninth Circuit expressed doubt over the validity of water quality trades given that "nothing in the Clean Water Act or the regulation" provides for trading.[234] Apparently, EPA's 2003 policy statement on water quality trading was not enough for the Ninth Circuit.[235] The overall lack of formality produces a lingering uncertainty for buyers about whether trades will satisfy their legal obligations,[236] as well as confusion among regulators about how formal requirements for antibacksliding and antidegradation should apply to water quality trading programs.[237]

Conservation banks predated any national guidance from the Fish and Wildlife Service (FWS) by at least eight years.[238] Guidance was first published as notice in Federal Register in 2003, seemingly without a comment period. In 2016, FWS adopted a more formal policy statement following a public comment period, but the agency still has no codified legislative regulations on conservation banking. In 2013, the Department of the Interior's Office of Policy Analysis had recommended that FWS consider adopting codified regulations.[239] A 2016 survey of conservation bank sponsors supported (by 61%) more formal regulations, to help make bank creation easier and reduce uncertainty.[240] In this survey, conducted just before FWS's new guidance was issued, 11% of bank managers reported not being familiar with the old 2003 guidance.[241] Even more shockingly, in 2013, only 68% of surveyed FWS staff were familiar with the agency's own 2003 guidance (only 30% were "very familiar," with another 38% saying "somewhat familiar").[242]

The National Marine Fisheries Service (NMFS) also approves conservation banks for mitigation, and some NMFS regions have developed guidance on banking.[243] However, there is no national guidance from NMFS, and according to one regional office, "Presently, NMFS has no standardized way of engaging new bank proposals."[244]

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[230] 68 Fed. Reg. 1609 (Jan. 13, 2003).
[231] EPA & USDA, Report on 2015 National Workshop on Water Quality Markets (2016).
[232] EPA, Water Quality Trading Toolkit (2009).
[233] *Id.*
[234] Friends of Pinto Creek v. EPA, 504 F.3d 1007, 1012 (9th Cir. 2007) (dicta).
[235] EPA had a potential fix to this issue on its regulatory agenda for years, *see* Letter from Inst. for Policy Integrity, to EPA, Oct. 1, 2012, http://policyintegrity.org/documents/Policy_Integrity_Final_Water_Quality_Trading_Letter.pdf, but 40 C.F.R. § 122.4(i) was never amended. *Pinto Creek* therefore leaves lingering uncertainty about legality of water quality trading.
[236] Willamette Partnership, *In It Together: A How-To Reference* (2012).
[237] IEc, Water Quality Trading Evaluation, *supra* note 50.
[238] FWS, Guidance for the Establishment, Use, and Operation of Conservation Banks (2003).
[239] DOI Office of Policy Analysis, Conservation Banking Overview (2013).
[240] DOI, Office of Policy Analysis, Results from a Survey of Conservation Bank Sponsors (2016).
[241] *Id.* (explaining managers are less likely than sponsors to deal with regulatory issues).
[242] DOI, Office of Policy Analysis, Preliminary Analysis of the Conservation Banking Program and Results from a Survey of USFWS Staff (2013).
[243] *E.g.* NMFS-Northwest Region, Guidance, Jan. 31, 2013. The West Coast Region emphasizes that it is just guidance, not a rule. NMFS West Coast Region, Conservation Banking Guidance (2015).
[244] NMFS West Coast Region, Conservation Banking Guidance (2015).

Recommendation: Guidance on marketable permit programs should minimally go through public notice and comment, and agencies should consider codifying regulations to resolve lingering legal uncertainty or inconsistent applications.

II. Efficiency and Distributional Consequences

Marketable permits are designed to achieve policy goals more efficiently. Before turning to whether marketable permit programs are able to achieve their policy goals (section III) and how to manage the markets (section IV), this section will first examine whether marketable permits can deliver on their promise of greater efficiency. This section examines both theoretical literature and empirical studies on the efficiency of marketable permit programs. However, it is important to bear in mind that any empirical evidence of a marketable permit program's efficiency depends on defining a counterfactual benchmark of what would have happened otherwise. Defining such benchmarks by reverse engineering the effects of a hypothetical prescriptive regulatory approach can be exceedingly difficult. Moreover, it is possible that other regulatory approaches besides markets may not have passed political muster.[245] Finally, a program's success or failure should never be judged too early, as the efficiencies of marketable permit programs can take time to develop or can disappear over time.[246]

This section also addresses potential effects of markets on small entities, new entrants, and consumers.

A. Do Marketable Permits Efficiently Lower Compliance Costs and Prioritize the Highest Value Uses of Resources?

1. Theory

A major theoretical advantage of marketable permits over traditional regulation is that market-based tools efficiently allocate privileges and obligations, lowering costs and raising value. Specifically, marketable permits programs equalize marginal compliance costs across regulated sources, by allowing the market to identify and prioritize the lowest-cost abatement opportunities. Similarly, instead of forcing regulators to divine how to allocate regulatory privileges to the highest value use of scarce resources, the market identifies the most valuable use of the permits.[247]

For example, when compliance costs vary greatly across regulated sources, uniformly prescriptive environmental standards can be counterproductively expensive.[248] If one source can reduce its greenhouse emissions at $1 per ton while another faces $1000 per ton abatement costs, requiring the same performance from both is inefficient: the same environmental gains could be achieved at lower overall cost (i.e., $2 instead of $1001 for the first two tons) by allowing the second source to pay the first to make extra reductions cheaply, at least until reaching a point when abating one more ton would cost each source the same. The flexibility of markets either lowers the total cost of achieving any given regulatory target or else, for any given total cost, achieves a more ambitious regulatory target.[249] One economic study estimated that, to achieve a 5% reduction in overall U.S. greenhouse emissions, the

[245] Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181
[246] *Id.*
[247] *See* Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 3 (1981) (explaining market-based regulation helps ensure that firms with highest-value use of the resource will obtain the permit).
[248] Robert Stavins, *Market-Based Environmental Policies* 2 (RFF Disc. 98-26, 1998, republished in Paul Portney & Robert Stavins eds., *Public Policies for Environmental Protection* (2000)).
[249] *See* U.S. Office of Mgmt. & Budget, *Regulatory Impact Analysis: A Primer* 6 (2011).

marginal welfare costs of a prescriptive regulatory scheme would be 1159% higher than the marginal welfare costs of a market-based regulatory scheme designed to achieve the same overall emissions reductions.[250]

The variation of abatement opportunities drives the market's efficiency.[251] Therefore, a regulatory market's size can enhance its efficiencies, as bigger markets maximize the number of opportunities for low-cost abatement. For example, even if a particular industry emits a relatively small volume of greenhouse gases, if it offers very low-cost abatement opportunities, it could be efficient to include that industry in a broader cap-and-trade program for greenhouse gases.[252] Trades in international allowances and offsets may provide especially low-cost abatement opportunities. In modeling the possibility of economy-wide cap-and-trade legislation in 2009, EPA found that offsets would have "a strong impact on cost-containment," and that without international offsets, allowance prices would have increased 89%.[253] The ozone-depleting substance market allows international transfers with EPA approval, and California's greenhouse gas cap-and-trade program allows links with Canada.[254]

The theory behind a marketable permit program's superior efficiency begins to break down if the standard is set so stringently as to require every source to control as much as possible. At that point, there will be few if any additional trades to make, and any efficiency advantage between marketable permits and prescriptive regulations will be small.[255]

David Driesen, a prominent skeptic of marketable permits, admits that overly uniform prescriptive standards may use private sector resources inefficiently, but he argues that prescriptive standards are more efficient for administrative resources and may also have equitable advantages.[256] Smaller firms, for example, may face monitoring and transaction costs under marketable permit programs that exceeds any cost savings they might experience, and so may prefer prescriptive regulations.[257] However, considering the following empirical evidence on efficiency and the subsequent sections of this report on administrative costs and distributional effects, Driesen's critique is overgeneralized. Marketable permit programs often have significant efficiency advantages, may have administrative advantages, and do not inherently have negative distributional consequences.

2. Evidence

Evidence from economic models and empirical data suggests marketable permit programs have efficiency advantages. Reviewing the literature, economist and expert on marketable permits Tom Tietenberg concludes that, assuming adequate enforcement, trading either lowers compliance cost of

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[250] Pizer, Burtraw et al., *supra* note 11, at tbl.3 ($277/ton versus $22/ton). The additional marginal welfare costs of performance standards over market-based regulation rise as the reduction target increases in stringency. *See id.* fig. 1.

[251] Nathaniel O. Keohane, *Cap and Trade, Rehabilitated: Using Tradable Permits to Control U.S. Greenhouse Gases*, 8 Rev. Envtl. & Econ. Pol'y 42, 49 (2009).

[252] Metcalf & Weisback, *supra* note 11, at 8.

[253] EPA, Analysis of H.R. 2454, at 3 (June 2009).

[254] California has linked with Quebec's emissions trading system. 17 Cal. Code Regs. § 95943 ("Linked External GHG ETS. Covered or opt-in entities may use compliance instruments issued by the following programs to meet their compliance obligation under this article: (a) Government of Quebec."). California has not yet extended its offset protocols to credit international projects, but its cap-and-trade laws contemplate the potential for offsets from at least Canada and Mexico. 17 Cal. Code Regs. §§ 95854, 95972(c).

[255] Bruce Ackerman & Richard Stewart, *Reforming Environmental Law: The Democratic Case for Market Incentives*, 13 Colum. J. Envtl. L. 171 (1987).

[256] David Driesen, *Is Emission Trading an Economic Incentive Program?, supra* note 18.

[257] Breger, Stewart, Elliott, & Hawkins, *Providing Economic Incentive in Environmental Regulation*, *supra* note 13.

emissions reductions or increases the value of the resource.[258] For example, a study by Winston Harrington and Richard Morgenstern identified six case studies where the United States and European Union countries picked different regulatory approaches, to compare prescriptive regulation against economic incentive systems (both cap-and-trade programs and taxes). Examining the case studies on sulfur dioxide, nitrogen oxides, water point sources, leaded gas, ozone-depleting substances, and chlorinated solvents, Harrington and Morgenstern found overall evidence that economic incentives were more efficient.[259]

The following specific evidence exists for U.S. marketable permit programs:

- The Clean Air Act's program to allow new sources to trade offsetting credits of "criteria"[260] pollutant reductions, by one estimate, resulted in $5-$12 billion in compliance cost savings.[261]
- Compared to the counterfactual costs of regulating lead without trading, EPA's inter-refinery trading system for phasing out lead from gasoline saved approximately $250 million per year, or 20% of total costs.[262]
- The acid rain market achieved cost savings (versus non-trading alternatives) estimated in the range of 15-90%, or $250 million to over $1 billion annually.[263]
- For fisheries, there is evidence that transferable catch shares help create more efficiently sized fleets that extract the resource at lower cost and with greater profitability.[264] In Alaska's halibut and sablefish fisheries, for example, tradable catch shares decreased operating costs and resulted in higher prices for caught fish at the docks.[265] (However, the halibut and sablefish tradable catch share program also showed signs of increased administrative costs and negative distributional effects like layoffs and barriers to entry.)
- Evidence of efficiency in water quality trading is harder to come by. According to EPA, Virginia's nutrient trading program for stormwater phosphorous saved over $1 million.[266] Some models have predicted that traditional water quality regulation is between 12% and 200% more expensive than marketable permits.[267]
- There is anecdotal evidence that conservation banks save project applicants time and money, simplify compliance, and improve regulatory predictability.[268]

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[258] Tom Tietenberg, *Tradable Permits in Principle and Practice*, *supra* note 181.

[259] Winston Harrington & Richard Morgenstern, *International Experience with Competing Approaches to Environmental Policy: Results from Six Paired Cases* 116, *in* Moving to Markets, *supra* note 2.

[260] Criteria pollutants are the six widely emitted pollutants for which EPA sets ambient air quality standards: particulate matter, sulfur dioxide, nitrogen dioxide, ground-level ozone, carbon monoxide, and lead.

[261] Stavins, *Market-Based Enviro. Policies*, *supra* note 248, at 7.

[262] *Id.* at 9; Robert Stavins, *U.S. Cap-and-Trade System to Address Global Climate Change* 9 (Harvard Kennedy School Reg. Pol'y Prog. Paper 2007-04).

[263] *Id.* at 7, 15; Stavins, *Market-Based Enviro. Policies*, *supra* note 248, at 7; H. Ron Chan et al., *The Net Benefits of the Acid Rain Program* 1 (RFF 15-25, 2015). As much as 5% of these savings ($1.3 billion of $20 billion in cumulative cost savings) may be ascribed specifically to the banking provisions. T.H. Tietenberg, Emissions Trading: Principles and Practice 114 (2006, 2d ed).

[264] NOAA Catch Share Policy (2010); *see also* Katrina Wyman, *The Recovery in U.S. Fisheries*, J. Land Use (forthcoming).

[265] Pew Envtl. Group, *Design Matters: Making Catch Shares Work* (2009).

[266] Ann Mills & Ellen Gilinsky, *EPA and USDA Pledge Actions to Support America's Growing Water Quality Trading Markets*, EPA Blog, Aug. 1, 2016.

[267] Bruce Ackerman & Richard Stewart, *Reforming Environmental Law: The Democratic Case*, *supra* note 255, n.11.

[268] FWS, Guidance for the Establishment, Use, and Operation of Conservation Banks (2003); Notice of Final Compensatory Mitigation Policy, 81 Fed. Reg. 95,316 (Dec. 27, 2016). Also tellingly, in a Statement of Policy and presumably based on at least anecdotal if not empirical evidence, President Obama affirmed that conservation banks reduce timelines for developers. Presidential Memorandum, Mitigating Impacts on Natural Resources from Development, Nov. 3, 2015.

Critics of marketable permit programs dispute some of these findings. For example, Driesen argues that the millions of dollars allegedly saved by the acid rain market came not from the efficiencies of trading (which was very rare in the early years anyway, accounting for less than 4% of allowances), but rather simply because the ex ante cost estimates had been overinflated.[269] Reviews of water quality trading note that, of the 37 pilot projects and programs that have existed, 26 have not yet seen actual trades, others have very few trades, and overall there is little empirical evidence of cost savings. For example, Wisconsin's Fox River program only had 1 trade before going defunct.[270] Similar skepticism has been expressed over whether wetlands mitigation banks have really lowered the costs of mitigation.[271]

Overall, however, the weight of the evidence does suggest marketable permit programs can improve efficiency in at least certain regulatory applications.

B. Do Marketable Permits Better Incentivize Innovation?

1. Theory

After efficiency, the second key theoretical advantage of marketable permits over traditional regulation is that market-based tools creates a price signal that dynamically incentivizes innovation and the diffusion of knowledge.[272] For example, because an air pollution cap-and-trade market puts a price on emissions but does not otherwise constrain compliance strategies, sources are free to experiment continually and develop new, unanticipated methods of low-cost abatement. And because unused permits can be sold for profit, sources can benefit the more reductions they make. By contrast, prescriptive environmental regulations give sources little incentive to innovatively reduce emissions so much as a single ton below their required limit. Similarly, prescriptive standards frequently—yet inefficiently—pick "winners" from among existing technologies: for example, regulating vehicle emissions by mandating use of certain biofuel technologies reduces the incentive to explore other, potentially better reduction opportunities, like new mass transit options.[273] A special additional advantage of credit programs is the potential stimulation of activity and innovation in otherwise unregulated sectors.

David Driesen has thoroughly attacked this theory of innovation incentives. Driesen argues that innovation is encouraged more by a regulation's stringency and enforcement than by its form. Performance standards with predictable increases in stringency over time would, according to Driesen, produce the same drive for continuous innovation.[274] In contrast, if marketable permit programs are weaker on enforcement than traditional regulation (because it is harder to continuously monitor emissions and permit transactions than to simply check whether a source installed an approved technology), marketable permits could produce less innovation than traditional regulation.[275] However, Driesen's argument depends on the willingness of regulators either to repeatedly issue new rules to increase stringency or else to initially make predictions far into the future about what levels of

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[269] David Driesen, *Is Emission Trading an Economic Incentive Program?, supra* note 18.
[270] James Boyd, *New Face of the Clean Water Act: A Critical Review of the EPA's New TMDL Rules*, 11 Duke Envtl. L. & Pol'y Forum 39 (2000).
[271] Tom Tietenberg, *Tradable Permits in Principle and Practice*, *supra* note 181.
[272] *Marketable Rights*, *supra* note 1, at 2-3; Gabriel Chan, Robert Stavins, et al., *The SO2 Allowance Trading System & the Clean Air Act Amendments of 1990: Reflections on Twenty Years of Policy Innovation* 23 (2012.
[273] Jack Lienke & Jason Schwartz, *Shifting Gears: A New Approach to Reducing Greenhouse Gas Emissions from the Transportation Section* 5 (Policy Integrity Brief, 2014).
[274] David Driesen, *Is Emission Trading an Economic Incentive Program?, supra* note 18.
[275] *Id.*

stringency will someday be appropriate. Marketable permit programs, on the other hand, incentivize innovation simply by tapping into the firms' profit motives, without needing to repeatedly increase the stringency of the cap.

Driesen also challenges the assumption that marketable permits uniquely encourage sources to go beyond their minimum compliance obligations: most polluters go at least slightly below their performance standards to guarantee consistent compliance (though admittedly, once regulated sources achieve an adequate compliance cushion, they have little incentive for additional reductions under traditional regulatory approaches).[276] Driesen also reminds that while any incentive to continually innovate and reduce emissions under a cap-and-trade program could reduce overall compliance costs, it will not actually decrease total emissions, since any reduction by one innovative source will allow another source to increase its emissions, back up to the level of the cap.[277]

Finally, Driesen worries that marketable permits programs will actually chill innovation. Trading incentivizes reductions first at sources with the cheapest abatement opportunities, but this low-hanging fruit may not require much technological innovation. Rather, according to Driesen, it is the reductions at the higher-cost sources that require true innovation.[278] However, as other scholars have pointed out, an exclusive focus on the very lowest hanging fruit requiring no innovation is only likely if the cap is too lenient.[279] An appropriately calibrated cap will encourage firms to look for any innovative opportunity to reduce costs.

That said, even proponents of the theory of marketable permits' innovation incentives recognize some limitations. For example, the dynamics of competition in regulated sources' underlying product markets can interfere with the incentive to innovate. Imagine several rival refineries all under the same cap-and-trade program. Innovation decreases marginal compliance costs, which decreases permit prices, which helps permit buyers but not permit sellers.[280] Because lowering permit prices will benefit any rivals who are permit buyers by lowering their production costs, some firms may strategically choose not to innovate. In such cases, traditional regulation may provide better innovation incentives: innovation under traditional regulation only lowers your own compliance costs, while innovation in a market may decrease costs for your rivals.[281] Strategic behavior can also negatively affect innovation under marketable permit programs in other ways: for example, firms may innovate out of a desire to reduce their need for permits in order to hoard permits and exercise market power.[282]

2. Evidence

Several scholars have commented on how few empirical studies have analyzed innovation under marketable permit programs.[283] The limited evidence provides somewhat weak support for the theory that marketable permit programs incentivize innovation better.[284]

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[276] *Id.*
[277] *Id.*
[278] *Id.*
[279] Jennifer Yelin-Kefer, *Warming Up to an International Greenhouse Gas Market: Lessons from the U.S. Acid Rain Experience*, 20 Stanford Envtl. L. J. 221 (2001).
[280] T.H. Tietenberg, Emissions Trading: Principles and Practice 43 (2006, 2d ed).
[281] *Id.* at 151.
[282] *Id.*
[283] David Driesen, *Is Emission Trading an Economic Incentive Program?, supra* note 18.
[284] Harrington et al. (2004) find general, but not universal, support that market-based provide greater incentives to innovate than traditional regulation; Tietenburg reports "some support" for innovation, though not a "ringing endorsement." Tom

The clearest evidence comes from the lead phase-out and acid rain markets.[285] The lead phase-out program resulted in "measurable incentives" for diffusion of cost-saving technologies.[286] The acid rain market at least likely contributed to the operational innovation of identifying fuel switching as a cheap compliance option,[287] and some studies have found the acid rain permit market helped diffuse critical technological advances.[288]

Other examples of innovations in production include:

- By allowing trading and leasing of electromagnetic spectrum, spectrum users may arrange to share channels and voluntarily accept more interference than FCC typically allows in its direct licensing.[289]
- Under a tradable catch share program, fishers no longer have to race to catch Alaskan halibut and sablefish, leading to longer seasons and increased profitability.[290]
- The Fish and Wildlife Service asserts, though without citing empirical evidence, that conservation banking consolidates scientific expertise and financial resources into larger projects compared to small-scale mitigation by individual permittees, and economies of scale lead to the creation of even more ecosystem services and credits.[291]

C. Do Marketable Permits Save Administrative Resources?

1. Theory

Crucial administrative tasks for either marketable permits or prescriptive regulation include designing the rules, responding to new information and changing circumstances, resolving disputes with regulated entities and stakeholders, and monitoring and enforcing the standards. Marketable permits have some theoretical advantages over prescriptive regulation for these tasks and will require a very different allocation of administrative resources.

First, once the cap or baseline has been set and the rules for allocation and trading have been finalized, in theory the market in a cap-and-trade or credit program then relieves the regulators of some decision-making responsibilities. Rather than forcing regulatory agencies to decide which industries, regions, or sources will bear the abatement costs or have access to valuable public resources, the market decides for itself. While marketable permits impose some new regulatory tasks on regulators, like running auctions and registries, arguably they eliminate one of "the greatest roadblock[s] to administrative efficiency, namely that technical and economic decisions will now be made by plants" instead of by bureaucrats who inevitably have less information on the costs and benefits facing individual regulated

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Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181; Harrington & Morgenstern, *supra* note 259, find some support, but mixed.

[285] Winston Harrington & Richard Morgenstern, International Experience with Competing Approaches to Environmental Policy: Results from Six Paired Cases 119, *supra* note 259.

[286] *Id.* at 9; Stavins, *U.S. Cap-and-Trade System*, *supra* note 262, at 9; Kerr and Newell (2003) find greater technological adoption because of trading in lead phase-out.

[287] T.H. Tietenberg, Emissions Trading: Principles and Practice 68 (2006, 2d ed) (citing Taylor et al (2005)).

[288] Chan, Stavins et al., *supra* note 272, at 25 (crediting the market with the wave of scrubber installments as well as the diffusion of low-sulfur coal mining and blending techniques).

[289] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 4 (1981).

[290] Pew Envtl. Group, *Design Matters: Making Catch Shares Work* (2009).

[291] FWS, Guidance for the Establishment, Use, and Operation of Conservation Banks (2003).

entities.[292] Historically, many federal and state agencies have been overwhelmed by the heavy information burdens of determining the best technologies for each individual industry and writing individual prescriptive permits.[293] In other words, marketable permit programs may create some new upfront administrative tasks, but may lower administrative costs over time. Besides saving administrative costs, market-based approaches may also advance rational decision-making, since the market efficiently assimilates existing information and bypasses the potential for agency bureaucrats injecting bias into permitting decisions.[294]

Critics like David Driesen challenge whether it is really more efficient to set a cap, design an allocation scheme, and create rules for trading than to simply set a uniform prescriptive standard.[295] Other scholars argue that effectively running a complex market-based scheme with few administrative resources is a myth. Markets will not function properly with only a passive regulator keeping a tally of permits. Rather, active regulators are needed to analyze and disseminate market information, and in some cases to create the platforms for trading; to coordinate with firms as a technical consultant and assist small entities and other sources in designing compliance plans; and to formulate a contingency plan in case the market fails to achieve the regulatory objective.[296] Ultimately, running a marketable permit program may be just as or more demanding for agencies than traditional regulation.[297]

Second, market systems may respond better to changing economic circumstance, like new technologies or new substitute goods, without necessarily prompting new regulatory proceedings. For example, prescriptive emissions regulation specific to each use of ozone-depleting substances would have to be repeatedly updated each time a new use for chlorofluorocarbons was discovered; a market just lets new users buy in to the existing cap. In particular, markets can automatically adjust to accommodate economic growth and the new levels of regulated activities that accompany growth; prescriptive regulation requires constant new efforts to accommodate growth without pollution increases.[298] Even Driesen admits that mass-based caps (though not rate-based marketable permits) can automatically accommodate economic growth, as the cap will incentivize additional reductions to offset any new demand for permits.[299] Additionally, by setting a clear price on the regulated activity, markets give agencies ready and accurate information on regulatory costs—information that agencies can incorporate to improve future regulatory decisions.[300]

Third, markets could ease disputes with regulated entities. Because trading lowers compliance costs, it lowers the incentive for firms to lobby or litigate for delay or to entertain noncompliance strategies: it simply may be cheaper to comply than to dispute.[301] Disappointed permit seekers may argue the cap was too stringent, but they cannot accuse the agency of individual bias or litigate each individual permitting decision as they can with prescriptive regulation.[302] Overall, market-based regulatory tools are thought to remove some of the friction between regulators and the regulated.[303] For a contrary

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[292] Bruce Ackerman & Richard Stewart, *Reforming Environmental Law: The Democratic Case*, *supra* note 255.
[293] *Id.*
[294] Michael Abramowicz, *The Law-and-Markets Movement*, *supra* note 94.
[295] David Driesen, *Is Emission Trading an Economic Incentive Program?, supra* note 18.
[296] Lesley McAllister, *Beyond Playing "Banker"*, 59 Admin. L. Rev. 269 (2007).
[297] *Id.*
[298] Bruce Ackerman & Richard Stewart, *Reforming Environmental Law: The Democratic Case*, *supra* note 255.
[299] David Driesen, *Is Emission Trading an Economic Incentive Program?*, *supra* note 18.
[300] *Marketable Rights*, *supra* note 1, at 5-7.
[301] T.H. Tietenberg, Emissions Trading: Principles and Practice 176 (2006, 2d ed).
[302] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 5-6 (1981)
[303] Lesley McAllister, *Beyond Playing "Banker"*, 59 Admin. L. Rev. 269 (2007).

perspective, Driesen argues that complexity, uncertainty, and delay are just as likely to plague marketable permits programs, which will inevitably face disputes about baseline, creditable reductions, and market restrictions.[304]

Fourth, markets could incentivize more accurate and cheaper monitoring and could be easier to enforce. Historically, agencies spent relatively little on monitoring compliance with prescriptive environmental regulations, relied heavily on industry-reported data, and enforcement was often weak.[305] By contrast, the market can give both agencies and regulated entities an incentive to support thorough monitoring.[306] Agencies could be especially motivated in an repeated auction system, because better compliance results in higher permit demand, higher permit prices, and greater revenue for the government.[307] Regulated entities will support monitoring and enforcement because noncompliance by other parties lowers the value of the permits they hold. The cost savings afforded by a market-based system may make it easier for agencies to transfer the responsibility and expense of monitoring to regulated entities. Additional advantages may arise in particular contexts: for example, because conservation banks consolidate mitigation efforts, it is easier for agencies to monitor a small number of large sites than a large number of small, disperse sites.[308] Driesen disagrees once again with this theory of administrative resource savings, arguing that marketable permit programs in fact double the cost and challenge of monitoring, because the regulator needs to monitor both buyers and sellers of allowances and credits, instead of just the regulated source itself.[309]

On enforcement, historically prescriptive environmental permits often featured vague standards and resulted in ineffective enforcement, and penalties for violation of prescriptive regulation were similarly inconsistent and weak.[310] Enforcement by agencies and courts may be easier under market-based systems in part because of the compliance cost savings: agencies and courts are less reluctant to simply require the purchase of additional credits as a penalty, as opposed to installing expensive retrofits.

Regardless of aggregate administrative costs, marketable permits will require a different allocation of agency resources. Agencies will have to retrain staff in the theory and operation of markets.[311] Agencies may also need to hire different staff: instead of engineers who identify control strategies and negotiate permit terms, under a marketable permit program agencies might need more people who can monitor and enforce.[312] However, setting the cap or baseline and verifying that credits are additional may require much of the same expertise and administrative work as under prescriptive regulations.[313]

2. Evidence

Literature reviews find some evidence that trading eventually lowers administrative costs, but also that trading changes bureaucratic functions as monitors replace engineers and could result in some short-

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[304] David Driesen, *Is Emission Trading an Economic Incentive Program?*, *supra* note 18.
[305] Bruce Ackerman & Richard Stewart, *Reforming Environmental Law: The Democratic Case*, *supra* note 255 (agencies spend on air monitoring 0.02% of the total estimated cost of air pollution controls)
[306] *Id.*
[307] Note that, unless given specific authority to keep revenue, individual federal agencies would have to deposit any revenue beyond covering their own expenses into the general U.S. treasury. State laws may allow individual state agencies to retain revenue.
[308] NMFS West Coast Region, Conservation Banking Guidance (2015).
[309] David Driesen, *Is Emission Trading an Economic Incentive Program?, supra* note 18.
[310] Bruce Ackerman & Richard Stewart, *Reforming Environmental Law: The Democratic Case*, *supra* note 255.
[311] T.H. Tietenberg, Emissions Trading: Principles and Practice 41 (2006, 2d ed).
[312] Tom Tietenberg, *Tradable Permits in Principle and Practice*, *supra* note 181.
[313] *Id.*

term cost increases.[314] Harrington and Morgenstern, for example, find reasonable evidence that economic incentives have a lower information burden than traditional regulation, but they find only mixed evidence that economic incentives have lowered administrative costs.[315] For example, EPA's lead trading program was so complex that unintentional violations in early years increased monitoring costs.[316] Meanwhile, though the U.S. acid rain market did have impressively low administrative costs, achieving nearly 100% compliance rates with only about 100 EPA staff,[317] administrative costs were also quite low for Germany's prescriptive regulations for sulfur dioxide from power plants.[318] Harrington and Morgenstern also point out that marketable permit programs explicitly authorized by statute, like the acid rain program, may have no advantage over prescriptive regulation for adapting to new information, because it would take an act of Congress to change the sulfur dioxide cap.[319]

Water quality trading programs reportedly can be costly to build from scratch, and unfortunately many state water quality programs are in fact built from scratch, despite the availability of models for best practices and the potential to share resources.[320]

There is some evidence that in fish catch share programs, the market can automatically adjust to socio-economic changes to the relative demand between commercial and recreational fishers.[321] Canada notably has long relied on fish catch share programs as a cost-effective way to manage a large number of fishers and fisheries in the face of inadequate technological solutions to prevent overfishing.[322] However, Alaska's halibut and sablefish tradable quota program has seen increased administrative costs.[323]

For conservation banking, it is perhaps notable that after two decades of activity, in Fish and Wildlife Service reaffirmed in 2016 its belief that conservation banking reduces the workload for its staff.[324] On the other hand, conservation bank sponsors complain about the lack of defined timeline for review, insufficient agency staff, and long review times: it reportedly takes about about 2.5 years to plan and get approval on a conservation bank, and about 40% of the time is spent waiting for FWS input.[325] Wetland mitigation banks may fare no better. While the Army Corps of Engineers contends that applicants who use a wetlands bank receive their permits about 50-120 days faster than applicants who undertake their own mitigation,[326] those figures do not account for the time spent approving the bank or in-lieu instrument in the first place. Despite codified timelines for review, approval, and oversight of wetland

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[314] T.H. Tietenberg, Emissions Trading: Principles and Practice 71 (2006, 2d ed).
[315] Winston Harrington & Richard Morgenstern, *International Experience with Competing Approaches to Environmental Policy: Results from Six Paired Cases*, *supra* note 259, at 117.
[316] *Id.* at 126.
[317] Lesley McAllister, *Beyond Playing "Banker"*, 59 Admin. L. Rev. 269 (2007).
[318] Winston Harrington & Richard Morgenstern, *International Experience with Competing Approaches to Environmental Policy: Results from Six Paired Cases*, *supra* note 259, at 126.
[319] Though, if Congress built in safety valves to relax or increase the cap stringency based on price, a marketable permit program established by statute could still automatically respond to new information. Winston Harrington & Richard Morgenstern, *International Experience with Competing Approaches to Environmental Policy: Results from Six Paired Cases*, *supra* note 259, at 134.
[320] Willamette Partnership, *In It Together: A How-To Reference* (2012); EPA & USDA, Report on 2015 National Workshop on Water Quality Markets (2016).
[321] NOAA, Catch Share Policy (2010).
[322] Katrina Wyman, *Why Regulators Turn to Tradable Permits: A Canadian Case Study*, 52 U. Toronto L.J. 419 (2002).
[323] Pew Envtl. Group, *Design Matters: Making Catch Shares Work* (2009).
[324] Notice of Final Compensatory Mitigation Policy, 81 Fed. Reg. 95,316 (Dec. 27, 2016).
[325] DOI, Office of Policy Analysis, Results from a Survey of Conservation Bank Sponsors (2016).
[326] U.S. Army Corps, Institute for Water Resources, The Mitigation Rule Retrospective (2015) (an average of 120 days versus 177-243 days, and rising).

banks, the Corps has no quantitative data to track compliance with those deadlines,[327] and bank sponsors report that timelines are not being met.[328] The National Mitigation Banking Association says that it would prefer to sometimes get a "no" early than to have every review drag on indefinitely.[329]

D. Distributional Consequences

1. Grandfathering, Windfalls, and Barriers to Entry

In cap-and-trade programs, regulators have several options for the initial allocation of privileges or obligations: by open auction; by lottery, either for free or with a fixed price per allocation awarded; or by criteria-based rules, such as historical use of the resource, again either free or with a fixed charge.[330] The two dominant choices[331] for existing and proposed cap-and-trade programs are auctions and free allocations based at least partly on historical use of the resource. The free allocation approach is a form of "grandfathering," which, broadly defined, means giving special regulatory treatment to existing actors compared to new actors.

In theory the method for initial allocation should not affect the ultimate efficiency of the market, so long as the allocation does not create a monopoly.[332] For example, consider a greenhouse gas cap-and-trade market. As I have written previously elsewhere:

> As soon as an emissions cap is put in place, the cost of electricity and energy-intensive goods will rise, creating a price signal across the economy to save energy and move to cleaner technologies like wind and solar. This effect will take place regardless of how permits are distributed, because utility companies will account for the market value of the permits, not the purchase price. The following analogy paints a clear picture: "A ticket scalper is going to charge the same amount — the going black-market price — whether he's selling a ticket that he found on the ground or a ticket that he bought. He's just going to turn more of a profit if he found it on the ground."[333]

However, that theory may be overstated. In reality, freely allocating valuable permits to existing actors based on their historical use of the resource increases the risk of monopoly power in the permit market and incentivizes perverse strategic behavior, like a firm artificially inflating its use of the resource in the baseline year to increase its allocation share.[334] The Federal Trade Commission has also found that, compared to auctions, grandfathering may reduce the incentive to innovate.[335] These efficiency concerns are discussed in sections below. This section focuses on a different distinction between

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[327] *Id.*
[328] *Id.*
[329] *Id.*
[330] But setting the right fee is very difficult, it is better to auction. FTC, Comments of the Staff of the Bureau of Economics on Protection of Stratospheric Ozone (1988).
[331] Other structures are possible. For example, the acid rain market allocated almost all allowances freely, but also required sources to auction a small percentage of their allowances at a zero-revenue auction, for purposes of price discovery and to allow a vehicle for new entrants into the market.
[332] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 12 (1981)
[333] Inimai Chettiar & Jason Schwartz, *The Road Ahead: EPA's Obligations and Options for Regulating Greenhouse Gases* (2009) (citing Rob Inglis, *The Power Industry's Prisoner's Dilemma*, THE NEW REPUBLIC: THE VINE, Mar. 23, 2009, *available at* http://blogs.tnr.com/tnr/blogs/environmentandenergy/archive/2009/03/23/the-power-industry-prisoner-s-dilemma.aspx).
[334] T.H. Tietenberg, Emissions Trading: Principles and Practice 138-139 (2006, 2d ed).
[335] FTC, Comments of the Staff of the Bureau of Economics on Protection of Stratospheric Ozone (1988).

grandfathering and auctions: distributional consequences, such as windfall profits and barriers to new entry.

Regulators often choose grandfathering to avoid disruptions to the status quo, to protect returns on past investments, and to ease tensions with the regulated industry.[336] In fish catch share programs, for example, grandfathering based on fishers' catch history has been preferred in order to protect traditional fishing communities, increase fishers' returns on investment, and provide incentives for existing communities to act collectively to enhance the long-term value of the fish stock.[337] Despite specific statutory authority to auction,[338] no U.S. fish catch share program has used auctions. The fishing industry has a loud voice on regional fishery councils, and therefore such councils are unlikely to vote for an auction. The National Marine Fisheries Service directly controls the catch share program for highly migratory Bluefin tuna, but the agency specifically declined to auction quotas in order to protect past investments and minimize uncertainty that an auction would create.[339]

However, grandfathering can be inequitable, as it awards the regulated industry a windfall enrichment and creates barriers to new entry. Returning to the ticket scalper analogy, whether the ticket was initially purchased or found for free on the ground does not change the opportunity cost or the black market price; it only affects the scalper's profits. Likewise, freely allocating or auctioning greenhouse gas permits will not affect the choices firms make about their individual levels of pollution or the costs passed on to customers; it only affects the firms' profits. By contrast, with a revenue-raising auction run by the government, only the taxpayer gets a windfall enrichment.[340]

Auctions also reduce barriers to entry compared to grandfather.[341] Grandfathering is a common feature of prescriptive regulation, and new entrants face disproportionately stringent standards while existing entities are protected out of political concerns.[342] Cap-and-trade auctions and credit programs may create fewer anticompetitive barriers to new entrants to industry than prescriptive regulation.[343] For example, the cost, delay, uncertainty, and contentiousness of FCC licensing proceedings discouraged new competitors from seeking access to electromagnetic spectrum; with license auctions, they can just buy in.[344] Similarly, in credit markets, new entrants can just buy in.

By contrast, when allowances are freely allocated, new entrants must rely on the secondary market for the necessary permits to operate. Existing entities that hold the permits have an incentive not to facilitate purchases from potential new competitors. For example, there have been accusations of

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[336] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 13 (1981)

[337] Terry Anderson et al., *Efficiency Advantage of Grandfathering*, NBER No. w161519 (2010).

[338] 16 U.S.C. § 1853a(d)-(e).

[339] 79 Fed. Reg. 71,509 (2014).

[340] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 12 (1981).

[341] Breger, Stewart, Elliott, & Hawkins, *Providing Economic Incentive in Environmental Regulation*, *supra* note 13.

[342] *See* Jonathan Nash & Richard Revesz, *Grandfathering and Environmental Regulation: the Law and Economics of New Source Review*, 101 Northwestern U. L. Rev. 1677 (2007). Also, prescriptive regulations like BAT place disproportionate burdens on new industries (i.e., more stringent because no fear of shutdown) and on more productive industries (i.e., more stringent because they can afford it); trading eliminates those disproportionate burdens. Bruce Ackerman & Richard Stewart, *Reforming Environmental Law: The Democratic Case*, *supra* note 255.

[343] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* at 4.

[344] *Id.* at 5.

collusion against new entrants in the airport landing slot market.[345] Airlines in possession of valuable landing slots, which they got for free, have an incentive to retain the slots for possible future ridership expansion, even if it means flying empty in the meantime.[346] Some regulators try to address such new entry barriers by creating a reserve pool or set-aside of allowances for new entrants. To that end, in 2011, FAA approved a trade of airport landing slots between Delta and U.S. Airways, but the agency conditioned its approval on a portion of the paired slots being auctioned to carriers who had less than 5% of the existing slots at those airports.[347] The European Union's Emissions Trading System has a set-aside pool for new entrants, as does the acid rain market, though these set-asides have never been accessed.[348] Overall, set-aside pools for new entrants remain rare in marketable permit programs.[349]

Auctions are typically considered to be politically more difficult to implement, because the benefits of auctioning are diffusely spread across all taxpayers, while the interests in favor of grandfathering are highly concentrated and often politically connected.[350] However, free initial allocations may create a constituency of concentrated interests that will politically oppose any future changes to the programs' stringency or allocations. In the long-run, auctions may make programmatic adjustments politically easier.

An alternative option to freely allocating allowances to regulated entities based on historic use is to allocate to other parties based on different criteria. For example, New Zealand gives 40% of its tradable fish catch shares to the Maori, so that the community can protect its own interests. Similarly, the Bering Sea Community Development Quota Program gave 7.5% of walleye Pollock quota to native communities.[351] In air pollution markets, some experts advocate for output-based allocations rather than historic emissions-based allocations, to reward renewable and nuclear electricity generators with allowances and to facilitate entry into the market.

Recommendation: Agencies should opt for auctions over grandfathering to prevent windfalls and barriers to entry. If auctions are not feasible, agencies should consider alternate allocation techniques, like set-asides for new entrants, output-based allocations, and community-based allocations.

2. Small Entities and Communities

In general, smaller entities may face special challenges in a marketable permit program. They may lack the resources for the kind of long-term planning necessary to manage risk in the market.[352] Because of economies of scale, they may have a harder time than larger sources offsetting the new monitoring costs of trading programs with the cost savings of trading.[353] They may face higher transaction costs on secondary markets and may not have the relationships with larger entities necessary to find buyers and sellers if permits are not traded on established, standardized markets. For example, even though EPA

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[345] The accusations led FAA to propose reforms in 2015 to increase transparency and public participation, 80 Fed. Reg. 1273; however, the proposed rule was withdrawn in 2016.
[346] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 42 (1981).
[347] FAA Briefing, *Auction Opens for Slots at New York and Washington Airports*, Nov. 14, 2011, https://www.transportation.gov/briefing-room/auction-opens-slots-new-york-and-washington-airports.
[348] T.H. Tietenberg, Emissions Trading: Principles and Practice 158 (2006, 2d ed).
[349] Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181.
[350] Interview with Don Elliott.
[351] Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181.
[352] Lesley McAllister, *Beyond Playing "Banker"*, 59 Admin. L. Rev. 269 (2007).
[353] T.H. Tietenberg, Emissions Trading: Principles and Practice 182 (2006, 2d ed).

designed its inter-refinery trading system for lead in gasoline in part to help small refiners manage their costs,[354] in reality both small and new refineries faced higher transaction costs.[355] As another example, small providers in rural areas have had trouble accessing spectrum on the secondary market,[356] and the FCC reserves some spectrum for public uses, out of concern that they cannot compete in auctions.

The distributional consequences of marketable permit programs to small entities and communities have attracted the most attention in fish catch share programs. The temporary moratorium on fish catch share programs imposed by Congress was motivated largely by concerns about equity, small communities, and a potential influx of outside investors.[357] Fishers have often insisted upon various trade restrictions—sometimes over the objections of regulators—in order to protect fishing communities from outside corporate interests.[358] For example, the Alaskan halibut tradable catch share program prohibits transfers across vessel class size and requires owners to be on board for catch,[359] and many fish catch share programs have position limits designed to minimize consolidation of permits.[360] In fact, share caps and other limits to prevent inequitable concentrations are required by statute,[361] and the regional fishery councils must consider employment and the cultural framework of the fishery in their initial allocations, to protect participation of small owners. The Magnuson-Stevens Act also allows the federal government to help finance the purchase of shares by small or new fishers.[362]

Nevertheless, several fisheries have experienced distributional consequences. Alaska's halibut and sablefish fisheries endured layoffs, with small fishers and small communities hit the hardest.[363] In a survey of red snapper shareholders, though large shareholders reported being "very satisfied" with the program, small shareholders were quite unsatisfied, and the overall rating of the program's success was "tepid."[364] Small shareholders felt the program had serious inequalities and resented the creation of a "new class of 'sea lords'" who own shares but lease them out rather than fish themselves.[365] In 1990, when the first U.S. tradable catch share program began, there were 117 unique holders of Mid Atlantic quahog allocations; since then, there has been a steady decline, and as of 2013 there were only 40 unique share holders.[366] Notably, the quahog program did not historically have accumulation limits, relying instead on standard antitrust laws to protect against excessive concentration. But while existing antitrust laws may prevent monopolies, they are insufficient to prevent permit consolidation.[367]

None of this suggests that distributional consequences are necessarily worse under marketable permit programs than traditional regulations. As noted above, marketable permits allocated by auction (or by credit system) can help put all firms—existing or new, large or small—on relatively equal footing, and

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[354] Stavins, What Can We Learn from U.S. Experience?, *supra* note 13, at 22.
[355] T.H. Tietenberg, Emissions Trading: Principles and Practice 69 (2006, 2d ed).
[356] FCC, *The National Broadband Plan* 83 (2010).
[357] Mark Fina, *Evolution of Catch Share Management*, 36 Fisheries 164 (2011); *cf.* NRC, *Sharing the Fish: Toward a National Policy on IFQs* (1999) (moratorium was because of congressional concerns about social, economic, and biological effects).
[358] Katrina Wyman, *Why Regulators Turn to Tradable Permits: A Canadian Case Study*, 52 U. Toronto L.J. 419 (2002).
[359] Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181. Also, the Pacific Coast Sablefish program prohibits transfers to partnerships or corporations.
[360] For example, the Sea Scallop IFQ ownership cap is 2.5% per vessel, 5% per entity. NOAA, Economic Performance of U.S. Catch Share Programs, NMFS-F/SPO-133 (2013). The Golden Tilfeish IFQ cap is 49%. *Id.*
[361] 16 U.S.C. § 1853a(c)(5).
[362] 16 U.S.C. § 1853a(g). Such loans do exist, with terms of twenty years or more. Mark Fina & Tyson Kade, *Legal and Policy Implications of the Perception of Property Rights in Catch Shares*, *supra* note 193.
[363] Pew Envtl. Group, *Design Matters: Making Catch Shares Work* (2009).
[364] Nat'l Marine Fisheries Serv., Red Snapper IFQ Five-Year Review (2013) (survey conducted by Louisiana State University).
[365] *Id.*
[366] NOAA, Economic Performance of U.S. Catch Share Programs, NMFS-F/SPO-133 (2013).
[367] NRC, *Sharing the Fish: Toward a National Policy on IFQs* (1999).

other allocation methods can specifically address distributional concerns, such as giving catch share directly to native communities. Regulators should generally be aware of the potential for distributional effects on small entities and communities, though there is likely no one-size-fits-all solution.

3. Consumer Effects and Auction Revenue

One concern raised about marketable permits is that by charging regulated entities for permits they once received for free, those costs will be passed on to consumers. However, economic theory suggests that the marketability or auctioning of permits should have no effect on consumers compared to other kinds of similarly stringent regulation or other methods of allocation. Under a greenhouse gas cap-and-trade program, it is the cap, not the trading or auctioning, that raises the cost of electricity and energy-intensive goods, and similarly stringent prescriptive regulations would have similar results. According to economic theory, consumer prices should not depend on the sunk cost of winning a bid at auction, but rather on the permit's opportunity cost, which is independent of allocation method.

Empirical evidence confirms this theory. For example, data on the cellular telephone market from 1985-1998 showed that FCC's spectrum auctions did not raise consumer prices.[368] Similarly, despite huge volatility in the price of renewable fuel credits in 2013, consumers did not experience any corresponding increases in overall retail price of transportation fuels.[369] More generally, economists have found that choosing free allocation instead of auctioning only results in transferring wealth to corporate shareholders, with little if any benefit to consumers.[370]

Even though an auction, free allocation, or prescriptive regulation might all have similar effects on consumer prices, an auction at least generates revenue that can potentially be returned to consumers by a per capita dividend. For example, any cap on greenhouse gas emissions will increase energy prices. Because lower- and middle-income households spend a larger percentage of their income on energy than higher-income households, increases in energy prices potentially have a regressive effect. By auctioning and distributing revenue back on a per capita basis, studies show that most consumers would actually come out ahead under this kind of cap-auction-dividend system.[371]

Direct dividend mechanisms typically will not be available to federal agencies implementing auctions. Unless specifically authorized otherwise by statute, the law requires all proceeds collected by federal

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[368] Evan Kwerel, *Spectrum Auctions Do Not Raise the Price of Wireless Services: Theory and Evidence (*FCC Paper, 2000).

[369] Dallas Burkholder, OTAQ, *Preliminary Analysis of RIN Market Dynamics, RIN Prices, and Their Effects* (2015). Though retail prices of fuels with a low percentage or no renewable content may increase with high RIN prices, while the retail price of fuels with a high percentage of renewables may decrease.

[370] *Policy Options to Prevent Climate Change: Hearing Before H. Comm. on Ways and Means*, 100th Cong., 8 (2008) (testimony of Dallas Burtraw, Senior Fellow, Resources for the Future). Economic experts and President Obama called for a 100% auction of all greenhouse gas allowances under a legislative cap-and-trade program, decrying any free allocation of permits as an industry giveaway. *See* Robin Bravender, *Economists Assail Industry's Push for Free Allowances*, E&E DAILY NEWS, Apr. 9, 2009. *But see* Ben Geman & Mike Burnham, *Obama Admin. Courting Moderate Senate Democrats*, E&E DAILY NEWS, Apr. 8, 2009 (noting Obama may be flexible on his call for a 100% auction).

[371] *See* Dallas Burtraw et al., *The Incidence of U.S. Climate Policy: Where You Stand Depends on Where You Sit* 36 (Res. for the Future Discussion Paper No. 08-28, 2008), *available at* http://www.rff.org/RFF/Documents/RFF-DP-08-28.pdf. This is true even before they change their behavior to save energy, which for lower-income Americans might not be financially feasible right away. The regional disparities from a cap with revenue distribution are also not large. *Id.* Recognizing the fairness of distributing auction revenue to the public, President Obama has voiced this policy preference. OMB, A NEW ERA OF RESPONSIBILITY, *supra* note 23, at 21. The President's budget proposed that, of the auction proceeds from a cap-and-trade system for greenhouse gases, $150 billion would be used to fund clean energy technologies, and the balance would be "returned to the people, especially vulnerable families, communities, and businesses to help the transition to a clean energy economy." *Id.*

agencies to be deposited into the general treasury of the United States,[372] except perhaps enough to cover administrative expenses.[373] Agencies most likely could not avoid this result by designating some non-profit third party to run the auction and distribute revenue.[374] Still, general treasury deposits could ultimately lighten the overall tax burden, and this result remains preferable to a free windfall for regulated entities. Notably, states are not under such constraints, including states implementing federal standards under a cooperative federalism statute like the Clean Air Act, and so states could dividend auction revenue back to consumers. And as seen with some fish catch share programs, it may be possible to allocate allowances to affected communities and let them put the allowances up for auction.

Recommendation: Federal agencies should opt for auctions and should encourage states to use an auction-and-dividend approach.

III. Policy Effectiveness

Do marketable permits maintain or exceed the required regulatory protections, or do they fall short and generate negative externalities?

A. Currency and Exchange Restrictions: Fungibility, Externalities, Uncertainty

In general, marketable permits work best when regulators care more about the total amount of activity than about who is undertaking the activity.[375] Global pollutants like greenhouse gases present the paradigmatic case for marketable permits because they are particularly flexible on the questions of "who, what, where, and when."[376] Greenhouse gases mix freely in the global atmosphere, have long lifespans, and affect global climate through their accumulated stock concentrations rather than through emissions flows. Because greenhouse gases have no localized effects, it does not matter which industries, sources, or regions reduce their emissions.[377] After adjusting for relative potencies, to some extent it also does not matter much which greenhouse gas variety is mitigated: carbon dioxide, methane, nitrous oxide, or highly-potent fluorinated gases. Similarly, at least within periods of a few years, to some extent it does not matter much when greenhouse emissions are abated, lending the market a degree of temporal flexibility that allows it to adjust to fluctuating compliance costs over time without sacrificing environmental benefits.[378] With greenhouse gases, essentially all that matters is identifying the optimal overall emissions cap for each period of years; the market then sorts out for itself who can achieve which emissions reductions at the lowest compliance cost. In short, a cap-and-trade market can exchange tons of carbon dioxide-equivalent emissions as a highly fungible kind of currency.

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[372] *See* Miscellaneous Receipts Act, 31 U.S.C. § 3302 (2008).

[373] *See* IOAA, 31 U.S.C. § 9701(a) ("It is the sense of Congress that each service or thing of value provided by an agency (except a mixed-ownership Government corporation) to a person (except a person on official business of the United States Government) is to be self-sustaining to the extent possible."). It is less clear whether EPA could keep enough to cover all its expenses relating to climate change regulation.

[374] "Government agencies cannot escape responsibility for failing to perform their statutory duties by hiring private parties to perform those duties." *Thomas v. Network Solutions*, 176 F.3d 500, 510 (D.C. Cir. 1999).

[375] *Marketable Rights*, *supra* note 1, at 9.

[376] Stavins, *U.S. Cap-and-Trade System*, *supra* note 262, at 31.

[377] In other words, allowing sources to trade greenhouse gas permits across sectors and regions does not create "hot spots" of localized pollution. Allowing greenhouse gas markets could change the distribution of co-benefits from the reduction of co-pollutants.

[378] Stavins, *U.S. Cap-and-Trade System*, *supra* note 262, at 31.

Complete fungibility rarely exists for other kinds of currencies in common marketable permits programs.[379] As Salzman and Ruhl have detailed, currencies that inadequately control for non-fungibility across space, type, or time may allow externalities to bleed out of the market.[380] For example, in RECLAIM's car scraping program, the fact that refinery emissions are concentrated, more carcinogenic, and spike at irregular times, while vehicle emissions are geographically diffuse, less carcinogenic, and fluctuate over regular 24-hour periods, meant that reductions in vehicle emissions were imperfectly fungible spatially, temporally, and by type with increased refinery emissions.[381] Without any additional regulatory controls, allowing trading between vehicle and refinery emissions to proceed on the false assumption that they are interchangeable ton for ton would generate unintended, negative externalities: instead of a diffuse population being exposed to somewhat dangerous pollution from cars, a concentrated population might be exposed to more highly dangerous pollution from refineries.

Eliminating all non-fungibilities may be practically impossible. As Salzman and Ruhl remark, nobody will trade identical blue marbles, and the whole point of a market is to take advantage of heterogeneity.[382] More complex currencies, like trading in units of cancer risk in the above RECLAIM example, could resolve some externalities, but at a heavy informational burden on agencies and attendant increased transaction costs, making the market less efficient.[383] Some critics of marketable permit programs note that designing sufficiently comprehensive currencies may be impossible: arguably, no expert could authoritatively answer whether one acre of wetland provided the same ecosystem services as another,[384] and regulators are unlikely to have the financial resources or technical expertise to judge the relative values of highly heterogeneous environmental assets like habitat and water quality.[385] To these critics, non-fungibility suggest marketable permits may not be appropriate in such contexts.

In reality, most marketable permit programs have accepted the fungibility problems of simple currencies like tons of pollution and acres of wetland, and address the resulting externalities by adopting restrictions on who can trade, where and when they can trade, and at what exchange rate they can trade.[386] Unfortunately, too many exchange restrictions will create risks of market imperfections, like thin, inactive markets, which undermine the efficiency of the program.[387]

Trading ratios can address *known* differences in impacts across space, time, or type.[388] However, uncertainty about fungibility and externalities creates its own challenges for a marketable permit program. Some imperfect fungibilities as to "who" can be dealt with through restrictions on market participation, such as restricting foreign ownership.[389] Other issues, like national security concerns over ownership of electromagnetic spectrum, can likely only be addressed through institutional reviews. Options for such exchange restrictions and institutional reviews are discussed in the following sections.

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[379] Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181 (Permit fungibility is frequently a "myth".)
[380] James Salzman & J.B. Ruhl, *Currencies and the Commodification of Environmental Law*, *supra* note 6.
[381] *Id.*
[382] *Id*.
[383] *Id*.
[384] David Driesen, *Trading and Its Limits*, 14 Penn. St. Envtl. L. Rev. 169 (2005).
[385] James Boyd, Dennis King & Lisa Wainger, *Compensation for Lost Ecosystem Services: The Need for Benefit-Based Transfer Ratios*, 20 Stanford Envtl. L. J. 393 (2001).
[386] James Salzman & J.B. Ruhl, *Currencies and the Commodification of Environmental Law*, *supra* note 6.
[387] *Id.*
[388] Willamette Partnership, *In It Together: A How-To Reference Part 2* (2012).
[389] The Magnunson-Stevens Act ,16 U.S.C. § 1853a(c), prohibits foreign ownership. CFC trading rule allows international transfers with EPA approval.

1. Spatial Issues and Hot Spots

One of the most common critiques of environmental marketable permit programs relates to spatial fungibility: namely, hot spots.[390] The concern is that by allowing certain sources to purchase credits and emit more than they would otherwise under a prescriptive standard, localized increases in emissions of either the target pollutant or co-pollutants could disproportionately affect certain populations. Depending on wind patterns and other factors, localized hot spots could occur even if the sources buying credits are not themselves geographically concentrated.[391] As Richard Revesz and Jonathan Nash point out, having disproportionate concentrations of pollution in some regions may be welfare maximizing or not, depending on the shape of the pollutant's damage function; but from a distributional perspective, concentrations are usually undesirable.[392] In short, it seems unfair to make residents of one region trade their environmental and health benefits against another population's.[393]

Economic theory puts forward one reason to expect hot spots absent any exchange restrictions. Correlation between higher abatement costs and higher damages—which would lead to hot spots as the highly damaging sources choose to buy allowances rather than abate given their high compliance costs—may be more likely than having high emissions where the costs can be easily absorbed.[394] There has been some sporadic evidence of marketable permits resulting in hot spots, as with RECLAIM's credit program that allowed trading diffuse mobile source pollution for concentrated stationary pollution.[395]

However, in general, there is not much evidence that hot spots have materialized in marketable permit programs.[396] For example, some worried the acid rain program would cause hot spots, as especially dirty power plants in the Midwest would choose to buy allowances rather than reduce their emissions. In fact, the acid rain program's much feared hot spots did not develop, nor did hot spot arise in NOx trading.[397] The acid rain market may have even benefited the most vulnerable regions.[398] More than just good luck, it makes some intuitive sense that the cheapest abatement opportunities (i.e., the abatement opportunities that markets will prioritize) might be found among the largest sources, which tend to be the sources located were the biggest environmental problems are.[399]

Nevertheless, concerns about hot spots have given rise to many proposed restrictions on trades. The acid rain market restricted trades that would result in violations of national ambient air quality standards,[400] though the program did not specify a mechanism for achieving this goal.[401] For air pollution markets, the three common exchange restrictions motivated by hot spots are: preventing inter-zonal

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[390] Dan Farber, *Pollution Markets and Social Equity*, 39 Ecol. L. Q. (2012).
[391] Jonathan Nash & Richard Revesz, *Markets and Geography: Designing Marketable Permit Schemes to Control Local and Regional Pollutants*, 28 Ecol. L. Q. 569 (2002).
[392] *Id.*
[393] Breger, Stewart, Elliott, & Hawkins, *Providing Economic Incentive in Environmental Regulation*, *supra* note 13.
[394] Byron Swift, *U.S. Emissions Trading: Myths, Realities and Opportunities*, 20 Nat. Res. & Envt. 3 (2005) (citing Stavins, *Correlated Uncertainty & Policy Instrument Choice*, 30 J. Envtl. Econ. & Mgmt. 218, 229-30 (1996).
[395] Richard Drury et al., *Pollution Trading and Environmental Injustice*, 9 Duke Envtl. L. & Pol'y Forum 231 (1999).
[396] Byron Swift, *supra* note 394.
[397] A. Denny Ellerman, *Are Cap and Trade Programs More Environmentally-Effective Than Conventional Regulation?* 55, *in* Moving to Markets, *supra* note 2.
[398] Winston Harrington & Richard Morgenstern, *International Experience with Competing Approaches to Environmental Policy: Results from Six Paired Cases*, *supra* note 259, at 128.
[399] Ellerman, *Are Cap and Trade Programs More Environmentally-Effective Than Conventional Regulation?*, *supra* note 397, at 53.
[400] Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181.
[401] Some states developed specific tools: for example, New York restricts upwind acid rain trades. James Salzman & J.B. Ruhl, *Currencies and the Commodification of Environmental Law*, *supra* note 6.

trades; changing the currency to units of environmental degradation instead of tons; and imposing offset ratios. Revesz and Nash explain why none of these solutions is optimal. Partitioning the market into several geographic zones will not solve all spatially differentiated impacts, and reducing the size of the markets increases the risk of market power and blocks some otherwise efficient trades from taking place. Moreover, allocating the "correct" number of permits to each zone could be administratively challenging. Trading in environmental degradation units essentially creates separate markets at each individual air quality monitoring station. In addition to the resulting market thinness—exacerbated by the fact that each source would have to simultaneously obtain all needed permits at every receptor point, since not having one permit would block the emission and render all purchased permits worthless—multiple markets entail substantial supervision costs for the agency and transaction costs for industry. Finally, offset ratios add complexity for both regulators and participants, because a permit would convey different rights to different holders at different times, depending on the ratio dictated by environmental quality factors unique to each source's location.[402] Revesz and Nash develop a fourth option as their preferred solution: emissions trades would be conducted online subject to a computerized model of local air quality effects, and trades would be constrained only if the model predicted the exchange would cause local air quality to exceed standards.[403] Ultimately, Congress seems to have responded to hot spot concerns with the acid rain program by just increasing the stringency of the standard: "it was understood [by Congress] that the greater the overall size of the reduction, the more indifferent society could be to the spatial impacts of trades."[404]

With the exception of global pollutants like ozone-depleting substances,[405] many existing marketable permit programs have adopted various restrictions to prevent externalities relating to spatial fungibility. RECLAIM limited trading to within designated zones, and other programs restrict trading across airsheds.[406] Water quality trading is limited to within watersheds, regulators can annul trades that lead to destructive localized pollution,[407] and ratios may be applied to adjust for how different locations of discharge can have different effects on water quality. Many state-based renewable electricity standards restrict eligible credits to within neighboring states.[408] For conservation banking, mitigation must be in locations identified in landscape-scale conservation plans,[409] though some spatial flexibility is allowed if the overall benefit to the species warrants it.[410] According to the Army Corps of Engineers, trades between urban and rural wetlands are not favored, but are sometimes unavoidable.[411]

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[402] Jonathan Nash & Richard Revesz, *Markets and Geography: Designing Marketable Permit Schemes to Control Local and Regional Pollutants*, 28 Ecol. L. Q. 569 (2002).
[403] *Id.*
[404] I*d.*
[405] There is unrestricted trading across airsheds for CFCs, *see* 42 U.S.C. § 7671f(a).
[406] James Salzman & J.B. Ruhl, *Currencies and the Commodification of Environmental Law*, *supra* note 6 (for example, trading programs for NOx or VOCs); *see* 42 U.S.C. § 7503(c)).
[407] Andrew Wolman, *Effluent Trading in the United States and Australia*, *supra* note 229; *see also* EPA, Water Quality Trading Policy, 68 Fed. Reg. 1609 (Jan. 13, 2003). EPA supports trading for total phosphorus and total nitrogen and sediment load, but other pollutants would be subject to higher level of case-by-case scrutiny, implicit concern is hot spots; in particular, EPA does not currently support trading in bioaccumulative toxics, but is open to a pilot project. *Id.*; EPA, Water Quality Trading Toolkit (2009).
[408] NREL, *Quantifying the Level of Cross-State Renewable Energy Transactions* (2015) (or within ISO). California limits percent of out-of-state credits allowed (in 2012, actual trades were at 28% out-of-state). *Id.*
[409] Notice of Final Compensatory Mitigation Policy, 81 Fed. Reg. 95,316 (Dec. 27, 2016).
[410] *See* NMFS West Coast Region, Conservation Banking Guidance (2015).
[411] Corps-EPA Final Rule, Compensatory Mitigation for Losses of Aquatic Resources, 73 Fed. Reg. 19,593 (2008).

2. Temporal Issues and Banking/Borrowing

Temporal issues that must be resolved in designing marketable permit programs include whether permits are perpetual or have fixed lives, and whether allowances and credits can be banked for use in future years or borrowed from future years to satisfy compliance today. More permanency encourages long-term investment decisions, while fixed lives make it easier for agencies to adjust supply and for participants to rethink their market strategies.[412] Shorter permit lifespans also means less is at stake with any individual transfer, which may reduce the need for rigorous agency scrutiny of each transfer.[413]

Banking can be crucial to letting regulated sources hedge against permit price volatility and unexpected economic changes. On the other hand, current regulated activities may not be perfectly fungible with regulated activities far in the future, as with the emission of bioaccumulative toxins. Banking can also increase the incentive for noncompliance, because any permits not cashed in at end of the year for compliance still have value in future years.[414] There was some evidence from the lead phase-down program that banking led to noncompliance in early years, but at the same time, the evidence further suggests that banking was crucial to the program's efficiency and therefore environmental success.[415]

Agencies employ a range of practices to manage temporal flexibilities. For EPA's regulation of vehicle emissions, each vintage-year credit can be held for a fixed duration of about 10 years,[416] while for EPA's renewable fuel standard, RINs can only be banked for one compliance year.[417] NOx trading programs have limited too much banking of allowances in any one period.[418]

For wetland and conservation banking, a major distinction between banks and in-lieu fee instruments is the timing of mitigation. With banks, mitigation is verified before credits are sold to allow a project to proceed with harm to the habitat; with in-lieu fees, mitigation is not necessarily achieved in advance, and credits purchased may represent more of a promise for future mitigation.[419] The Fish and Wildlife Service has stated a preference for advance mitigation, and when that is not possible the agency recommends increasing the trading ratio to reflect any temporal species losses.[420] The Army Corps of Engineers has addressed similar concerns about in-lieu fees and the timing of mitigation by limiting the number of advance credits that can be sold and requiring in-lieu instruments to be operated by local governments or nonprofit groups, not by for-profit businesses.[421]

3. Type and Value Issues

Does a ton of pollution mitigated present the same carcinogenic risks as the additional ton of pollution it offset? Can one pollutant be traded for another?[422] Does an acre of wetlands newly created provide the

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412 Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 10-11 (1981)
413 *Id.* at 11.
414 T.H. Tietenberg, Emissions Trading: Principles and Practice 179 (2006, 2d ed).
415 *Id.*
416 EPA, Manufacturer Performance Report for 2015 MY (2015).
417 EPA, RINs under the Renewable Fuel Standard Program, https://www.epa.gov/renewable-fuel-standard-program/renewable-identification-numbers-rins-under-renewable-fuel-standard.
418 Jonathan Nash & Richard Revesz, *Markets and Geography: Designing Marketable Permit Schemes to Control Local and Regional Pollutants*, 28 Ecol. L. Q. 569 (2002).
419 Notice of Final Compensatory Mitigation Policy, 81 Fed. Reg. 95,316 (Dec. 27, 2016).
420 *Id.*
421 Corps-EPA Final Rule, Compensatory Mitigation for Losses of Aquatic Resources, 73 Fed. Reg. 19,593 (2008).
422 Don Elliott and Gail Charnley have called for trading among different pollutants where benefits of reduced risk are clear (cited in Salzman and Ruhl, *supra* note 6). Cross-pollutant trading works for greenhouse gases and CFCs. Some restrictions on

same ecosystem services as the acre of wetlands destroyed in its place? Do fish catch share programs increase the bycatch and discarding of non-target species,[423] or do conservation banks inadvertently degrade non-target species?[424] Different type- and value-fungibility issues crop up in each marketable permit application, and responses vary widely as well.

EPA has long had a generic policy for air pollution trading that trades must be environmentally equivalent,[425] though the agency does not clearly specify how that is to be achieved in every case. By contrast, the rules for wetland mitigation banks do not explicitly require replacement of lost social value.[426] In general wetland banking tries to replace the exact function of the wetland, while conservation banking tries to offset the impact to the endangered species.[427] The Army Corps has a preference for in-kind mitigation, especially for hard to replace wetlands like bogs, fens, and vernal pools, but does allow out-of-kind mitigation between different kinds of wetlands.[428] Conservation banking must be in-kind for the species, but it could involve trading different habitat types if the species outcome is the same.[429]

Fish and Wildlife Service policy states that habitat credits should be measured in the same terms as the impacts: acre for acre, family group for family group.[430] The Corps' 2008 regulation tried to move wetland mitigation banks away from proxies like acres and toward functional assessments to quantify credits and debits.[431] However, most habitat and wetland mitigation banks continue to rely on simply currencies, like acres (sometimes with trading ratios), rather than complex currencies like functional value or species family groups.[432] Acreage-based trades may be weighted for quality and value, and ratios can either increase or decrease the number of acres to be mitigated: for example, a loss of two acres of low-quality habitat may only need 1 high-quality credit.[433] Unfortunately, there are no simple, off-the-shelf valuation tools for measuring biophysical or functional site characteristics of wetlands or habitat, let alone for comparing the relative economic values of the habitat being traded.[434]

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cross-pollutant trading appear in EPA's 1996 draft framework on watershed-based trading (1996), but more recently EPA supports cross-pollutant trading for oxygen-related pollutants if adequate information is available on impacts. EPA, Water Quality Trading Policy, 68 Fed. Reg. 1609 (Jan. 13, 2003).

[423] Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181.

[424] FWS, Guidance for the Establishment, Use, and Operation of Conservation Banks (2003).

[425] James Salzman & J.B. Ruhl, Currencies and the Commodification of Environmental Law, *supra* note 6 (citing 51 Fed. Reg. 43,814 (Dec. 4, 1986)).

[426] James Boyd, Dennis King & Lisa Wainger, *Compensation for Lost Ecosystem Services*, *supra* note 385.

[427] FWS, Guidance for the Establishment, Use, and Operation of Conservation Banks (2003).

[428] Corps-EPA Final Rule, Compensatory Mitigation for Losses of Aquatic Resources, 73 Fed. Reg. 19,593 (2008).

[429] Notice of Final Compensatory Mitigation Policy, 81 Fed. Reg. 95,316 (Dec. 27, 2016). Ninth Circuit caselaw prevents using non-critical habitat credits to offset effects to critical habitat. *See* NMFS West Coast Region, Conservation Banking Guidance (2015).

[430] FWS, Guidance for the Establishment, Use, and Operation of Conservation Banks (2003).

[431] Corps-EPA Final Rule, Compensatory Mitigation for Losses of Aquatic Resources, 73 Fed. Reg. 19,593 (2008).

[432] James Boyd, Dennis King & Lisa Wainger, *Compensation for Lost Ecosystem Services*, *supra* note 385 (In 1992, of 46 wetlands banks, 20 used functional assessments, 26 used rough acreage-based trading ratios); *see also* James Salzman & J.B. Ruhl, *Currencies and the Commodification of Environmental Law*, *supra* note 6 (of 36 banks established after 1994, simply currencies, like acres, continue to dominate). As of 2003, the most common metric for conservation banking was acreage; some banks used acreage plus multipliers; number of species is the least common metric. Stratus Consulting for Northwest Fisheries Science Center, NOAA, A Nationwide Survey of Conservation Banks (2003).

[433] FWS, Guidance for the Establishment, Use, and Operation of Conservation Banks (2003).

[434] James Boyd, Dennis King & Lisa Wainger, *Compensation for Lost Ecosystem Services*, *supra* note 385.

4. Institutional Review Mechanisms

The preceding three sections discussed various non-fungibilities and the exchange restrictions some agencies apply to all trades to compensate for resulting externalities. Another option is, instead of universal restrictions, case-by-case reviews. Not only could case-by-case reviews address externalities, but they can also prevent unfit parties from acquiring permits.[435] However, a "gatekeeper"[436] with power to reject trades case-by-case increases transaction costs, and presents problems of false positives, overcorrection, and invalidation of good trades.[437] For example, when EPA originally insisted on ex post review of trades for criteria pollutants offsets, fewer than half the trades took place compared to states with no ex post review.[438] Some agencies continue to exercise a gatekeeper role. The Fish and Wildlife Service must approve all credit transactions for use in any Endangered Species Act permit, and the Service also approves all conservation bank operations.[439]

There are several other models of institutional review. The government could act as a market middleman and take charge of all buying in selling: for example, Puerto Rico's Planning Board acts as buyer and seller in all exchanges of transferable development rights.[440] Trading programs could provide for public comment and review on all individual trades, but the transaction costs would likely undermine an efficient market.[441] A more targeted approach could allow citizens to flag certain trades for review by an independent panel of scientific experts and public interest group, though transaction costs could still be prohibitive.[442] Finally, there could be greater judicial accountability for permit transactions. Judicial review of permits are usually quite deferential, but an agency could shift burdens of proof onto the applicant, or Congress could grant liberal citizen suit rights;[443] once again, transaction costs and uncertainty would be high.[444]

B. Setting a Cap and Adaptive Management

A prerequisite for a marketable permit program is sufficient information for regulators to set a cap or baseline.[445] The slow development of watershed-specific pollution loading limits (TMDLs), for example, is a major reason for the slow development of water quality trading.[446] The cap must be sufficiently stringent both to achieve the policy objective and to facilitate an active market; if the cap is too weak, there will not be enough demand for allowances to support a market.[447] For example, the Regional

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[435] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 17-18 (1981) (also preventing undue market concentration, though position limits can also do that).
[436] *Id.* at 16.
[437] Salzman & Ruhl, *supra* note 6.
[438] *Id.*
[439] Notice of Final Compensatory Mitigation Policy, 81 Fed. Reg. 95,316 (Dec. 27, 2016).
[440] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 38 (1981).
[441] Salzman & Ruhl, *supra* note 6.
[442] *Id*.
[443] Robert Glicksman, *Regulatory Safeguards for Accountable Ecosystem Service Markets in Wetlands Development*, 62 Kansas L. Rev. 943 (2014).
[444] Salzman & Ruhl, *supra* note 6.
[445] Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181.
[446] EPA & USDA, Report on 2015 National Workshop on Water Quality Markets (2016).
[447] Willamette Partnership, *In It Together: A How-To Reference* (2012).

Greenhouse Gas Initiative's cap proved to be too weak in the face of changing economic conditions, and for most of the program's existence the cap has not been a binding constraint on emissions.[448]

1. Capping Total Activity Levels Is Often More Efficient Than Capping Rates

The choice of capping either total activity or the rate of activity arises most often in the context of air and water pollution markets, though the question does occur in other policy contexts. For example, in a proposed market to control the issuance of antibiotic prescriptions, it is the difference between capping total prescriptions or just capping the number of prescriptions a doctor can write per patient.[449] For simplicity, since the choice does occur most often in the pollution context, this section will assess mass-based caps (hard limits on total emissions) versus rate-based systems (limits instead on emission per unit of activity). The economics literature shows that mass-based cap-and-trade systems offer more efficient and predictable reductions than rate-based trading schemes.[450] By placing a hard cap on total emissions, a mass-based trading program puts a price on every ton emitted. A rate-based trading program, by contrast, raises the cost of only some emissions—namely, those in excess of the relevant performance standard. Emissions below the performance standard remain implicitly subsidized under a rate-based approach. Because sources do not have to internalize the externalities of their pollution emitted below the rate, total emissions will end up inefficiently high. As demand for the regulated activity increases, under a rate-based systems sources can continue to meet their required limit per unit of activity while increasing their overall activity, resulting in more emissions. For example, with population and economic growth, drivers will travel more miles in their motor vehicles and burn more gasoline, and transportation emissions will rise even with a rate-based standard in place.[451]

A similar problem results from the "rebound effect."[452] For example, regulating vehicles' emissions through a rate-based standard prompts manufacturers to build cars that consume less gasoline per mile. Consumers therefore need less gasoline to drive a mile. As the cost of driving each mile falls, consumers begin driving more miles, and overall emissions slightly rebound.[453] Rebound can occur in any sector where regulation prompts sources to improve the efficiency of their activities, including in the electricity sector.[454] Mass-based caps avoid the rebound effect.

A mass-based cap-and-trade program is also easier to administer, particularly with respect to allowing credits into the market, such as from energy efficiency projects, renewable energy, or early action

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[448] Interagency Working Group on Carbon Market Oversight, *Report on the Oversight of Existing and Prospective Carbon Markets* n.11 (2011).

[449] *See* Richard D. Smith & Joanna Coast, *Controlling Antimicrobial Resistance: A Proposed Transferable Permit Market*, 43 Health Policy 219 (1998)).

[450] *See* Jan-Tjeerd Boom & Bouwe R. Dijkstra, *Permit Trading and Credit Trading: A Comparison of Cap-Based and Rate-Based Emissions Trading Under Perfect and Imperfect Competition*, 44 Envtl. Res. Econ. 107, 131 (2009) ("[U]nder perfect competition, [rate-based] credit trading always leads to higher abatement costs than [mass-based] permit trading."); Carolyn Fischer, *Combining Rate-Based and Cap and Trade Emissions Policies* 8 (Resources for the Future, Discussion Paper 03–32, 2003) ("Given an equivalent emissions rate (or permit price), total emissions will be higher [in a rate-based trading system] than with [mass-based trading]."). *See also* Policy Integrity Comments on Federal Plan and Model Rules, http://policyintegrity.org/documents/PolicyIntegrity_CommentsonFederalPlanandModelRules.pdf.

[451] *See* U.S. Energy Info. Admin., Ann. Energy Outlook 2013 tbl.18, available at http://www.eia.gov/ forecasts/ aeo/data.cfm#co2emsec (showing 2025 transportation emissions under "High Economic Growth" scenario).

[452] 77 Fed. Reg. at 62,716.

[453] Some studies suggest that a 10% increase in fuel efficiency for automobiles would likely result in a 1-2% increase in vehicle miles traveled. See Nat'l Res. Council, *Effectiveness and Impact of Corporate Average Fuel Economy (CAFE) Standards* 19 (2002).

[454] *See* 80 Fed. Reg. at 64,745 (noting the possibility of rebound for power plants but expressing confidence that other provisions in the Clean Power Plan will prevent it).

credits.[455] Take the example of a carbon permit market for power plant emissions. Successful energy efficiency projects decrease electricity demand and reduce aggregate emissions, but they have no effect on the rate at which generators emit carbon. Renewable energy production reduces the demand for fossil fuels, but likewise has no effect on the emissions rate of fossil fuel-fired sources. Integrating efficiency efforts or renewable energy credits into a rate-based program therefore requires EPA and states to make complex predictions about the degree to which a particular renewable or efficiency investment will reduce fossil fuel demand below the business-as-usual baseline. A mass-based program simply caps emissions, requires sources to hold a permit for every ton of greenhouse emissions, and lets the market decide whether power plants will reduce emissions by improving the efficiency of their coal-fired units or by investing in energy efficiency programs or renewable generation to offset their own demand.

Note that, depending on the nature of the problem to be address, a rate-based system could be more effective. For example, in the context of a market for antibiotic prescriptions, if the problem is that the aggregate number of prescriptions is too high, then a total cap is most effective appropriate; but if the problem is that a few prescribers or patients abuse the system and get too many prescriptions, then a rate-based limit may be more appropriate.

Recommendation: Agencies should strongly consider capping the total activity level, rather than just capping the rate of activity.

2. Features of a Market-Based System Can Increase Stringency

The cost savings offered by marketable permit programs may enable regulators to set a more stringent cap than they could under prescriptive regulation, or may even break a political logjam blocking any regulation at all. Though it may not always happen, the cost savings of trading can be channeled back into more stringency:[456] for any given total compliance cost that is politically acceptable, marketable permits can achieve greater stringency than traditional regulation. A set cap may also achieve targets with greater certainty and transparency versus technological design standards, which are prone to both under- and over-compliance.[457]

Some evidence bears out these theories. Economists have specifically credited the acid rain market's cost savings as making dramatic cuts to sulfur dioxide pollution both possible and politically feasible.[458] The lower costs predicted from trading were also instrumental in negotiating more stringent limits for ozone-depleting substances and California's RECLAIM program, as well as a faster phase-out timeline for lead in gasoline.[459] EPA claims that trading similarly helped it increase stringency earlier for vehicle emissions standards.[460] The institution of tradable catch shares has sometimes, though not always, resulted in lower total allowable catches.[461]

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[455] Rate-based also makes it harder to process early action credits, because early action is not a permanent rate change. T.H. Tietenberg, Emissions Trading: Principles and Practice 17 (2006, 2d ed).
[456] David Driesen, *Is Emission Trading an Economic Incentive Program?*, *supra* note 18.
[457] Robert Stavins, *U.S. Cap-and-Trade System to Address Global Climate Change* 10 (Harvard Kennedy School Reg. Pol'y Prog. Paper 2007-04).
[458] Dallas Burtraw & Erin Mansur, *The Effects of Trading and Banking in the SO_2 Allowance Market* 20 (Res. for the Future, Disc. Paper 99-25, 1999), http://www.rff.org/documents/RFF-DP-99-25.pdf.
[459] Tom Tietenberg, Tradable Permits in Principle and Practice *supra* note 181.
[460] EPA, Manufacturer Performance Report for 2015 MY (2015).
[461] Tom Tietenberg, Tradable Permits in Principle and Practice *supra* note 181.

Marketable permit programs can also easily be designed to advance policy goals by requiring trading ratios greater than 1:1. For example, Maryland's water quality trading program has adopted a retirement ratio of 1.1:1, meaning that for every 10 pounds of pollution emit, 11 offset credits must be purchased, with 10% of all credits bought automatically retired.[462] Similarly, EPA conditioned its approval of a regional cap-and-trade for haze in southwestern states on achieving "greater reasonable progress" in reducing regional haze compared to a non-market approach.[463] Though such retirement ratios can advance policy goals, they undermine efficiency by blocking otherwise efficient trades. Unlike trading ratios used to manage externalities or uncertainties, a retirement ratio imposes an artificial premium on the cost of off-site reductions compared to on-site reductions. When the off-site reductions are cheaper than on-site reductions, but not by more than the artificial premium imposed by the retirement ratio, an otherwise efficient trade will be blocked, resulting in continued reliance on the most costly on-site abatement.[464] If it is important for the marketable permit program to affirmatively advance policy goals beyond even the outcomes prescriptive regulations would achieve, increasing the overall stringency of the cap may be preferable to selectively distort the market through retirement ratios. Note, however, that if a regulator is unable to tighten the cap directly (as, for example, with some state-run water quality trading programs subject to caps set at the federal level by EPA), the regulator may consider whether the tradeoff between efficiency and policy goals justifies a retirement ratio.

Another market feature that can affirmatively further the program's policy goals is open participation rules. By allowing anyone to participate in the market, public-minded groups or citizens can purchase and retire emission allowances, as they often do in the acid rain market.[465] Other programs have declined to allow such public participation. The National Oceanic and Atmospheric Administration believes, based on the legislative history of Magnuson-Stevens Act, that Congress did not intend for tradable fish share to become a mechanism to reduce the harvest by letting non-fishers buy and retire quota.[466]

Recommendation: To use the advantages of the market structure to enhance policy effectiveness, agencies should focus on fine-tuning the cap's stringency in light of cost savings and should allow open access to the market so citizens can retire credits. Retirement ratios undermine a program's efficiency and should be avoided unless the regulator cannot tighten the cap directly.

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[462] WRI, *Addressing Risk and Uncertainty in Water Quality Markets* (2014). EPA briefly considered requiring a 1.5:1 ratio for purposes of affirmatively improving water quality, Revisions to the National Pollutant Discharge Elimination System Program and Federal Antidegradation Policy in Support of Revisions to the Water Quality Planning and Management Regulation, 64 Fed. Reg. 46,058, 46,063 (Aug. 23, 1999), but ultimately abandoned the proposal, Revisions to the Water Quality Planning and Management Regulation and Revisions to the National Pollutant Discharge Elimination System Program in Support of Revisions to the Water Quality Planning and Management Regulation, 65 Fed. Reg. 43,586, 43,640 (July 13, 2000) ("the offset requirement, as proposed, is not the best mechanism to achieve progress in impaired waters in the absence of a TMDL").

[463] Final Rule, Approval and Promulgation of State Implementation Plans; Wyoming, 77 Fed. Reg. 73,926, 73,927 (Dec. 12, 2012); Final Rule, Approval, Disapproval and Promulgation of State Implementation Plans; Utah, 77 Fed. Reg. 74,355, 74,357 (Dec. 14, 2012); Final Rule, Approval and Promulgation of State Implementation Plans; New Mexico, 77 Fed. Reg. 70,693, 70,695 (Nov. 27, 2012); Final Rule, Approval and Promulgation of State Implementation Plans; City of Albuquerque-Bernalillo County, 77 Fed. Reg. 71,119, 71,121 (Nov. 29, 2012).; see also 40 C.F.R. § 51.309(d)(4)(i); upheld by WildEarth Guardians v. EPA, 770 F.3d 919, 925 (10th Cir. 2014). NAAQS offsets also require affirmative progress on air quality through a greater than 1:1 offset ratio.

[464] Policy Integrity Letter on Water Quality Trading, *supra* note 235.

[465] Tom Tietenberg, Tradable Permits in Principle and Practice *supra* note 181.

[466] NOAA, Catch Share Policy (2010).

3. Adjusting the Cap

Caps can be designed in advance with a predetermined increase in stringency over time, as with the lead phase-out market. If new and unexpected information about costs, benefits, changing economic conditions, or technological innovation indicates that the stringency of the cap needs to be adjusted, regulators have several options. To make the cap more stringent, a straightforward but expensive option would be for the regulator to purchase and retire allowances off the market.[467] Lowering the cap directly will remain a politically challenging option, though perhaps no more so than increasing the stringency of prescriptive regulations.[468] One way to short-circuit some of the political opposition to lowering a cap is by allocating relative allowances instead of absolute allowances. For example, fish permits typically define a percentage share of total allowable catch, so the agency can change cap without triggering legal recourse by permit holders.[469] Changing the cap under a marketable permit program may also be easier than under prescriptive regulation because marketable permits typically have shorter lifespans than traditional permits:[470] a firm that has to buy permits at auction every year will have fewer reliance expectations about a total cap.

If a cap turns out to be overly stringent and needs to be relaxed, regulators can create more rights and trust the market to allocate them efficiently.[471] Such an action may seem politically costless, but in fact owners of existing permits could complain that the agency is diluting the value of their permits.[472] Such complaints from existing permit owners will likely be no louder than the complaints of firms that already complied with prescriptive regulation and so oppose any relaxation to the standard that might make it cheaper for new competitors to enter the market.

Recommendation: To facilitate adjusting the cap over time, agencies should consider allocating percentages of a cap, rather than allocating absolute subunits of a cap.

4. Exemptions

Prescriptive regulations are often riddled with exemptions to address distributional effects on small businesses or other specific regions or sources, and exemptions weaken the overall effectiveness of regulation.[473] By contrast, few if any exemptions are sought under marketable permit programs, because it is often cheaper to just comply with the marketable permit program than to spend money seeking an exemption with no guarantee of securing it.[474] In fact, regulators are unlikely to grant exemptions under a marketable permit program because, unlike with prescriptive regulation, there are no cases special compliance hardships, as every regulated entity faces same permit price.[475]

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[467] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 6 (1981).
[468] *Id.* at 6-7 (under prescriptive regulation, very difficult analytically and politically to decide which firms should lose their licenses).
[469] Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181. Relative shares have also been proposed, though not implemented, for air markets. *Id.*
[470] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 22 (1981).
[471] *Id.* at 7.
[472] *Id.* at 22.
[473] *Id.* at 11.
[474] Ellerman, *Are Cap and Trade Programs More Environmentally-Effective Than Conventional Regulation?*, *supra* note 397, at 53.
[475] *Id.*

5. Uncovered Sources

Besides the stringency of a cap, another key issue for whether a cap will achieve its policy outcome is coverage and leakage. Coverage and leakage concerns arise most often in the context of air and water pollution, though they may also occur in other policy contexts. Take, for example, the hypothetical market for antibiotic prescriptions: if human prescriptions are regulated but veterinary or agricultural uses of antibiotics are not, those unregulated sectors could create challenges. However, given that these problems are most prominent in the environmental context, this section will discuss pollution markets.

First, an unexpected, exogenous increase in demand at an unregulated sector could undermine all other emissions reductions.[476] Second, emissions can "leak" from regulated to unregulated sectors.[477] For example, if a greenhouse gas cap-and-trade covers only large power plants but not other fossil fuel combustion, unregulated sources may begin to generate their own electricity on-site, or residential and commercial heating may switch from electricity to heating oil.[478] Similarly, water quality trading effectively puts the cleanup costs of nonpoint sources on point sources, which may respond by preemptively trying to be categorized as nonpoint themselves, making pollution harder to control.[479]

To some extent, any regulatory design needs to consider coverage and leakage. Critics of marketable permit programs like David Driesen, however, worry that marketable permit programs will increase resistance to future regulation of uncovered sources, since the market gives uncovered sources a profit motive to protect their future potential to generate credits by avoiding new legal obligations.[480] On the other hand, from a practical perspective, technological, administrative, and political limitations would prevent many categories of uncovered sources from being regulated by prescriptive standards. If they are not generating credits under a marketable permit program, they very well may not be making any affirmative progress. Under a credit program, uncovered sources are making reductions and innovating the new technologies that may make future regulation possible. Moreover, the cost savings of generating credits from cheap abatement opportunities at uncovered sources can be channeled back into making the cap more stringent.

6. Effect of Allocation Options on Policy Outcomes

Marketable permits have value, and that value sometimes can be recaptured and directed back toward the policy objectives. For example, revenue from a greenhouse gas auction could be invested back in clean energy and energy efficiency projects. Unfortunately, without specific statutory authorization to retain proceeds, federal agencies will usually be required to deposit auction revenue into general treasury. States, on the other hand, can and do direct auction revenue toward policy outcomes. States in the Regional Greenhouse Gas Initiative, for example, funnel some auction revenue to low-energy

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[476] Stavins, *U.S. Cap-and-Trade System*, *supra* note 262, at 18

[477] Joseph Aldy & William Pizer, *Issues in Designing U.S. Climate Change Policy*, 30 Energy J. 179, 187 (2009); Stavins, *U.S. Cap-and-Trade System*, *supra* note 262, at 18.

[478] Similarly, pairing a market with mass-based caps for existing power plants under the Clean Power Plan with rate-based command-and-control regulation for new power plants created the risk of leakage caused by generation shifting from existing to new sources. EPA addressed this leakage risk by requiring states to develop plans to prevent such leakage, 80 Fed. Reg. at 64,823, creating administrative burdens and market complications that could be avoided under a unified Section 115 approach.

[479] Carol Rose, *The Several Futures of Property*, *supra* note 186.

[480] David Driesen, *Is Emission Trading an Economic Incentive Program?*, *supra* note 18.

investments. Another option would be allocating some permits on an output-basis to renewable electricity generators, thereby providing additional financial support for the policy objective.[481]

C. Setting Baselines and Verifying Credits

Credit programs need to ensure that credits are, for lack of a better word, real.[482] Obviously, credits should not be fraudulent, but "real" signifies a higher bar,[483] as explored below.

1. Additionality and Gaming the Baseline

Credits must be measured against a realistic baseline and must be "additional." The baseline scenario predicts what the credit generator would have done but-for the opportunity to generate credits. An "additional" credit reflects actions that would not have occurred without the financial incentive provided by the regulatory market. If an aircraft operator had always planned to switch to quieter aircraft even without a rule, allowing that operator to earn noise reduction credits for switches that would have happened away will undermine the program's overall effectiveness.

Questions of additionality and realistic baselines have been raised in a number of programs. In air pollution markets, overinflated baselines are said to produce "hot air." For example, in RECLAIM's car-scraping credit program, not only were many of the dirty cars destroyed for credits already at the end of their useful lives,[484] but inaccuracies in the baseline models may have inflated the allocation of allowances and credits.[485] Similarly, with vehicle efficiency credit programs, some credits are currently being awarded to firms that have historically and voluntarily over-complied with their regulatory standards anyway.[486] The United Nation's Clean Development Mechanism for greenhouse gas reductions is infamous for outright fraud over matters of additionality, with some firms purposefully manufacturing highly potent greenhouse gases just to earn credits by destroying them.[487] For conservation banks, the main additionality question is whether the habitat being preserved to earn credits was really under any immediate danger of development.[488] Courts will likely give agencies discretion in defining the baseline year and making determinations about additionality.[489]

A related risk, which may occur either in credit programs or cap-and-trade programs, is parties trying to "game" the baseline. For example, it can take years of public debate to develop a fish catch share program. Because fish shares are typically awarded based on historical catch, there is a risk of incentivizing new entrants into the fishery or an increased harvest by fishers in advance the program's establishment, in order to win a larger share of the valuable allocation.[490] This scenario highlights the importance of setting a firm baseline and picking the right baseline year. If the baseline year is after

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[481] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 14 (1981).
[482] *See, e.g.*, Offset Quality Initiative, *Ensuring Offset Quality* (2008).
[483] *See id.*; Cong. Budget Office, *The Use of Offsets* (2009).
[484] Robert Glicksman, Regulatory Safeguards for Accountable Ecosystem Service Markets in Wetlands Development, *supra* note 443; Richard Drury et al., *Pollution Trading and Environmental Injustice*, *supra* note 395.
[485] Richard Drury et al., Pollution Trading and Environmental Injustice, *supra* note 395.
[486] Leard & McConnell, *supra* note 32. The authors argue that because early banked credits will expire and stringency will increase, over-crediting will not be a long-term problem.
[487] Robert Glicksman, Regulatory Safeguards for Accountable Ecosystem Service Markets in Wetlands Development, *supra* note 443.
[488] Stratus Consulting for Northwest Fisheries Science Center, NOAA, A Nationwide Survey of Conservation Banks (2003).
[489] *See* Citizens Against the Refinery's Emissions v. EPA, 643 F.2d 183, 186-87 (1981) (ruling that EPA had discretion to approve of 1977, a year of high demand, as the baseline for a criteria offset under a state implementation plan).
[490] NRC, *Sharing the Fish: Toward a National Policy on IFQs* (1999).

announcement of the marketable permit program, strategic actors may try to game the baseline. On the other hand, if a baseline is set too early, it may not reflect recent voluntary actions like voluntary emission reductions, and so may result in hot air. Another way to prevent additionality problems is to clearly set minimum baseline requirements: for example, for water quality trading, non-point sources usually need to follow state-set best management practices as a baseline requirement before they can begin to generate additional credits.[491]

2. Quantification and Certainty

Credits must be quantifiable and certain. Measuring credits can often be a challenge, as the variety of credit-generating projects makes it difficult to apply standardized tools.[492] Yet credit generators will need clear standards and established tools so they can calculate their ability to produce credits.[493] Often the necessary off-the-shelf tools do not exist, though some agencies are working toward them. In 2016, EPA and USDA agreed to develop a list of pre-approved tools for calculating water quality credits.[494]

Direct monitoring of activity to measure credits will frequently be infeasible. For example, it is very difficult to measure reduced pollution flows and water quality improvements from non-point sources of water pollution: after all, a major reason they are considered "non-point" and are largely unregulated is because of the difficulty measuring their discharge.[495] Instead, regulators may calculate credits by developing site-specific models or applying pre-determined rates based on best professional judgment, such as assuming so many pounds of water quality credits per acre of cover crops planted on a non-point farm. However, there is a tradeoff between the simplicity, predictability, and accuracy of such methods.[496]

The science of water quality and ecosystem services is so complex that inevitably there will be some degree of uncertainty about credits. Will a newly created, still immature wetland site really provide comparable flood protection as the mature wetland being destroyed? Trading ratios can be applied to adjust for such uncertainty, requiring more credits than even the best available quantification tools would predict are needed to offset the licensed action. For example, a common uncertainty ratio for water quality trading is 2:1, requiring at least two credits to offset a single ton of emissions; some water quality programs have uncertainty ratios as high as 3:1.[497] Applying conservative assumptions to credit calculations may also be appropriate.[498]

3. Leakage and Permanence

Credits must represent some degree of permanence and guaranteed execution. If a reforestation project earns carbon credits based on the assumption that the trees planted will sequester carbon for decades or centuries, but several years into operations a fire decimates the reforested area, the credits sold years ago suddenly do not reflect real reductions. A related question, discussed briefly above with the issue of temporal fungibility, is whether credits can be sold before their mitigation project has been implemented and the reductions have been certified.[499] Wetland banks, for example, must fully

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[491] Willamette Partnership, *In It Together: A How-To Reference* (2012).
[492] Byron Swift, *U.S. Emissions Trading: Myths, Realities, and Opportunities*, 20 Nat. Res. & Envt. 3 (2005).
[493] EPA & USDA, Report on 2015 National Workshop on Water Quality Markets (2016).
[494] *Id.*
[495] Willamette Partnership, *In It Together: A How-To Reference Part 2* (2012).
[496] *Id.*
[497] WRI, *Addressing Risk and Uncertainty in Water Quality Markets* (2014).
[498] EPA, Water Quality Trading Policy, 68 Fed. Reg. 1609 (Jan. 13, 2003).
[499] Interagency Working Group on Carbon Market Oversight, Report, *supra* note 448, at 13.

implement their mitigation before selling credits, while in-lieu fee instruments can sell some number of credits in advance of implementation.

Credits also must not cause "leakage." Leakage occurs, for example, if a project earns carbon credits by preventing deforestation in one region, yet ultimately the same level of logging or deforestation simply shifts to another region. Monitoring for leakage can be a challenge, as it potentially involves tracking global activities in the relevant industries.

4. Double Counting: Stacked and Voluntary Credits

Credits must not be double counted. Largely this can be addressed through careful accounting practices, thoroughly tracking credit transactions and ensuring unambiguous ownership of credits.

The concept of credit stacking also raises some risks of double counting. Credit stacking occurs when a single project can produce credits for multiple markets: for instance, if a wetlands mitigation bank also provides endangered species habitat and sequesters carbon dioxide.[500] Credit stacking potentially can help reluctant credit sellers enter the market with more confidence, since they can hedge against the risk of not enough demand in a single marketable permit program, thus making nascent markets more economically viable.[501] Another argument in favor of credit stacking is the potential that providing value in multiple resources will make a credit project more sustainable over time.[502] The ability to engage in multi-pollutant stacking is strongly desired by water quality traders.[503]

The double-counting concern with credit stacking is essentially one of additionality: would the wetland credit project not have generated those additional carbon credits but-for the opportunity to stack credits, or is the market inefficiently rewarding behavior that would have happened anyway?[504] The Fish and Wildlife Service has addressed this issue by allowing stacked credits to be used only to compensate for the effects of a single development project; the credits cannot be unbundled to compensate multiple projects. For example, if endangered frog habitat credits and wetland credits are bundled, the stacked credits can offset a single project that also has impacts on both endangered frogs and wetlands, or they can offset either individual impact from a single project, but they cannot offset endangered frog and wetland impacts separately at two different projects.[505] On the other hand, the National Marine Fisheries Service does not have a clear policy on stacking. Its West Coast region supports multi-resource banking, but says it is the responsibility of the banker to ensure that credits are not double counted.[506]

Voluntary credit markets also create the potential for double counting.[507] For both greenhouse gases and renewable energy,[508] unregulated entities may seek voluntary credits: airplane passengers purchasing carbon offsets to address their personal contributions to climate change, or businesses buying renewable energy credits for P.R. value. Regulators of mandatory marketable permit programs need to monitor voluntary markets to prevent the same credit from being sold in both markets. Regulators may also need to make adjustments to their marketable permit program based on

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[500] Royal Gardner & Jessica Fox, *Legal Status of Environmental Credit Stacking*, 40 Ecol. L. Q. (2013).
[501] NMFS West Coast Region, Conservation Banking Guidance (2015).
[502] *Id.*
[503] EPA & USDA, Report on 2015 National Workshop on Water Quality Markets (2016).
[504] *See* J.B. Ruhl et al. Stacking Ecosystem Services, 12 Frontiers of Eco. & Env't 186 (2014).
[505] Notice of Final Compensatory Mitigation Policy, 81 Fed. Reg. 95,316 (Dec. 27, 2016).
[506] NMFS West Coast Region, Conservation Banking Guidance (2015).
[507] NREL, REC Tracking Systems: Costs and Verification Issues (2013).
[508] For example, the Chicago Climate Exchange operated a voluntary carbon offset program. Interagency Working Group on Carbon Market Oversight, Report, *supra* note 448, at 10 (CCX operated from 2003 to 2010).

interactions with voluntary markets. For example, both the Regional Greenhouse Gas Initiative and California's cap-and-trade program for greenhouse gases have provisions to adjust their emissions caps downward to account for voluntary purchases of renewable energy credits.[509] A buyer of a renewable energy credit expects the purchase to fund the reduction of carbon emissions from the electricity sector, but unless the cap is adjusted, the electricity sector will continue to emit up to the level of the cap no matter how many renewable credits are purchased voluntarily. (The Federal Trade Commissions has established policies to ensure that voluntary environmental credits are real.)

5. Other Risks

An additional requirement for credits is sometimes sought by advocates: credits should not inflict ancillary harms.[510] For example, some the methane released from coal mines can be captured and used to generate greenhouse gas credits, but some mine methane capture techniques can risk explosions, putting miners in danger.[511] However, relying on credit verification programs to address all ancillary harms could inefficiently block some credit opportunities. When other regulators have the authority to address these potential ancillary harms directly (as the Mine Safety and Health Administration does in the previous example), it may be preferable to rely on those regulatory authorities rather than distort the credit market. On the other hand, when no such authority exists—as with the risk of conservation banking inadvertently degrading non-target, non-endangered, and unprotected species[512]—some verification that the credit does not produce significant, foreseeable ancillary harms may be appropriate.

Some marketable permit programs allow credits to be generated in foreign countries. For example, California's cap-and-trade program for greenhouse gases allows certain carbon offsets from Canada and Mexico. International credits could represent especially low-cost opportunities,[513] but ensuring ongoing quality could be more difficult.[514]

There is a risk that, in a marketable permit program, buyers and sellers could collude to work against regulators and lower credit quality requirements. Unlike conventional markets, in permit markets buyers and sellers are not so much competing against each other as they are competing against the regulator, who is trying to protect public interest. For example, in wetlands trading, both buyer and seller could earn more profit if the regulator lets them trade commercial development on high-quality mangroves in exchange for protecting a "two-snake mud puddle."[515] Buyers and sellers can work together to exploit uncertainty and lobby for lower quality standards, and asymmetric information between buyers and sellers on one hand and regulators on other could allow cheap, low-quality credits to undercut high-quality, more expensive credits and force them out of the market.[516] This scenario heightens the need for clear, strong quality assurance checks. Credits should have to meet clearly defined criteria and should not be approved on an ad hoc basis.[517] For example, the fact that the

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[509] NREL, REC Tracking Systems: Costs and Verification Issues (2013).
[510] *See, e.g.*, Offset Quality Initiative, Ensuring Offset Quality (2008).
[511] *See* Harworth Power Ltd., CMM Flaring (2007), http://www.epa.gov/cmop/docs/cmm_conference_sep07/uk_coal_flaring.pdf.
[512] FWS, Guidance for the Establishment, Use, and Operation of Conservation Banks (2003).
[513] EPA, Analysis of H.R. 2454, at 3 (June 2009).
[514] *See, e.g.*, Michael W. Wara & David G. Victor, *Working Paper: A Realistic Policy on International Carbon Offsets* (April 2008), http://pesd.fsi.stanford.edu/sites/default/files/WP74_final_final.pdf (discussing the potential of "laundered" international offsets).
[515] Dennis King, *Managing Environmental Trades: Lessons from Hollywood*, 32 ELR 11317 (2002).
[516] *Id.*
[517] *Id.*

National Marine Fisheries Service has no standardized protocol for approving conservation banks could become problematic.

A related risk is that buyers and sellers will agree to low-quality standards to govern any unofficial, voluntary, or early trading program.[518] These early, low-quality standards may then anchor the discussion about trading rules for the marketable permit program, leading to the ultimate adoption of weak standards for verifying the quality of regulatory credits.

Recommendation: Agencies should have clearly defined criteria for credit approval, to ensure credits are "real." Credit approval systems should not reward behavior that would have happened anyway ("additionality"), should not incentivize strategic gaming of the system, should allow for predictable and repeatable calculations, should address uncertainty, and should avoid double-counting. Credit approval programs should include procedures for selecting clear baselines, developing predictable and pre-approved calculation tools, applying consistent standards for uncertainty ratios, and establishing policies on credit stacking.

6. Quality Assurance Tools

Primary quality assurance tools include third-party verifications, regular audits to ensure permanence, and trading ratios to address uncertainty. Credit generation may also be restricted to certain categories: for example, most state water quality trading only allows non-point farms, and not other non-point landowners, to generate credits,[519] and California's cap-and-trade has designated approved offset categories (reforestation, livestock, mine methane).[520]

Initial approval of credit generators can be time-consuming for agencies. Unlike the Army Corps of Engineers, the Fish and Wildlife Service (FWS) does not have timelines for approving conservation bank plans. Despite the agency's policy to make bank reviews a priority,[521] bank sponsors complain of delays.[522] FWS has promised that any bank agreeing to more conservative trading ratios and promising to achieve a net gain for the endangered species (rather than just no net loss) will receive an expedited review.[523] Meanwhile, even with timelines for review at the Corps, bank sponsors indicate timelines are not being met.[524] The National Mitigation Banking Association says that it would prefer to sometimes get a "no" early than to have every review drag on.[525]

Deciding who conducts credit verification requires balancing several factors. Some property owners, like farmers, may be reluctant to allow government officials onto their property to conduct verification inspections.[526] Agencies resources and expertise are also relevant considerations. Self-verification could be an appropriate alternative in certain circumstances,[527] such as when verification procedures can be

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[518] *Id.*
[519] Willamette Partnership, *In It Together: A How-To Reference* (2012).
[520] California Air Resources Board, Compliance Offset Program, https://www.arb.ca.gov/cc/capandtrade/offsets/offsets.htm.
[521] Notice of Final Compensatory Mitigation Policy, 81 Fed. Reg. 95,316 (Dec. 27, 2016).
[522] DOI, Office of Policy Analysis, Results from a Survey of Conservation Bank Sponsors (2016).
[523] Notice of Final Compensatory Mitigation Policy, 81 Fed. Reg. 95,316 (Dec. 27, 2016).
[524] U.S. Army Corps, Institute for Water Resources, The Mitigation Rule Retrospective (2015).
[525] *Id.*
[526] Willamette Partnership, *In It Together: A How-To Reference Part 2* (2012).
[527] One example of total self-verification is the small alternative fuel vehicles program. The Department of Energy's website instructs regulated parties to, "after locating a buyer or seller, print and complete the Proof of Credit Transfer form," which simply asks for number of credits exchanged and notes that parties are responsible for truthfulness and subject to prosecution for violations. Dept. of Energy-EERE, Standard Compliance: Guidelines to Help State and Alternative Fuel Provider Fleets Meet Their Energy Policy Act Requirements (2014).

standardized, agencies can impose strong penalties for false reporting, and citizen suits are available to help agencies police noncompliance.[528] If neither direct agency oversight nor self-verification are appropriate, agencies will need to rely on third parties for verification. For example, EPA uses third party engineering reports to verify production of renewable fuel credits.[529] (One third-party verifier has creatively proposed a fourth option: crowd-sourced verification for certain contexts, like monitoring urban stormwater by smartphone photographs.)[530]

Relying on third parties for credit verification has some advantages: third parties may have more individualized knowledge of the practices being implemented, may have an easier time charging fees for inspections, and can staff up or down more flexibly than an agency in response to changing transaction volumes. At the same time, the agency risks that the third party will not accomplish the agency's mission. Third parties need minimum education and experience requirements, and may also need specialized training and accreditation.[531] Third parties also needs liability insurance, dispute resolution system, and system for protecting confidential information.[532] Agencies will need rules to ensure third parties do not develop conflicts of interest.[533] Third party verifiers have a financial incentive to brand themselves as "market advocates" and encourage sub-par trades.[534] Conflict of interest rules need to go beyond preventing direct financial stakes in water quality trading.[535] Conflicts can develop over time, for example if the same reviewer depends on the same projects year after year for revenue. Agencies could require that verifiers rotate every few years or could randomly assign reviewers to projects.[536] Ultimately, when relying on third parties, agencies will need to retain some oversight and final decisionmaking authority and the ability to resolve disputes.[537]

The timing of verification is another key decision. Some credits require ongoing reviews of quality and performance. Ongoing reviews could be applied annually with the same rigor as the initial approval, or the frequency and rigor could be reduced, with a focus on specific quality criteria or spot checks of projects selected randomly or based on risk.[538] Remote inspections, as through aerial images or other technology, may be useful in some contexts and may reduce the costs of ongoing verification procedures.[539]

Some programs do not have mandatory pre-approvals of credits, but instead only check credits' validity when they are cashed in for compliance obligations, which creates some risk for buyers of having invalid credits.[540] For example, EPA's policy on renewable fuel credits is generally "buyer beware": the industry is responsible for its own quality control and integrity, and any buyer of fraudulent credits will be on the hook to replace them. EPA has developed a voluntary Quality Assurance Program, through which EPA-approved third parties provide quality checks.[541] The voluntarily program provides buyers with some

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528 Willamette Partnership, *Verification in Markets for Water Quality and Habitat* (2014).
529 RIN Alliance, *Making the RIN Program Work* (2011).
530 Willamette Partnership, *Verification in Markets for Water Quality and Habitat* (2014).
531 *Id.*
532 *Id.*
533 Willamette Partnership, *In It Together: A How-To Reference Part 2* (2012).
534 Dennis King, *Managing Environmental Trades: Lessons from Hollywood*, *supra* note 515.
535 Nat'l Network on Water Quality Trading, *Building a Water Quality Trading Program* (2015).
536 Willamette Partnership, *Verification in Markets for Water Quality and Habitat* (2014).
537 Nat'l Network on Water Quality Trading, *Building a Water Quality Trading Program* (2015).
538 Willamette Partnership, *Verification in Markets for Water Quality and Habitat* (2014).
539 *Id.*
540 Breger, Stewart, Elliott, & Hawkins, *Providing Economic Incentive in Environmental Regulation*, *supra* note 13.
541 EPA, Approved Quality Assurance Plans and Q-RIN Pathways, https://www.epa.gov/fuels-registration-reporting-and-compliance-help/approved-quality-assurance-plans-and-q-rin-pathways.

affirmative defense in case of invalid credits, and instead the third party verifier carries the liability for invalid credits.[542] For example, in January 2017, EPA filed a notice of intent to revoke Genscape as a quality assurance provider, alleging that Genscape had verifying millions of fraudulent renewable fuel credits.[543] Nevertheless, most renewable fuel credits (as of 2015, 88%) do not go through this voluntary quality assurance program.[544]

Sufficiently stringent verification checks will limit the number of credits entering the market. For example, the California Air Resources Board could have authorized about 62.5 million offset credits from 2013 through February 2016 for its greenhouse gas cap-and-trade program.[545] The Board, however, approved only about 38.5 million credits through mid-March 2016 as meeting the state's standards,[546] likely indicating a natural limit on the number of high-quality, low-cost offset opportunities. Indeed, California has taken offset quality quite seriously, having recently concluded an investigation into 4.3 million offsets for quality violations and invalidated 89,000 credits as faulty or fraudulent.[547]

Recommendation: If direct agency oversight of credits is not efficient and if self-verification is not effective, use of third-party verifiers may be appropriate. Such third-party verifiers should be qualified, insured, and free of conflicts.

D. Responsibility and Compliance

How effective a marketable permit program will be at achieving its policy goal may depend on what happens in the event of a failure.[548] Key questions include: does the credit buyer or seller have the liability, what contingency plan is in place for unexpected events, what upfront financial guarantees of performance are required, what compliance monitoring or audits are required, and how will violations be enforced?

1. Liability, Performance Guarantees, and Contingencies

Some marketable credit programs have a "buyer beware" policy: if a credit generator does not perform—either intentionally, such as fraud, or unintentionally, such as unexpected acts of nature or miscalculation—the buyer retains responsibility for compliance. For example, under EPA's water quality trading policy, if a credit seller does not deliver the expected pollution offsets, the buyer becomes responsible for complying with any default, on-site emissions limits established in the permit.[549]

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[542] Byron Bunker, Compliance Division Director, OTAQ, *RIN Fraud and Compliance* (2015).
[543] EPA, Civil Enforcement of RFS Program, https://www.epa.gov/enforcement/civil-enforcement-renewable-fuel-standard-program. Genscape must retire valid RINs to replace fraudulent ones they verified (i.e., Genscape has to replace, not buyers)
[544] Byron Bunker, Compliance Division Director, OTAQ, *RIN Fraud and Compliance* (2015).
[545] By state law, covered sources may count offsets toward compliance for eight percent of annual allowance budgets. *See* BGC ENVTL. BROKERAGE SERVS., CALIFORNIA CARBON CAP AND TRADE OFFSETS OVERVIEW: REGULATIONS AND TRADING 12 (2011), http://www.climateactionreserve.org/wp-contenduploads/2009/05/BGCCarbon-Offsets-Market-Overview.pdf. The potential offset budget for years 2013 and 2014 collectively was 26.8 million credits. Id. The potential offset budget for years 2015-2017 is 91.8 million credits total, which, on average, is about 2.55 million credits per month. Id. From the start of 2013 through the end of February 2016, therefore, the potential offset budget was 26.8 million [years 2013 and 2014] + 30.6 million [year 2015] + 5.1 million [January and February 2016] = 62.5 million. *See id*.
[546] CAL. AIR RES. BD., ARB OFFSET CREDITS ISSUED 1 (updated March 9, 2016), https://web.archive.org/web/20160317072216/http://www.arb.ca.gov/cc/capandtrade/offsets/issuance/arb_offset_credit_issuance_table.pdf
[547] Gloria Gonzalez, *Despite Market Outcry, California Voids Some Carbon Offsets*, Ecosystem Marketplace, Nov. 14, 2014.
[548] Lesley McAllister, *Beyond Playing "Banker"*, 59 Admin. L. Rev. 269 (2007) (Trading requires rigid compliance policy with adequate sanctions.).
[549] EPA, Water Quality Trading Policy, 68 Fed. Reg. 1609 (Jan. 13, 2003).

Similarly, industry is responsible for quality control and integrity of renewable fuel credits,[550] and fraudulent renewable fuel credits must be replaced by the buyers, often at great cost.[551] EPA runs a voluntary quality assurance program for renewable fuel credits, which gives buyers some affirmative defense against civil liability.[552] On the other end of the spectrum, under the Army Corps' wetland mitigation banking and the Fish and Wildlife Service's conservation banking, liability for noncompliance transfers from the buyer to the bank sponsor upon purchase of a credit.[553] However, this policy is not applied consistently among the agencies responsible for various conservation bank programs: the West Coast Region of the National Marine Fisheries Service reports that, for users of its conservation banks, responsibility for adequate mitigation stays with permit applicant.[554]

Credit programs do not always clearly assign liability in the event of acts of nature.[555] According to a 2003 survey of conservation banks, many bank agreements did not specify what happens in event of natural catastrophe, no bank agreements included insurance policies for natural catastrophes, and management endowment funds typically do not include contingency funds for acts of nature.[556] Unassigned risks fall by default on the public.[557]

When buyers retain liability, they have several options for managing that risk. They could seek insurance, either from third parties or through an agreement to share liability among an association of buyers.[558] Consistent with any regulatory limits, buyers can negotiate with credit sellers to allocate responsibilities and provide remedies through a contract.[559] Finally, some credit aggregators assume some of the risk of project failure, and they may manage that risk by diversifying their credit projects and possibly self-insuring by holding some percentage of credits in reserve.[560]

Financial guarantees can provide some certainty over performance. The Fish and Wildlife Service encourages conservation banks to set aside a bond, endowment, or surety to cover future management costs sufficient to guarantee future performance.[561] Similarly, the Federal Communication Commission requires a refundable deposit to bid in an auction,[562] to prevent winning bids from entities that may actually lack the financing to purchase the spectrum.[563]

Imposing monetary fines after the fact for violations or even penalizing noncompliance by increasing the stringency of obligations in future years may not truly compensate for any environmental or other policy losses suffered in the meantime. Marketable permit programs have several options for advance planning to handle contingencies. EPA's water quality trading policy recommends that states consider establishing centralized reserve credit pools from which buyers can purchase additional credits during

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[550] RIN Alliance, Making the RIN Program Work (2011).
[551] Energy & Environmental Law Adviser, *CFTC and EPA Sign MOU on Renewable Fuel Markets*, Mar. 23, 2016.
[552] EPA finalized this rule in July 2014.
[553] Willamette Partnership, *In It Together: A How-To Reference Part 2* (2012).
[554] NMFS West Coast Region, Conservation Banking Guidance (2015).
[555] FWS 2003 guidance undear on acts of nature; 2016 guidance.
[556] Stratus Consulting for Northwest Fisheries Science Center, NOAA, A Nationwide Survey of Conservation Banks (2003).
[557] Dennis King, *Managing Environmental Trades: Lessons from Hollywood*, *supra* note 515.
[558] Willamette Partnership, *In It Together: A How-To Reference* (2012) *& Part 2*; Notice of Final Compensatory Mitigation Policy, 81 Fed. Reg. 95,316 (Dec. 27, 2016).
[559] Willamette Partnership, In It Together: A How-To Reference Part 2 (2012); WRI, Addressing Risk and Uncertainty in Water Quality Markets (2014).
[560] WRI, Addressing Risk and Uncertainty in Water Quality Markets (2014).
[561] FWS, Guidance for the Establishment, Use, and Operation of Conservation Banks (2003).
[562] FCC, About Auctions, *supra* note 67.
[563] Michael Abramowicz, *The Law-and-Markets Movement*, *supra* note 94 (some high bidders lacked financing, hoped to attract it by winning).

an end-of-year compliance deadline to make up for unanticipated shortfalls.[564] Many water quality trading programs do apply uncertainty ratios or reserve credits in anticipation of potential calculation errors, project failures, or unanticipated events like floods.[565] For example, the Ohio River trading program requires all projects to hold 10% of credits in reserve.[566] Some fish catch share programs allow short-notice online transfers for fishers coming in to dock with larger than expected catch, so they have an alternative to illegal dumping.[567]

Recommendation: Agencies should establish clear rules for liability and responsibility for acts of nature. Performance bonds are one useful tool.

2. Compliance Monitoring

Scholars and advocates agree that marketable permit programs require sophisticated compliance monitoring to succeed, though many of the monitoring requirements are similar to needs of traditional regulatory tools as well.[568] Notable skeptic of marketable permit programs David Driesen has suggested that the market structure can exacerbate the difficulties of monitoring. According to Driesen, monitoring compliance with prescriptive environmental regulations is often a relatively simple matter, such as checking that a firm installed an approved technological solution. This may be an overgeneralization, as Driesen readily acknowledges that most environmental standards are not technological design standards but rather performance standards, and even equipment standards still require monitoring to ensure proper operation. Nevertheless, according to Driesen, a marketable permit program requires regulators to monitor double the number of sites (both buyer and seller), and to monitor even more broadly to ensure credits are additional, are not double counted, and do not leak.[569] A failure of monitoring may be doubly detrimental in an environmental market as compared to prescriptive regulation, as a cheating source both emits more and gets away with selling credits that allow pollution increases elsewhere.[570]

There are some theoretical reasons to believe that monitoring will be easier to implement successfully under a marketable permit program.[571] Auction revenue creates a special incentive for agencies to invest in monitoring and enforcement, to ensure that noncompliance rates do not drive down permit prices and reduce total revenue.[572] Similarly, permit holders themselves may support monitoring to prevent cheating by others that would depreciate their investment: better monitoring increases the costs of noncompliance, which increases demand for permits, which increases the value of excess permits held by compliant firms.[573] Moreover, because marketable permit programs can lower overall compliance costs, agencies may be less reluctant to impose costly monitoring requirements on regulated entities. The anticipated lower costs of the acid rain market may have helped justify the

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[564] EPA, Water Quality Trading Policy, 68 Fed. Reg. 1609 (Jan. 13, 2003); *see also* WRI, *Addressing Risk and Uncertainty in Water Quality Markets* (2014).
[565] Willamette Partnership, In It Together: A How-To Reference (2012) & Part 2.
[566] Willamette Partnership, In It Together: A How-To Reference Part 2 (2012).
[567] Tom Tietenberg, Tradable Permits in Principle and Practice *supra* note 181.
[568] Lesley McAllister, *Beyond Playing "Banker"*, 59 Admin. L. Rev. 269 (2007).
[569] David Driesen, *Is Emission Trading an Economic Incentive Program?*, *supra* note 18.
[570] *Id*.
[571] Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181 (concerning better monitoring spurred by trading: a "number of errors in pre-existing emission registries [were] brought to light by the need to create accurate registries for [tradable permit] schemes.")
[572] Bruce Ackerman & Richard Stewart, *Reforming Environmental Law*, *supra* note 255.
[573] *Id.*; Jennifer Yelin-Kefer, *supra* note 279.

requirement for power plants to fund continuous emissions monitoring.[574] The Magnuson-Stevens act also requires some fisher-funded monitoring activities in conjunction with catch share programs.

The practical challenges of monitoring vary from context to context. Non-point sources generating water quality credits by definition have no fixed point (like a pipe) at which to monitor discharges, and determining watershed loadings is highly complex.[575] Programs with heterogeneous and small sources, like RECLAIM, complicate creating uniform data reporting and auditing, since the data required for verification may vary from source to source.[576] The Department of the Interior's Office of Policy Analysis raised questions about the adequacy and funding of monitoring and enforcement for conservation banks.[577]

On the other hand, arguably it has been easier for agencies to monitor a fewer number of large conservation bank sites rather than numerous smaller permittee-implemented mitigation projects. Additionally, in the past some permittee-responsible mitigation projects have been "greenwashed," since it is cheaper for a project developer to hire a landscaper to make a site appear like it has preserved habitat rather than invest in the scientific experts needed for meaningful restoration.[578] Large conservation banks allow efficient consolidation of scientific expertise, and would be significantly harder to "greenwash." In one survey, a plurality of Fish and Wildlife Service staff felt monitoring at conservation banks was adequate and better than monitoring at permittee-responsible mitigation.[579]

After the initial approval of credits, ongoing performance must also be monitored. Some water quality programs only spot check a small percentage of projects, while other require third-party audits on all credits annually or every few years.[580]

3. Enforcing Compliance

Economic theory predicts that regulated entities will not comply when the value of noncompliance outweighs the penalty for noncompliance multiplied by the chance of detection and enforcement. By reducing compliance costs, marketable permit programs could lower the incentive for firms to entertain noncompliance strategies. Compliant sources may support strict enforcement, because noncompliance by other actors lowers the value of their allowances. In the wreckfish fishery and other catch share programs, fishers more readily cooperate with enforcement officials, recognizing that illegal fishing reduces the value of their quota.[581] In fact, the National Research Council has recommended that fish catch quotas include the right to civil action against other fishers whose noncompliance or other unlawful actions adversely affect the marine resource and reduce the value of the quotas.[582]

Furthermore, agencies and courts may be less reluctant to enforce a marketable permit program than a prescriptive regulation with higher compliance costs: it is much easier for an agency or court to direct a noncompliant source simply to buy additional permits, compared to forcing a source to install expensive retrofit technologies to comply with prescriptive regulation.[583] On the other hand, because markets

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[574] Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181, at n.13.
[575] James Boyd, New Face of the Clean Water Act, *supra* note 270.
[576] Lesley McAllister, Beyond Playing "Banker", 59 Admin. L. Rev. 269 (2007).
[577] DOI Office of Policy Analysis, Conservation Banking Overview (2013).
[578] James Salzman & J.B. Ruhl, Currencies and the Commodification of Environmental Law, *supra* note 6.
[579] DOI, Office of Policy Analysis, Preliminary Analysis of the Conservation Banking Program and Results from a Survey of USFWS Staff (2013) (but most did not know).
[580] WRI, Addressing Risk and Uncertainty in Water Quality Markets (2014).
[581] Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181 (citing OECD 1997).
[582] NRC, Sharing the Fish: Toward a National Policy on IFQs (1999).
[583] T.H. Tietenberg, Emissions Trading: Principles and Practice 176-177 (2006, 2d ed).

create a profit incentives, a marketable permit program could increase the incentives for noncompliance, since any allowances that a firm does not need to cash in for compliance can be resold for a profit.[584] Marketable permit programs may also exacerbate the negative outcomes of noncompliance. Noncompliance lowers demand for allowances or credits and so reduces permit prices, and with lower prices other firms will choose to increase their activity and buy permits rather than mitigate.[585] Though the cap in a cap-and-trade system would still limit the overall level of activity, lower permit prices due to noncompliance could undercut the incentive to innovate.

For proper compliance incentives, both the expected cost of underreporting (probability of detection multiplied by the fine for lying) and the fine for the violation must be greater than the permit price.[586] However, "penalties that are unrealistically high may be counterproductive if authorities are reluctant to impose them."[587] Penalties can be a fixed amount or related to the allowance price, such as a requirement not only to pay a penalty for noncompliance but to compensate for missing allowances by buying new allowances at market price.

The acid rain market is famous for its near 100% compliance rates.[588] The program features a stiff and certain penalty of $2000 per excess ton (in 1990 dollars; the penalty is fixed to inflation), plus a requirement to submit a plan for how those excess emissions will be offset in future years, and EPA deducts allowances equal to the excess tonnage from the firm's free allocation for the following year.[589] (Others suggest that the 100% compliance figure really refers to the lack of exemptions granted under the program.[590]) The acid rain market has high levels of detection and almost self-executing enforcement by virtue of two linked tracking systems: allowance holdings are tracked by EPA's Allowance Management System and are compared at the end of the compliance period to the total emissions registered by the Continuous Emissions Monitoring Systems (CEMS).[591] The NOx trading programs have also seen relatively high rates of compliance.[592]

Other markets have more mixed compliance and enforcement records. Several fish catch share programs have seen enforcement costs rise.[593] Some markets lack the clarity of the acid rain program's noncompliance penalties: for example, noncompliance with EPA's vehicle emission programs could result in penalties as high as $37,500 per car, though much uncertainty remains.[594] In the lead phase-down program, the strong incentive to bank allowances in the early years may have contributed to initial noncompliance. Increased audits and stiffer penalties in subsequent year—as well as publicizing those enforcements—helped deter additional violations and brought the program into compliance.[595] With the RECLAIM program, calculation errors, missing data, and uncertainty about consequences due to case-by-case sanction determinations contributed to initial noncompliance rates of 4-15%.[596] RECLAIM also significantly exceeded the nitrogen oxide cap during California's energy crisis as demand

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584 Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181.
585 T.H. Tietenberg, Emissions Trading: Principles and Practice 171 (2006, 2d ed).
586 *Id.* at 175.
587 Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181.
588 Lesley McAllister, Beyond Playing "Banker", 59 Admin. L. Rev. 269 (2007).
589 Mark Jickling & Larry Parker, CRS, Regulating a Carbon Market 9.
590 Ellerman, Are Cap and Trade Programs More Environmentally-Effective Than Conventional Regulation?, *supra* note 397, at 51.
591 Jennifer Yelin-Kefer, *supra* note 279.
592 T.H. Tietenberg, Emissions Trading: Principles and Practice 182 (2006, 2d ed).
593 Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181 (citing OECD 1997).
594 Leard & McConnell, *supra* note 32.
595 T.H. Tietenberg, Emissions Trading: Principles and Practice 179, 181 (2006, 2d ed).
596 Lesley McAllister, Beyond Playing "Banker", 59 Admin. L. Rev. 269 (2007).

for electricity spiked. However, some evidence suggests that noncompliance rates during such periods of extreme demand might have been even worse under a prescriptive approach that lacked RECLAIM's market flexibilities.[597]

Recommendation: Marketable permit programs need clear, adequate sanctions, ideally including both penalties and plans for coming into compliance.

E. Ancillary Benefits

Beyond achieving primary policy objectives, some special features of marketable permits may also generate additional benefits.

For example, without conservation banking, developers and permittees seeking to destroy wetlands or endangered species habitats would have to undertake mitigation themselves, often attempting to replace lost habitat with small-scale efforts on their individual sites. This piecemeal approach can result in small, unconnected habitats, which may technically replace the lost acreage or ecosystem services. However, conservation banking can consolidate mitigation efforts into establishing larger, connected habitat reserves.[598] Biological economies of scale mean that these larger habitats deliver more environmental benefits than the sum of their parts, and the consolidated scientific expertise brought to bear at these unified mitigation sites may lead to better management.[599]

Tradable fish quota programs have the potential to reduce the incidental killing of non-target species. For instance, fishers with licenses for other species may incidentally catch red snapper; historically, such bycatch has often been discarded, unceremoniously dumped back into the ocean with little chance of survival. But when fishers have the ability to go online quickly and buy catch share for red snapper to cover their bycatch, such discards decrease.[600] More generally, without catch share programs, fishers only see value in caught fish; with catch share programs, fishers have an interest in fish still in the water. Consequently, tradable fish quota programs may make fishers better stewards of the resource, though it is unclear whether leaseholders of catch shares will have the same incentive as share owners to preserve the long-term health of the fishery. Some fisheries also report improved safety conditions as tradable catch shares replace the chaotic race-to-fish derby conditions, as well as longer fishing seasons as fishers no longer race to catch as quickly as possible.[601]

Marketable permits programs can even be designed to incentivize co-benefits. For example, trading ratios for conservation banking or water quality trading could be tweaked to reward projects that deliver co-benefits, such as non-point water quality projects that also benefit endangered species.[602] Similarly, a percentage of allowances could be set aside for allocation to fishers with the lowest bycatch.[603]

Finally, the revenue generated by marketable permit programs can provide ancillary benefits. For example, to the extent society desires to support farming communities, conservative banks and water quality trading programs can provide an attractive income stream for farmers and other landowners,

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[597] T.H. Tietenberg, Emissions Trading: Principles and Practice 182 (2006, 2d ed).
[598] Notice of Final Compensatory Mitigation Policy, 81 Fed. Reg. 95,316 (Dec. 27, 2016); *see also* James Salzman & J.B. Ruhl, Currencies and the Commodification of Environmental Law, *supra* note 6.
[599] FWS, Guidance for the Establishment, Use, and Operation of Conservation Banks (2003).
[600] Nat'l Marine Fisheries Service, 2014 Gulf of Mexico Red Snapper IFQ Annual Report (2015).
[601] Pew Envtl. Group, Design Matters: Making Catch Shares Work (2009) (Alaska halibut and sablefish).
[602] Willamette Partnership, In It Together: A How-To Reference Part 2 (2012).
[603] NRC, Sharing the Fish: Toward a National Policy on IFQs (1999).

and some claim that such arrangements even improve relationships between rural and urban communities.[604] When the government auctions off permits, the revenue can be redirected either to mitigate distributional issues or to further promote the policy objectives. For example, auction revenue from carbon cap-and-trade programs has been used to invest further in the low-carbon energy economy and to support low-income communities.[605] However, only state governments and federal agencies specifically authorized to deposit fees into special accounts could directly control auction revenue; without specific authorization, federal agencies would need to deposit auction revenue into the general treasury.[606]

F. Policy Performances

Many marketable permit programs have achieved their policy goals as well or better than prescriptive regulation likely could have. As discussed above when reviewing the empirical evidence of the market's efficiency advantages, care must be exercised in drawing conclusions from studies comparing the effectiveness of a market to a hypothetical counterfactual regulatory system, as well as judging a program's success or failure too early.[607] Furthermore, the causes of effectiveness or ineffectiveness should not be conflated: the environmental effectiveness of the Renewable Fuel Standards has been widely questioned, but due to the lifecycle emissions of ethanol[608] and rate-based nature of the cap,[609] not because of the program's trading elements. Additionally, in some contexts prescriptive regulations might not have been politically feasible, and so absent a market solution no policy goals would have been advanced.[610]

As summarized previously, there is some evidence that use market tools increased the stringency of regulatory programs. Economists have specifically credited the acid rain market's cost savings with making dramatic cuts to sulfur dioxide pollution both possible and politically feasible.[611] The acid rain market also achieved its emissions targets ahead of schedule.[612] The lower costs predicted from trading were also instrumental in negotiating a more stringent limits for ozone-depleting substances and California's RECLAIM program, as well as a faster phase-out timeline (by perhaps as much as six years[613]) for lead in gasoline.[614] EPA claims that trading similarly helped it increase stringency earlier for vehicle emissions standards.[615] The institution of tradable catch shares has sometimes, though not always, resulted in lower total allowable catches.[616]

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[604] Willamette Partnership, In It Together: A How-To Reference (2012); FWS, Guidance for the Establishment, Use, and Operation of Conservation Banks (2003).
[605] Evidence from RGGI.
[606] *See supra*.
[607] Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181.
[608] Ignacy Sachs, U.N. Conf. on Trade & Dev., *The Biofuels Controversy* (2007).
[609] If the total demand for fuel increased—as some projections predict—total emissions will continue to rise. *See* Lienke & Schwartz, *supra* note 273.
[610] Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181.
[611] Dallas Burtraw & Erin Mansur, *The Effects of Trading and Banking in the SO_2 Allowance Market* 20 (Res. for the Future, Disc. Paper 99-25, 1999), http://www.rff.org/documents/RFF-DP-99-25.pdf.
[612] *Id.* at 7, 15; Stavins, *Market-Based Enviro. Policies*, *supra* note 248, at 7; H. Ron Chan et al., *The Net Benefits of the Acid Rain Program* 1 (RFF 15-25, 2015).
[613] Winston Harrington & Richard Morgenstern, International Experience with Competing Approaches to Environmental Policy: Results from Six Paired Cases, *supra* note 259, at 122-123.
[614] Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181.
[615] EPA, Manufacturer Performance Report for 2015 MY (2015).
[616] Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181.

Some general studies of environmental markets have found no environmental degradation resulting from major trading programs.[617] Harrington and Morgenstern's comparative study finds "mixed" evidence of policy effectiveness, though it notes that the acid rain market's strong compliance record suggests the program has been highly effective.[618] Ellerman concludes that the acid rain market, the NOx trading programs, and even the much maligned RECLAIM program performed better on environmental outcomes than prescriptive regulation would have.[619] Ellerman identifies several features of the markets that contributed to policy effectiveness. First, the markets achieved strong reductions in the early years, accelerated by voluntary banking; prescriptive regulations would not have seen any voluntary early compliance actions. Second, there were no widespread exemptions or waivers or cap relaxations under the market programs; prescriptive regulations are often riddled with exemptions. Third, Ellerman alleges that implementation of prescriptive regulations would have been delayed by litigation, though it is possible the acid rain market only avoided major litigation because key decisions had been made in statute by Congress, not by agencies.[620] Nitrogen oxide emissions under RECLAIM did exceed the cap in one year during an energy crisis, but Ellerman argues prescriptive regulation would have fared no better.[621]

Allowing the public to participate in markets by purchasing and requiring credits, as with the acid rain market, directly advances the policy objectives. Retirement ratios, frequently seen with water quality trading,[622] can do the same, though at the expense of the program's efficiency, as discussed above.

Other evidence of the effectiveness of marketable permit programs includes:

- In 2015, several water quality trading programs were phased out as cleanup goals were met.[623] Other still active programs have had notable successes. EPA has recorded the following successes in water quality trading: in Long Island Sound, nitrogen removal was achieved ahead of the TMDL target; in the Lower San Joaquine River, selenium loading decreased in six of seven years; in the Southern Minnesota Beet Sugar Cooperative, trading resulted in more than double the required phosphorus reductions; in North Carolina's Neuse River Basin, the total nitrogen combined estuary loading was 50% of the allocation; and in Oregon's Clean Water Services program, trading significantly increased the pace and quantity of riparian restoration.[624]
- NOAA claims that annual harvest limits in fish catch share programs are rarely exceed, because catch shares programs generally include increase monitoring.[625] For the Gulf of Mexico red snapper fishery in particular, before establishing tradable catch shares, the fishery saw quota

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[617] Ellerman, Are Cap and Trade Programs More Environmentally-Effective Than Conventional Regulation?, *supra* note 397 (citing Burtraw & Mansur 1999 and Swift 2000).
[618] Winston Harrington & Richard Morgenstern, International Experience with Competing Approaches to Environmental Policy: Results from Six Paired Cases, *supra* note 259, at 122-123.
[619] Ellerman, Are Cap and Trade Programs More Environmentally-Effective Than Conventional Regulation?, *supra* note 397, at 48.
[620] *Id.* at 50, 52.
[621] Prescriptive rate-based regulations might not have even registered an increase in total emissions if rate was never exceeded and sources just upped their output, and the retrofits that would have been necessary to have prevented the exceedance would have been very costly. *Id.* at 57.
[622] Maryland's water quality trading retirement ratio is 1.1:1, i.e. 10% of all credits bought are automatically retired. WRI, Addressing Risk and Uncertainty in Water Quality Markets (2014). Also, Offset ratios can be designed to explicitly to promote policy goals, as with NAAQS offsets, more than 1:1. Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181.
[623] Ecosystem Marketplace, State of Watershed Investment (2016).
[624] EPA, Water Quality Trading Toolkit, Appendix A (2009) (but also noting that in Wisconsin Red Cedar, water quality improvement, if any, was unknown).
[625] NOAA, Economic Performance of U.S. Catch Share Programs, NMFS-F/SPO-133 (2013).

overruns in 11 of 17 years (from 1990-2006); since establishing the program, no quota overruns have occurred,[626] and the ratio of landed fish to discarded fish improved by three to four times.[627] Katrina Wyman concludes that, while there is no empirical evidence of direct causation, "the health of U.S. fish stocks has significantly improved in roughly the past decade," and catch share programs may be partly responsible.[628] There is some empirical evidence that catch shares promote better stewardship of the resource among fishers, and that fisheries with tradable catch shares are less likely to collapse.[629] The cost savings and increased profitability generated by the market system may also help fishers more readily accept the harvest limits necessary for rebuilding stock.[630]

- The Fish and Wildlife Service (FWS) reports that conservation banking is "generally perceived as successful" and often achieves net benefits to endangered species habitat.[631] Similarly, President Obama conclusively stated that mitigation banks lower long-term risk to the environment.[632] In a 2013 survey, 62% of FWS staff felt banks were generally effective at aiding species recovery, and another 18% felt banks did about as well as other mitigation options; only 8% felt banks were generally ineffective.[633] 57% of FWS staff felt additional species or habitats could benefit from banks.[634] Because conservation banks require mitigation to be completed before selling credits, banking may provide more certain environmental benefits than permittee-responsible, on-site mitigation, which does not necessarily have to be completed in advance of the habitat impacts.[635]
- The record for permittee-responsible wetland mitigation in the 1980s was abysmal: one study found that 34% of the proposed mitigation [by acreage] had not been constructed, and that 93% of applicants were not in compliance.[636] In 2001, the National Research Council concluded that the goal of no net wetlands loss was not being achieved under permittee-responsible mitigation, and that mitigation banks could offer advantages.[637]

Not everyone agrees with this rosy depiction of marketable permit programs' policy effectiveness. Most prominently, Driesen argues there is little empirical evidence that trading has produced environmental results superior to traditional regulation.[638] In particular, Driesen asserts that a prescriptive approach to the lead phase-down would have produced the same result more quickly than trading.[639] The effectiveness of wetland banking and water quality trading have also faced blistering critiques. In 2008, a consultant hired by EPA reported that of over twenty-five water quality trading pilots and programs,

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[626] Nat'l Marine Fisheries Serv., Red Snapper IFQ Five-Year Review (2013).
[627] Pew Envtl. Group, Design Matters: Making Catch Shares Work (2009).
[628] Katrina Wyman, The Recovery in U.S. Fisheries, J. Land Use (forthcoming). Worldwide: Analysis of 20 IFQs in several countries found that 12 populations improved, while 8 continued to decline, though unclear whether improvement or declines could be traced to IFQ or just to development of strict catch share limits and other larger management plans. Pew Envtl. Group, Design Matters: Making Catch Shares Work (2009).
[629] Katrina Wyman, The Recovery in U.S. Fisheries, J. Land Use (forthcoming).
[630] *Id.*
[631] Notice of Final Compensatory Mitigation Policy, 81 Fed. Reg. 95,316 (Dec. 27, 2016).
[632] Presidential Memorandum, Mitigating Impacts on Natural Resources from Development, Nov. 3, 2015.
[633] DOI, Office of Policy Analysis, Preliminary Analysis of the Conservation Banking Program and Results from a Survey of USFWS Staff (2013).
[634] Id.
[635] DOI, Office of Policy Analysis, Preliminary Analysis of the Conservation Banking Program and Results from a Survey of USFWS Staff (2013).
[636] 1991 FDER Study, cited by Corps-Jacksonville.
[637] NRC, Executive Summary (2001).
[638] David Driesen, Is Emission Trading an Economic Incentive Program?, *supra* note 18.
[639] *Id.*

"very few" could claim any significant impact on water quality.[640] Several environmental law experts question whether wetland banking has improved the environment at all.[641] As of 2003, the literature suggested that the wetlands program had failed to achieve its goal of "no net loss."[642] Limited agency resource for enforcement may be partly to blame.[643] On the other hand, the Army Corps argues that any effectiveness problems at wetlands banks would be the same or worse at permittee-responsible mitigation, because of greater uncertainty; at least banks achieve some compensation before the destruction.[644]

To some extent, the public and researchers do not have access to the ecological data necessary to analyze the success of conservation banking[645] and other environmental markets. For example, under various habitat mitigation programs, some ecological performance data is collected by agencies, but it is not comprehensively or easily accessible on the credit tracking website used by the Army Corps, the Fish and Wildlife Service, and the National Marine Fisheries Service.[646] EPA has called for periodic assessments of environmental and economic effectiveness of water quality trading,[647] though it is not clear this has taken place. The Magnunson-Stevens Act requires programmatic reviews of fish catch shares every five to seven years,[648] and fisheries are conducting such reviews. In 2015, the Army Corps did a retrospective review of the administration of its wetland banking rule, but not of ecological outcomes.[649] Also in 2015, the Corps began efforts to make mitigation plans and ecological monitoring reports more publicly available on the website (RIBITS.usace.army.mil) that it, the Fish and Wildlife Service, and the National Oceanic and Atmospheric Administration all use to track habitat credits.[650]

Recommendation: Agencies should release any non-confidential data that would help the public gauge a market's policy effectiveness, and should periodically assess both the policy and economic effectiveness of a program.

IV. Market Integrity and Oversight

A. Creating a Market

1. Auctions

The distributional and policy consequences of various methods for initially allocating allowances and credits are discussed above. In particular, procedures for approving credits for primary sale are discussed in Section III.C, and the distributional consequences of freely allocating, or grandfathering, permits according to historic use of the resource are discussed in Section II.D. Some additional

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640 IEc, Water Quality Trading Evaluation, *supra* note 50. Note that the data is ten years old and predates EPA's water quality trading toolkit, which gave state regulators concrete guidance. EPA also commented, on the draft version of this report, that some water quality trading programs are designed specifically to include only a limited number of sources, and so a "significant" effect on overall water quality is not necessarily surprising; additionally, EPA commented that the difficulty with verifying credits is a relevant factor in this 2008 study's claims.

641 Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181.

642 *Id.*

643 *Id.*

644 Corps-EPA Final Rule, Compensatory Mitigation for Losses of Aquatic Resources, 73 Fed. Reg. 19,593 (2008).

645 DOI, Office of Policy Analysis, Results from a Survey of Conservation Bank Sponsors (2016).

646 *Id.*

647 EPA, Water Quality Trading Policy, 68 Fed. Reg. 1609 (Jan. 13, 2003).

648 16 U.S.C. § 1853a(c)

649 Corps, Institute for Water Resources, The Mitigation Rule Retrospective (2015).

650 *Id.*

advantages and disadvantages of auctions versus grandfathering, in terms of market power, price discovery, and other oversight issues, are discussed below.

Some auction design issues, like the best bidding structure to prevent market manipulation,[651] are too complex to cover in this report, and likely there are no one-size-fits-all solutions to those issues. As the Federal Trade Commission has recommended, auctions, whether for airport landing slots or electromagnetic spectrum, need to be tailored to the unique context.[652] However, a few additional points about creating and running auctions bear mentioning here.

First, an auction can be revenue generating for the government or not. Revenue management is discussed above, in Section II.D.3. A zero-revenue auction combines some traditional features of an auction with some of the objectives of grandfathering. The acid rain program features a zero-revenue auction. Acid rain allowances are allocated freely, but each source is required to put 2.8% of their allowances up for auction. Revenue generated from the auction is distributed back to those sources, not to the government. Because there is an auction, price discovery is facilitated and new entrants have a clear path to enter the market; but because it is zero-revenue, existing regulated entities' past investments are not threatened and political opposition is less than with a revenue-generating auction.[653] The acid rain's auction has historically been relatively efficient and successful.[654]

Second, regulators must determine the frequency of auction. If there is sufficient volume to ensure a robust market, more frequent auctions could give participants greater flexibility to adjust their buying and selling strategies from sale to sale, and may disrupt coordinated attempts to corner the market.[655] However, if the frequency of auctions reduces the number of allowances sold per auction, the smaller market size could increase the risk of manipulation.[656] Other auction design features, such as bidding structure, could affect the risk of market power.[657]

Finally, regulators can operate and supervise auctions themselves or enlist third parties. For thirteen years, the Chicago Board of Trade conducted the acid rain program's zero-revenue auctions. It did so without compensation and was not allowed to charge a fee. In 2006, the Board decided to stop running the auction, and EPA now conducts auctions directly.[658] Both the Regional Greenhouse Gas Initiative and California's cap-and-trade program use an outside company to evaluate auction data to ensure there is no manipulation.[659]

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[651] Peter Cramton & Jesse Schwartz, Collusive Bidding: Lessons from the FCC Spectrum Auctions, 17 J. Reg. Econ. 229 (2000).
[652] FTC Comments to FAA, Notice 08-04 (2008).
[653] Zero revenue auction grandfathers the value of permits but lets the market freely allocate the uses of permits. Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 13-14 (1981). NRC recommended one for fish quotas, as way to ensure price discovery and let new entrants in to an otherwise grandfathered system. NRC, Sharing the Fish: Toward a National Policy on IFQs (1999).
[654] T.H. Tietenberg, Emissions Trading: Principles and Practice 11 (2006, 2d ed).
[655] Western Climate Initiative, Auction Design White Paper (2010) (more auctions also improves liquidity and may make it easier for small firms to participate).
[656] EDF Comments to CFTC (2010).
[657] Certain auction designs may decrease risk of market power, like instead of paying a single market-clearing price, you pay the highest unsuccessful bid, then no source could unilateraly affect prices by artificially raising/lowering demand, though could still with collusion with other sources. T.H. Tietenberg, Emissions Trading: Principles and Practice 157 (2006, 2d ed). FCC auction structure lead to some inefficient allocations, see Posner & Wilde.
[658] Mark Jickling & Larry Parker, CRS, Regulating a Carbon Market 11.
[659] Center for Climate and Energy Solutions (C2ES), Market Oversight under the Clean Power Plan (2016).

2. Secondary Markets

Secondary markets refer to transactions after the initial allocation. The two main categories of transactions on secondary markets are spot sales, which are sales for immediate delivery of the allowance or credit, and forwards, which set a fixed price for future delivery of the allowance or credit.[660] Secondary transfers may be permanent sales or lease arrangements.[661]

Not every marketable permit system provides for secondary transfers. Notably, neither conservation or wetland credits can be resold or traded after the initial purchase from the credit bank.[662] But the initial sale of such habitat credits strongly resembles secondary market transactions, with buyers and sellers searching for trading partners. For example, exchanges and clearinghouses are starting to be used for conservation banking.[663]

Secondary transactions can be accomplished through a variety of channels. Bilateral trading allows direct negotiation between buyer and seller, possibly mediated by a broker. Aggregators and clearinghouses convert credits with variable prices and quality into a more uniform currency. For example, an aggregator may pay farmers to install best management practices to generate water quality credits, which the aggregator then sells at a fixed price.[664] Clearinghouses act as an intermediary between buyers and sellers and guarantee performance in the event of default. Exchanges automatically match buyers and sellers in standardized transactions. Transactions not conducted on exchanges are called "over-the-counter."[665]

Sales directly negotiated bilaterally entail numerous transaction costs for buyers and sellers: researching the market and determining the going price, finding a trading partner, negotiating terms, handling paperwork and payments, and enforcing the contract.[666] For smaller and less sophisticated entities without preexisting connections with potential trading partners, search costs can be significant in a purely bilateral market.[667] Similarly, smaller credit sellers that generate credits more infrequently may have difficulty gaining credibility about the validity of their credits.[668] Brokers, aggregators, and clearinghouses help minimize some of those transaction costs. Exchanges have the lowest transaction costs:[669] contract terms are standardized, prices are transparent, buyers and sellers are matched automatically. Exchanges are also highly transparent and so facilitate monitoring of the market by regulators, other market actors, and the public.[670] However, those advantages come at the cost of the customization of terms available in over-the-counter transactions.

Regulators must determine how involved to become in facilitating the creation and operation of secondary markets. For large programs with sufficient value to attract intermediaries and market makers, secondary markets may "emerge quickly . . . with no need for government assistance."[671] For

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[660] Also repurchase agreements and short sales. Interagency Working Group on Carbon Market Oversight, Report, *supra* note 448, at 14.
[661] NOAA, Economic Performance of U.S. Catch Share Programs, NMFS-F/SPO-133 (2013).
[662] Notice of Final Compensatory Mitigation Policy, 81 Fed. Reg. 95,316 (Dec. 27, 2016).
[663] Id.
[664] Willamette Partnership, In It Together: A How-To Reference (2012).
[665] Interagency Working Group on Carbon Market Oversight, *supra* note 448, at 14.
[666] T.H. Tietenberg, Emissions Trading: Principles and Practice 40 (2006, 2d ed). Also cost of optimizing decision between abatement and buying permits.
[667] Breger, Stewart, Elliott, & Hawkins, Providing Economic Incentive in Environmental Regulation, *supra* note 13.
[668] *Id.*
[669] Andrew Wolman, Effluent Trading in the United States and Australia, *supra* note 229.
[670] Lesley McAllister, Beyond Playing "Banker", 59 Admin. L. Rev. 269 (2007).
[671] Mark Jickling & Larry Parker, CRS, Regulating a Carbon Market 28.

example, the European Union's Emissions Trading System did not explicitly provide for the creation of secondary markets, yet such markets materialized and flourished. Similarly, while the acid rain program allowed permit holders to use the structure of the zero-revenue auction to sell additional allowances beyond the required minimum 2.8%,[672] the bilateral, over-the-counter market remained "vastly more important."[673] Brokers facilitated acid rain transactions by maintaining price information and matching buyers and sellers.[674]

However, in other programs, robust secondary markets have been slow to develop without active involvement of regulators. For example, EPA and the Department of Transportation's trading programs for vehicle emissions and efficiency provide no centralized setting for trading to take place, which has made price discovery difficult and possibly limited the number of transactions that occur.[675] With electromagnetic spectrum licenses, because of interference issues caused by neighboring channels, transferring spectrum from one use (such as television broadcast) to another (like wireless carriers) can be difficult without coordination. The Federal Communications Commission is currently running a two-step "incentive auction" wherein the Commission acts as intermediary between broadcasters with underutilized spectrum and wireless providers seeking additional spectrum, which enables the Commission to "repack" channels to minimize such interference.

Regulators can facilitate secondary transactions in a variety of ways. Some agencies provide only minimal support in finding a trading partner. For example, the National Marine Fisheries Service advises interested buyers and sellers of Bluefin tuna shares either to e-mail the agency's customer service department to be added to a list of interested buyers and sellers, or else to download a list of initial quota allocations (though the list does not reveal the amount of share held or whether the holder has an interest in selling).[676] The PJM Interconnection—a regional transmission organization that coordinates wholesale electricity through thirteen states—has a website entitled "How Do I Sell RECs?," which recommends advertising renewable electricity credits for sale on their bulletin board.[677] In addition to privately-run exchanges, exchanges can also be operated directly by regulators.[678]

One difficulty for water quality trading is point sources that are potential credit buyers and sources that are potential sellers do not necessarily receive their permits simultaneously, and so they enter the market at different times. The lack of synchronicity makes it harder for buyers and sellers to find each other. A recent EPA-USDA workshop on water quality trading raised the idea that states could use "general permits" to establish pollution caps for groups of similar sources watershed-wide, and allow such sources to trade among themselves to achieve net pollution reductions.[679] As ACUS has previously defined, "In general permitting, an agency issues a permit that defines and approves a category of activity on its own initiative, and allows entities engaging in that activity to readily take advantage of the

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[672] T.H. Tietenberg, Emissions Trading: Principles and Practice 11 (2006, 2d ed).
[673] Stavins, What Can We Learn from U.S. Experience?, *supra* note 13, at 23.; *see also* Mark Jickling & Larry Parker, Cong. Res. Serv., *Regulating a Carbon Market: Issues raised by the European Carbon and U.S. Sulfur Dioxide Allowance Markets* 17 (2008).
[674] Jonathan Nash & Richard Revesz, Markets and Geography: Designing Marketable Permit Schemes to Control Local and Regional Pollutants, 28 Ecol. L. Q. 569 (2002).
[675] Leard & McConnell, *supra* note 32.
[676] NMFS, IBQ Program and Electronic Monitoring Reminders, Oct. 15, 2015.
[677] Or working with an aggregator or broker, or using an exchange platform. PJM, How Do I Sell RECs?
[678] EPA, Water Quality Trading Toolkit (2009) (EPA says a water quality trading exchange would "likely" have to be either operated or overseen by a state agency).
[679] EPA & USDA, Report on 2015 National Workshop on Water Quality Markets (2016). EPA has long supported use of watershed general permits to facilitate trading. EPA, Water Quality Trading Policy, 68 Fed. Reg. 1609 (Jan. 13, 2003).

permit."[680] General permitting tends to be appropriate when "[t]he agency does not need to tailor permits to context-specific instances of the activity,"[681] which would also be true for such a water quality market: what matters is the total discharges into the watershed by a category of point sources, and not the individual activity level of any one actor.

Finally, regulators must decide whether to require pre-approval of transfers. As discussed above in Section III.A., exchange restrictions can be implemented automatically through computer modeling or through case-by-case reviews.

Recommendation: Regulators should consider whether they can address barriers to efficient secondary transactions, for example by facilitating price discovery. EPA should encourage states to consider using general permits to facilitate water quality trading.

3. Derivatives

"A derivative contract is a financial instrument whose value is based on, or derived from, the value of an underlying asset, commodity, or measurable event."[682] Species of derivative contracts include futures, options, and swaps. Such contracts do not necessarily involve the actual transfer of allowances. However, future contracts can provide for near-term delivery of allowances and, because marketable allowances and credits are more uniform and easily transferable than many other commodities, future contracts can serve as "very close economic substitutes" to secondary market transactions.[683] On the European Union's Emissions Trading System, for example, "futures are not only used for hedging strategies, but as a [direct] means of buying or selling allowances."[684]

Derivatives are used for hedging and speculation. Hedging allows the transfer of market risks to parties more capable of assuming it. For example, regulated entities anticipating a future need for permits and worried about price volatility may want to hedge against potential price spikes; entities with banked allowances may want to hedge against falling prices, to protect the value of their permits. Non-regulated entities may also need to hedge their risks. For example, under a greenhouse gas cap-and-trade system, firms that produce abatement technologies may face financial exposure from carbon price changes,[685] and clean energy providers may wish to hedge against falling prices to ensure wholesale electricity prices do not dip and hurt their profits.[686] Distinct from hedging, speculation involves attempting to earn profit by anticipating price movements or taking advantage of a perceived mispricing.[687]

Some advocates worry that excessive speculation in derivative markets creates unnecessary risks of market manipulation and will undermine the effectiveness and efficiency of the marketable permit program.[688] Some have pushed for bans on derivatives of marketable permits, arguing that predictable increases in stringency and provisions for contingencies will ensure a clear price path and so minimize

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[680] https://www.acus.gov/sites/default/files/documents/recommendation-2015-4-designing-federal-permitting-programs_3.pdf at 2.
[681] *Id.* at 6. Note that not all the factors weighing in favor of general permits align with the features of marketable permits.
[682] Interagency Working Group on Carbon Market Oversight, Report, *supra* note 448, at 15.
[683] *Id.* at 33-34.
[684] *Id.* at n.27.
[685] *Id.* at 15.
[686] *Id.* at 38.
[687] *Id.* at 16-17.
[688] Michelle Chan, Friends of the Earth, *Smaller, Simpler, and More Stable: Designing Carbon Markets for Environmental and Financial Integrity* (2009).

the kinds of price risks that derivatives are designed to hedge against.[689] Others point out that a ban on U.S. derivatives based on marketable permits could simply prompt covered entities to hedge their risks in less transparent markets. For example, to hedge risks in carbon markets, covered sources may simply enter derivative markets in energy commodities or derivative markets based outside the United States.[690] Excessive speculation may be better addressed by requiring derivatives to be traded on exchanges, with position limits.

Derivatives can be traded on exchanges or bilaterally over-the-counter. Exchanges offer a centralized marketplace for buyers and sellers to meet and enter into highly standardized contracts. Exchanges manage the risk of default by requiring the deposit of some collateral to participate (also known as "margin requirements"), and typically provide for centralized clearing through a clearinghouse, which acts as an intermediary to guarantee performance.[691] Exchanges also often have position limits, to prevent excessive speculation. Standardizing contract terms can help reduce transaction costs and promote market liquidity, and help exchanges maintain high levels of transparency, which both facilitates price discovery by market actors as well as oversight by regulators and the public.[692]

On the other hand, over-the-counter transactions allow parties more customization and innovation in contract terms. For example, in the European Union's Emissions Trading System, exchange-traded futures contracts were limited to three-to-five year durations; if a utility wants to lock in allowance prices for a decade or more, it needs over-the-counter derivatives.[693] Some regulated entities may also feel they can negotiate better prices over-the-counter than what is set on exchanges; to the extent that is true, over-the-counter may lower overall compliance costs.[694] Historically over-the-counter trades have also avoided the capital costs of margin requirements.[695] Margin requirements can tie up cash, complicating participation for smaller firms and for entities like utilities that need to invest heavily in capital improvements.[696] However, the Dodd-Frank Wall Street Reform and Consumer Protection Act requires margins and clearing even for some kinds of over-the-counter derivatives,[697] as well as reporting certain details on over-the-counter swaps.[698]

Environmental Defense Fund has argued that all allowances and derivatives in carbon markets should be traded on registered exchanges to facilitate effective market oversight.[699] "Our extensive consultation with a range of experts…leads us to conclude that the benefits of allowing over-the-counter trades (even if cleared) would be very small related to the costs in terms of lost transparency."[700] However, Environmental Defense Fund admits that contracts for the development of offsetting credits may be too hard to standardize to put exclusively on exchanges, given the wide variety of credit-generating projects

[689] *Id.*
[690] CBO, Evaluating Limits (2010).
[691] Interagency Working Group on Carbon Market Oversight, Report, *supra* note 448, at 19.
[692] *Id.* at 18-19.
[693] Pew Ctr. on Global Climate Change, Carbon Market Design and Oversight (2010).
[694] *Id.*
[695] Interagency Working Group on Carbon Market Oversight, Report, *supra* note 448, at 18-19.
[696] Pew Ctr. on Global Climate Change, Carbon Market Design and Oversight (2010).
[697] Interagency Working Group on Carbon Market Oversight, Report, *supra* note 448, at 19.
[698] *Id.* at 21.
[699] EDF, Comments to CFTC (2010).
[700] *Id.*

and uncertainty about project approval and performance.[701] Credit markets, therefore, may need some level of over-the-counter trading.[702]

Derivatives have been used most actively in air pollution and renewable energy markets. As of 2010, exchange-traded derivatives for the Regional Greenhouse Gas Initiative were valued at $2 billion; for the acid rain market, $0.7 billion; and for the European Union's Emissions Trading System, $71 billion (not counting the significant number of over-the-counter derivatives).[703] There has also been strong interest in derivatives to hedge against the tremendous price volatility experienced in the renewable fuel standard market.[704]

B. Oversight of Primary, Secondary, and Derivative Markets

The Dodd-Frank Wall Street Reform and Consumer Protection Act established an interagency working group to investigate the oversight of carbon markets. The working group was chaired by the Commodity Futures Trading Commission (CFTC), and further composed of officials from EPA, the Department of Agriculture, the Department of the Treasury, the Securities and Exchange Commission, the Federal Energy Regulatory Commission, the Federal Trade Commission, and the Energy Information Administration.[705] In 2010, this group issued its report and concluded that while CFTC should have the authority for "comprehensive oversight" of derivative markets relating to carbon allowances, primary and secondary markets "will not be subject to the same comprehensive oversight,"[706] since "[n]o set of laws currently exists that apply a comprehensive regulatory regime" specifically to primary and secondary permit markets.[707]

CFTC likely does have sufficient authority to monitor derivative markets effectively, whether trades are conducted over-the-counter or on exchanges;[708] whether it exercises that authority for marketable permit programs remains an open question. For derivatives traded on exchanges, CFTC has thorough oversight, and exchanges must publish certain trading information, giving CFTC the data it needs to detect fraud or manipulation.[709] The Dodd-Frank Act strengthened CFTC's oversight of over-the-counter transactions as well. For example, CFTC can require swaps to be cleared and reported.[710] CFTC also has authority to impose position limits on both exchange-traded and over-the-counter derivatives to prevent excessive speculation.[711] However, CFTC has not established position limits for carbon market derivatives or other environmental commodity derivatives. At least some allowance transactions and most offset credits will qualify for CFTC's so-called "forward exclusion" from the definition of "swap."[712] In fact, the strong similarities between regulated futures contracts and unregulated forwards could make it easy for some transactions to evade oversight.[713] Certain activities by "commercial hedgers"—

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[701] *Id.*; *see also* Pew Ctr. on Global Climate Change, Carbon Market Design and Oversight (2010).
[702] Instead of banning over-the-counter, could require registry and tracking and raise transaction fees on trades that do not clear. CBO, Evaluating Limits (2010).
[703] *Id.*
[704] CME Group, Announces New Futures Contracts for RINs, Apr. 25, 2013.
[705] § 750.
[706] Interagency Working Group on Carbon Market Oversight, Report, *supra* note 448, at 51.
[707] *Id.* at 42.
[708] *Id.* at 51.
[709] *Id.* at 44.
[710] *Id.* at 47.
[711] *Id.* at 45.
[712] Joshua Schneck & Jonas Monast, Financial Market Reform and the Implications for Carbon Trading (2011).
[713] Leo Mensah, Missed Opportunity: Excluding Carbon Emissions Markets from Comprehensive Oversight, 38 Wm. & Mary Envtl. L. & Pol'y Rev. 795 (2014).

that is, non-financial entities using swaps to hedge against commercial risk, which would likely include any regulated entity using derivatives under a permit market to manage their exposure to price volatility—are exempt from CFTC's broadest authorities.[714] Nevertheless, CFTC has the statutory authority to eliminate many of these exemptions and to provide comprehensive oversight of derivatives in permit markets.

Oversight of primary and secondary markets will largely depend on the statutory authority of the individual agencies implementing marketable permit schemes. Arguably, the spirit of the Dodd-Frank Act was to ensure no market falls wholly outside regulatory authority. Some experts encourage agencies to aggressively read their statutes to find authority over any un-regulated secondary markets. However, these experts also caution that acquiring expertise in market oversight takes time and resources.[715]

The Federal Trade Commission (FTC) and the Department of Justice have some general authorities relevant to oversight of primary and secondary markets. FTC has general authority to act against unfair, anticompetitive, and deceptive practice affecting commerce.[716] However, despite their antitrust responsibilities, the FTC and Justice Department have had limited involvement with marketable permit programs. FTC issued guidance to combat deceptive practices only in the *voluntary* carbon offset and renewable energy certificate markets.[717]

CFTC has broad enforcement authority to pursue manipulation of a commodity's price in interstate commerce, and some authority to obtain information on holdings and secondary transactions of traders who also participate in regulated futures markets.[718] But "absent specific action by Congress, neither CFTC nor any other federal agency may have any authority to routinely monitor trading in the secondary markets."[719] CFTC only rarely brings enforcement actions for fraud in spot markets, as legislative history does not suggest Congress intended CFTC to have a huge role in secondary markets.[720]

CFTC also has authority to surveil any spot trading voluntarily conducted on registered exchanges.[721] For example, CFTC oversees trading of allowances for the Regional Greenhouse Gas Initiative and the acid rain market on exchanges like the Chicago Climate Futures Exchange.[722] Regulated exchanges also partly police themselves, with rules on position limits and to ensure fair trading.[723] Banning over-the-counter secondary transactions and requiring all trades to be on exchange might, therefore, strengthen federal oversight of marketable permit programs (as well as improve transparency and price discovery). However, such a ban would erase the flexibility and potential cost savings of over-the-counter trading, and contracts for variable credits and offsets may be difficult to standardize sufficiently to place on regulated exchanges. One compromise could be allowing over-the-counter transactions only for types of contracts not likely to be traded on exchanges.[724]

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[714] In 2012, CFTC voted to exempt non-financial commodities, including environmental commodities from "swap," including carbon forwards. McGuireWoods, Legal Alert, July 11, 2012.
[715] Interview by Author.
[716] Interestingly, the Deep Seabed Hard Minerals Act is one of the few (or only) statutes to specifically provide DOJ/FTC the opportunity to review the antitrust implications of permit transfers.
[717] OECD, Emission Permits and Competition (2010).
[718] Interagency Working Group on Carbon Market Oversight, Report, *supra* note 448, at 43.
[719] *Id.* at 43.
[720] Mark Jickling & Larry Parker, CRS, Regulating a Carbon Market n.20.
[721] *See* CFTC, Market Surveillance Program, http://www.cftc.gov/IndustryOversight/MarketSurveillance/CFTCMarketSurveillanceProgram/index.htm.
[722] *Id.*; Jonas Monast, Climate Change & Financial Markets: Regulating the Trade Side of Cap and Trade, 40 ELR 10051 (2010).
[723] Mark Jickling & Larry Parker, CRS, Regulating a Carbon Market 30.
[724] Jonas Monast, Climate Change & Financial Markets, *supra* note 722.

Testifying at a 2009 congressional hearing, witnesses from the Nicholas Institute for Environmental Policy Solutions at Duke University, the Chicago Mercantile Exchange, Exelon, and Iowa Farm Bureau all agreed that CFTC may be best positioned to try to comprehensively oversee permit markets.[725] However, there is similar consensus that CFTC would need additional authority to provide effective oversight. It is notable that all the legislative proposals in 2009-2010 for a national greenhouse gas cap-and-trade program would have granted CFTC or other agencies additional oversight authorities; existing authorities are likely insufficient.

Recommendation: CFTC should monitor any active derivative markets relating to regulatory permits and exercise its statutory authority when necessary to prevent fraud and manipulation. CFTC should consult with other agencies on the oversight of secondary permit markets, and should identify to Congress any need for additional statutory authorities to regulate permit markets. Agencies should presumptively limit secondary trading of allowances and credits to exchanges, as appropriate and consistent with their legal authority. An exception could be made for over-the-counter contracts that cannot be standardized, like forward contracts for the delivery of offset credits.

C. Fraud and Manipulation

Fraud and price manipulation not only undermine economic efficiency, but also erode confidence in the market.[726] Some marketable permit programs, like the acid rain market, have seen very little fraud or manipulation.[727] The acid rain market's lack of manipulation can be explained because there are relatively few regulated entities and they are largely major utilities, all of which have the same information on energy prices and weather forecasts. Under such conditions, it is difficult for one party to develop an information advantage and defraud another party.[728] Similarly, no manipulation to date has been detected in the Regional Greenhouse Gas Initiative.[729]

However, different markets with heterogeneous entities and asymmetrical information could face greater risks of fraud and manipulation.[730] In 2001, California's air pollution market suffered through a Ponzi scheme.[731] In the mid-1990s, before the Federal Communications Commission tweaked its auction design, there were allegations of firms colluding through bid signals to manipulate the price.[732]

The renewable fuel standard market has been especially plagued by both real and perceived fraud. As of 2014, at least 140 million invalid or imaginary renewable fuel credits have been generated.[733] Several credit producers have been charged with wire fraud, money laundering, and violations of the Clean Air Act.[734] In March 2016, the owner of a biodiesel company received ten years in prison and a $138 million

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[725] *Id.*

[726] Interagency Working Group on Carbon Market Oversight, Report, *supra* note 448, at 24.

[727] 80 Fed. Reg. at 64,977 ("The EPA has over 20 years of experience implementing emissions trading programs for the power sector and based on that experience, believes the potential or likelihood of market manipulation is fairly low.")

[728] Mark Jickling & Larry Parker, CRS, Regulating a Carbon Market 30-31.

[729] C2ES, *supra* note 659.

[730] "A system with numerous interrelated markets" versus a single market "may have some markets in which only one or a few polluters participate, leading to inefficiencies resulting from market concentration." Nash & Revesz, *supra* note 5 (quoting Hahn & Noll at 120).

[731] CBO, Evaluating Limits (2010); *see also* Richard Drury et al., Pollution Trading and Environmental Injustice, *supra* note 395 (outright fraud in RECLAIM).

[732] Peter Cramton & Jesse Schwartz, Collusive Bidding: Lessons from the FCC Spectrum Auctions, 17 J. Reg. Econ. 229 (2000).

[733] Susan Lafferty & David McCullough, Sutherland LLP, EPA's Renewable Fuel Standard: What to Expect in 2014 (2014).

[734] Robert Glicksman, Regulatory Safeguards for Accountable Ecosystem Service Markets in Wetlands Development, *supra* note 443; see also Energy & Environmental Law Adviser, CFTC and EPA Sign MOU on Renewable Fuel Markets, Mar. 23, 2016 (owner of Clean Green Fuel found guilty of wire fraud, money laundering, and Clean Air Act violations).

restitution penalty for selling sixty million bogus renewable fuel credits.[735] Between 2013 and 2016, EPA has taken eleven civil enforcement actions.[736] In January 2017, EPA placed a quality assurance provider on notice for allegedly verifying verifying millions of fraudulent renewable fuel credits.[737]

In addition to such fraud, there have been allegations of price manipulation in the renewable fuel credit market. In 2013, Senator Grassley identified market manipulation as the cause of a dramatic spike in prices for renewable fuel credits, and the *New York Times* investigated Wall Street speculators' exploitation of the market.[738] In 2016, the Renewable Fuels Association asked for EPA and the Commodity Futures Trading Commission to investigate the market for price manipulations by those seeking to erode confidence in the program, who hope to lobby for reforms or a complete repeal of the renewable fuel standard.[739] Also in 2016, investor Carl Icahn (who owns 82% of an independent refinery) called for EPA and the Federal Trade Commission to investigate the "rigged" renewable fuel market for "secret deals" wherein blenders sell credits preferentially to speculators instead of refineries, allowing speculators to hoard credits until the price increases. Icahn likened the market to a cocaine cartel, quoting the CEO of a refinery as saying, "if Pablo Escobar were alive, he wouldn't be doing coke, he'd be trading RINs [renewable fuel credits]."[740] Other industry experts question whether there is any evidence for Icahn's allegations.[741]

Tools to manage fraud and abuse include position limits, accountability provisions, reporting requirements, and effective surveillance.[742] Transparent price information can prevent large, sophisticated players from exploiting information asymmetries with smaller firms.[743]

D. Volatility

Price volatility can occur in marketable permit programs even without fraud or manipulation, due to unexpected increases in demand or reductions in supply. For example, in 2000, California's energy crisis caused demand to spike, and RECLAIM allowance prices rose twenty-five times; consequently, regulated sources exceeded the overall nitrogen oxide cap by 19%.[744] Cheap credits in RECLAIM's early years may have habituated firms to low prices, causing them to fail to plan for future contingencies.[745] Conservation bank prices range $1836 to $400,000 per credit due to scarcity of certain kinds of credits in certain areas.[746] Most notoriously, in 2013, some renewable fuel categories saw credit prices increase 2500% over a six month period.[747]

Volatility creates financial risks in both regulated markets and related markets, increases the risk of noncompliance, and decreases confidence in the market system. Too much volatility can even lead to

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[735] Energy & Environmental Law Adviser, CFTC and EPA Sign MOU on Renewable Fuel Markets, Mar. 23, 2016.
[736] EPA, Civil Enforcement of RFS Program.
[737] *Id.* Genscape must retire valid RINs to replace fraudulent ones they verified (i.e., Genscape has to replace, not buyers)
[738] Sutherland, *supra* note 733 (2014).
[739] Letter from Renewable Fuels Assoc., to EPA and CFTC, Aug. 1, 2016.
[740] Laura Blewitt & Zachary Mider, Icahn Calls on EPA to Fix "Mother of All Short Squeezes," Bloomberg, Aug. 15, 2016.
[741] Dallas Burkholder, OTAQ, Preliminary Analysis of RIN Market Dynamics, RIN Prices, and Their Effects (2015).
[742] Interagency Working Group on Carbon Market Oversight, Report, *supra* note 448, at 20.
[743] Mark Jickling & Larry Parker, CRS, Regulating a Carbon Market 31.
[744] Lesley McAllister, Beyond Playing "Banker", 59 Admin. L. Rev. 269 (2007).
[745] Id.
[746] DOI Office of Policy Analysis, Conservation Banking Overview (2013). For just vernal pools in California, range is $50,000 to $325,000
[747] Progressive Fuels Ltd., RIN Pricing and Opportunities, Aug. 26, 2013. One type increase from just a few cents to over a dollar per credit. Dallas Burkholder, OTAQ, Preliminary Analysis of RIN Market Dynamics, RIN Prices, and Their Effects (2015).

"demoralization," as businesses stop trying to predict future prices, which undermines the incentives for innovation and planning created by long-term price signals.[748]

Regulators can manage price volatility with several tools. "Circuit breakers" limit how much prices can rise or fall in given period.[749] Safety valves can set maximum prices or release reserve credits into the market in case of emergencies or demand spikes.[750] For example, the Department of Transportation sets a fine for exceeding fuel efficiency standards, which acts as a price cap in the efficiency credit market.[751] Authorizing the banking and borrowing of allowances also helps mitigate against price volatility:[752] borrowing credits from future years can dampen price spikes,[753] and banking for future compliance obligations can help maintain market activity during periods of low prices, such as in years when caps do not prove to be binding on emissions.[754] Finally, by defining a broader program that covers more regulated entities under a single market, regulators diversify the portfolio of permit seekers, reducing the risk of unexpectedly high costs in an isolated sector.[755] Any individual regulated sector can experience unexpected compliance costs as economic conditions change; a broader market offers more flexibility, better absorbs price volatility, and so increases certainty for regulated parties and investors.

E. Thinness, Hoarding, and Monopolies

Thin markets occur when transaction costs are so high or covered entities are defined so narrowly that not enough potential buyers and seller participate to support a robust market.[756] For example, too many exchange restrictions will thin the market.[757] Every marketable permit program must balance the complexity of currency design, the number of exchange restrictions to mitigate remaining externalities, and market thickness.[758] Thin markets increase the risk of market power like monopolies and monopsonies and, by limiting the number of trading opportunities, restrict the market's overall efficiency. Without enough actors to provide competitive prices, trading will not generally deliver on its promise of cost-effective solutions.[759] Economists, like Tom Tietenberg, usually argue to err on the side of thicker markets and deal with any remaining externalities on an ad hoc basis.[760]

Firms with market power can unduly influence the market's efficiency to their advantage, moving the price and quantity of permits traded away from the optimal equilibrium that balances true supply and demand. Firms may hoard allowances to inflate the price. To corner a market, a firm can amass a large inventory of allowances and simultaneously take future or forward positions that will require other

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[748] Interview with Don Elliott.
[749] CBO, Evaluating Limits (2010).
[750] Safety valve as a pre-defined penalty that can be paid on emissions over the cap in event of emergency, different than noncompliance penalty. Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181.
[751] Leard & McConnell, *supra* note 32.
[752] Interagency Working Group on Carbon Market Oversight, Report, *supra* note 448, at 35.
[753] *Id.* at 36.
[754] *Id.* at n.11.
[755] Stavins, *U.S. Cap-and-Trade System*, *supra* note 262, at 19; Nash & Revesz, *supra* note 5, at 616, 630.
[756] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 9 (1981)
[757] T.H. Tietenberg, Emissions Trading: Principles and Practice 160 (2006, 2d ed).
[758] James Salzman & J.B. Ruhl, Currencies and the Commodification of Environmental Law, *supra* note 6.
[759] Nash & Revesz, *supra* note 5 (citing T.H. Tietenberg 61-62 (1965)); *see also* Congressional Research Service, Regulating a Carbon Market: Issues Raised by the European Carbon and U.S. Sulfur Dioxide Allowance Markets (2008) (warning of market power in illiquid markets).
[760] James Salzman & J.B. Ruhl, Currencies and the Commodification of Environmental Law, *supra* note 6.

market participants to make future deliveries of allowances back to the firm; the firm with market power can then dictate the price for satisfying those forward positions.[761]

Besides trying to extract monopoly rent from the permit market, firms may also try to manipulate the permit market as a way to punish rivals in a product market. By driving up permit prices, firms can increase their rivals' production costs and reduce their share of the product market.[762] For example, firms could hoard spectrum licenses with the intent not of driving up permit prices but rather of preventing competition in broadcast markets.[763] However, many permit markets will not contain a large number of direct competitors in the output market. For example, it is unlikely for multiple businesses competing in the same product market to be located in a given airshed or watershed. The permit market is, therefore, likely a poor vehicle to try to wield anti-competitive power in the product market.[764] Moreover, standard antitrust laws may be sufficient to handle these risks.[765]

Market power can be difficult to detect. It remains unclear whether the hoarding of renewable fuel credits by certain banks helped cause the 2013 price spike.[766] Similarly, the market for trading emissions credits among passenger vehicle manufacturers is relatively thin, with only about twenty car manufacturers actually subject to the regulation. In this constrained market, market thinness and the lack of transparency about buyers' offer prices and sellers' asking prices likely were responsible, among other factors, for the dearth of trades between companies in early years.[767] Additionally, since only six car manufacturers hold nine of every ten permits, the lack of trades may be due to a monopoly-like attempt to restrict permit supply in the market's initial years to drive up permit prices in later periods.[768] However, as stringency has increased over time, the vehicle emissions market has become thicker: through the year 2013, only 2.6 million credits total had been traded cumulatively, but in 2014, another 7.2 million were traded, and in 2015, 10.2 million were traded.[769] The number of buyers and sellers has likewise increased.[770]

One market with a real risk for monopoly power was the ozone-depleting substance market. The Federal Trade Commission calculated the market's Herfindahl-Hirschmann Index: a metric of market competition with a scale of 0 to 10,000, with any score over 1500 signifying a risk of market power. The ozone-depleting substance market scored 2958. The Federal Trade Commission recommended that EPA retain the right to take back any credits being hoarded.[771] In the conservation banking context, some banks have a de facto monopoly on certain types of credits in certain areas (though of course permittees could always implement their own mitigation).[772]

In general, though, market power has not been a significant issue in most permit markets. In some marketable permit programs, the accumulation of allowances is unlikely to generate monopoly-type

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[761] Mark Jickling & Larry Parker, CRS, Regulating a Carbon Market 33.
[762] T.H. Tietenberg, Emissions Trading: Principles and Practice 150 (2006, 2d ed).
[763] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 20 (1981)
[764] T.H. Tietenberg, Emissions Trading: Principles and Practice 157 (2006, 2d ed).
[765] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 20 (1981)
[766] Robert Glicksman, Regulatory Safeguards for Accountable Ecosystem Service Markets in Wetlands Development, *supra* note 443.
[767] Leard & McConnell, *supra* note 32, at 2, 7, 15, 26.
[768] *Id.* at 28.
[769] EPA, Manufacturer Performance Report for 2015 MY (2015); *compare* EPA, Manufacturer Performance Report for 2014 MY.
[770] In 2015, there were 5 sellers and 7 buyers, up from 3 and 3 in 2013. EPA, Manufacturer Performance Report for 2015 MY.
[771] FTC, Comments of the Staff of the Bureau of Economics on Protection of Stratospheric Ozone (1988).
[772] Stratus Consulting for Northwest Fisheries Science Center, NOAA, A Nationwide Survey of Conservation Banks (2003).

powers, either because of the high number of market participants (as with air markets) or because the underlying good is a globally competitive market (as with fish).[773] Regulators have also often preempted the risk of hoarding and market power by imposing position limits, either on the purchasing or the holding of allowances, including the total banking of allowances.[774] For example, the Federal Communications Commission limits stockpiling and speculative trafficking,[775] and California's cap-and-trade program for greenhouse gases has both purchase and holding limits.[776] Exchanges also typically set their own purchase limits.

Position limits to protect against market power can be derived from formulas based on elasticities and other factors. However, regulators may want to go beyond the minimum limit necessary to prevent market power, in order to prevent inequitable concentrations short of monopolies, or to further other management goals.[777] For example, most fisheries score low on the Herfindahl-Hirschmann Index for market concentration: the red snapper fishery's scores were all below 190 (recall that anything under 1500 suggests no market power).[778] Yet most fish catch share programs have position limits. These limits are designed more to protect traditional fishers and communities than to prevent true monopolies.

Several other regulatory tools besides position limits can minimize the risk of market power and ensure sufficiently thick markets. Monopoly risk is less common in auctions.[779] Regulators can reserve a supply of allowances to be sold at set price in case of hoarding. Position accountability triggers would simply require a permit holder wishing to exceed a certain threshold of allowances to submit to additional reporting and oversight.[780] Regulators can help minimize transaction costs and ensure adequate participation by supporting or operating brokerages or exchanges.[781] Finally, credit generators will be reluctant to spend money generating credits if they are not confident that sufficient market demand will exist to sell their credits at a profit. To counteract uncertainty for would-be market participants about whether supply or demand will exist, regulators can support the use of clearinghouses, which guarantee performance and so lower risk for buyers and sellers.[782]

Recommendation: Regulators should adopt position limits on purchasing and holding marketable permits, or employ other tools to adequately prevent monopolies, hoarding, and other manipulations.

F. Speculators and Other Participants

Regulators must decide whether to restrict market participation to regulated entities or to allow in third parties and the general public. Brokers and market makers enter a market seeking profit, but they also provide much-needed liquidity and lower transaction costs. Hedgers may be looking either to profit on speculation or to offset financial exposure. For example, the firms that produce abatement technologies and clean energy companies do not have a compliance obligation under a greenhouse gas cap-and-

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[773] Tom Tietenberg, Tradable Permits in Principle and Practice, *supra* note 181.
[774] EDF Comments to CFTC (2010).
[775] Pablo Spiller & Carlo Cardilli, Toward a Property Rights Approach to Communications Spectrum, *supra* note 70.
[776] C2ES, *supra* note 659
[777] Lee Anderson & Mark Holliday, Nat'l Marine Fisheries Serv., *The Design and Use of Limited Access Privilege Programs* (2007).
[778] Nat'l Marine Fisheries Serv., Red Snapper IFQ Five-Year Review (2013).
[779] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 20 (1981); see also Hahn (1983), cited in Tietenberg 2006 at 155.
[780] CBO, Evaluating Limits (2010).
[781] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 21 (1981)
[782] Also government guarantee to purchase any unsold credits in early years. WRI, Addressing Risk and Uncertainty in Water Quality Markets (2014).

trade, but face financial exposure to changes in carbon allowance prices.[783] Advocacy groups and the general public may even want to enter a market to purchase and retire credits to promote environmental objectives. Broader markets with more participants facilitate price discovery, help with liquidity, and decrease the risk of price manipulation.[784] The Federal Trade Commission generally advises making market open to all participants, since involving third parties lets markets transfer risk to those best able to absorb it.[785]

On the other hand, excessive speculation can result in bubbles and price decoupling, as price no longer tracks mitigation costs and becomes inflated, distorted, or manipulated.[786] Some environmental advocates argue that too much liquidity undermines the goals of an emissions market: as the cap tightens, it is supposed to be harder to find a seller, to provide incentive to make extra reductions.[787] However, participation restrictions that shut out speculators will raise transaction costs and may be hard to enforce. For example, several large investment banks already own power plants and transmission facilities, and even if shut out of an air pollution market as speculators they could enter it as regulated entities.[788] In fact, participation restrictions may ultimately not address the risk of excessive speculation. If speculators are shut out, some covered entities will try to fill that role to provide liquidity and enable hedging. These entities will likely not be as experienced or as effective as speculators are at absorbing risk, and as a result, market stability will decline.[789] For example, while EPA expects that the only parties without renewable fuel volume obligations who will hold renewable fuel credits are the middlemen in fuel transactions like blenders,[790] there have been accusations that some of these actors behave as speculators. Instead of participation restrictions, position limits and price circuit breakers may be better tools to address the risk of excessive speculation.

Marketable permit programs vary widely on participation restrictions. Anyone can participate in the acid rain market,[791] and the public has used this openness to occasionally purchase and retire credits. By contrast, in EPA's vehicle greenhouse gas program, third parties may facilitate trades but only manufacturers can hold credits and transact.[792] The ocean quahog catch share program allows the transfer of permits to anyone *eligible* to own a Coast Guard-approved vessel regardless of actual vessel ownership—essentially, any U.S. citizen or corporation may participate.[793] In the Gulf of Mexico Red Snapper catch share program, 32% of all accounts, holding 28% of shares, were "public participants" without a commercial fishing permit.[794] Other fish catch share programs restrict transfers to maintain character of the fishery,[795] such as blocking purchases by partnerships or requiring quota holders to be on board the vessel using the quota. Conservation mitigation markets typically allow a range of actors to

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[783] Interagency Working Group on Carbon Market Oversight, Report, *supra* note 448, at 15.
[784] C2ES, *supra* note 659.
[785] FTC, Comments of the Staff of the Bureau of Economics on Protection of Stratospheric Ozone (1988).
[786] Interagency Working Group on Carbon Market Oversight, Report, *supra* note 448, at 20, 23.
[787] Michelle Chan, *supra* note 688.
[788] CBO, Evaluating Limits (2010).
[789] *Id.*
[790] EPA, Annual RIN Sales/Holdings Summary (listing categories as: importers, exporters, refiners, and parties without a renewable volume obligation (for example, renewable producers, fuel marketers, and fuel blenders)).
[791] Jonathan Nash & Richard Revesz, Markets and Geography: Designing Marketable Permit Schemes to Control Local and Regional Pollutants, 28 Ecol. L. Q. 569 (2002).
[792] EPA, Manufacturer Performance Report for 2015 MY (2015).
[793] NOAA, Economic Performance of U.S. Catch Share Programs, NMFS-F/SPO-133 (2013).
[794] Nat'l Marine Fisheries Serv., 2014 Gulf of Mexico Red Snapper IFQ Annual Report (2015).
[795] NMFS, Catch Share Spotlight: Alaska Halibut/Sablefish IFQ.

qualify as credit bank sponsors:[796] as of 2013, 73% of banks were private commercial, 5% were government sponsored, and only 2% were operated by non-profit organizations.[797]

G. Information and Communication

Regulators, market actors, and the public all have different needs for information on transactions in permit markets.[798] Categories of information include prices and quantities of bids and actual transactions; total number of allowances and credits in circulation; demand for allowances; and aggregate trading activity and the distribution of allowances across classes of participants.[799]

1. Information for the Regulators: Tracking Transaction

Regulators need to track transactions and permit holdings to detect fraud, manipulation, market power, and abuse, and to enforce compliance. This section surveys some of the tracking tools used by regulators in sample contexts, and identifies some programs where important information may not be available.

EPA uses the Allowance Management System (formerly called the Automated Tracking Service) to track trades in air pollution markets. The System numbers and serializes each individual allowance. It is not a trading platform itself, and so market participants manually record transfers either as they occur or retroactively upon submitting the allowance in question for compliance.[800] Total allowance holdings in accounts on the Allowance Management System are checked against the Emissions Tracking System (ETS).[801] The System does not record the prices of allowance bought or sold, or derivative transactions like options.[802] Similarly, EPA and the Department of Transportation seemingly do not require reporting of prices for their vehicle emissions and efficiency markets, and manufacturers do not report transactions as they occur, but only at the end of the compliance period.[803]

For the renewable fuel market, EPA originally tracked credits "on excel spreadsheets" checked once at the end of the year; the "practicalities of tracking a national credit scheme" in this manner was "fraught with errors."[804] The agency's solution was the EPA Moderated Transaction System. The System requires online submission of transaction records by each trading partner and offers immediate validation of status of the credits, for a more a real-time accounting.[805]

For state-based renewable electricity credits, ten separate tracking systems more or less follow the boundaries of regional transmission organizations or independent system operators.[806] A unique identification number is given to each megawatt-hour generated.[807] The Department of Energy's

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[796] FWS, Guidance for the Establishment, Use, and Operation of Conservation Banks (2003) (Conservation banks can be publicly sponsored, privately sponsored, or run by entrepreneurial third parties).
[797] DOI Office of Policy Analysis, Conservation Banking Overview (2013).
[798] Interagency Working Group on Carbon Market Oversight, Report, *supra* note 448, at 15.
[799] *Id.* at 15.
[800] Acid rain, reporting is not required until compliance deadline, but in fact many report in real time, and information (without price) is posted online. Jonas Monast, Climate Change & Financial Markets, *supra* note 722.
[801] Mark Jickling & Larry Parker, CRS, Regulating a Carbon Market 10.
[802] *Id*.
[803] EPA, Manufacturer Performance Report for 2015 MY (2015).
[804] RIN Alliance, Making the RIN Program Work (2011).
[805] *Id.*; EPA, RINs under the Renewable Fuel Standard Program.
[806] NREL, Quantifying the Level of Cross-State Renewable Energy Transactions (2015).
[807] EPA, How is Renewable Energy Tracked?

National Renewable Energy Laboratory reportedly does not have data from all tracking systems on the number of banked credits in each state,[808] suggesting some gaps in the data exist.

The Regional Greenhouse Gas Initiative tasks an independent third party with monitoring the performance of auctions and the secondary market.[809]

At least some fish catch share programs require reporting of transaction information, including prices. However, in the grouper-tilefish program in 2014, 33% of share transaction records had no price information or reported unreasonably low prices, like $0.01 per pound (the number was 52% for allowance transactions). Another 31% of share transactions had mismatched information reported by the buyers and sellers.[810] Unreasonably low prices could be because of reporting errors, reluctance to enter price information, gifts, transfers to related accounts, package deals containing other terms, or unrecorded bartering.[811] The regional council for that fishery added a "reason for transaction" reporting requirement, but in 2014, 17% of share transactions and 46% of allowance transaction declined to state the nature of the transaction.[812] Some unusually high prices were also reported, but the National Marine Fisheries Service does not fully disclose them in its annual reports.[813] Industry feedback suggests that privacy concerns may lead some fishers to deliberately misreport prices.[814]

The grouper-tilefish program also has difficulty tracking total holdings by owner, since "currently it is not possible to link ownership of a shareholder account to ownership of a dealer account, as accounts may be held under different names….Individual units of allocation cannot be tracked in the system (e.g., the same pounds may be transferred multiple times)."[815] This problem, largely still unresolved, was first flagged by the Government Accountability Office (GAO) in 2002. GAO expressed concern that the National Oceanic and Atmospheric Administration was underestimating the consolidation of permits in the fishing industry, because the agency could not identify links between different holders who were actually part of a single corporation or family business.[816] In 2014, the National Oceanic Atmospheric Administration's inspector general found that the Pacific sablefish catch share program did not track individual permits and was using paper-based records subject to error.[817]

The Army Corps of Engineers developed the Regulatory In-Lieu Fee and Bank Information Tracking System (RIBITS) to monitor wetland mitigation credits and debits.[818] The Fish and Wildlife Service and the National Oceanic and Atmospheric Administration also use RIBITs to track conservation banking.[819] In 2013, the Department of the Interior's Office of Policy Analysis raised questions about whether RIBITS collected and published enough data.[820] As of 2015, the Corps has been working to make data entry more timely and to integrate mitigation plans and monitoring reports.[821]

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808 NREL, Quantifying the Level of Cross-State Renewable Energy Transactions (2015).
809 Interagency Working Group on Carbon Market Oversight, Report, *supra* note 448, at 9.
810 Nat'l Marine Fisheries Serv., 2014 Grouper-Tilefish IFQ Annual Report (2015).
811 *Id*.
812 *Id*.; *see also* Nat'l Marine Fisheries Serv., 2014 & 2015 Gulf of Mexico Red Snapper IFQ Annual Reports.
813 Nat'l Marine Fisheries Serv., 2014 Grouper-Tilefish IFQ Annual Report (2015).
814 Nat'l Marine Fisheries Serv., Red Snapper IFQ Five-Year Review (2013).
815 Nat'l Marine Fisheries Serv., 2014 Grouper-Tilefish IFQ Annual Report (2015).
816 GAO, Better Information Could Improve Project Management, GAO-03-159 (2002).
817 Dept. of Commerce Office of Inspector General, Review of NOAA Catch Share Program (2014).
818 https://ribits.usace.army.mil/ribits_apex/f?p=107:2
819 Notice of Final Compensatory Mitigation Policy, 81 Fed. Reg. 95,316 (Dec. 27, 2016).
820 DOI Office of Policy Analysis, Conservation Banking Overview (2013).
821 Corps, Institute for Water Resources, The Mitigation Rule Retrospective (2015).

The Corps has also suggested that states could use RIBITS to track state-based water quality trading programs.[822] Historically, EPA has had two water quality permit data tracking systems (PCS[823] and ICIS), but neither is structured to actually track trades: instead, manual adjustments are required to reflect any transactions. For example, a credit seller would report the sum of its actual discharge plus any credits sold as its reported discharge, and the tracking system would have to confirm that sum is greater than or equal to that firm's individual pollution limit.[824] Some states assign water quality credits a unique serial number and vintage year, like the Ohio River trading program;[825] other programs, like Florida's Lower St. Johns trading program, only track credits linked to projects as a group, not individually, which makes it more difficult to split use of credits and to prevent double counting.[826]

Finally, though some information on marketable permit holdings and transactions may be included in public financial statements, inconsistent accounting practices make it hard to compare such statements. Are allowances zero basis, fair value, or revenue? Are they intangible assets, inventory, current assets, or deferred expenses? According to the International Carbon Action Partnership, such inconsistent accounting practices increase the risk of risk of laundering and fraud.[827]

Recommendation: Marketable permit programs should assign unique serial numbers to allowances and credits. Registries should track the status of each allowance and credit[828] in as close to real time as practical, as well as transaction prices and each account's total holdings. That does not necessarily mean such information should be publicly disclosed in real time.

2. Information for Market Actors: Price Discovery

Market participants need accurate information on prices and allowance availability to make appropriate decisions about whether to purchase allowances.[829] "Transparent and timely information about current and future market clearing prices" is "a condition for achieving low costs."[830] Besides market participants, other actors—like developers of abatement technologies—need market data, for example to determine a strategy for developing and deploying new abatement technologies.[831]

However, too much transparency has a cost, as even reporting transactions and prices could reveal confidential business information about a firm's technology and costs to trading partners, competitors, and the public.[832] Speculators can take advantage of rich market data to anticipate and attempt to manipulate future prices.

Ideally there should be a single authoritative source of price information that brings together data from both secondary and derivative markets and puts all players on equal informational footing. Many commodity spot markets look to futures exchanges for current price information.[833] Exchanges might

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822 *Id.*
823 PCS has been fully discontinued.
824 EPA, Water Quality Trading Toolkit (2009).
825 Nat'l Network on Water Quality Trading, Building a Water Quality Trading Program (2015).
826 *Id.*
827 International Carbon Action Partnership (2013).
828 Nat'l Network on Water Quality Trading, Building a Water Quality Trading Program (2015) (status of each credit: pre-implementation, implemented, verified, active, retired, suspended). Registries need to track whether quotas are encumbered with a lien, otherwise risk of transferring to purchaser without knowledge. NRC (1999).
829 Interagency Working Group on Carbon Market Oversight, Report, *supra* note 448, at 22.
830 *Id.* at 7.
831 *Id.* at 28.
832 *Id.* at 23.; Breger, Stewart, Elliott, & Hawkins, Providing Economic Incentive in Environmental Regulation, *supra* note 13.
833 Mark Jickling & Larry Parker, CRS, Regulating a Carbon Market 29.

charge fees for access to real-time, proprietary price data, and both the Securities and Exchange Commission and the Commodity Futures Trading Commission have grappled with balancing public access to information against the exchanges' interest in not giving away proprietary information for free.[834] Without reliable information on prices, buyers and sellers will have difficulty coming to terms, reducing the number of trades and limiting the market's efficiency. There may be a role for regulators to play as "information brokers."[835]

In several air pollution markets, poor price discovery has hindered trading, and EPA often makes no effort to facilitate price discovery. EPA's Allowance Management System, for example, does not include price information, which contributes to uncertainty.[836] In the lead phase-out trading program, a much greater proportion of large refiners traded than small refiners, perhaps because of informational and other transaction costs: prices were treated as highly confidential by most market participants and were not reported, leading to increased search costs to discover the price.[837] Inadequate information about the market probably also contributed to RECLAIM's price spike in 2000, as the relatively smaller sources that populated the RECLAIM program probably needed more help navigating the market than larger sources would have, such as the power plants operating in the acid rain market.[838] Similarly, because EPA does not disclose the how many renewable fuel credits are traded by whom, it is difficult to discern whether the price spike of 2013 was due to banks hoarding credits.[839] By contrast, EPA has called for the source, quantity, and price of water quality trades to be publicly posted online,[840] though states largely have not followed through on that.

Neither EPA nor the Department of Transportation reports prices for trades in vehicle emissions and efficiency markets, and the Department of Transportation does not report any information on trading activity.[841] Researchers have been able to pull indirect evidence of prices by comparing non-compliance settlement agreements with SEC filing statements on sources of revenue,[842] but that hardly works for real-time price discovery.

Transaction data for fish catch shares is equally spotty. For grouper, tilefish, and snapper, the National Marine Fisheries Service's South-East Regional Office posts an "unofficial compilation" of shareholder information with contact and number of shares, but warns it may contain errors.[843] Alaska's sablefish and halibut program posts current information on the amounts of quota held by individual permittees[844] and summarizes a "description of transfers" but does not list prices.[845] Various annual reports on catch share programs contain similar summary statistics on transfers, but no details of actual trades.[846] In the National Oceanic and Atmospheric Administration's 2010 catch share policy, the agency promised to

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[834] *Id.* at 29.
[835] Project on Alternative Regulation, *Marketable Rights: A Practical Guide to the Use of Marketable Rights as a Regulatory Alternative* 15 (1981).
[836] Jennifer Yelin-Kefer, *supra* note 279.
[837] Breger, Stewart, Elliott, & Hawkins, Providing Economic Incentive in Environmental Regulation, *supra* note 13.
[838] Lesley McAllister, Beyond Playing "Banker", 59 Admin. L. Rev. 269 (2007).
[839] Robert Glicksman, Regulatory Safeguards for Accountable Ecosystem Service Markets in Wetlands Development, *supra* note 443.
[840] EPA, Water Quality Trading Policy, 68 Fed. Reg. 1609 (Jan. 13, 2003).
[841] Leard & McConnell, *supra* note 32. NHTSA reports that since 2011, six manufacturers have traded 151 million CAFÉ credits, but does not disclose specifics and nothing in real time. EPA & NHTSA, Draft Technical Assessment Report: Midterm Evaluation, 420-D-16-900.
[842] Leard & McConnell, *supra* note 32.
[843] Nat'l Marine Fisheries Serv., FOIA IFQ Shareholders.
[844] IFQ Halibut and Sablefish Permits and Licenses, alaskafisheries.noaa.gov.
[845] Alaska Sablefish and Halibut, Number and Description of QS/IFQ Transfers for Year 2016.
[846] Nat'l Marine Fisheries Serv., 2014 Grouper-Tilefish IFQ Annual Report (2015).

help prevent uninformed transactions by establishing a source of authoritative market information and an exclusive central registry for permits.[847] In fact, the Magnuson-Stevens Act required such a central registry by 1997.[848] Yet at least as of 2013, "there is no Central Registry System in place."[849]

EPA has received "positive feedback from the regulated industry that the publication of Renewable Fuel Standard data helps inform compliance planning."[850] Nevertheless, price information for renewable fuel credits are only available through third parties for a fee,[851] and EPA's data on sales and holdings, meant to be updated annually, does not seem to have been updated since early 2015.[852] In state-based renewable electricity markets, credit prices "can be difficult to determine without the assistance of a broker, and even then, available information only indicates the transactions made by one broker."[853] Only a few jurisdictions (Maryland, Pennsylvania, and DC) require disclosure of renewable electricity credit prices.[854]

The Federal Communications Commission's spectrum auctions are conducted online and results are publicly available in near real-time.[855] However, similar information is not always available to facilitate secondary transactions. Historically, neither industry nor FCC had sufficient information on who had spectrum and what they were doing with it; poor record-keeping and disclosure was blocking secondary trading.[856] FCC's License Search now lets buyers look for leasing opportunities,[857] but the Spectrum Dashboard, a way for buyers and citizens to search who owns spectrum and how it is being used, never advanced beyond its beta release and has not been updated since 2014.[858]

Recommendation: Without revealing proprietary information or too much confidential business information, regulators should act as information brokers, collecting information on trade prices and volumes across secondary and derivative markets, to facilitate price discovery.

3. Information for the Public: Transparency and Participation

The public needs some ability to assess and comment on both the rules establishing a trading program and the implementation of that program. To some critics, marketable permit programs are more opaque than traditional regulation, obscuring how much firms are allowed to pollute and how much they are actually polluting.[859] To proponents Bruce Ackerman and Richard Stewart, marketable permits programs advance democratic goals better than traditional regulation, since a market-based environmental regulatory approach will focus political debate on the level of desired environmental quality rather than on arcane technical questions.[860]

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[847] NOAA Catch Share Policy (2010).
[848] Magnuson-Stevens Act § 305.
[849] NMFS, Electronic Monitoring White Papers, Feb. 15, 2013.
[850] EPA, Annual RIN Sales/Holdings Summary (last updated Apr. 1, 2015).
[851] Argus, RIN Prices, http://www.argusmedia.com/methodology-and-reference/key-prices/argus-rin-prices/.
[852] EPA, Annual RIN Sales/Holdings Summary (last updated Apr. 1, 2015).
[853] Dept. of Energy-EERE, REC Prices.
[854] *Id.*
[855] FCC, About Auctions, *supra* note 67.
[856] Michele Farquhar & Ari Fitzgerald, Legal and Regulatory Issues Regarding Spectrum Rights Trading, 27 Telecomm. Pol'y 527 (2003).
[857] FCC, Secondary Markets Initiative.
[858] Reboot.FCC.gov.
[859] Andrew Wolman, Effluent Trading in the United States and Australia, *supra* note 229.
[860] Bruce Ackerman & Richard Stewart, Reforming Environmental Law: The Democratic Case, *supra* note 255.

In the past, some agency guidance on marketable permit programs has not been submitted for public comment (see Section I.D.4). Even when rules for marketable permit programs have been submitted for public comment, they are sometimes short on details, as the Federal Trade Commission pointed out in critiquing the Federal Aviation Administration's 2008 effort to create an auction for airport landing slots.[861] Other programs require rigorous public input for their creation. A new fish catch share program in New England or the Gulf or Mexico, for examples, requires a two-thirds vote approval on referendum to current permit holders, following public hearings and public comments.[862]

In terms of monitoring transaction information, too much public transparency risks revealing confidential business information.[863] However, if all information on trading is considered confidential, as with the ozone-depleting substance market, it is difficult for the public to gauge the program's effectiveness.[864] Every marketable permit program must confront this balancing act. For example, if water quality trading programs reveal the location of credit-generating projects, it could raise privacy concerns for farmers and other landowners; but without location information, the public may not feel confident that the credits reflect real reductions. Different programs have resolved this matter differently: the Ohio River Basin trading program withholds project location, while Florida's water quality trading programs disclose the identity of both buyer and seller.[865]

Ultimately, the public likely does not need real-time data or highly specific information on individual participants to evaluate the overall market's efficiency and effectiveness. While regulators need full, real-time access to a range of transaction data to uncover manipulations,[866] and market actors may need regular information to facilitate price discovery, the public's needs are not as great. Weekly disclosure of aggregate holdings and transaction data without information on individual actors or trades is likely sufficient, supplemented perhaps by more detailed and individualized disclosures of holdings on a one-quarter delay (in line with the SEC's quarterly disclosures of material information).[867] For example, the Commodity Futures Trading Commission publishes weekly reports on derivative transactions, enough information to let the public gauge the overall level of trading.[868] More transparency could raise the risk of excessive speculation and collusion,[869] and could reveal confidential business information.

Because detailed, real-time public disclosures on individual trades may not be beneficial, public comments on individual trades may also not be appropriate, let alone practical. Most marketable permit programs do not provide for public comments on individual transactions. For example, while public notice and comment must be provided on Clean Water Act discharge permits, if the general conditions for trades are detailed in the permit, EPA does not require additional notice and comment on subsequent specific trades.[870] Most state-run water quality trading programs provide for comments only on trading plans, not individual trades.[871] Similarly, the Fish and Wildlife Service's 2016 policy on

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[861] FTC Comments to FAA, Notice 08-04 (2008).
[862] 50 C.F.R. § 600.1310.
[863] Interagency Working Group on Carbon Market Oversight, Report, *supra* note 448, at 23.
[864] T.H. Tietenberg, Emissions Trading: Principles and Practice 9 (2006, 2d ed).
[865] Nat'l Network on Water Quality Trading, Building a Water Quality Trading Program (2015).
[866] Accusations of collusion against new entrants and uncertainty about value in the airport landing slot market led FAA to propose reforms in 2015 to increase transparency and public participation, 80 Fed. Reg. 1273; rule withdrawn in 2016.
[867] Jonas Monast, Climate Change & Financial Markets, *supra* note 722.
[868] Interagency Working Group on Carbon Market Oversight, Report, *supra* note 448, at 27.
[869] EDF Comments to CFTC (2010).
[870] EPA, Water Quality Trading Policy, 68 Fed. Reg. 1609 (Jan. 13, 2003).
[871] Wisconsin water quality trading sends trading plans for comment; Pennsylvania provides notice and comment after complete proposal is submitted; Minnesota only provides comment on trades occurring outside of an approved plan, regular

conservation banking provided for stakeholder participation in landscape-scape planning but not necessarily for individual permits and transactions.[872] When endangered species act permits do go through public notice and comment, details may be limited: for example, a recent request for comments on an application for an Endangered Species Act Section 10 permit mentions that credits would be bought from an approved bank but does not specify which bank, how many credits, or what trading ratios may apply.[873]

Many of the data gaps facing market actors discussed above are the same for the general public: data on prices, for example, often is unavailable. In some cases, market actors may have access to additional data for a fee. For example, while RIBITS does not disclose price and other market data about conservation and wetland banking, some third parties have started collecting proprietary information which they sell to interested parties.[874] Meanwhile, "very little ecological and economic data on conservation banks is freely available to the public."[875] Even the data available on RIBITS is not easily accessible in a user-friendly manner for average citizens: it has restricted access and is partly encrypted,[876] though the Army Corps has been working to improve accessibility in recent years.[877]

Recommendation: Agencies should consider implementing a system of weekly or quarterly public disclosures, which generally should be adequate to provide the general public with sufficient information to assess the marketable permit program's efficiency and effectiveness.

4. Information on Related Markets

Regulators need to monitor international markets and related private markets as well.

Some state-based marketable permit programs have international links. Even if allowance trading is not linked internationally, there is a risk that derivative markets tied to U.S. allowances could be hosted by foreign jurisdictions, possibly including countries with lax oversight.[878] Regulators also need to ensure that firms do not attempt to escape position limits by holding some assets abroad, in a scheme known as the "London loophole." The Commodity Futures Trading Commission has an information-sharing agreement with the United Kingdom,[879] though it does not specifically address permit markets and derivatives, and it does not cover other countries. Regulators need to coordinate with other countries to effectively monitor large, valuable permit markets, like greenhouse gas markets.

Regulators also need to monitor related private markets. Regulatory markets and private markets interact. For example, the European Union's Emission Trading System proved that greenhouse gas allowance prices will be linked to the price of other energy commodities, and traders will pursue arbitrage strategies involving simultaneous transactions on both markets.[880] Excessive speculation in private markets—as is widely suspected in the energy markets—could lead to distortions that will spill

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permits do not go through comments. Nat'l Network on Water Quality Trading, Building a Water Quality Trading Program (2015).

[872] Notice of Final Compensatory Mitigation Policy, 81 Fed. Reg. 95,316 (Dec. 27, 2016).

[873] 81 Fed. Reg. 62,758 (Oct. 12, 2016),

[874] like EcoBlue Analyst DOI, Office of Policy Analysis, Results from a Survey of Conservation Bank Sponsors (2016). EcoBlue charges $199 for report

[875] DOI, Office of Policy Analysis, Results from a Survey of Conservation Bank Sponsors (2016).

[876] Robert Glicksman, Regulatory Safeguards for Accountable Ecosystem Service Markets in Wetlands Development, *supra* note 443.

[877] Ecosystem Marketplace, State of Biodiversity Markets (2011).

[878] EDF Comments to CFTC (2010).

[879] CBO, Evaluating Limits (2010); Jonas Monast, Climate Change & Financial Markets, *supra* note 722.

[880] Mark Jickling & Larry Parker, CRS, Regulating a Carbon Market 2 (2008).

over to the permit market.[881] Interactions between conservation permit markets and real estate markets could also give rise to undesirable arbitrage opportunities. As Salzman and Ruhl show, if the real estate underlying some credit-generating acres is priced more cheaply than others, the resulting arbitrage could irreversibly damage certain kinds of habitat located on cheaper real estate.[882]

5. Intra-agency Communication and Resource Sharing

Ideally, a federal agency will set the tone for its staff, regional offices, or state implementers to execute a trading program. In practice, support for trading programs varies across different levels of government and different staff positions. The National Marine Fisheries Service has no official guidance on conservation banking, leaving regional offices like the West Coast to develop their own approaches.[883] Conservation banks reported general lack of support and varying levels of support across local Fish and Wildlife Service officials;[884] likely ecological conditions are not the only reason why California—where conservation bank first began—is home to 76% of all conservation banks.[885] Shockingly, in 2013, only 68% of surveyed Fish and Wildlife staff were familiar with the Service's own 2003 guidance: only 30% "very familiar," with another 38% claiming to be "somewhat familiar."[886] Many Fish and Wildlife field officers personally viewed conservation banks positively, but were unsure whether the regional and national offices really supported banking.[887] Stakeholders report that support for water quality trading varies by EPA regional office and by state, and—at least as of 2008—was particularly spotty among legal counsel and permit writers.[888] Miscommunications between regional EPA offices and state agencies regarding the scope of trading programs has led to confusion.[889] Similarly, while the Army Corps has an established preference for mitigation banks over fees or permittee-responsible,[890] many wetland bank sponsors indicate that district officials will only approve banked credits for small wetlands offsets and are reluctant to approve banked credits for large mitigation projects.[891] Bank sponsors feel that many districts hold banks to higher standards and advise permit applicants that on-site, permittee-responsible mitigation is the cheaper and preferred options.[892]

The Fish and Wildlife Service's approvals of conservation banks are frequently delayed by poor coordination between federal, regional, and local officials, as well as insufficient staffing, inadequate training, and lack of management support.[893] 61% of Fish and Wildlife staff responsible for supervising conservation banks reportedly have no formal training on conservation banks.[894]

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[881] Id. 2; *see also* Interagency Working Group on Carbon Market Oversight, Report, *supra* note 448, at 31 ("significant interactions between carbon markets and markets for fossil fuels").
[882] Salzman & Ruhl, *supra* note 6.
[883] NMFS West Coast Region, Conservation Banking Guidance (2015).
[884] Stratus Consulting for Northwest Fisheries Science Center, NOAA, A Nationwide Survey of Conservation Banks (2003).
[885] DOI Office of Policy Analysis, Conservation Banking Overview (2013).
[886] DOI, Office of Policy Analysis, Preliminary Analysis of the Conservation Banking Program and Results from a Survey of USFWS Staff (2013).
[887] Id.
[888] IEC, Water Quality Trading Evaluation, *supra* note 50.
[889] Id.
[890] Corps-EPA Final Rule, Compensatory Mitigation for Losses of Aquatic Resources, 73 Fed. Reg. 19,593 (2008).
[891] Corps, Institute for Water Resources, The Mitigation Rule Retrospective (2015).
[892] Id. Corps disagrees and says that in some regions, bank credits are simply not available always. Corps, Institute for Water Resources, The Mitigation Rule Retrospective (2015).
[893] DOI, Office of Policy Analysis, Results from a Survey of Conservation Bank Sponsors (2016). See also 2013 survey. DOI, Office of Policy Analysis, Preliminary Analysis of the Conservation Banking Program and Results from a Survey of USFWS Staff (2013).
[894] Id.

Lack of sharing of information and resources between field offices and states is a missed opportunity for efficiency. Poor information sharing between Fish and Wildlife field offices has been reported,[895] and states have asked for more training and support from EPA on water quality trading.[896] EPA has encouraged states to share resources to support water quality trading, like a single credit registry serving multiple markets,[897] but such sharing has not yet materialized. Trading programs can be costly to build from scratch, yet many states continue to reinvent the wheel. A 2015 workshop on water quality trading recommended reducing start-up costs for states on water quality by standardizing design and sharing resources, and EPA and USDA agreed in 2016 to pursue a national registry platform for credits.[898] EPA's EnviroAtlas now includes locations of water quality trading programs, and more pointedly EPA supported Maryland's development of a credit registry platform designed to work throughout the Chesapeake Bay watershed, with other states in that watershed having been consulted and showing interest in joining.[899]

Some federal agencies do provide training to regional and local officials. From 2008-2009, the Army Corps and EPA held six workshops to train federal and state officials about wetland mitigation banking, and many districts developed their own workshops for staff and the public.[900] The National Oceanic and Atmospheric Administration has pledged sharing technical expertise, administrative support, and assistance with outreach about catch share programs to the regional fishery councils.[901] The Federal Communications Commission hosted numerous trainings on its novel broadcast incentive auction.

Recommendation: When possible, regulators should pursue economies of scale in management, for example by spreading the costs of credit registries over multiple species or multiple fisheries.[902] Federal agencies should provide clear guidance on trading policy to regional and state officials, including through trainings. Public trainings are also useful.[903]

6. Inter-Agency Communication

Regulators need to share information and resources to streamline credit approvals, to ensure consistent monitoring of markets for manipulation, and to avoid reinventing the wheel.

Credit approvals may implicate the jurisdictions of multiple agencies. For example, wetland credits must not violate endangered species act standards. Fish and Wildlife Service staff report that poor coordination with other federal agencies contributes to delayed reviews of conservation banks.[904] Similarly, wetland mitigation bank sponsors report that interagency reviews are repetitive and accuse the Army Corps of failing to exercise its authority as chair of the interagency review process to make decisions.[905] The Corps has begun working to improve review times by clarifying responsibilities on interagency teams and by standardizing tools and practices.[906] Interagency coordination will become

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[895] Id.
[896] EPA & USDA, Report on 2015 National Workshop on Water Quality Markets (2016).
[897] Id.
[898] Id.
[899] These details come from EPA's comments on the draft version of this report.
[900] Corps, Institute for Water Resources, The Mitigation Rule Retrospective (2015).
[901] NOAA Catch Share Policy (2010).
[902] Id.
[903] FCC has trainings, EPA holds regular training course on water quality trading. IEC, Water Quality Trading Evaluation, *supra* note 50.
[904] DOI, Office of Policy Analysis, Preliminary Analysis of the Conservation Banking Program and Results from a Survey of USFWS Staff (2013).
[905] Corps, Institute for Water Resources, The Mitigation Rule Retrospective (2015).
[906] Id.

even more important if credit stacking increases, as agencies will need to work together to detect double counting.[907]

Some agencies have been working to share resources. EPA and the Department of Agriculture have partnered on water quality trading, given the prominent role of farmers as non-point source credit generators. The two agencies coordinate on outreach, share information on rule developments that might affect water quality trading, and collaborate on developing tools and informational resources.[908] The Army Corps is working to integrate RIBITS data with Fish and Wildlife Service and EPA databases.[909]

Finally, agencies need to share information to ensure consistent protection against manipulation across interconnected markets. Regulators with oversight authority over primary and secondary permit markets need to coordinate with the Commodity Futures Trading Commission (CFTC) on derivative markets, with regulators that may oversee related commodity markets, like the Federal Energy Regulatory Commission, and with the Federal Trade Commission and the Department of Justice on antitrust matters.[910]

On March 15, 2016, EPA and CFTC signed a memorandum of understanding on sharing information on renewable fuel credit trading. The agreement tasks CFTC with advising EPA and reviewing market data for fraud, abuse, and violations.[911] The memorandum provides structure to the relationship, to help avoid duplicative information requests, coordinate investigative and enforcement activities, prevent further sharing of data beyond CFTC, allow direct access to databases, protect proprietary information, and assign responsibility for handling congressional or court subpoenas and Freedom of Information Act requests.[912] CFTC also has an information-sharing agreement with the Federal Energy Regulatory Commission.[913] However, CFTC does not have memoranda of understanding with EPA on other markets besides renewable fuel credits, or with other agencies responsible for marketable permit programs.[914]

CFTC has a history of turf wars and infighting with both the Securities and Exchange Commission and the Federal Energy Regulatory Commission.[915] As the financial crisis triggered by manipulation of credit default swaps made painfully clear, a system of multiple regulators, none with complete authority, can hamper efforts to monitor and manage systemic risk.[916] Too many regulators could lead to inconsistent standards, and sophisticated market actors will take advantage of inconsistencies through a kind of "regulatory arbitrage."[917]

The Dodd-Frank Act contained some provisions on inter-agency communications. The statute established an Office of Financial Research to end the stove-piping of information between different regulators, but reportedly the Office has yet to live up to its mission. The Act also created an Interagency Working Group on Carbon Oversight, chaired by CFTC: the working group satisfied its charge to issue a report on the oversight of carbon markets, and subsequently disbanded. Finally, the Act created an Energy and Environmental Markets Advisory Committee within CFTC, but the Committee has only met

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[907] Royal Gardner and Jessica Fox, Legal Status of Environmental Credit Stacking, 40 Ecol. L. Q. (2013).
[908] USDA Press Release, #0226.13, 12/3/13 (summarizing 11/18/13 partnership agreement).
[909] Corps, Institute for Water Resources, The Mitigation Rule Retrospective (2015).
[910] For example, NOAA is authorized to consult with other federal agencies on information collection to determine any anti-competitive, price collusion or price fixing. 16 U.S.C. § 1853a(c).
[911] EPA-CFTC, Memorandum of Understanding on RFS Data, Mar. 15, 2016.
[912] Id.
[913] Press Release, Jan. 2, 2014.
[914] GAO, Carbon Trading: Current Situation and Oversight Consideration for Policymakers (2010).
[915] EDF Comments to CFTC (2010).
[916] GAO, Carbon Trading, *supra* note 914.
[917] EDF Comments to CFTC (2010).

three times since its creation and no panel has been on an obviously environmental market-specific topic.[918] The Congressional Research Service has recommended an "umbrella group . . . to prevent regulatory gaps or conflicts" in environmental permit markets, modeled on President Reagan's Working Group on Financial Markets.[919]

Recommendation: Regulators should explore additional memoranda of understanding with agencies responsible for markets related to permit markets. In particular, the regulators of permit markets should develop relationships with CFTC to coordinate investigative and enforcement activities.

7. Market-Moving Communications

Statements and actions from regulators can move permit markets. For example, in the early years of the European Union's Emissions Trading System, leaks regarding the stringency of the cap and measurements of firms' existing emissions may have allowed some traders to profit off nonpublic information.[920] Similarly, a study of the acid rain market suggests that price volatility correlates with both EPA and Congressional announcements on potential permanent changes to the regulatory scheme as well as with day-to-day announcements, such as notices of enforcement.[921]

The federal agencies responsible for generating the kind of statistics, forecasts, and policies that move financial markets, like the Federal Reserve and the Bureau of Labor Statistics, have developed procedures to prevent pre-publication leaks and information asymmetries.[922] For example, requiring market participants to check agency website continually or rely on press coverage for new information creates opportunities for some participants to learn and trade on information before others.[923] Financial regulators typically release pre-announcements or announce new policies at pre-scheduled times. The European Union's Emissions Trading System has copied such approaches, and now releases pre-announcement and has new procedures to control leaks.[924] Clear communication strategy is essential for market regulators, just as it is for central banks,[925] since "noise" can create inefficient price volatility.[926]

Recommendation: Marketable permit regulators should develop communication policies to prevent pre-publication leaks and information asymmetries.

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[918] Advisory Committee website.
[919] Mark Jickling & Larry Parker, CRS, Regulating a Carbon Market 37-38.
[920] *Id.* at 7.
[921] Claudia Hitaj & Andrew Stocking, Market Efficiency and the U.S. Market for SO2 Allowances (CBO Working Paper, 2014).
[922] Mark Jickling & Larry Parker, CRS, Regulating a Carbon Market 35.
[923] Claudia Hitaj & Andrew Stocking, *supra* note 921.
[924] *Id*.
[925] *Id.*
[926] *Id.*

Exhibit D:

Kimberly M. Castle & Richard L. Revesz, *Environmental Standards, Thresholds, and the Next Battleground of Climate Change Regulations*, 103 MINN. L. REV. (forthcoming 2019).

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Environmental Standards, Thresholds, and the Next Battleground of Climate Change Regulations

Kimberly M. Castle and Richard L. Revesz

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Environmental Standards, Thresholds, and the Next Battleground of Climate Change Regulations

Kimberly M. Castle[*] and Richard L. Revesz[**]

This Article addresses a central battleground of the debate about the future of greenhouse gas regulations: the valuation of particulate matter reductions that accompany reductions in carbon dioxide emissions. The benefits from particulate matter reductions are substantial for climate change rules, accounting for almost one half of the quantified benefits of the Obama Administration's Clean Power Plan. These benefits are also significant for regulations of other air pollutants, making this issue one of far-reaching importance for the future of environmental protection.

Opponents of environmental regulation, including the Trump Administration, have recently embraced an aggressive line of attack on particulate matter benefits. They argue alternatively that these benefits are not real; are being "double counted" in other regulations; or should not be considered when they are the co-benefits, rather than the direct benefits, of specific regulations. This Article collects and analyzes for the first time the robust support for valuing particulate matter benefits. An examination of the scientific literature, longstanding agency practices under administrations of both major political parties, and judicial precedent reveals that particulate matter benefits deserve a meaningful role in regulatory cost-benefit analysis.

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INTRODUCTION

In its landmark decision *Michigan v. EPA*,[1] the Supreme Court held that the Environmental Protection Agency (EPA) is required to consider costs before deciding to regulate the hazardous air pollutant emissions of power plants through its Mercury and Air Toxics Standards,[2] which were promulgated during the Obama Administration. The Court, however, did not decide how benefits should be taken into account, and identified but left open a significant question: how to address the benefits from reductions in particulate matter beyond the levels already required under the Clean Air Act's National Ambient Air Quality Standards (NAAQS).[3] Reductions of hazardous air pollutant emissions are the direct benefits of the Mercury and Air Toxics Standards, whereas particulate reductions are the indirect benefits, also referred to as co-benefits or ancillary benefits,[4] which result from the actions that power plants are expected to take in order to comply with these standards.[5]

Courts may soon have the opportunity to address the question of how to treat particulate matter co-benefits as a result of President Trump's efforts to undo the most significant environmental regulations of the Obama Administration. In particular, a top priority of the Trump Administration is repealing the Clean Power Plan,[6] which would regulate the greenhouse gas emissions of power plants, and a proposed rule to that effect has already been published.[7]

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[1] 135 S. Ct. 2699 (2015).
[2] *See id*. at 2712.
[3] *See id.* at 2711 ("Even if the Agency could have considered ancillary benefits when deciding whether regulation is appropriate and necessary—a point we need not address—it plainly did not do so here.").
[4] *See* Samuel J. Rascoff & Richard L. Revesz, *The Biases of Risk Tradeoff Analysis: Towards Parity in Environmental and Health-and-Safety Regulation*, 69 U. CHI. L. REV. 1763, 1766 (2002). Throughout the literature, co-benefits are alternatively referred to as ancillary benefits, secondary benefits, or indirect benefits. *See* David Pearce, *Policy Frameworks for the Ancillary Benefits of Climate Change*, *in* ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT, ANCILLARY BENEFITS AND COSTS OF GREENHOUSE GAS MITIGATION 518 (2000). For simplicity, this Article uses the term "co-benefits."
[5] *See* Hazardous Air Pollutants From Coal and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units, 77 Fed. Reg. 9304, 9428 (Feb. 16, 2012) (to be codified at 40 C.F.R. pts. 60 and 63) [hereinafter MATS Rule].
[6] *See* Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64,662, 64,663 (Oct. 23, 2015) (to be codified at 40 C.F.R. pt. 60) [hereinafter Clean Power Plan].
[7] *See* Proposed Rule on the Repeal of Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 82 Fed. Reg. 48,035, 48,045-46 (Oct. 16, 2017) (to be codified at 40 C.F.R. pt.

Attacking the consideration of co-benefits is an important strategy in this quest. Indeed, it is only by completely disregarding the Clean Power Plan's principal co-benefits, particulate reductions under the level of the NAAQS, that the Trump Administration is able to conclude that the cost savings from repealing the rule exceed the foregone benefits that would result from the repeal.[8] The validity of co-benefits will certainly be at issue in the inevitable ensuing litigation.

Further, on remand from the Supreme Court in the MATS litigation, EPA evaluated the reasonableness of the rule's costs under multiple metrics and put forward two approaches to demonstrate that the rule is cost-benefit justified in a Supplemental Finding, one of which includes a discussion of co-benefits.[9] However, because this method is EPA's altnernative approach, the D.C. Circuit would need to rule on the validity of including co-benefits only if it does not uphold the rule under EPA's preferred approach. The case is now being held in abeyance[10] while the Trump Administration considers whether to modify the Supplemental Finding.[11] However, if the Trump Administration reverses itself on the inclusion of co-benefits, environmental groups would likely challenge the decision, bringing the question before a federal court.

How courts ultimately respond to challenges of the reliance on co-benefits of particulate reductions below the NAAQS will have far reaching consequences for climate change regulations, as well as for public health rules more generally, because co-benefits of particulate

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60), https://www.gpo.gov/fdsys/pkg/FR-2017-10-16/pdf/2017-22349.pdf [hereinafter Clean Power Plan Proposed Repeal].

[8] *See* Clean Power Plan Proposed Repeal, *supra* note 7, at 48,045-46. EPA presents the net benefits of repeal under different scenarios: rate-based and mass-based implementation. At a 3% discount rate, net benefits of the repeal are negative in the year 2030—meaning that the foregone benefits from the Clean Power Plan (or, put differently, the costs of repeal) are higher than the benefits from repeal in every scenario, except where all $PM_{2.5}$ benefits below the NAAQS fall to zero.

EPA also presents calculations of benefits at a 7% discount rate, but that figure is out of line with economists' practice. *See* Richard G. Newell, *Unpacking the Administration's Revised Social Cost of Carbon*, RESOURCES FOR THE FUTURE (Oct. 10, 2017), http://www.rff.org/blog/2017/unpacking-administration-s-revised-social-cost-carbon ("It is clearly inappropriate . . . to use such modeling results with OMB's 7 percent discount rate, which is intended to represent the historical before-tax return on private capital . . . Practically speaking, the use of such a high discount rate means that the effects of our actions on future generations are largely unaccounted for in the new analysis. This is incompatible with the long-lived nature of greenhouse gas emissions in the atmosphere, and the fact that damages from emissions today will continue to be felt for generations to come.").

In order to justify the repeal, EPA also needs to significantly downplay the direct benefits of carbon dioxide reductions. *See* Niina Heikkinen, *EPA Revises the Social Cost of a Potent Greenhouse Gas*, SCI. AM. (Nov. 20, 2017), https://www.scientificamerican.com/article/epa-revises-the-social-cost-of-a-potent-greenhouse-gas.

[9] *See* Supplemental Finding That It Is Appropriate and Necessary To Regulate Hazardous Air Pollutants From Coal- and Oil-Fired Electric Utility Steam Generating Units, 81 Fed. Reg. 24,420, 24,420 (Apr. 25, 2016) (to be codified at 40 C.F.R. pt. 63). EPA's preferred approach weighed the costs of compliance against the volumetric reduction in hazardous air pollutants. *See id.* at 24,426. In turn, the agency's alternative approach compared the costs against the quantified benefits, including co-benefits and unquantified benefits. *See id.* at 24,427, 24,437-42.

[10] *See* Murray Energy Corp. v. EPA, No. 16-1127 (D.C. Cir. Apr. 27, 2017).

[11] *See* Respondent EPA's Motion to Continue Oral Argument, No. 16-1127 (D.C. Cir. filed Apr. 18, 2017). It seems highly likely that the Trump Administration will reverse the EPA's position on the use of co-benefits: in an early iteration of this litigation, EPA Administrator Scott Pruitt, then the Attorney General of Oklahoma, filed a brief, together with a number of other state Attorneys General and industry groups, strongly arguing that the particulate reduction co-benefits were not cognizable for the purposes of evaluating the permissibility of EPA's decision to regulate hazardous air pollutant emissions of power plants. *See* Opening Brief of State and Industry Petitioners at 41-55, Murray Energy Corp. v. EPA, No. 16-1127 (D.C. Cir. filed Nov. 18. 2016).

reductions under the NAAQS are a substantial portion of the total benefits from regulating the emissions from stationary sources, and, strikingly, a substantial portion of the benefits of all federal regulation.

Indeed, EPA rules accounted for 61-80% of the monetized benefits from *all* major federal regulations over the past ten years, and 98 to 99% of those monetized benefits come from air quality rules.[12] And, the large estimated benefits of air quality rules "are mostly attributable to the reduction in public exposure to fine particulate matter."[13]

Furthemore, as the Mercury and Air Toxics Standards and the Clean Power Plan illustrate, a highly significant proportion of these reductions come from the co-benefits of particulate reductions. The Mercury and Air Toxics Standards, in particular, have the second-highest quantified benefits of all of EPA's 22 clean air rules of the past decade.[14] EPA estimated $4 to $6 million in direct quantified benefits under the Mercury and Air Toxics Standards from the target hazardous pollutants,[15] in addition to significant unquantified benefits,[16] but quantified benefits of $37 to $90 billion in health co-benefits from particulate reductions.[17] For the Clean Power Plan, EPA under President Obama calculated $20 billion in climate benefits, and an additional $13 to $30.3 billion from particulate reduction co-benefits.[18]

The bulk of these particulate co-benefits come from reductions below the NAAQS. For example, in the case of the Mercury and Air Toxics Standards, EPA notes that a small percentage

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[12] *See* Office of Management and Budget, *2016 Draft Report to Congress on the Benefits and Costs of Federal Regulations and Agency Compliance with the Unfunded Mandates Reform Act*, at 2, 7-8, 11-12 (2016), https://obamawhitehouse.archives.gov/sites/default/files/omb/assets/legislative_reports/draft_2016_cost_benefit_report_12_14_2016_2.pdf.

[13] *See id.* at 12.

[14] *See id.* at 12.

[15] *See* Brief for the Federal Respondents at 55, Michigan v. EPA, 135 S. Ct. 2699 (2015) (No. 14-46), 2015 WL 797454.

[16] *See id.* ("[V]irtually all of the direct benefits from reducing emissions of hazardous air pollutants are unquantifiable.).

[17] *See id.* at 54; Environmental Protection Agency, *Regulatory Impact Analysis for the Final Mercury and Air Toxics Standards*, EPA-452/R-11-011, at 5-1 (Dec. 2011), https://www3.epa.gov/ttnecas1/regdata/RIAs/matsriafinal.pdf [hereinafter MATS RIA]. These numbers were calculated using a 3% discount rate. *See id*.

[18] *See* Environmental Protection Agency, *Regulatory Impact Analysis for the Clean Power Plan Final Rule*, EPA-452/R-15-003, at 4-27 (Aug. 2015), https://www3.epa.gov/ttnecas1/docs/ria/utilities_ria_final-clean-power-plan-existing-units_2015-08.pdf. This estimate includes reductions in SO_2, which is both a precursor to the formation of $PM_{2.5}$ as well as a component of $PM_{2.5}$ (since SO_2 itself is often present as a fine particle). *See id.* at 4-11. EPA, surveying the scientific literature, also noted that "scientific differences existed only with respect to the magnitude of the effect of $PM_{2.5}$ on mortality, not whether such an effect existed." *Id.* at 4-17. Notably, the Clean Power Plan rule is cost-benefit justified without these additional health benefits; EPA estimated that the regulation would cost between $5.1 and $8.4 billion in 2030, a range dwarfed by the total estimate benefits of between $34 and $54 billion. *See id.* at ES-22, ES-23. Moreover, recent analyses of Clean Power Plan compliance costs suggest that the cost of complying with the Plan has fallen since 2015, when EPA's analysis was released. These compliance costs fell due to declines in the cost of renewable energy, declines in the forecast price of natural gas, extensions of federal tax credits for renewable energy, and expansions of state programs supporting the adoption of clean energy. *See generally* Denise A. Grab & Jack Lienke, *The Falling Cost of Clean Power Plan Compliance*, INSTITUTE FOR POLICY INTEGRITY (Oct. 2017), http://policyintegrity.org/files/publications/Falling_Cost_of_CPP_Compliance.pdf (collecting and analyzing reports of independent groups calculating the updated costs of compliance with the Clean Power Plan).

of the co-benefits come from reductions in particulate matter above the NAAQS, as the regulation would help to bring out of compliance areas into compliance, but that "a large fraction of the . . . related benefits . . . occur below the level of the National Ambient Air Quality Standard (NAAQS)."[19]

The preceding analysis reveals how much is at stake in the controversy over the permissibility of relying on the co-benefits of particulate reductions below the NAAQS. Ignoring these benefits will threaten significant regulatory initiatives and adversely affect populations such as the elderly and asthmatic children, who are particularly sensitive to the adverse health effects particulate matter at levels below the NAAQS.[20]

Opponents of these regulations employ a few key arguments to suggest that these benefits should not be cognizable in evaluating of EPA regulations. In this Article, we address each of these argument in turn. Relying on scientific evidence, EPA practice, and judicial decisions, we show that these arguments are unfounded.

Critics argue first that the benefits from particulate matter reduction do not exist.[21] They do so by assuming that particulate matter is a threshold pollutant. By implication, these critics make the same assumption for all "criteria pollutants," which are pollutants regulated by NAAQS standards pursuant to Section 108 of the Clean Air Act: ground level ozone, particulate matter, carbon monoxide, lead, sulfur dioxide, and nitrogen dioxide.[22] A threshold is the level below which there are no quantifiable health effects from pollutant exposure,[23] and threshold pollutants are those pollutants for which a threshold can be identified. The Clean Air Act

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[19] MATS RIA, *supra* note 17, at ES-4.

[20] In a 2017 study of Medicare recipients, discussed further *infra* in Part III, researchers observed a rising risk of death from any cause in association with $PM_{2.5}$ exposure beginning at levels significantly below the NAAQS for $PM_{2.5}$. *See* Quan Di, et al., *Air Pollution and Mortality in the Medicare Population*, 376 NEW ENG. J. MED. 2513, 2513 (2017). In a study of inner-city children with asthma, short-term increases in $PM_{2.5}$ concentrations below the NAAQS were associated with adverse respiratory health effects. *See* George T. O'Connor et al., *Acute Respiratory Health Effects of Air Pollution on Children with Asthma in US Inner Cities*, 121 J. ALLERGY & CLINICAL IMMUNOLOGY 1133, 1135 (2008).

[21] *See infra* notes 258-263 and accompanying text; *see also* C. Boyden Gray, *EPA's Use of Co-Benefits*, FEDERALIST SOCIETY (Sept. 24, 2015), https://fedsoc.org/commentary/publications/epa-s-use-of-co-benefits ("As a former Chairman of the Texas Commission on Environmental Quality has explained, '[i]f reducing particulate matter had the enormous benefits that EPA's analysis claims, it has a legal responsibility to lower the national ambient standard to a level that is actually protective of human health. The fact that it has not done so suggests that EPA does not really believe its own numbers.' . . . [Agencies should not] be allowed to count reductions of pollutants in areas where they appear below the national standard EPA has already set for those pollutants."); Jonathan A. Lesser, *Missing Benefits, Hidden Costs: The Cloudy Numbers in the EPA's Proposed Clean Power Plan*, MANHATTAN INSTITUTE at 5 (June 16, 2016), https://www.manhattan-institute.org/download/8988/article.pdf ("The EPA's estimates of co-benefits from future air-pollution reductions also suffer from significant uncertainty and modeling errors, [including the] use of epidemiological models that assume that there are no threshold air-pollution concentration levels below which additional health benefits cannot be obtained, even though under the Clean Air Act, the EPA is required to establish exposure levels that are supposed to incorporate an adequate margin of safety to protect the public health."); *id.* at 18-19 ("But because the magnitude of CO_2 reductions under the [Clean Power Plan] is below the threshold level (assumed to be the level where there are measurable climate impacts), the [Plan]'s actual CO_2 reduction benefits are effectively zero.").

[22] *See* Clean Air Act, 42 U.S.C. § 7408 (2012).

[23] *See* Al McGartland et al., *Estimating the Health Benefits of Environmental Regulations*, 357 SCIENCE 457, 458 (2017).

requires that NAAQS levels allow an "adequate margin of safety . . . requisite to protect the public health."[24] The logic of critics who claim criteria pollutants have a threshold is that NAAQS standards are set with reference to the threshold, plus an adequate margin of safety. Thus, they argue, there should be no adverse health effects below the threshold, and therefore no benefits from lowering pollution levels below the NAAQS.

The Trump Administration has embraced these criticisms despite their lack of empirical foundation. In its proposed rule to repeal the Clean Power Plan, announced in October 2017, the Trump EPA presents radically different estimates of the costs and benefits than those presented in the original Plan.[25] The proposed rule includes three estimates of health benefits, the first of which closely mirrors the estimates in the original rule promulgated during the Obama Administration and includes the full range of particulate matter benefits.[26] The middle estimate assumes – without scientific basis – that the benefits of particulate matter reductions fall to zero below the "lowest measured level" or LML, which is the lowest level of exposure studied.[27] There is no scientific support for the proposition that risks are nonexistent below this level, though there is greater uncertainty about the magnitude of risk below this level.[28] Finally, the lowest estimate of benefits incorporates the assumption that NAAQS have a threshold for particulate matter.[29] This estimate completely eliminates all particulate matter benefits below the NAAQS,[30] essentially ignoring a bulk of the benefits of the rule in order to more easily justify the repeal.[31] Even with the significant changes made to other cost and benefits estimates throughout the proposed rule, only this last estimate makes the repeal cost-benefit justified.[32] The issue of how particulate matter benefits are calculated will thus be of central importance in the inevitable slew of litigation challenging the repeal.[33]

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[24] Clean Air Act, 42 U.S.C. § 7409(b)(1) (2012). According to EPA, the margin of safety component is "intended to address uncertainties associated with inconclusive scientific and technical information available at the time of standard setting . . . [and] to prevent lower pollutant levels that [the Administrator] finds pose an unacceptable risk of harm, even if that risk is not precisely identified as to nature or degree." Revisions to the National Ambient Air Quality Standards for Particulate Matter, 52 Fed. Reg. 24,635 (July 1, 1987) (to be codified at 40 C.F.R. pt. 50).
[25] *Compare* Clean Power Plan Proposed Repeal, *supra* note 7, at 48,044-47, *with* Clean Power Plan, *supra* note 6, at 64,928-29, 64,934-35.
[26] *See* Clean Power Plan Proposed Repeal, *supra* note 7, at 48,045-47.
[27] *Id*. at 48,044.
[28] *See infra* notes 355-370 and accompanying text.
[29] *See* Clean Power Plan Proposed Repeal, *supra* note 7, at 48,044.
[30] *See id.* at 48,045-46.
[31] *See* Clean Power Plan Proposed Repeal, *supra* note 7, at 48,043 ("[T]his analysis increases transparency of the 2015 [Clean Power Plan] analysis by presenting the energy efficiency cost savings as a benefit rather than a cost reduction and provides a bridge to future analyses that the agency is committed to performing. The current analysis also provides alternative approaches for examining the forgone benefits, including more clearly distinguishing the direct benefits from the co-benefits and exploring alternative ways to illustrate the impacts on the total net benefits of the uncertainty in health co-benefits at various $PM_{2.5}$ cutpoints. This approach shifts the focus to the domestic (rather than global) social cost of carbon, and employs both 3 percent and 7 percent discount rates. Finally, we consider how changing market conditions and technologies may have affected future actions that may have been undertaken by states to comply with the [Clean Power Plan] and how these changes may affect the potential benefits and costs of the [Plan's] repeal.").
[32] *See supra* note 8.
[33] *See* Caroline Cecot & W. Kip Viscusi, *Judicial Review of Agency Benefit-Cost Analysis*, 22 GEO. MASON L. REV. 575, 578 (2015) (noting that "[a]s agencies rely more on [cost-benefit analyses] in their decision making, challenges

EPA's own early treatment of criteria pollutants potentially contributed to confusion over whether these pollutants have a threshold, as some early analyses arguably implied that criteria pollutants had thresholds. However, EPA has subsequently adjusted its practices in ways that make clear the agency views particulate matter and most criteria pollutants as non-threshold.

As a general matter, EPA currently assumes that carcinogenic pollutants do not have a threshold, and that non-criteria non-carcinogenic pollutants do have a threshold.[34] In its earliest analyses in the late 1970s, EPA treated criteria pollutants similarly to other non-carcinogens. For example, the agency used language that suggested thresholds when setting allowable pollutant levels, such as the "critical populations, critical effects" model.[35] However, as scientific research accumulated showing adverse health effects at lower concentrations, EPA quickly departed from this approach and the agency has not treated criteria pollutants as threshold pollutants for several decades under administrations of both parties. First, EPA has explicitly acknowledged in many NAAQS rulemakings that there is no evidence to support the view that specific criteria pollutants have a threshold.[36] Further, EPA has stopped using the "critical effects" language when setting NAAQS standards.[37] Additionally, EPA has calculated benefits for reducing criteria pollutants below NAAQS levels—a practice that is inconsistent with the notion of a threshold.[38] EPA's modern treatment of the NAAQS moved the agency in line with current science on this question, which supports a non-threshold model.[39]

Critics next argue that EPA "double counts" benefits by claiming benefits already implemented through other regulations.[40] For example, Senator John Barrasso asserted in an Environmental and Public Works Committee hearing in 2015 that multiple EPA rules were using

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to [cost-benefit analyses] will rise, and judicial review of [cost-benefit analyses] will become increasingly important").

[34] *See* NATIONAL RESEARCH COUNCIL, SCIENCE AND DECISIONS: ADVANCING RISK ASSESSMENT 8 (2009) [hereinafter SCIENCE AND DECISIONS].

[35] *See infra* notes 160-169 and accompanying text. The "critical populations, critical effects" model refers to a way of setting the NAAQS with reference to a sensitive population and key early health effects of the pollutant. *Id.*

[36] *See infra* Part II.C.

[37] *See infra* notes 180-181 and accompanying text.

[38] *See infra* Part II.C.

[39] *See id.*

[40] *See* Michael Bastach, *Critics Accuse EPA of Fudging the Math on Its Global Warming Rule*, DAILY CALLER (Oct. 1, 2015), http://dailycaller.com/2015/10/01/critics-accuse-epa-of-fudging-the-math-on-its-global-warming-rule ("Former Sen. John Kyl, an Arizona Republican, also criticized the EPA over double-counting $PM_{2.5}$ reduction benefits in its [Mercury and Air Toxics Standards] rule. In 2012, Kyl took to the Senate floor to lambast the EPA for double-counting the benefits of reducing particulates."); Jude Clemente, *The Clean Power Plan Is Irrelevant*, FORBES.COM (Oct. 29, 2017), https://www.forbes.com/sites/judeclemente/2017/10/29/the-clean-power-plan-is-irrelevant/#38a9a8892732 ("And there seems to be some serious 'double counting' going on under the promoted [Clean Power Plan] benefits. That's mostly because the emissions of criteria pollutants NOx, SO_2, and PM have been regulated for decades, but they are erroneously counted in the claimed benefits of the [Plan]."); Diana Furchtgott-Roth, *Ten Problems with EPA's Clean Power Plan Analysis*, MANHATTAN INSTITUTE (March 20, 2017), https://economics21.org/html/ten-problems-epa%E2%80%99s-clean-power-plan-analysis-2275.html ("If reductions in particulates can be counted as a health benefit of reducing mercury, the first of three major rules put in place by EPA, the agency cannot then count these same reductions as a benefit from reducing ozone and carbon dioxide."); C. Boyden Gray, *EPA's Use of Co-Benefits*, FEDERALIST SOCIETY (Sept. 24, 2015), https://fedsoc.org/commentary/publications/epa-s-use-of-co-benefits ("[W]henever EPA counts $PM_{2.5}$ or ozone reductions in its cost-benefit analysis for other rules, it is double-counting reductions already mandated by the NAAQS.").

"the same reductions in particulate matter [to] claim the same health benefits," including the Clean Power Plan.[41] Other opponents of the Clean Power Plan likewise contend that "not only are [the agency's] estimates of co-benefits highly subjective and uncertain, but the EPA has almost surely double-counted some of those estimates."[42] These critics also allege that the agency achieves the same end by failing to properly calibrate its baseline levels from which to measure costs and benefits.[43] In fact, however, EPA's longstanding guidelines on baselines state that it is the agency's practice "to assume full compliance with regulatory requirements," including newly enacted regulations that are not yet implemented.[44] Moreover, EPA expressly discusses the methods by which it accounts for benefits previously achieved under the NAAQS regime and other rules, which include an explanation of how the agency accounted for existing regulations of particulate matter.[45]

Finally, critics suggest that, even if these benefits are real and not "double-counted," they should not be considered in cost-benefit analyses because they are "co-benefits" instead of direct benefits.[46] For example, while the Mercury and Air Toxics Standards primarily target mercury pollution[47] and the Clean Power Plan directly regulates carbon dioxide emissions,[48] both rules would reduce particulate matter as well.[49] Opponents claim that accounting for co-benefits skews cost-benefit analyses in favor of regulation[50] and exceeds the statutory bounds of EPA's power to regulate these pollutants under the Clean Air Act.[51] The Trump Administration, a key critic of

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[41] *Barrasso Questions EPA Air Official on Ozone Rule, Clean Power Plan*, (Sept. 29, 2015), https://www.barrasso.senate.gov/public/index.cfm/2015/9/barrasso-questions-epa-air-official-on-ozone-rule-clean-power-plan ("Yet when you take a look at the EPA's own documents, you state that you are counting co-benefits of reducing the same PM 2.5 in other rules before [the] 111(d) rule for existing power plants was even released.").
[42] *See* Lesser, *supra* note 21, at 5.
[43] *See id.*
[44] Environmental Protection Agency, *Chapter 5: Baseline* (Dec. 2010) *in* GUIDELINES FOR PREPARING ECONOMIC ANALYSES (updated May 2014), https://yosemite.epa.gov/ee/epa/eerm.nsf/vwAN/EE-0568-05.pdf/$file/EE-0568-05.pdf at 5-3.
[45] *See infra* notes 376-384.
[46] *See* Michael Bastach, *Trump's Executive Order To Repeal Regulations Puts EPA in the Crosshairs*, DAILY CALLER (Jan. 13, 2017), http://dailycaller.com/2017/01/31/trumps-executive-order-to-repeal-regulations-puts-epa-in-the-crosshairs ("Republicans have long criticized EPA for counting "co-benefits" of regulation towards its cost effectiveness."); Diana Furchtgott-Roth, *supra* note 40 ("If EPA believes that their levels of other substances should be reduced, it should issue rules to lower them, with their own comment periods and cost-benefit analysis."); *infra* notes 399-409 and accompanying text.
[47] *See* MATS Rule, *supra* note 5, at 9,305.
[48] *See* Clean Power Plan, *supra* note 6, at 64,663, 64,710.
[49] *See id.* at 64,670, 64,679; MATS Rule, *supra* note 5, at 9,305. Some of these rules would also have the co-benefit of reducing other criteria pollutants. *See* MATS Rule, *supra* note 5, at 9,305, 9,380, 9,418 (noting incidental reductions in sulfur dioxide pollution). While this article focuses primarily on particulate matter because of the scope of those benefits and the clarity of the scientific evidence that particulate matter lacks a threshold, there is likewise no reason to exclude co-benefits of reductions of other NAAQS pollutants where sufficient evidence shows that such pollutants also lack a threshold.
[50] *See* Kyle Feldscher, *Senate Republicans Take Aim at Cost of EPA Regs*, Wash. Examiner, (Oct. 21, 2015), http://www.washingtonexaminer.com/senate-republicans-take-aim-at-cost-of-epa-regs/article/2574605 (quoting Senator Mike Rounds' statement that "[b]ecause of [its] exorbitant regulations, the EPA attempts to justify . . . the costs by identifying ancillary benefits, which the EPA refers to as co-benefits, to help outweigh the cost of regulations.").
[51] *See* C. Boyden Gray, *EPA's Use of Co-Benefits*, FEDERALIST SOCIETY (Sept. 24, 2015), https://fedsoc.org/commentary/publications/epa-s-use-of-co-benefits ("EPA is treating the Clean Air Act as a completely open-ended grant of power, precisely as the Supreme Court forbids. . . . The costs of complying with a

these rules, decries these benefits and asserts that their inclusion "essentially hid[es] the true net cost" of rules like the Clean Power Plan.[52]

This view, however, conflicts with four decades of EPA practice under administrations of both parties: EPA during that time has taken co-benefits under consideration when evaluating air pollution regulations.[53] Further, Office of Management and Budget (OMB) Circular A-4, issued during the George W. Bush Administration, instructs agencies like EPA to look at and consider co-benefits and their mirror image: indirect costs.[54] Indirect costs are consistently calculated for Clean Air Act and other EPA regulations,[55] and it would be incoherent to consider the negative indirect effects of regulations without similarly considering the positive indirect effects.[56] The benefits from reducing particulate matter below the levels of the NAAQS in terms of avoided health harms and premature mortality are scientifically well established and have been acknowledged by EPA for decades.[57] As well-documented co-benefits, there is no reason these benefits should be excluded from analyses of air pollution regulations.

Courts likewise have long held that when a rule's justification includes economic analyses, agencies may not ignore important costs or benefits, whether the effect is direct or ancillary. For example, the D.C. Circuit, the most important appellate court for federal regulation of environmental law,[58] has held that EPA must consider indirect effects in its rulemakings. In 1999, the court remanded a revision to the NAAQS standards for ozone and particulate matter because, in the court's view, the agency failed to consider the potential indirect health costs from lowering pollution.[59] Likewise, in *American Trucking Association v. EPA*,[60] the court held that

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given regulation should be compared against the social goods that that regulation is authorized to achieve—not incidental co-benefits."); *infra* notes 389-398 and accompanying text.

[52] Environmental Protection Agency, *News Releases: EPA Takes Another Step To Advance President Trump's America First Strategy, Proposes Repeal Of "Clean Power Plan"* (Oct. 10, 2017), https://www.epa.gov/newsreleases/epa-takes-another-step-advance-president-trumps-america-first-strategy-proposes-repeal.

[53] *See infra* Part IV.B.

[54] *See* Circular A-4: Regulatory Analysis, OFF. MGMT. & BUDGET 26 (2003) https://obamawhitehouse.archives.gov/sites/default/files/omb/assets/omb/circulars/a004/a-4.pdf (Agencies should "look beyond the direct benefits and direct costs and consider any important ancillary benefits and countervailing risks."). Just as there are various terms for "co-benefits," there are likewise multiple names for "indirect costs," including countervailing risks. This article primarily uses the term "indirect costs," but occasionally employs "countervailing risks" as well.

[55] *See* Samuel J. Rascoff & Richard L. Revesz, *The Biases of Risk Tradeoff Analysis: Towards Parity in Environmental and Health-and-Safety Regulation*, 69 U. CHI. L. REV. 1963, 1980-90 (2002) (chronicling the rise of risk-risk analysis in the regulatory state); *infra* Part IV.B.

[56] *See generally id*. (making the argument that ancillary benefits should be considered, given the rise in consideration of risk tradeoffs).

[57] *See infra* Part III.

[58] *See* Richard J. Lazarus, *Senator Edmund Muskie's Enduring Legacy in the Courts*, 67 ME. L. REV. 239, 242 (2015) ("[T]he D.C. Circuit of course is the nation's most important court for federal environmental law because it has original jurisdiction to hear challenges to EPA rules promulgated under a host of federal environmental laws, including the Clean Air and Clean Water Acts, and exclusive jurisdiction to consider some of those challenges.").

[59] *See* Am. Trucking Ass'ns v. EPA, 175 F.3d 1027, 1036-37 (D.C. Cir. 1999*), rev'd on other grounds sub nom.* Whitman v. Am. Trucking Ass'ns, 531 U.S. 457 (2001).

[60] 175 F.3d 1027 (D.C. Cir. 1999), *rev'd on other grounds sub nom.* Whitman v. Am. Trucking Ass'ns, 531 U.S. 457 (2001).

the agency must consider incidental countervailing risks.[61] More recently, in *Sugar Corp v. EPA* the court upheld an EPA regulation that relied on co-benefits in its analysis of the effects of reducing hazardous air pollutants from boilers, process heaters, and incinerators.[62] The labels "benefit" and "cost" merely serve as useful shorthand for positive effects versus negative effects. In the context of cost-benefit analysis, neither possesses any inherent quality warranting different weight or analytical treatment from the other.[63]

Because the frontal attack on the co-benefits of particulate reductions below the NAAQS arose so recently, there is no existing academic literature in this area. Neither is there sustained discussion on the evolution in the understanding of thresholds for criteria pollutants following the enactment of the Clean Air Act in 1970, or on how this understanding developed alongside different approaches used for carcinogens and non-carcinogens other than criteria pollutants. Neither is there a historical, scientific, and practical analysis of the question of how the competing arguments on thresholds interact with cost-benefit analysis.

This Article fills these voids. Part I discusses EPA's approaches for assessing the risks of carcinogenic and non-carcinogenic pollutants other than criteria pollutants. EPA has consistently treated carcinogens as non-threshold pollutants, whereas for non-carcinogen, non-criteria pollutants, EPA's approach has lagged behind the scientific evidence and assumes that there is a no-harm threshold. Part II turns to criteria pollutants. It examines Congress's growing doubts about the existance of NAAQS thresholds, which resulted in a significant conceptual change in the understanding of criteria pollutant reflected in the 1977 amendments to the Clean Air Act and shows how EPA's approach has evolved, from embracing threshold models in the 1970s to consistently rejecting them since the 1980s. Part III addresses the critics' first two arguments: that benefits from particulate matter reductions below the NAAQS do not exist, and that EPA erroneously "double counts" benefits by failing to adjust its estimation baselines to account for prior regulation of particulate matter. We explain the scientific basis for calculating particulate matter benefits below the NAAQS, as well as EPA's longstanding practice of measuring and quantifying these benefits. We also examine how the agency deals with uncertainty and sets its baselines when revising the NAAQS. Part IV assesses the final assertion of the critics: that even if real, these benefits should not be included in cost-benefit analyses when they are co-benefits as opposed to direct benefits. We discuss the treatment of co-benefits in a range of contexts over the past four decades by academics, EPA, and the judiciary.

I
TRADITIONAL RISK ASSESSMENT MODELS

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[61] *See id.* at 1051-53; *cf.* Michael Livermore & Richard Revesz, *Rethinking Health-Based Environmental Standards*, 89 N.Y.U. L. REV. 1184, 1250 (2014) (quoting Am. Trucking Ass'ns v. EPA, 175 F.3d at 1051-52) ("In a portion of its *American Trucking* opinion not reviewed by the Supreme Court, the D.C. Circuit stated that at least certain types of secondary effects must be considered by the agency when setting the NAAQS. . . . The court noted that it 'seems bizarre that a statute intended to improve human health would . . . lock the agency into looking at only one half of a substance's health effects in determining the maximum level for that substance.' Thus, the D.C. Circuit required the agency to account for the negative secondary consequences of regulation—the countervailing risks.").
[62] *See* U.S. Sugar Corp. v. EPA, 830 F.3d 579, 591, 625 (D.C. Cir. 2016).
[63] *See* Institute for Policy Integrity, *The Importance of Evaluating Regulatory "Co-Benefits,"* at 2 (Feb. 2017), http://policyintegrity.org/files/media/Co-Benefits_Factsheet.pdf.

EPA currently uses different risk assessment approaches for carcinogens, non-carcinogens, and NAAQS criteria pollutants, respectively. This Part analyzes the agency's current models for evaluating the health and environmental risks posed by carcinogens and by noncarcinogens other than criteria pollutants.

A. Carcinogens

EPA assumes that carcinogens have no thresholds unless sufficient pollutant-specific data leads the agency to conclude that a particular carcinogen has a threshold.[64] Under this approach, EPA first attempts to discern a "mode of action" for carcinogens,[65] which describes the sequence of key events and processes resulting in cancer formation.[66] When EPA can determine the mode of action, it will model the risk-exposure relationship based on that mode of action. If that mode suggested a linear, non-threshold relationship, EPA will so model the relationship; if, in contrast, the mode suggests a threshold, EPA will model the threshold. Where EPA does not have sufficient data to determine the mode of action, the agency assumes that pollutants that cause tumors in animals are harmful to humans,[67] that cancer risks of these pollutants do not have a threshold,[68] and that the effects can be modeled by low dose linearity,[69] which describes a relationship between exposure and risk under which additional exposure will result in additional risk at a constant rate.[70]

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[64] *See* SCIENCE AND DECISIONS, *supra* note 34, at 127-28. Note that EPA will adjust its model to include a threshold where there is such evidence. For example, EPA treats chloroform as a threshold carcinogen. *See* Environmental Protection Agency, *Integrated Risk Information System: Chloroform Chemical Assessment Summary*, at 1 (Oct. 19, 2001) https://cfpub.epa.gov/ncea/iris/iris_documents/documents/subst/0025_summary.pdf. However, EPA has not identified many exceptions to its general rule that carcinogens should be treated as non-threshold and non-carcinogens should be treated as having a threshold. *See* Wendy Wagner et al., *Misunderstanding Models in Environmental and Public Health Regulation*, 18 N.Y.U. ENVTL. L.J. 293, 335 (2010) (discussing EPA's assumption that carcinogens have no threshold of effect and noting that EPA has identified threshold carcinogens, including chloroform, and has struggled with accommodating such exceptions). In 2000, the D.C. Circuit spurred the Agency to action on chloroform, finding that EPA's use of an assumption of linearity for chloroform violated the Safe Drinking Water Act because it "openly overrode the best available scientific evidence which suggested that chloroform is a threshold carcinogen." *Chlorine Chemistry Council v. EPA*, 206 F.3d 1286, 1290 (D.C. Cir. 2000).
[65] Environmental Protection Agency, *Guidelines for Carcinogen Risk Assessment*, EPA/630/P-03/001F, at 1-10 (Mar. 2005), https://www.epa.gov/sites/production/files/2013-09/documents/cancer_guidelines_final_3-25-05.pdf.
[66] *See id.* at 1-10 n.2.
[67] *See id.* at 1-10, 1-11.
[68] *See id.* at 1-11; SCIENCE AND DECISIONS, *supra* note 34, at 8.
[69] *See* Environmental Protection Agency, *Guidelines for Carcinogen Risk Assessment*, *supra* note 65, at 1-11.
[70] *See id.* This approach comports with cancer policies of other federal agencies. For example, EPA, FDA, and OSHA "all . . . employ a linear mathematical model for low-dose extrapolation" of carcinogenic risk assessment. Government Accountability Office, *Chemical Risk Assessment: Selected Federal Agencies' Procedures, Assumptions, and Policies*, GAO-01-810, at 40, 173, 197 (Aug. 2001), https://books.google.com/books?id=MfWUWX0L814C&lpg=PP1&pg=PP1#v=onepage&q&f=false (noting FDA's assumption of a "linear, no-threshold approach" for low dose cancer estimation, as well as OSHA's acceptance of the "overwhelming scientific consensus . . . that genotoxins follow low-dose linear functions"); Centers for Disease Control and Prevention, *Current Intelligence Bulletin 68: NIOSH Chemical Carcinogen Policy* (July 2017), https://www.cdc.gov/niosh/docs/2017-100/pdf/2017-100.pdf?id=10.26616/NIOSHPUB2017100revised ("For carcinogen risk assessment, NIOSH generally treats exposure-response as low-dose linear unless a non-linear mode of action has been clearly established, in which case NIOSH will adopt a modeling approach defined by the data

Next, the agency reviews the evidence available from scientific studies and produces a "weight of the evidence narrative," which is intended to assess the health impacts of a pollutant and the strength of the evidence of those effects.[71] EPA considers factors such as whether tumors were found in humans or animals, the agent's chemical and physical properties, and studies addressing its mode of action.[72] The agency uses standard descriptors to express the weight of the evidence: "carcinogenic to humans," "likely carcinogenic to humans," "suggestive evidence of carcinogenic potential," "inadequate information to assess carcinogenic potential," and "not likely to be carcinogenic."[73]

Dose response assessments, the next phase of EPA's analysis of risk from carcinogens, are generally completed for pollutants labeled "carcinogenic to humans" and "likely to be carcinogenic to humans."[74] Dose-response assessments aim to measure health effects at different exposure levels. [75] These assessments are performed by first assessing data to determine a "point of departure" (POD),[76] which marks the beginning of extrapolation to lower doses based on experimental data.[77] Above the point of departure, EPA attempts to develop a tailored model of dose-response pattern, and where it lacks sufficient data to develop one, the agency states that "an appropriate policy choice" is to use a standard curve-fitting model, which is a standardized mathematical function for drawing a trend line among data points.[78] Below the point of departure, EPA assumes that risk is related to exposure in a linear pattern.[79]

EPA's cancer guidelines emphasize that "a critical analysis of all of the [relevant] available information . . . [is] the starting point from which a default option *may* be invoked *if needed* to address uncertainty or the absence of critical information."[80] Thus, if evidence emerges that a particular carcinogenic pollutant does in fact have a threshold, or is non-linear at low levels or all levels (for example if data instead suggests a logarithmic relationship), EPA may depart from the default no-threshold, linear model.[81]

Other agencies have taken similar approaches to regulating carcinogens. The Occupational Safety and Health Administration (OSHA), under its guidance for regulating potential carcinogens,[82] has not standardized its classification and regulation of carcinogens to the degree that EPA has. Rather than identifying default models that will be used when data is

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(including non-linear approaches when appropriate). In general, whether the model forms are linear or non-linear, any nonzero exposure to a carcinogen is expected to yield some excess risk of cancer.").

[71] *Id.*

[72] *See id*.

[73] *Id*. at 1-12.

[74] *Id*. at 3-2.

[75] *See id*. at 1-12.

[76] *Id*. at 1-13.

[77] *See id*. at 1-13 n.4.

[78] *Id*. at 1-9, 1-10.

[79] *See* SCIENCE AND DECISIONS, *supra* note 34, at 127.

[80] Environmental Protection Agency, *Guidelines for Carcinogen Risk Assessment, supra* note 65, at 1-7 (emphasis added).

[81] A linear model is not synonymous with a non-threshold model. A non-threshold model may be non-linear, so long as it includes health effects even at very low levels. However, a linear model is necessarily a non-threshold model as a linear model does display health effects at every positive level of exposure.

[82] *See* 29 C.F.R. § 1990.101 et seq. (2017) (providing guidance for the identification, classification, and regulation of carcinogens).

insufficient to tailor a model, as EPA has done, OSHA has identified the type of data it will consider,[83] criteria used to evaluated arguments for certain carcinogen regulations,[84] and specific issues to be assessed when in the rulemaking including what data is available.[85] Further, OSHA guidance has been affected by the landmark *Benzene* case, in which the Supreme Court struck down OSHA's standard for benzene of 1 part per million (ppm) after the Labor Secretary concluded that there was no safe level of benzene because it was a carcinogen, but did not specifically quantify the risks from benzene exposure at levels below 10 ppm.[86] In order to satisfy the requirements of the *Benzene* case, OSHA now estimates the risk to workers subject to a lifetime of exposure at various potential exposure levels.[87] It is more difficult to discern what OSHA's specific models are for evaluating risks posed by carcinogens and managing those risks. However, OSHA carcinogen guidance makes clear that the agency treats carcinogens as non-threshold pollutants.[88] The agency develops models for risk that "best fit existing data and are consistent with available information on mode of action," but also notes that there is "a reasonable body of scientific evidence that genotoxic carcinogens, and perhaps other carcinogenic modes of action, display linear, non-threshold behavior at very low dose levels."[89]

The National Institute for Occupational Safety and Heath (NIOSH), established under the same legislation as OSHA[90] and empowered to "develop and establish recommended occupational safety and health standards,"[91] recently released a revised chemical carcinogen policy.[92] NIOSH, like EPA, generally treats the exposure response relationship as linear at low

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[83] *See* 29 C.F.R. § 1990.145 (2017).
[84] *See* 29 C.F.R. § 1990.144 (2017).
[85] *See* 29 C.F.R. § 1990.146 (2017).
[86] *See Industrial Union Department, AFL-CIO v Amer. Petroleum Institute (The Benzene Case),* 448 U.S. 607, 613-15 (1980).
[87] *See* Proposed Rule on Chemical Management and Permissible Exposure Limits (PELs), 79 Fed. Reg. 61,384, 61,387 (Oct. 10, 2014) (to be codified at 29 C.F.R. Parts 1910, 1915, 1917, 1918, and 1926), https://www.gpo.gov/fdsys/pkg/FR-2014-10-10/pdf/2014-24009.pdf.
[88] *See* 29 C.F.R. § 1990.143(h) ("No determination will be made that a 'threshold' or 'no-effect' level of exposure can be established for a human population exposed to carcinogens in general, or to any specific substance.").
[89] Proposed Rule on Chemical Management and Permissible Exposure Limits (PELs), *supra* note 87, at 61,391.
[90] Occupational Safety and Health Act of 1970, 29 U.S.C. § 671 (2012).
[91] *Id*. at § 671(c)(1). NIOSH was originally conceived as the research arm of a coordinated federal effort to regulate workplace safety, and OSHA was to be the standard-setting agency. *See* Occupational Safety and Health Administration, *All About OSHA: The Standards-Setting Process*, (2006), https://www.osha.gov/Publications/about-osha/3302-06N-2006-English.html ("The OSH Act established the National Institute for Occupational Safety and Health in the Department of HHS as the research agency for occupational safety and health. NIOSH conducts research on various safety and health problems, provides technical assistance to OSHA, and recommends standards for OSHA's consideration."); Centers for Disease Control and Prevention, *About NIOSH* (June 15, 2016), https://www.cdc.gov/niosh/about/default.html. The agencies, however, have not always worked collaboratively. *See* Kyle W. Morrison, *Partners in Safety*, SAFETY & HEALTH (Mar. 1, 2012), http://www.safetyandhealthmagazine.com/articles/partners-in-safety-2. NIOSH's 2017 guidance on carcinogens post-dates OSHA's guidance, which was published in 1980. *Compare* Centers for Disease Control and Prevention, *Current Intelligence Bulletin 68: NIOSH Chemical Carcinogen Policy* (July 2017), https://www.cdc.gov/niosh/docs/2017-100/pdf/2017-100.pdf?id=10.26616/NIOSHPUB2017100revised *with* 29 C.F.R. § 1990. As such, it is not entirely clear how extensively OSHA relies on NIOSH data to set regulations on carcinogens in the workplace. OSHA guidance does, however, reference consulting with the Director of NIOSH. *See* 29 C.F.R. §§ 1990.106, 1990.104 (2017).
[92] *See* Centers for Disease Control and Prevention, *Current Intelligence Bulletin 68: NIOSH Chemical Carcinogen Policy*, *supra* note 91.

doses, which implies a non-threshold model.[93] Also like EPA, NIOSH will depart from this model where a non-linear mode of action has been clearly established.[94] Further, NIOSH explicitly notes that even where there is evidence of a non-linear relationship between risk and exposure at low doses, "it is highly unlikely that one can demonstrate empirically that a threshold exists."[95]

Based on the relevant scientific evidence, EPA, OSHA, and NIOSH all treat carcinogens as non-threshold contaminants. Further, EPA and NIOSH both assume linearity at low doses, unless the data strongly suggests a different relationship between exposure and risk to health. The assumption of non-threshold low dose linearity presumes health impacts even at very low levels of exposure.[96] Because health effects can be estimated at low doses under this model, the agencies can include those health benefits in cost-benefit analyses used to support allowable standards for carcinogenic pollutants. Considering these benefits of pollution regulation allows agencies to more accurately weigh the effects of regulations at different stringencies, facilitating more informed decision-making.

Accounting for adverse health impacts from very low levels of pollution does not mean that EPA or other agencies must or will require the elimination of that pollutant.[97] For example, under the Safe Drinking Water Act (SDWA),[98] EPA is required to set maximum contaminant

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[93] *See id.* at 19.
[94] *See id*.
[95] *Id*.
[96] *See id.*
[97] Commentators have suggested that the non-threshold approach to carcinogens was responsible for EPA's reluctance to list carcinogenic pollutants during the 1970s and much of the 1980s. *See* Matthew D. Adler, *Against "Individual Risk": A Sympathetic Critique of Risk Assessment*, 153 U. PA. L. REV. 1121, 1150 (2005); John P. Dwyer, *The Pathology of Symbolic Legislation*, 17 ECOLOGY L.Q. 233, 251–52 (1990); Bradford C. Mank, *What Comes After Technology: Using an "Exceptions Process" To Improve Residual Risk Regulation of Hazardous Air Pollutants*, 13 STAN. ENVTL. L.J. 263, 268 (1994); Deanna Schmitt, Note, *North Carolina Air Toxics Regulations*, 69 N.C.L. REV. 1579, 1581–82 (1991). Originally, section 112 of the Clean Air Act required an "ample margin of safety" for "hazardous air pollutants." 42 U.S.C. § 7412(b)(1)(B) (1988), amended by Pub. L. No. 101-549, 301, 104 Stat. 2399, 2531 (1990). Because carcinogens have no threshold below which they are safe, EPA officials feared listing a pollutant as a carcinogen might forbid emitting the pollutant at all, shuttering entire industries. *See* Adler, *supra*; Dwyer, *supra*, at 251; Mank, *supra*; Schmitt, *supra*, at 1581. However, the U.S. Supreme Court determined that zero tolerance for carcinogens was not an appropriate approach, at least with regard to Occupational Safety and Health Administration regulations. In *The Benzene Case*, Justice Stevens relied heavily on statutory language mandating that OSHA only regulate standards for toxic materials "to the extent feasible," and determined that before the agency enact more stringent standards, OSHA had to determine the regulated chemical exposure posed a "significant risk." *See* Indus. Union Dep't, AFL-CIO v. API, 448 U.S. 607, 612, 641 (1980). Eventually EPA linked safety to "best available technology" standards: After identifying the lowest level of emissions possible with the best available technology, EPA would decide whether to set emissions at an even lower level by weighing the reduction in health risks against costs of setting the lower standard. *See* NRDC v. EPA, 824 F.2d 1146, 1163–64 (D.C. Cir. 1987). In 1987, the D.C. Circuit rejected this approach, favoring instead a two-step process in which EPA first determined what would be an "acceptable" risk to health without any consideration of cost or technological capability, and in a second step, determined the ample margin of safety, incorporating feasibility considerations. *Id.* at 1164–65. EPA then settled on this approach for regulating carcinogenic air pollutants: EPA would set standards so that the maximally exposed individual had a risk of 1 in 10,000 or less, and if economically feasible, further regulate the pollutant to minimize the number of people with a risk greater than 1 in 1 million. *See* National Emission Standards for Hazardous Air Pollutants, 54 Fed. Reg. 38,044, 38,044-45 (40 C.F.R. pt. 61) (Sept. 14, 1989); Adler, *supa*, at 1151.
[98] *See* 42 U.S.C. § 300f et seq. (2012).

level goals (MCLG), which is the maximum level of a contaminant in drinking water at which no known or anticipated health effects would occur.[99] When EPA regulates carcinogens under the SDWA, the agency sets the MCLG at zero where there is evidence that the chemical may cause cancer, and there is no dose below which the chemical is considered safe.[100] However, the MCLG is *not* an enforceable standard. Rather, the enforceable standard, known as the maximum contaminant level (MCL), is set as close to the MCLG as feasible, taking into consideration costs and available technology.[101] In short, even where EPA recognizes that a carcinogen is unsafe at every level, the agency can, and does, set standards above zero. Including health costs from low level exposure to carcinogenic pollutants does not force EPA to ban the pollutant; it merely facilitates more informed decisions about how to regulate these pollutants.

B. Non-Carcinogens Other than Criteria Pollutants

In contrast to carcinogens, EPA treats non-carcinogens other than criteria pollutants as threshold pollutants. EPA assumes that there is a threshold below which such pollutants do not have adverse health impacts.[102] EPA does so even though the threshold assumption for non-carcinogens is inconsistent with modern scientific understanding.[103] This Section analyzes EPA's current practice and then criticizes its continued use of this assumption.

EPA assessments for non-carcinogens focus on finding a "reference dose," which is the quantity "likely to be without an appreciable risk of deleterious effects."[104] The reference dose is derived from the point of departure, which is the point from which EPA extrapolates the risk-exposure relationship.[105] For non-cancer pollutants, this point of departure is generally the no-observed-adverse-effect level (NOAEL),[106] which is "the highest exposure level at which no statistically or biologically significant increases are seen in the frequency or severity of adverse effect[s],"[107] or the lowest-observed-adverse-effect level (LOAEL), which is "[t]he lowest dose in a study in which there was an observed toxic or adverse effect."[108] The reference dose might also be derived based on the "benchmark dose," which is calculated using "a predetermined

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[99] *See* 42 U.S.C. § 300g-1(b)(4)(A) (2012) ("Each maximum contaminant level goal established under this subsection shall be set at the level at which no known or anticipated adverse effects on the health of persons occur and which allows an adequate margin of safety.").
[100] *See* Environmental Protection Agency, *How EPA Regulates Drinking Water Contaminants*, https://www.epa.gov/dwregdev/how-epa-regulates-drinking-water-contaminants#develop (last visited Dec. 22, 2017) ("For chemical contaminants that are carcinogens, EPA sets the MCLG at zero if . . . there is evidence that a chemical may cause cancer [and] there is no dose below which the chemical is considered safe.").
[101] *See* 42 U.S.C. § 300g-1(b)(4)(B)-(D) (2012).
[102] *See* SCIENCE AND DECISIONS, *supra* note 34, at 128; LOUIS THEODORE & R. RYAN DUPONT, ENVIRONMENTAL HEALTH AND HAZARD RISK ASSESSMENT: PRINCIPLES AND CALCULATIONS 289 (2017).
[103] *See id.* at 8.
[104] SCIENCE AND DECISIONS, *supra* note 34, at 128 (quoting EPA pesticide risk-assessment guidance from 2002).
[105] *See id.*
[106] *See id*.
[107] Environmental Protection Agency, *Conducting a Human Health Risk Assessment: Dose-Response*, https://www.epa.gov/risk/conducting-human-health-risk-assessment#tab-3 (last visited Dec. 23, 2017).
[108] National Institutes of Health, *ToxTutor: Risk Assessment*, https://toxtutor.nlm.nih.gov/06-003.html (last visited Feb. 13, 2018); *see id.* (stating that EPA uses LOAEL "in cases in which a NOAEL has not been demonstrated experimentally").

change in the response rate of an adverse effect."[109] Once EPA determines the NOAEL, LOAEL, or benchmark dose, the agency divides that dose by the "uncertainty factor," a margin of safety intended in part to reflect the possible differences between human and animal responses.[110] The resulting number is the reference dose.[111] This model presumes a threshold at the reference dose: below this exposure level, the health risk from exposure to non-carcinogenic pollutants is considered to be effectively zero.[112]

Modern scientific challenges the accuracy of EPA's threshold approach for non-carcinogens, and suggests that many of these pollutants do not have a population threshold.[113] Epidemiological studies now provide information about the health impacts of pollutants across a range of human exposures, including a very low levels.[114] Most significantly, a 2009 report of the National Research Council of the National Academy of Sciences[115]—an independent organization of distinguished scholars in science and engineering, dedicated to the use of science and technology to improve the general welfare, and created by an act of Congress with a mandate to provide independent and objective advice to the federal government[116]—explained that EPA's current threshold assumption model for non-carcinogens is based on outdated approaches developed in the 1950s to 1980s.[117] The report observed that non-carcinogenic pollutants do not necessarily have a threshold,[118] and recommended that EPA evaluate all non-carcinogens without assuming that they have a threshold.[119] According to the report, the current model yields end products "inadequate for benefit-cost analyses or for comparative risk analyses,"[120] and instead "creates an inconsistent approach for bringing toxicology and risk science into the decision-making process."[121] EPA has largely ignored this particular

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[109] Environmental Protection Agency, *Conducting a Human Health Risk Assessment: Dose-Response*, *supra* note 107.
[110] *See id.*
[111] *See id.*
[112] *See* SCIENCE AND DECISIONS, *supra* note 34, at 128.
[113] *See id.* at 8.
[114] *See* McGartland et al., *Estimating the Health Benefits of Environmental Regulations*, *supra* note 23, at 458.
[115] NAS was chartered by the Senate in 1863 with the purpose to, "whenever called upon by any department of the Government, investigate, examine, experiment, and report upon any subject of science or art." Steve Olson, *The National Academy of Sciences at 150*, PNAS ONLINE (June 24, 2014), http://www.pnas.org/content/111/Supplement_2/9327.full. The organization is "a private agency with the public role of advising the government on policy-related technical issues." *Id.* The National Research Council is the "principal operating agency" of the National Academies. National Academies of Sciences, Engineering, and Medicine, Articles of Organization of the National Research Council, (June 1, 2015), http://www.nationalacademies.org/nasem/na_070358.html. It was established in 1916 at the request of President Wilson to recruit specialists to participate in the National Academy of Sciences' advisory work for the government. *See* National Academies of Sciences, *About NAS: History*, http://www.nasonline.org/about-nas/history (last visited Dec. 23, 2017).
[116] *See* National Academies of Sciences, *About NAS: Mission*, http://www.nasonline.org/about-nas/mission (last visited Dec. 23, 2017).
[117] *See* McGartland et al., *Estimating the Health Benefits of Environmental Regulations*, *supra* note 23, at 458. The report concluded that EPA's approach is no longer scientifically supportable, as it "does not make the best possible use of available scientific evidence." SCIENCE AND DECISIONS, *supra* note 34, at 177.
[118] *See* SCIENCE AND DECISIONS, *supra* note34, at 8.
[119] *See id*. at 132.
[120] *Id*. at 133.
[121] *Id.*

recommendation from the 2009 report, and has not changed its model for assessing non-carcinogens.[122]

Even if there were a threshold for an averagely sensitive individual, that level would, by definition, be lower for more sensitive individuals. Especially sensitive individuals would have an even lower threshold. And for the most sensitive individuals in a population, there might be no threshold at all.[123] While there might be individual thresholds for average people, there would be no population threshold—the level at which a population experiences no negative health effects.[124] Thus, deciding to treat one individual's threshold as a population threshold necessarily is a decision to leave some individuals—those with lower thresholds—unprotected. For example, very young children, pregnant women, or the elderly might have harm thresholds for certain pollutants that are much lower than the average population threshold.[125] By assuming a threshold for a typical person, EPA overlooks sensitive individuals who may experience negative health impacts at exposure levels lower than the regulatory standard. The question of how many people to leave unprotected is ultimately a policy question. An accurate accounting of the effects of these pollutants on sensitive people does not necessitate draconian regulations to completely eliminate all risks; rather this information facilitates more informed decision-making that accurately accounts for the impacts on all members of the population.

The current threshold model also ignores all scientific evidence of health effects that lacks a high level of confidence. This problem is built in to EPA's process for determining the limits for these pollutants: when EPA determines standards, it performs a benefits analysis that includes evidence of different health impacts of the pollutant.[126] It classifies evidence as "likely" or "known" if there is a high degree of confidence in the association between exposure and a health outcome, or as "suggestive" where there is lesser confidence in the link.[127] "Suggestive" evidence is generally excluded from the potential health risks assessed by EPA in its primary

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[122] It is interesting to note that Dr. Thomas Burke, who chaired that NAS committee that wrote *Science and Decisions*, served as the Deputy Assistant Administrator of EPA's Office of Research and Development during the Obama Administration and did not, during that time, usher in implementation of the *Science and Decisions* recommendation to eschew the threshold assumption for non-carcinogens. *See* Environmental Protection Agency, *About the Deputy Assistant Administrator of EPA's Office of Research and Development, and EPA's Science Advisor*, https://19january2017snapshot.epa.gov/aboutepa/about-deputy-assistant-administrator-epas-office-research-and-development-and-epas-science_.html (last updated Jan. 19, 2017).

[123] *See* Lorenz R Rhomberg et al., *Linear Low-Dose Extrapolation for Noncancer Health Effects Is the Exception, Not the Rule*, 41 CRITICAL REV. TOXICOLOGY 4 (2011) ("[L]ow-dose linearity asserts that there is no population threshold, meaning that there will always be some individuals having personal thresholds of zero, and so they will respond to any increment of dose no matter how small.").

[124] *See* Environmental Protection Agency, *Summary of Expert Opinions on the Existence of a Threshold in the Concentration-Response Function for $PM_{2.5}$-related Mortality*, (June 2010), https://www3.epa.gov/ttnecas1/regdata/Benefits/thresholdstsd.pdf (defining a population threshold as "the concentration below which no member of the study population would experience an increased risk of death").

[125] *See, e.g.*, Bingheng Chen & Haidong Kan, *Air Pollution and Population Health: A Global Challenge*, 13 ENVTL. HEALTH PREV. MED. 94, 96 (2008) (noting that for "[a]dverse health effects associated with exposure to air pollution . . . . [h]igh-risk subgroups include young children, the elderly, persons with predisposed diseases, and persons with low socioeconomic status."); National Ambient Air Quality Standards for Particulate Matter, 78 Fed. Reg. 3,086, 3,104 (Jan. 15, 2013) (to be codified at 40 C.F.R. pts. 50, 51, 52, 53 and 58) ("There is emerging, though still limited, evidence for additional potentially at-risk populations, such as those with diabetes, people who are obese, pregnant women, and the developing fetus.").

[126] McGartland et al., *Estimating the Health Benefits of Environmental Regulations*, *supra* note 23, at 457.

[127] *See id.*

benefits analysis for non-carcinogenic effects.[128] As a result, EPA essentially gives health effects that have not been conclusively demonstrated no weight when determining the benefits of a regulation. In effect, EPA imposes a sharp discontinuity in the level of risk depending on how the agency classifies the evidence: the agency assumes there is a risk associated with "known" and "likely" evidence, the specific level of which is based on data, but assumes a 0% probability of risk when evidence is "suggestive." But the probability of an adverse impact is not zero. "Suggestive" evidence, instead, presents some other positive level of risk which is arbitrarily ignored.

Economics has a way of addressing uncertainty without ignoring it completely. Using the concept of expected value, economists can incorporate the level of uncertainty into the calculation of overall risk.[129] In the example of non-carcinogenic pollutants, if EPA employed this concept, the expected value of the health risk posed by exposure to these pollutants would incorporate both the best estimates for overall harm from exposure and the level of uncertainty. The fact of uncertainty would lower the estimated potential risk, but some level of risk would still be calculated from exposure at low levels.

Another way to better account for this risk would be to look at the willingness of individuals to pay to avoid risks from low level exposures. The "willingness to pay" measure can be calculated by directly asking people what they would hypothetically pay to avoid a risk, or by comparing wages from similar jobs that are more or less risky.[130] Workers who take riskier jobs get higher wages to compensate for that risk. By measuring this difference, it is possible to calculate the "risk premium," or willingness to pay for the additional risk posed by the job.[131] By assuming there is zero risk below the threshold, EPA has presumed that there is zero willingness to pay to avoid low level exposure. There is evidence to suggest, however, that individuals actually display a greater willingness to pay when risk is ambiguous than they do for unambiguous risks with the same expected value.[132] A willingness to pay or expected value model would better account for the magnitude and the certainty of these risks.

EPA's failure to update its non-carcinogen model to account for more recent scientific evidence, sensitive populations, and scientific uncertainties has important policy implications. Because EPA ignores risks below the threshold, the agency is unable to fully incorporate data on health effects at low levels of exposure. EPA cannot calculate what percentage of the population or how many additional people would be protected by reductions in pollution below the reference dose. Further, when EPA regulates these pollutants it does not include any health benefits from reducing pollution below the reference dose, thus undercounting potential benefits of regulation. The resulting standards therefore do not reflect any potential harm from lower-

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[128] *See id.*

[129] *See* INSTITUTE OF MEDICINE OF THE NATIONAL ACADEMIES, ENVIRONMENTAL DECISIONS IN THE FACE OF UNCERTAINTY 167-69 (2013).

[130] *See* John Bronsteen et al., *Well-Being Analysis vs. Cost-Benefit Analysis*, 62 DUKE L.J. 1603, 1645-46 (2013).

[131] *See id.* at 1646.

[132] *See* Paul A. Kivi & Jason F. Shogren, *Second-Order Ambiguity in Very Low Probability Risks: Food Safety Valuation*, 35 J. AGRIC. RES. ECON. 443, 446 (2010) (finding in the context of food safety that "people prefer unambiguous food safety choices over ambiguous ones with the same expected value," asserting that "[a]mbiguity premiums—how much more people are willing to pay to avoid an ambiguous situation than an equivalent unambiguous one—are positive" for scenerios the authors tested, and noting that the findings are consistent with previous studies.)

level exposure. If EPA instead modeled the marginal risk of reductions or increases in dose exposure at every level using a tool like willingness to pay or expected value, the agency would be able to calculate with greater accuracy the overall costs and benefits of different levels of regulation, which would facilitate more informed decision-making.

II
TREATMENT OF CRITERIA POLLUTANTS

The previous Part analyzed EPA's risk assessment models of carcinogens and noncarcinogens other than criteria pollutants. That discussion provides a useful foundation upon which to examine NAAQS criteria pollutants. EPA's understanding of criteria pollutants has evolved over five decades of implementing the Clean Air Act, shifting from a model that resembled the current treatment of other noncarcinogens, which are treated as threshold contaminants, to an analysis that more closely approximates its handling of carcinogens, which are treated as no threshold contaminants. Under multiple presidential administrations of both parties, the agency has calculated benefits from reducing criteria pollutants below the NAAQS, acting inconsistently with the existence of thresholds. Further, EPA has explicitly stated in recent rules when there is no evidence of thresholds for certain criteria pollutants.

This Part first explores Congress's understanding of criteria pollutants, and describes how even by the mid-1970s, Congress had already recognized that criteria pollutants likely do not have a threshold. It then presents EPA's revision of lead NAAQS standards in 1978 and 2008 as a case study demonstrating EPA's shift away from threshold language in its promulgation of criteria pollutant standards. The Part concludes with a survey of EPA's rejection of thresholds, both in its rulemaking language and in its calculation of benefits, for the remaining criteria pollutants excepting particulate matter, which receives an in-depth examination in Part III.

A. Clean Air Act Amendments of 1977

The NAAQS criteria pollutants are six air pollutants for which there are clearly established public health concerns at historic ambient levels.[133] The Clean Air Act governs the establishment, review, and revision of the NAAQS to provide for the protection of public health and the environment.[134] Health-based standards have been developed for each pollutant, and the standards are periodically reviewed based on human exposure assessments, health risk assessments, and ecological risk assessments.[135]

Critics of clean air regulations have asserted that the NAAQS levels are adequate to fully address criteria pollutant risks, and that reductions in these pollutants below the level of the standard are not beneficial.[136] Even though the statute does not refer to thresholds, some of these

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[133] *See* SCIENCE AND DECISIONS, *supra* note 34, at 368.
[134] *See* Clean Air Act, 42 U.S.C. § 7401 et seq. (2012); Environmental Protection Agency, *Criteria Air Pollutants: Process of Reviewing the National Ambient Air Quality Standards*, https://www.epa.gov/criteria-air-pollutants/process-reviewing-national-ambient-air-quality-standards (last visited Dec. 24, 2017).
[135] *See* Clean Air Act, 42 U.S.C. § 7409(d)(1) (2012) (mandating periodic review of NAAQS every five years); SCIENCE AND DECISIONS, *supra* note 34, at 369 ("Human exposure and/or health risk assessments and ecological risk assessments are performed during the periodic reviews of these standards.").
[136] *See supra* note 21.

critics argue that thresholds are implied by the statutory requirement commanding EPA to set the NAAQS at levels that "allowing an adequate margin of safety, are requisite to protect the public health."[137] This argument requires the significant leap of equating "requisite to protect the public health" with a no-risk standard.

An examination of the legislative history for the 1977 Clean Air Act Amendments reveals that, in the years following the 1970 Act, Congress developed a more nuanced understanding of the relationship between air pollution at low concentrations and adverse health effects[138]—so much so that by the mid-1970s, Congress expressly rejected the view that criteria pollutants have thresholds.

Congress's understanding of thresholds by the time of the 1977 amendments was influenced by an evaluation by the National Academy of Sciences (NAS), [139] which was contracted in 1973 by the Senate Public Works Committee to evaluate and study the implementation of the 1970 Clean Air.[140] Among other questions, the Committee asked NAS to determine whether "there [are] assumed to be 'threshold' effects levels" for various criteria pollutants.[141] The NAS conducted a review of existing studies on air pollutants, including several it had undertaken for both the Committee and for EPA.[142] The result of that effort, the NAS's

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[137] *See* Clean Air Act of 1970, § 109(b)(1), Pub. L. No. 91–604, 84 Stat. 1679, 1680.

[138] Congress's early acknowledgement of the threshold concept's inapplicability to air pollutants has been discussed extensively in literature about the Clean Air Act. *See, e.g.*, Cary Coglianese & Gary E. Marchant, *Shifting Sands: The Limits of Science in Setting Risk Standards*, 152 U. PA. L. REV. 1255, 1288–90, 1360 (2004) ("The absence of clear thresholds for these pollutants was a well-known fact to members of Congress during deliberations over the 1977 amendments to the Clean Air Act, if not earlier."); Christopher T. Giovinazzo, *Defending Overstatement: The Symbolic Clean Air Act and Carbon Dioxide*, 30 HARV. ENVTL. L. REV. 99, 112 (2006) ("By 1977, when Congress undertook major revisions to the [Clean Air Act], it was perfectly clear that most pollutants had no clear thresholds, and that it would therefore be impossible to set NAAQS 'requisite to protect the public health' without considering cost. Yet Congress chose to maintain the fiction that thresholds exist."); Craig N. Oren, *Prevention of Significant Deterioration: Control-Compelling Versus Site-Shifting*, 74 IOWA L. REV. 1, 71 (1988) ("Judging from its frequency of citation, the apparent lack of thresholds was considered by PSD supporters to be a powerful argument for the program.").

[139] *See* Cary Coglianese & Gary E. Marchant, *Shifting Sands: The Limits of Science in Setting Risk Standards*, 152 U. PA. L. REV. 1255, 1288–90, 1360 (2004) ("Congress was strongly influenced by a 1974 report prepared for the Senate by the National Academy of Sciences and National Academy of Engineering which concluded that, contrary to the assumption underlying the 1970 Act, there were no thresholds for criteria pollutants.").

[140] NAS was explicitly contracted under section 202(d) of the 1970 Clean Air Act to examine "the health effects of air pollutants, the relation of automobile emissions to ambient air quality, and the costs and benefits of automobile emission control." National Research Council, *Report of the Conference on Air Quality and Automobile Emissions*, at 4 (May 5, 1975), https://books.google.com/books?id=DUMrAAAAYAAJ&lpg=PP1&pg=PP1#v=onepage&q&f=false. According to the Committee, "[t]he Academy was chosen as the body most likely to provide an independent and objective study of issues relating to health effects of air pollution at a time when the Committee found it increasingly difficult to obtain sufficient independent and objective information through its own limited staff investigative capacity." National Academy of Sciences, *Air Quality and Automobile Emission Control: A Report*, at 22 (Aug. 31, 1974), https://books.google.com/books?id=rlgrAAAAYAAJ&lpg=PP2&pg=PR8#v=onepage&q&f=false.

[141] *Id.* at 23. The Public Works Committee asked NAS to specifically examine "the health effects of air pollutants, the relation of automobile emissions to ambient air quality, and the costs and benefits of automobile emission control." National Research Council, *Report of the Conference on Air Quality and Automobile Emissions*, at 4 (May 5, 1975), https://books.google.com/books?id=DUMrAAAAYAAJ&lpg=PP1&pg=PP1#v=onepage&q&f=false.

[142] *See id.* at 4.

1974 "Air Quality and Automobile Emission Control" report, embraced a non-threshold view of NAAQS pollutants:

> "The present standards were derived on the assumption that such thresholds do exist. . . . However, in no case is there evidence that the threshold levels have a clear physiological meaning, in the sense that there are genuine adverse health effects at and above some level of pollution, but no effects at all below that level. On the contrary, evidence indicates that the amount of health damage varies with the upward and downward variations in the concentration of the pollutant, with no sharp lower limit.[143]

The NAS's guidance for the Committee was clear: "Thus, at any concentration, no matter how small, health effects may occur, the importance of which depends on the gravity of the effect."[144]

Similarly, the House Committee report for the amendments emphasized that there was "neither empirical evidence nor a theoretical basis for a threshold phenomenon" for any of the NAAQS pollutants.[145] The report, analyzing the limitations of NAAQS standards in 1976, also stated as one of its key findings: "The national primary standards are based on the assumption that a no-effects threshold level exists and can be proved; in fact, this assumption of a safe threshold appears to be false."[146] The report likewise discounted the utility of a threshold's "margin of safety": "From the fact that the 'safe threshold' concept is, at best, a necessary myth to permit the setting of some standards, it necessarily follows that the margin of safety concept is also an illusion. . . . [T]he supposed existence of even a modest (two or threefold) margin of safety is hardly reassuring."[147] The House Committee report endorsed verbatim NAS's assertion that "it is impossible at this time to establish an ambient air concentration for any pollutant—other than zero—below which it is certain that no human beings will be adversely affected."[148] Even by 1976, "[t]he idea that the national primary standards are adequate to protect the health of the public ha[d] been belied."[149]

In the floor debates leading up to 1977 Clean Air Act Amendments, various members of both chambers endorsed a nonthreshold view of NAAQS contaminants.[150] The bill's chief

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[143] *Id.* at 17.

[144] *Id.* at 18. The report further noted that "other considerations also argue against accepting a threshold model for health effects literally. Even if there were sharp threshold levels for individual persons, the levels would certainly not be the same for different persons, or even for the same person in different states of health." *Id.* at 17. Moreover, thresholds fail to account for "synergistic effects" of combining several pollutants, both in the human body and in the atmosphere. *See id.* at 18-19. The D.C. Circuit cited NAS's discussion of NAAQS thresholds in its *Lead Industries Ass'n v. EPA* decision, one of the early legal challenges to the 1977 amendments. *See* 647 F.2d 1130, 1152 n.43 (D.C. Cir.), *cert. denied*, 442 U.S. 1042 (1980) (quoting the NAS report as countering "the assumption that there is a discoverable no-effects threshold").

[145] Clean Air Act Amendments of 1977: Report by the Committee on Interstate and Foreign Commerce, H.R. Rep No. 95-294 (May 12, 1977).

[146] Clean Air Act Amendments of 1976: Report by the Committee on Interstate and Foreign Commerce, H.R. Rep. No. 94-1175, at 89 (May 15, 1976).

[147] *Id.* at 91.

[148] Clean Air Act Amendments of 1976: Report by the Committee on Interstate and Foreign Commerce, H.R. Rep. No. 94-1175, at 91 (May 15, 1976) (citing National Academy of Sciences, *Summary of Proceedings: Conference on Health Effects of Air Pollution*, at 7 (Nov. 1973)).

[149] *Id.*

[150] Senators Muskie and Brooke, as well as Representatives Waxman, Rogers, Preyer, Maguire, and Staggers, all contested the assumption of a "safe" threshold. *See* Senate Committee on Environment and Public Works, *A*

author, Senator Edmund Muskie, emphasized a consistent theme throughout the deliberations: "There is no threshold health effect which can be used to say that above this threshold there is danger to health and below it there is not. The testimony before the committee is replete over 14 years to that effect."[151] Only seven years into the Clean Air Act regime, Senator Muskie was unequivocal, stating that "there is no such thing as a threshold for health effects. Even at the national primary standard level, which is the health standard, there are health effects that are not protected against."[152] There was evidence suggesting these pollutants were non-threshold before the 1970 Clean Air Act was passed, and at least some members of Congress were aware of that issue.[153] But whatever Congress believed in 1970, by 1977 Congress was well aware of the threshold model's inaccuracy.

Most importantly, the core element of the PSD program is inconsistent with the notion that criteria pollutants have thresholds. The PSD program constrains the degradation of ambient air quality in areas that have air quality that is better than the NAAQS.[154] If criteria pollutants had thresholds and if the NAAQS were set at these thresholds, then there would be no reason for Congress to attempt to provide such protection. A program of this sort would have costs but no benefits. Quite to the contrary, in establishing the PSD program, Congress rejected the argument

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Legislative History of the Clean Air Act Amendments of 1977: A Continuation of the Clean Air Act Amendments of 1970, CONG. RES. SERV. (1979), https://catalog.hathitrust.org/Record/002947778 (collecting six volumes of congressional reports, floor debates, and testimony for the 1977 amendments).

[151] 123 CONG. REC. S9162 (daily ed. June 8,1977) (statement of Sen. Muskie). Senator Muskie was emphatic on this point, stressing that "[l]ong-term, low-level exposure to pollutants produce health effects which are not guarded against by national primary standards. We would have to get down to zero pollution in order to eliminate all health effects. At any level between zero pollution and the pollution permitted by national primary standards, there are health effects. Let us not disabuse ourselves on that score." 123 CONG. REC. S18460 (daily ed. June 10, 1977) (statement of Sen. Muskie). Senator Muskie's views on environmental legislation have held particularly strong sway in the federal courts. As Professor Richard Lazarus concluded:

> Congressional intent in the context of federal environmental law may be fairly equated with the intent of Senator Ed Muskie of Maine. Federal courts in their opinions have cited to the views of Senator Muskie in the enactment of federal environmental statutes in at least 293 separate cases. That is an enormous number of cases. The United States Court of Appeals for the District of Columbia has itself cited to Muskie's views in fifty-four cases. . . . Looking just to the United States Supreme Court, the statistics are even more striking. The Justices have cited to Muskie in twenty-two different cases. They include eight Clean Air Act cases, and eleven Clean Water Act cases. For each of those laws, that number constitutes a large percentage of Clean Air and Clean Water Act cases decided by the Court. The Senator, moreover, was cited most often by the Court majority in those cases, meaning that his views literally influenced the reasoning underlying the Court's ruling. Seventeen different majority opinions cited to Muskie. . . . The Justices referred to the Senator as "the principal Senate sponsor" and the "primary author" of federal environmental legislation.

Richard J. Lazarus, *Senator Edmund Muskie's Enduring Legacy in the Courts*, 67 ME. L. REV. 239, 242–43 (2015).

[152] 123 Cong. Rec. S9423 (daily ed. June 10, 1977).

[153] In fact, Muskie asserted that Congress was aware of this issue when it passed the original Act: "The [1970] Clean Air Act is based on the assumption, although we knew at the time it was inaccurate, that there is a threshold." Hearing Before the Subcommittee on Environmental Pollution of the Senate Committee on Environment and Public Works, (pt. 3), 95th Cong., 1st Sess. 8 (1977); *see* Cary Coglianese & Gary E. Marchant, *Shifting Sands: The Limits of Science in Setting Risk Standards*, 152 U. PA. L. REV. 1255, 1288–90, 1360 (2004) ("The absence of clear thresholds for these pollutants was a well-known fact to members of Congress during deliberations over the 1977 amendments to the Clean Air Act, if not earlier.").

[154] *See* Clean Air Act, 42 U.S.C. § 7473(b), 7476 (2012).

now being made by opponents of the Obama Administration's environmental regulations: that there can be no benefits from particulate reductions below the NAAQS.[155]

In sum, a broad collection of evidence—advisory group reports, committee reports, floor debates, and the structure of the legislation itself—all indicate that by 1977 Congress had rejected the view the threshold model for criteria pollutants. Only a few years after the setting of the first standards for criteria pollutants, Congress equated "[t]he concept of a 'no-effect' concentration" with "a chimera."[156]

B. Shift in EPA's Approach: A Case Study of Lead

Some early EPA practices, before the 1977 amendments, were consistent with a threshold model. This approach, however, did not persist, as a result of advances in scientific understanding. In this Section, we illustrate EPA's shift through a comparison of how EPA set the NAAQS levels for one pollutant—lead—for the first time in 1978 and how it revised it in 2008.

When EPA first developed standards for criteria pollutants, the agency treated these contaminants similarly to the way in which it treats other non-carcinogens, using language suggesting criteria pollutants had thresholds.[157] The first model developed by EPA was used during the promulgation of the 1978 lead standard,[158] which focused on finding the "safe level of total lead exposure."[159] To find this level, EPA employed the "critical population, critical effects" model: identify a "critical population" and "critical effect," analyze the relationship between environmental exposure and the critical effect, and determine an averaging period.[160] The first step of this model was to identify the critical population, a particularly vulnerable segment of the population that differed depending on the pollutant and the type of harm posed.[161] EPA chose young children ages one to five as the critical population for lead, both because young children are more susceptible to adverse health effects at lower exposure levels than adults

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[155] *See supra* notes 21-24 and accompanying text; *infra* notes 257-273 and accompanying text.

[156] Clean Air Act Amendments of 1977, H.R. Rep No. 95-294, at 111 (May 12, 1977). The report further quotes NAS's findings that it had "been unable to . . . prove that a threshold for nitrogen dioxide-induced injury exists" and that "ozone is a compound like carbon monoxide for which no safe threshold exists." *Id.*

[157] *See* Livermore & Revesz, *Rethinking Health-Based Environmental Standards*, *supra* note 61, at 1202, 1203 n.111, 1206, 1227-28 (discussing EPA's use of threshold language for its earliest NAAQS). It is worth noting that even by the 1978 Lead Rule, which as discussed in this section included language suggestive of a threshold of health effects for lead, EPA acknowledged that a threshold may not, in fact, exist. "It is also true that the absence of statistical correlation of EP levels with blood lead levels below15 pg Pb/d does not necessarily mean that these lower blood lead levels are known to be without risk." National Primary and Secondary Ambient Air Quality Standards for Lead (Proposed Rule), 42 Fed. Reg. 63,076, 63,279 (Dec. 14, 1977) (to be codified at 40 C.F.R. pt. 50).

[158] *See* Livermore & Revesz, *Rethinking Health-Based Environmental Standards*, *supra* note 61, at 1211.

[159] Lead: Proposed National Ambient Air Quality Standard, 42 Fed. Reg. 63,076, 63,079 (proposed Dec. 14, 1977) (to be codified at 40 C.F.R. pt. 50) [hereinafter Lead 1977 Proposed Rule]. A "safe level" assumes there is a threshold; by definition, a threshold is a level below which there are no health effects. For a more detailed discussion of how EPA set the 1978 lead standard, see Livermore & Revesz, *Rethinking Health-Based Environmental Standards*, *supra* note 61, at 1202-06.

[160] *See* Livermore & Revesz, *Rethinking Health-Based Environmental Standards*, *supra* note 61, at 1211.

[161] *See id.*

and because children are at higher risk of exposure to lead through dirt and soil.[162] EPA noted that children are at greater risk because of higher intake of lead per unit of body weight, greater absorption and retention of ingested lead, physiologic stresses due to rapid growth and dietary habits, incomplete development of metabolic defense mechanisms, and greater sensitivity of developing systems.[163] EPA acknowledged that there were other potential critical populations, notably pregnant women and fetuses, but stated that there was no available evidence to indicate that this population would require more stringent standards than small children.[164]

The critical effect is defined by EPA as the first adverse effect or known precursor which occurs to the critical population.[165] EPA identified as the critical effect lead-induced elevation of erythrocyte protoporphyrin (EP elevation), which is limited iron absorption in red blood cells that can be caused by exposure to lead.[166] EPA noted that EP elevation indicates impairment of cell functions which should not, in the agency's view, be permitted to persist as a chronic condition.[167]

In 1978, EPA reasoned that if the most sensitive population was protected, everyone else would be protected as well.[168] Moreover, if the critical population is protected against the critical effect, then everyone would be protected against every effect of the pollutant.[169] After making these two determinations, EPA established a relationship between environmental exposure and the critical effect of EP elevation. The agency first determined the blood lead level at which children ages one to five would experience EP elevation. EPA selected 30 µg/dL as the "maximum safe blood level for an individual child."[170] This was the individual threshold of risk for children established by the Center for Disease Control at that time.[171] EPA then selected 15 µg/dL as the average blood level target, reasoning that at that level 99.5% of the population of children would have blood levels below the 30 µg/dL level.[172]

EPA then attempted to account for non-air sources of lead, which are much more significant than airborne lead pollution and include lead paint, which may be ingested by small children.[173] Studies examined by EPA suggested nonair pollution to be from from 10.2 µg/dL to

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[162] *See* Lead 1977 Proposed Rule, *supra* note 159, at 63,077-78.
[163] *See id*. at 63,078.
[164] *See id*.
[165] *See* Environmental Protection Agency, *Fate, Exposure, and Risk Analysis: Risk Assessment for Other Effects*, https://www.epa.gov/fera/risk-assessment-other-effects (last visited Dec. 25, 2017).
[166] *See* Lead 1977 Proposed Rule, *supra* note 159, at 63,077-78.
[167] *See id*.
[168] *See* National Primary and Secondary Ambient Air Quality Standards for Lead, 43 Fed. Reg. 46,246, 46,250, 46,252, 46,254 (Oct. 5, 1978) (to be codified at 40 C.F.R. pt. 50) [hereinafter 1978 Lead Final Rule]; *see also* Livermore & Revesz, *Rethinking Health-Based Environmental Standards*, *supra* note 61, at 1203.
[169] *See* Livermore & Revesz, *Rethinking Health-Based Environmental Standards*, *supra* note 61, at 1203.
[170] 1978 Lead Final Rule, *supra* note 168, at 46,253.
[171] *See* Lead 1977 Proposed Rule, *supra* note 159, at 63,079.
[172] *See id*. Despite its use of a threshold model, EPA effectively opted to leave more than 20,000 children unprotected and likely subjected to levels of blood above 30 µg/dL. *See* Livermore & Revesz, *Rethinking Health-Based Environmental Standards*, *supra* note 61, at 1207 (citing to 1978 Lead Final Rule, *supra* note 168, at 46,255). Thus, even when the agency tried to set a threshold standard, it knowingly failed to set that standard at a level below which no adverse health effects occurred.
[173] *See* 1978 Lead Final Rule, *supra* note 168, at 46,253-54.

as much as 14.4 μg/dL,[174] from which the agency estimated a contribution of 12 μg/dL.[175] EPA then subtracted the nonair contributions from its target average blood level of 15 μg/dL, leading to a permissible air contribution of 3 μg/dL.[176]

EPA then needed to translate the target level of lead in blood into a limitation on lead in air, which is what the NAAQS regulate. To do so, EPA estimated the ratio of lead in air to lead in blood. Finally the agency divided by 2, the air-to-blood ratio it had selected.[177] The final standard set was a maximum allowable concentration of lead in the air of 1.5 $\mu g/m^3$.[178]

In 2008, EPA under President George W. Bush revisited its 1978 lead NAAQS determination and revised from 1.5 $\mu g/m^3$ to one tenth that amount; 0.15 $\mu g/m^3$.[179] EPA maintained its focus on young children, but shifted its focus from EP elevation to loss of IQ points. EPA did so because of a "general consensus" that these effects were among the most sensitive of lead's harms and of the greatest public concern.[180] Though EPA focused on loss of IQ points, EPA eliminated the "critical effect" language.[181]

In evaluating potential lead limits, EPA focused on measurements of lead in urban areas[182] where lead pollution and lead exposure is generally higher.[183] EPA chose three urban case studies: Cleveland, Chicago, and Los Angeles to measure ambient air quality.[184] EPA also included a "general urban case study," not based on a specific geographic area, but using simplifications to represent exposure of children in small residential areas near the current NAAQS.[185] Finally, EPA included a "primary smelter case study," based on a specific area not currently in compliance with NAAQS.[186] The agency analyzed each of these cases under alternative NAAQS, including the current standard, and calculated the median blood level associated with each scenario.[187] To convert each ambient air standard into a distribution of blood levels in children, EPA used two models that incorporated air, soil, and indoor dust estimations for each case study and separated sources of blood level into non-air related, "recent air," including ingesting ambient air and dust recently carried into the home, and "past air," air, including sources less immediately affected by a standard change, like ingesting outdoor soil and

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[174] *See id*.
[175] *See id*. at 46,254. One consequence of selecting the 12 μg/dL estimate for contribution was that individuals living in areas of the country in which non-air contribution exceeded 12 μg/dL were left unprotected by the threshold that EPA ultimately chose.
[176] *See id.*; Lead 1977 Proposed Rule, *supra* note 159, at 63,081.
[177] *See* 1978 Lead Final Rule, *supra* note 168, at 46,252, 46,254; Lead 1977 Proposed Rule, *supra* note 159, at 63,081.
[178] *See* 1978 Lead Final Rule, *supra* note 168, at 46,246.
[179] *See* 2008 Final Rule National Ambient Air Quality Standards for Lead, 73 Fed. Reg. at 66,964, 66,966 (Nov. 12, 2008) (to be codified at 40 C.F.R. pts. 50, 51, 53, 58) (hereinafter 2008 Lead Final Rule).
[180] *See* National Ambient Air Quality Standards for Lead, 73 Fed. Reg. 29,184, 29,198 (proposed May 20, 2008) (to be codified at 40 C.F.R. pts. 50, 51, 53, 58) (hereinafter 2008 Lead Proposed Rule).
[181] *See id.* at 29,198-29,207.
[182] *See id.* at 29,208.
[183] *See* Ronnie Levin et al., *Lead Exposures in U.S. Children, 2008: Implications for Prevention*, 116 ENVTL. HEALTH PERSP. 1285, 1289 (2008), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2569084/pdf/ehp-116-1285.pdf.
[184] *See* 2008 Lead Proposed Rule, supra note 179, at 29,210.
[185] *Id.* at 29,209.
[186] *Id.* at 29,209-10.
[187] *See id.* at 29,216.

dust.[188] For each blood level estimated as a result of a particular NAAQS scenario, EPA attempted to estimate what percentage of the blood level was attributable to air sources, with the lower bound of the estimate including only recent air sources and the upper bound including recent and past air sources.[189]

EPA then needed to translate blood levels into lost IQ points. EPA noted that the slope for effects on IQ is steeper at lower blood lead levels,[190] meaning that one additional unit of exposure at low levels has a greater health effect than one additional unit at higher levels. EPA suggested that one possible reason for this is that lead at low exposures might interfere with different biological mechanisms than lead at higher exposures, and the mechanisms affected at lower levels might be more easily saturated.[191]

Across the case study locations, at the then-current standard of 1.5 $\mu g/m^3$, the model showed a median loss of more than two IQ points, and an upper bound of four or more IQ points lost.[192] This is not a small risk: because this figure measures a *median* loss, the actual loss for certain individuals at the high end of the distribution could be much greater.[193] EPA also estimated the number of children in Cleveland, Chicago, and Los Angeles likely to lose between one and seven IQ points under the 1978 NAAQS regime, still in place at the time.[194] One model[195] predicted 395,528 children in Chicago, 13,857 in Cleveland, and 284,945 in Los Angeles would lose more than one IQ point.[196] In Chicago, 100,159 children were estimated to lose more than seven IQ points; in Cleveland, 1,858 children would suffer such losses; as would 57,834 children in Los Angeles.[197] As a result of the existing studies and risk assessment, the Administrator determined the current standard did not protect public health with an adequate margin of safety.[198]

Reviewing this data, a panel of the Clean Air Scientific Advisory Committee (CASAC), a

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[188] *See id*. at 29,210-11.
[189] *See id.* at 29,215.
[190] *See id.* at 29,201.
[191] *See* Environmental Protection Agency, *Air Quality Criteria for Lead*, EPA/600/R-5/144aF, at 8-66 (Oct. 2006), http://ofmpub.epa.gov/eims/eimscomm.getfile?p_download_id=459555.
[192] *See* 2008 Lead Proposed Rule, *supra* note 179, at 29,217.
[193] *See id.* at 29, 195 ("While levels in the U.S. general population, including geometric mean levels in children aged 1–5, have declined significantly, levels have been found to vary among children of different socioeconomic status . . . and other demographic characteristics . . For example, while the 2001–2004 median blood level for children aged 1–5 of all races and ethnic groups is 1.6 µg/dL, the median for the subset living below the poverty level is 2.3 µg/dL and 90th percentile values for these two groups are 4.0 µg/dL and 5.4 µg/dL, respectively. Similarly, the 2001–2004 median blood level for black, non-Hispanic children aged 1–5 is 2.5 µg/dL, while the median level for the subset of that group living below the poverty level is 2.9 µg/dL and the median level for the subset living in more well-off households (i.e., with income more than 200% of the poverty level) is 1.9 µg/dL. Associated 90th percentile values for 2001–2004 are 6.4 µg/dL (for black, non- Hispanic children aged 1–5), 7.7 µg/dL (for the subset of that group living below the poverty level) and 4.1 µg/dL (for the subset living in a household with income more than 200% of the poverty level).")
[194] *See id.* at 29,219.
[195] *See id.* (employing a log-linear model).
[196] *See id.* at 29,219-20.
[197] *See id.* at 29,220.
[198] *See id.* at 29,229.

non-partisan entity tasked with providing independent scientific advice to EPA,[199] advised EPA that a population IQ loss of 1-2 points represented a "highly significant" public health loss[200] and advised a standard "no higher than 0.2 μg/m^3."[201] Using the air-to-blood ratio and the concentration-response function, the Administrator determined in the final rule that 0.15 μg/m^3 would result in a mean IQ loss within the subset population below two points.[202]

Between 1978 and 2008, EPA's analysis shifted significantly with regard to the issue of thresholds.[203] In 1978, EPA adopted the CDC's threshold of 30 μg/dL as the "maximum safe blood lead level."[204] The agency's next steps were all premised on the assumption that so long as a child's blood level remained below this limit, adverse health effects would be avoided. In EPA's 2008 revision for lead, this premise was gone. The proposed rule explicitly stated that "the Administrator recognizes that [lead] can be considered a non-threshold pollutant."[205] Moreover, EPA noted in 2008 that the Center for Disease Control and Prevention recognized that no "safe" threshold for blood lead has been identified,[206] and stated that "[t]hreshold levels, in terms of blood [lead] levels in individual children, for neurological effects cannot be discerned from the currently available studies."[207] The agency acknowledged that there are effects from lead at very low levels,[208] and even asserted that the slope for effects on IQ is actually steeper at lower blood lead levels.[209] Further, though EPA based the final steps of its analysis around the "significant health effect" of loss of 1-2 IQ points, the agency did not claim that this was a level below which there are no health risks. The Administrator even acknowledged that standards would ideally be set so that no children would lose IQ points due to lead pollution.[210] The rule's Regulatory Impact Analysis (RIA), which examines the "the potential social benefits and social costs of a regulation,"[211] effectively reaffirmed these conclusions about risks below thresholds:

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[199] CASAC was established as part of the 1977 amendments "to review the criteria and standards promulgated [by EPA] and provide other related scientific and technical advice." Environmental Protection Agency, *EPA Clean Air Scientific Advisory Committee (CASAC): Charter*, https://yosemite.epa.gov/sab/sabproduct.nsf/WebCASAC/currentcharter?OpenDocument (last updated Sept. 21, 2015). By statute, CASAC is composed of seven members appointed by the EPA Administrator, "including at least one member of the National Academy of Sciences, one physician, and one person representing State air pollution control agencies." Clean Air Act, 42 U.S.C. § 7409(d)(2) (2012).

[200] 2008 Lead Proposed Rule, *supra* note 179, at 29,226.

[201] *Id.* at 29,241.

[202] *See* 2008 Lead Final Rule, *supra* note 179, at 67,005-06. Note that the proposed rule modeled the median loss of IQ points, whereas the final rule modeled the mean loss of IQ points.

[203] Though the 2008 method represents a significant shift, there are still concerns about this analysis. For a brief overview, see Livermore & Revesz, *Rethinking Health-Based Environmental Standards*, *supra* note 61, at 1214. The most significant issue is that the population IQ loss of 1-2 points is rather arbitrary. *Id.*

[204] 1978 Lead Final Rule, *supra* note 168, at 46,253.

[205] 2008 Lead Proposed Rule, *supra* note 179, at 29,244. This claim is reiterated in the final rule, albeit qualified by the possibility that thresholds may still exist at levels "at levels distinctly lower than the lowest exposures examined in these epidemiological studies." 2008 Lead Final Rule, *supra* note 179, at 66,999.

[206] *See* 2008 Lead Final Rule, *supra* note 179, at 66,972.

[207] *Id*. at 66,975.

[208] EPA "recognizes today that there is no level of [lead] exposure that can yet be identified, with confidence, as clearly not being associated with some risk of deleterious health effects.'' *Id.* at 66,992.

[209] *See id.* at 66,987.

[210] *See* 2008 Lead Proposed Rule, *supra* note 179, at 29,242.

[211] Environmental Protection Agency, *Regulatory Impact Analyses for Air Pollution Regulations*, https://www.epa.gov/economic-and-cost-analysis-air-pollution-regulations/regulatory-impact-analyses-air-pollution (last visited Dec. 18, 2017). The agency's RIAs include descriptions of social costs and benefits "that cannot be

While EPA ultimately adopted an updated standard of 0.15 μg/m^3, it had also analyzed the costs and benefits of a more stringent standard of 0.10 μg/m^3 [212] and found additional total benefits from moving to a 0.15 μg/m^3 level to a 0.10 μg/m^3 level to be between $1.1 billion and $1.7 billion.[213] These are benefits that would not exist below a true threshold. EPA acknowledged that the decision was ultimately a "public health policy judgment" because there is no "evidence- or risk-based bright line that indicates a single appropriate level."[214] Overall, this 2008 rulemaking reflected an important shift in how EPA regulates NAAQS pollutants: from assuming that there is a threshold below which no health effects will occur to acknowledging that the decision is ultimately a policy judgment because there is no exposure level where all risks can be avoided.[215]

C. Rejecting Thresholds and Calculating Benefits Below the NAAQS

EPA's rejection of thresholds for lead is not atypical. Across the range of criteria pollutants, EPA has moved toward a nonthreshold model. For many criteria pollutants, EPA has explicitly acknowledged—in some cases for decades—where it has evidence to suggest that NAAQS pollutants lack a threshold. Futher, for all but one of the criteria pollutants,[216] the

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quantified in monetary terms and a determination of the potential net benefits of the rule[,] including an evaluation of the effects that are not monetarily quantified." *Id.*

[212] *See* Environmental Protection Agency, *Regulatory Impact Analysis of the Proposed Revisions to the National Ambient Air Quality Standards for Lead*, at 1-7 (Oct. 2008), https://www3.epa.gov/ttn/ecas/docs/ria/naaqs-lead_ria_final_2008-10.pdf.

[213] *See id.* at ES-11. This number is the difference between the low estimate for the 0.10 μg/m^3 level and the 0.15 μg/m^3 level and the difference between the high estimates at those levels. Both estimates are calculated using a 3% discount rate, though EPA also calculates benefits and costs using a 7% discount rate. *Id.* However, economists generally find the 7% rate to be unrealistically high for air pollution estimates. *See* Newell, *Unpacking the Administration's Revised Social Cost of Carbon*, *supra* note 8. The benefits discussed in this section were all calculated using the 3% discount rate unless otherwise noted.

[214] 2008 Lead Final Rule, *supra* note 179, at 67,006.

[215] In 2016, EPA again reviewed the lead NAAQS and declined to adjust the standard, leaving in place the 0.15 μg/m^3 level. The agency noted that newly available evidence "reaffirms conclusions" from the 2008 NAAQS, and stated that the "currently available evidence is generally consistent with the evidence available in the last review." Review of the National Ambient Air Quality Standards for Lead, 81 Fed. Reg. 71,906, 71,907 (Oct. 18, 2016) (to be codified at 40 C.F.R. pt. 50). The agency also reiterated that the NAAQS were not a no-risk threshold. In reviewing the 2008 standard, EPA "recognize[ed] the continued lack of a discernible threshold of exposure associated with neurocognitive effects." *Id.* at 71,929. Moreover, the Administrator, responding to comments that there is no safe level of lead exposure, instead noted that she was not required by the Clean Air Act to establish a NAAQS with zero risk. *Id.* at 71,928. *See also* Joseph M. Feller, *Non-Threshold Pollutants and Air Quality Standards*, 24 ENVTL. L. 821, 824-25, 837 (1994) ("The absence of health or welfare thresholds is well-known not only to scientists but also to Congress, EPA, and the courts, which are often called on to oversee EPA's implementation of the Act. Nonetheless, attempts to deal rationally with the problems of air pollution are frustrated because the threshold assumption is built into the structure of the Act. . . . While recognizing that health-effects thresholds may not exist for some pollutants, EPA has nonetheless generally structured its NAAQS rulemakings as if they do.").

[216] EPA found benefits for every criteria pollutant for which has it performed an RIA in recent times. The sole exception is carbon monoxide: the agency reviewed the carbon monoxide NAAQS in 2011, but did not conduct an RIA. *See* Review of National Ambient Air Quality Standards for Carbon Monoxide, 78 Fed. Reg. 54,294 (Aug. 31, 2011) (to be codified at 40 C.F.R. pts. 50, 53 and 58). The most recent RIA for carbon monoxide was conducted in 1985. *See* Environmental Protection Agency, *Regulatory Impact Analysis of the National Ambient Air Quality Standards for Carbon Monoxide*, EPA-450/5-85-007, (July 1985), http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=2000NK80.TXT.

agency has calculated benefits from alternatives more stringent than what EPA ultimately selected as its standard, and it has done so under presidents from both parties.[217] That EPA finds additional benefits for levels more stringent than the NAAQS is inconsistent with the existence of a threshold for these pollutants: below a threshold there should be no additional benefits from reductions. This section surveys EPA's historical practices for ozone, carbon monoxide, nitrogen dioxide, and sulfur dioxide,[218] revealing the agency's consistent calculations of benefits below NAAQS levels and its more explicit finding on the lack of evidence of thresholds. A similar analysis for particulates follows in Part III.

As early as 1979, EPA began to acknowledge the difficulty of identifying thresholds for criteria pollutants. In its revision for ozone, President Jimmy Carter's EPA noted that the rule's "criteria document supports the contention that a clear threshold of adverse health effects cannot be identified with certainty for ozone."[219] In revising that standard, EPA under President George H.W. Bush concluded that "[t]here appears to be no threshold level below which materials damage will not occur, exposure of sensitive materials to any non-zero concentration of O_3 (including natural background levels) can produce effects if the exposure duration is sufficiently long."[220] In its 1997 review for ozone, President Bill Clinton's EPA went even further. The agency recognized "O_3 may elicit a continuum of biological responses down to background concentrations."[221] In stark terms, the agency noted that, "in the absence of any discernible threshold, it is not possible to select a level below which absolutely no effects are likely to occur. . . [or] to identify a level at which it can be concluded with confidence that no 'adverse' effects are likely to occur."[222] In 2008, the George W. Bush EPA's final rule for ozone repeatedly confirmed that "the underlying scientific evidence is [not] certain enough to support a focus on any single bright line benchmark level."[223] The rule's Regulatory Impact Analysis explicitly

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[217] These calculations are part of EPA's efforts to comply with Executive Order 12,866, issued during the Clinton Administration, and OMB Circular A-4, issued during the George W. Bush Administration. *See* Environmental Protection Agency, *Final Regulatory Impact Analysis (RIA) for the NO_2 National Ambient Air Quality Standards (NAAQS)*, at ES-2 (Jan. 2010), https://www3.epa.gov/ttn/ecas/docs/ria/naaqs-no2_ria_final_2010-01.pdf (discussing these documents as presenting "guidelines for EPA to assess the benefits and costs of the selected regulatory option, as well as one less stringent and one more stringent option.").

[218] The additional benefits for more stringent lead standards were discussed as part of the case study in Part II.B, while the benefits for additional particulate matter reductions are discussed in depth *infra* Part III.

[219] Revisions to the National Ambient Air Quality Standards for Photochemical Oxidants, 44 Fed. Reg. 8,202, 8,213 (Feb. 8, 1979) ("Rather, there is a continuum consisting of ozone levels at which health effects are certain, through levels at which scientists can generally agree that health effects have been clearly demonstrated, and down to levels at which the indications of health effects are less certain and harder to identify.").

[220] Proposed Rule for National Ambient Air Quality Standards for Ozone, 57 Fed. Reg. 35,542, 35,553 (Aug. 10, 1992) (to be codified at 40 C.F.R. pt. 50).

[221] National Ambient Air Quality Standards for Ozone, 62 Fed. Reg. 38,856, 38,863 (July 18, 1997) (to be codified at 40 C.F.R. pt. 50).

[222] *Id.*

[223] National Ambient Air Quality Standards for Ozone, 73 Fed. Reg. 16, 436, 16,465, 16,747, 16,476-77, 16,481-82 (Mar. 27, 2008) (to be codified at 40 C.F.R. pts. 50 and 58). Moreover, the rule noted that, in light of the continuum of effects associated with varying levels of exposure to ozone, adverse health effects are "related to the actual magnitude of the O_3 concentration, not just whether the concentration is above a specified level." *Id.* at 16, 475. The Administrator recognized "that exposures of concern must be considered in the context of a continuum of the potential for health effects of concern, and their severity, with increasing uncertainty associated with the likelihood of such effects at lower O_3 exposure levels." *Id.* at 16,465, 16,466.

noted that "ozone is a non-threshold pollutant."[224] In 2015, EPA under President Obama noted in its final rule for ozone that "[f]rom the inception of the NAAQS standard-setting process, EPA and the courts have acknowledged that scientific uncertainties in general, and the lack of clear thresholds in pollutant effects in particular, preclude any [] definitive determinations."[225] Similarly, the rule's Integrated Science Assessment stated more explicitly the agency's "overall conclusion[] that the epidemiologic studies . . . indicated a generally linear [concentration-response] function with no indication of a threshold. . . ."[226]

EPA in 2008 also included benefits calculations for levels below the standard set by the regulation. While EPA selected a standard of 75 ppb,[227] the agency also analyzed a more stringent standard of 70 ppb—the level later selected by the Obama Administration in 2015—as well as an even more stringent 65 ppb standard.[228] The agency provided third-party estimates of benefits for its chosen standard of 75 ppb which ranged from $2 billion to $19 billion in 2020.[229] For a more stringent standard of 70 ppb, the agency estimated benefits of $3.5 billion to $37 billion.[230] For the most stringent standard of 65 ppb, EPA included estimates of benefits ranging from $5.5 billion to $58 billion in 2020.[231]

In its 2015 RIA, EPA again calculated benefits for reductions in ozone below its chosen NAAQS level. In the RIA analyszing a revision of the secondary standard for ozone from 75 to 70 ppb,[232] EPA provided an analysis of the benefits of a 70ppb standard and an alternative of 65 ppb.[233] The agency estimated the benefits of the 70 ppb level to be between $2.9 and $5.9 billion in 2025, and the benefits of a 65ppb level to be between $15 and $30 billion over the same period.[234] Further, the agency found that in 2025, the 70 ppb standard would prevent between 96 and 160 ozone-related premature deaths and 220 to 500 particulate matter-related premature deaths. However, the 65 ppb level would prevent between 490 and 820 ozone-related deaths and between 1,100 and 2,500 particulate matter-related deaths.[235]

In its 1985 revision for nitrogen dioxide, the Reagan EPA asserted a qualified rejection of NO_2 thresholds, stating that "none of the evidence presented in the Criteria Document shows a

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[224] Environmental Protection Agency, *Final Ozone NAAQS Regulatory Impact Analysis*, at 6-30 (Mar. 2008), https://www3.epa.gov/ttn/ecas/docs/ria/naaqs-o3_ria_final_2008-03.pdf.
[225] National Ambient Air Quality Standards for Ozone, 80 FR 65,292, 65,355 (to be codified at 40 C.F.R. Parts 50, 51, 52, 53, and 58) (Oct. 26, 2015).
[226] *Id.* at 65,309.
[227] *See* Environmental Protection Agency, *Final Ozone NAAQS Regulatory Impact Analysis*, *supra* note 224, at ES-1.
[228] *See id*.
[229] *See id*. at 7-3, Table 7.1a.
[230] *See id*. at 7-3, Table 7.1c.
[231] *See id*. at 7-4, Table 7.1d.
[232] *See* Environmental Protection Agency, *Regulatory Impact Analysis of the Final Revisions to the National Ambient Air Quality Standards for Ground-Level Ozone*, EPA-452/R-15-007, at 1-1 (Sept. 2015), https://www3.epa.gov/ttn/ecas/docs/ria/naaqs-o3_ria_final_2015-09.pdf. The standard was set with an averaging time of 8 hours and the form of annual fourth-highest daily maximum averaged over three years. *See id*.
[233] *See id*. at ES-2.
[234] *See id*. at ES-15, Table ES-5. These figures were calculated at a 7% discount rate as EPA only summarized benefits at the 7% discount rate. *Id*.
[235] *See id.* at ES-16, Table ES-6.

clear threshold of adverse health effects for NO_2."[236] As it had done six years earlier with ozone, the agency described adverse health effects from nitrogen dioxide exposure as occupying "a continuum, ranging from NO_2 levels at which health effects are undisputed, through levels at which many, but not all scientists generally agree that health effects have been convincingly shown, down to levels at which the indications of health effects are less certain and more difficult to identify."[237] In the 2010 update to that standard, the Obama EPA noted that "[t]he meta-analysis does not provide any evidence of a threshold below which effects do not occur."[238] The revision's Integrated Science Assessment also "concluded that NO_2 epidemiologic studies provide 'little evidence of any effect threshold'" and that "concentration-response relationships… appear linear."[239] That 2010 review prompted EPA to set at new short-term NO_2 standard of 100 parts per billion (ppb), based on the 3-year average of the 98th percentile of 1-hour daily maximum concentrations.[240]

The agency in 2010 also found additional benefits for reductions in nitrogen dioxide below NAAQS levels. In addition to its 100 ppb standard, EPA also analyzed a lower, more stringent level of 80ppb.[241] At and above 100 ppb, according to the controlled human exposure studies, increased airway responsiveness was observed in "a large percentage of asthmatics."[242] However, EPA acknowledged that people with more severe asthma would be expected to experience symptoms at concentrations below the 100 ppb standard.[243] The agency calculated that there would be an additional $3.2 to $8.6 million in benefits in 2020 for an 80 ppb standard than there are under the 100 ppb standard EPA chose.[244]

The primary sulfur dioxide NAAQS standard was most recently revised under the Obama Administration in 2010. The final rule recognized that "the available health effects evidence reflects a continuum consisting of ambient levels of SO_2 at which scientists generally agree that health effects are likely to occur, through lower levels at which the likelihood and magnitude of the response become increasingly uncertain."[245]

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[236] Retention of the National Ambient Air Quality Standards for Nitrogen Dioxide, 50 Fed. Reg. 25,532, 25,537 (June 19, 1985) (to be codified at 40 C.F.R. pt. 50).
[237] *Id.* The agency went on to note that there was uncertainty, acknowledinging that based on evidence available at the time, "[t]his does not necessarily mean that there is no threshold, other than zero, for NO_2 related health effects; it simply means no precise threshold can be identified with certainty based on existing medical evidence." *Id.*
[238] Primary National Ambient Air Quality Standards for Nitrogen Dioxide, 75 Fed. Reg. 6,474, 6,500 (Feb. 9, 2010) (to be codified at 40 C.F.R. pts. 50 and 58).
[239] *Id.* at 6,480; *see also id.* at 6,500 (stating that ISA's "meta-analysis does not provide any evidence of a threshold below which effects do not occur"). For further discussion of EPA's acknowledgment of scienfitic "uncertainty" of thresholds, see *infra* Part III.C.
[240] *See* Environmental Protection Agency, *Final Regulatory Impact Analysis (RIA) for the NO_2 National Ambient Air Quality Standards (NAAQS)*, at ES-1 (Jan. 2010), https://www3.epa.gov/ttn/ecas/docs/ria/naaqs-no2_ria_final_2010-01.pdf.
[241] *See id*.
[242] Livermore & Revesz, *Rethinking Health-Based Environmental Standards*, *supra* note 61, at 1218.
[243] *See id.* at 1218.
[244] *See* Environmental Protection Agency, *Final Regulatory Impact Analysis (RIA) for the NO_2 National Ambient Air Quality Standards (NAAQS)*, *supra* note 240, at ES-6, ES-7. This is at the 65% gradient, which was the level EPA chose in its final regulation. *See id*.
[245] Primary National Ambient Air Quality Standard for Sulfur Dioxide, 75 Fed. Reg. 35,520, 35,529 (June 22, 2010) (to be codified at 40 C.F.R. pts. 50, 53, and 58).

As part of these regulations, EPA set a new standard of 75 ppb, based on the 3-year average of the 99th percentile of 1-hour daily maximum concentrations,[246] but also analyzed alternative primary standards of 50 ppb.[247] At the 75 ppb level, EPA found $2.2 million in benefits, including 260 fewer emergency room visits for respiratory symptoms.[248] At the lower 50 ppb level, EPA calculated $8.5 million in benefits, including 930 fewer such emergency room visits.[249] The agency also calculated that a 50ppb standard could have yielded as much as $46 billion in additional $PM_{2.5}$ co-benefits compared to the 75 ppb standard.[250]

In its 2011 revision for carbon monoxide, the Obama EPA recognized carbon monoxide pollution as similarly exhibiting a "continuum" of adverse health effects with varying degrees of certainty.[251] The agency highlighted two studies that were unable to discern a threshold for cardiovascular effects from carbon monoxide exposure.[252] The rule's Integrated Science Assessment concluded that "[e]pidemiologic analyses investigating the exposure-response relationship for mortality and cardiovascular morbidity did not find evidence for a departure from linearity or a threshold for CO effects."[253]

In short, EPA has moved away from the "critical effect" language it originally developed for NAAQS pollutants in 1978 and which might have suggested a threshold,[254] and since the late 1970s has openly rejected the threshold assumption for criteria pollutants on the basis of advances in the scientific understanding of these pollutants. EPA also calculates benefits for criteria pollutant reductions below the levels at which the agency chose for each of the most

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[246] *See id.* at 35,524.

[247] *See* Environmental Protection Agency, *Final Regulatory Impact Analysis (RIA) for the SO_2 National Ambient Air Quality Standards (NAAQS)*, at ES-1 (June 2010), https://www3.epa.gov/ttn/ecas/docs/ria/naaqs-so2_ria_final_2010-06.pdf.

[248] *See id*. at 5-21, Table 5.5. These figures represent "the incidences of health effects and monetized benefits of attaining the alternative standard levels by health endpoint. Because all health effects from SO_2 exposure are expected to occur within the analysis year, the monetized benefits for SO_2 [for these figures] do not need to be discounted. Please note that these benefits do not include any of the benefits listed as 'unquantified' . . . nor do they include the PM co-benefits . . ." *Id.* at 5-20.

[249] *See id*.

[250] *See id.* at 5-31 (comparing estimates in particulate matter co-benefits calculated in the Laden study, using a 3% discount rate).

[251] *See* National Ambient Air Quality Standards for Carbon Monoxide, 76 Fed. Reg. 54,294, 54,308 (Aug. 31, 2011) (to be codified at 40 C.F.R. pts. 50, 53, and 58) ("These judgments are informed by the recognition that the available health effects evidence generally reflects a continuum, consisting of ambient levels at which scientists generally agree that health effects are likely to occur, through lower levels at which the likelihood and magnitude of the response become increasingly uncertain.").

[252] *See id.* at 54,300 ("Among the controlled human exposure studies, the ISA places principal emphasis on the study of CAD patients by Allred et al. (1989a, 1989b, 1991) (which was also considered in the previous review) for the following reasons: (1) Dose-response relationships were observed; (2) effects were observed at the lowest COHb levels tested (mean of 2–2.4% COHb following experimental CO exposure), with no evidence of a threshold."). EPA later in the same section on "Cardiovascular Effects" notes that "an important finding of the multilaboratory study was the dose-response relationship observed between COHb and the markers of myocardial ischemia, with effects observed at the lowest increases in COHb tested, without evidence of a measurable threshold effect." *Id*.

[253] Environmental Protection Agency, *Integrated Science Assessment for Carbon Monoxide*, EPA/600/R-09/019F, at 2-16 (Jan. 2010), http://ofmpub.epa.gov/eims/eimscomm.getfile?p_download_id=494432.

[254] *See supra* notes 160-169 and accompanying text; *supra* notes 180-181 and accompanying text.

recent NAAQS.[255] All of this is flatly inconsistent with the notion, advanced by the Trump Administration and by other opponents to Obama era regulations in litigation,[256] that the NAAQS standards represent a no-harm threshold for criteria pollutants, and that Obama-era rules inflated benefits in ways inconsistent with historical EPA practices by quantifying the benefits of reductions in NAAQS pollutants below the NAAQS.

III
CALCULATING HEALTH BENEFITS FROM PARTICULATE REDUCTIONS BELOW THE NAAQS

Critics of climate change regulations argue that particulate reduction benefits do not exist below the NAAQS standards, which they characterize as a no-harm threshold.[257] According to adherents of this view, "[b]oth theory and data suggest that thresholds exist below which further reductions in exposure to $PM_{2.5}$ do not yield changes in mortality response and that one should expect diminishing returns as exposures are reduced to lower and lower levels."[258] Similarly, the Heartland Institute, which bills itself as "the world's most prominent think tank promoting skepticism about man-made climate change,"[259] advocates "the widely held belief among scientists and health experts, supported by ample research, that some threshold must exist below which pollution has no health impact. That belief is often summarized as '[t]he dose makes the poison.'"[260] More recently, it has deemed $PM_{2.5}$ "a favorite new bogeyman"[261] of EPA, and thresholds the result of "a fabricate[d] disease entity [of] post-modern pseudo-science."[262] The National Mining Association advanced the same line of reasoning in *Michigan v. EPA* in its challenge to the Mercury and Air Toxics Standards: "EPA concedes that most of these benefits supposedly result from reducing [particulate matter] concentrations to below the level that EPA set in its $PM_{2.5}$ NAAQS. . . . But EPA set the [particulate matter] NAAQS, as it set all of the

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[255] Note that EPA did not calculate benefits for carbon monoxide, the lone exception to this pattern, as EPA did not produce a new RIA. *See supra* note 117.
[256] *See supra* notes 24-30. Moreover, this argument is not supported by science. *See infra* notes 355-370and accompanying text.
[257] *See supra* note 21.
[258] Susan E. Dudley, *OMB's Reported Benefits of Regulation: Too Good to Be True?*, REGULATION, July 8, 2013, at 28, http://www.cato.org/sites/cato.org/files/serials/files/regulation/2013/6/regulation-v36n2-4.pdf.
[259] *Arthur B. Robinson Center on Climate and Environmental Policy: About*, Heartland Inst., https://www.heartland.org/Center-Climate-Environment/About/index.html (last visited Jan. 1, 2018).
[260] Jay Lehr, *Warning: New HEI Report on PM10 Easy to Misinterpret*, HEARTLAND INST. (June 17, 2004), https://www.heartland.org/news-opinion/news/warning-new-hei-report-on-pm10-easy-to-misinterpret?source=policybot; *see also* Paul Driessen, *EPA's Dangerous Regulatory Pollution*, HEARTLAND INST. (Sept. 6, 2016), https://www.heartland.org/news-opinion/news/epas-dangerous-regulatory-pollution ("How can it be that $PM_{2.5}$ particulates are dangerous or lethal for Americans in general, every time they step outside—but harmless to human guinea pigs [in EPA experiments] who were intentionally administered pollution dozens of times worse than what they would encounter outdoors? How can it be, as EPA-funded researchers now assert, that 'acute, transient responses seen in clinical studies cannot necessarily be used to predict health effects of chronic or repeated exposure'—when that is precisely what EPA claims they can and do show?"). The Heartland Institute now asserts that EPA's $PM_{2.5}$ science constitutes "an attempted takeover of absolutely all industry in the United States," despite "[t]he best scientific research show[ing] these particles are ubiquitous and, contrary to EPA's claims, . . . harmless." H. Sterling Burnett, *EPA Air Quality Research, Regulations Flawed, Study Finds*, HEARTLAND INST. (Aug. 23, 2017), https://www.heartland.org/news-opinion/news/epa-air-quality-research-regulations-flawed-study-finds.
[261] Charles Battig, *Driving Policies Through Fraud and Fear-Mongering*, HEARTLAND INST. (July 10, 2015), https://www.heartland.org/news-opinion/news/driving-policies-through-fraud-and-fear-mongering?source=policybot.
[262] *Id.*

NAAQS, at a level that is 'requisite to protect the public health' with a margin of safety and without considering compliance costs."[263] In other words, the National Mining Association asserts, if EPA followed its mandate to regulate particulate matter to the extent required under the NAAQS regime, then there would be no benefits below the NAAQS standard because the NAAQS standard would be set at the point at which benefits would not accrue below it. Either, they assert, EPA has not appropriately set the particulate matter NAAQS standard with the requisite margin of safety or the asserted co-benefits of particulate matter reduction are nonexistent.

Opponents also challenge the science underlying EPA's calculation of additional benefits from pollution reduction below the NAAQS. EPA's use of a linear, non-threshold approach for low-level PM concentrations[264] has been criticized as "highly imprecise" and guilty of "cherrypicking" epidemiology studies en route to a "biased assessment of the available data."[265] Moreover, EPA's assertion of benefits from particulate matter have been deemed "illusory";[266] based on "empty generalities and speculative claims";[267] "based on questionable assumptions and . . . likely overstated";[268] "specious";[269] and "employ[ing] a methodology that places a thumb on the scale at every step of its benefit calculations and that regularly eschews real data in place of unrealistic assumptions and wild speculations."[270] These purported benefits are allegedly "vague[,] un-monetized,"[271] and "too speculative,"[272] with the implication that if they are too uncertain to be quantified, they are too uncertain to be contemplated at all. The agency simply "cannot quantify them [because] they are not supported by the scientific literature."[273]

Benefits from particulate matter reductions are thus a key battleground in the fight over major Obama era Clean Air Act rules, and will almost certainly be a point of contention over future climate change regulations. Because of the size of these benefits, both in absolute terms and in comparison with other regulatory effects, there is a substantial incentive for both sides to misrepresent them, and a critical need to get these estimates right. The following section describes the robust scientific basis for EPA's determination that particulate matter lacks a threshold below which adverse health effects occur.

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[263] Opening Brief of Petitioner the National Mining Association at 41 n.19, Michigan v. EPA, 135 S. Ct. 2699 (2015) (No. 14-46), 2015 WL 294672 (internal citations omitted).
[264] *See* National Ambient Air Quality Standards for Particulate Matter, 78 Fed. Reg. 3,086, 3,119 (Jan. 13, 2013) (to be codified at 40 C.F.R. pts. 50, 51, 52, 53 and 58); *infra* notes 347-348 and accompanying text.
[265] Brief for the Cato Institute as Amicus Curiae in Support of Petitioners at 25, Michigan v. EPA, 135 S. Ct. 2699 (2015) (No. 14-46), 2015 WL 412058.
[266] Opening Brief of State and Industry Petitioners at 51, Murray Energy Corp. v. EPA, No. 16-1127 (D.C. Cir. filed Nov. 18, 2016).
[267] *Id.* at 56.
[268] Brief of the Chamber of Commerce of the United States of America, the National Association of Manufacturers, the National Federation of Independent Business, and the National Association of Home Builders as Amici Curiae in Support of Petitioners at 22 n.15, Michigan v. EPA, 135 S. Ct. 2699 (2015) (Nos. 14-46, 14-47, 14-49), 2015 WL 428995.
[269] Brief of Amicus Curiae Cato Institute in Support of Petitioners at 4, Murray Energy Corp. v. EPA, No. 16-1127 (D.C. Cir. filed Nov. 18, 2016).
[270] *Id.*
[271] Opening Brief of State and Industry Petitioners at 55, Murray Energy Corp. v. EPA, No. 16-1127 (D.C. Cir. filed Nov. 18, 2016).
[272] *Id.* at 56.
[273] *Id.*

A. Scientific Basis

Particulate matter (PM) is a mixture of very small particles and liquid droplets that are found in the air. Some particles including dust, dirt, soot, and smoke are large enough to be visible, while others are too small to be seen with the naked eye.[274] Exposure to particulate matter can have negative effects on lung and heart health, including coughing or difficulty breathing, aggravating asthma and decreased lung function, as well as heart attacks and irregular heartbeat. Exposure can be deadly, particularly for people with heart or lung disease.[275]

EPA regulates particulate matter under two standards, which are based on the size of the particulate matter particles. Extremely small particles, those measuring 2.5 micrometers or less, are regulated under the $PM_{2.5}$ standards, while larger particles measuring between 2.5 and 10 micrometers are regulated under the PM_{10} standards. The current standards for particulate matter set limits on $PM_{2.5}$ of 35 $\mu g/m^3$ averaged over 24 hours and of 12 $\mu g/m^3$ averaged annually.[276] The PM_{10} standard is a 24-hour average of 150 $\mu g/m^3$, and there is no annual standard.[277]

These standards do not represent the level at which there are no health effects from particulate matter exposure. The science on benefits from reductions in particulate matter below the NAAQS, some of which is summarized in this section, is robust. In general, the evidence suggests there is no threshold for particulate matter, which means that risk from particulate matter exists at every level of exposure.[278]

For example, in 2006, EPA solicited a report of judgments from experts on the concentration response relationship between small particulate matter particles ($PM_{2.5}$) and mortality.[279] The twelve experts who participated were selected through a peer-nomination process and included experts in epidemiology, toxicology, and medicine.[280] As part of this study, the experts were asked about their views on the concentration-response function, which measures health effects at different levels of exposure.[281] While all experts believed that individuals may exhibit thresholds for PM-related mortality, eleven of the twelve rejected the idea of a population

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[274] *See* Environmental Protection Agency, *Particulate Matter (PM) Basics: What Is PM, and How Does It Get into the Air?*, https://www.epa.gov/pm-pollution/particulate-matter-pm-basics#PM (last updated Sept. 12, 2016).
[275] *See* Environmental Protection Agency, *Health and Environmental Effects of Particulate Matter (PM)*, https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm (last updated July 1, 2016).
[276] *See* National Ambient Air Quality Standards for Particulate Matter, 78 Fed. Reg. 3086, 3086 (Jan. 13, 2013) (to be codified at 40 C.F.R. pts. 50, 51, 52, 53 and 58).
[277] *See id.* at 3,089.
[278] It is well beyond the scope of this article to comprehensively review and independently evaluate all of the scientific research on the relationship between particulate matter exposure and negative health outcomes. The research presented here thus focuses primarily on aggregated reports written by scientists, doctors, and other experts on the effects of particulate matter on human health. In doing so, the authors defer to the expertise of these writers and their judgments in aggregating and analyzing evidence on the health effects of particulate matter.
[279] *See* Industrial Economics, Inc., *Expanded Expert Judgment Assessment of the Concentration-Response Relationship Between $PM_{2.5}$ Exposure and Mortality*, at i-ii (Sept. 21, 2006), https://www3.epa.gov/ttnecas1/regdata/Uncertainty/pm_ee_report.pdf (documenting "expert judgments concerning the impact of a one $\mu g/m^3$ change in ambient, annual average $PM_{2.5}$ on annual, adult, all-cause mortality in the U.S.")
[280] *See id*. at ii.
[281] *See id*. at iv.

threshold, stating that was is insufficient evidence to support such a threshold.[282] Seven experts noted that a population threshold was unlikely due to variations in susceptibility as a result of genetic, environmental, and socioeconomic factors.[283] The single expert who believed it was possible to make a conceptual argument for a population threshold noted that he did not believe such a threshold was detectable in currently available epidemiologic studies.[284] This expert also stated that he was 50 percent certain a population threshold existed, and that if there were a threshold, he thought there was an 80 percent chance the threshold would be less than 5 $\mu g/m^3$, and a 20 percent chance that it would fall between 5 and 10 $\mu g/m^3$.[285] Both levels cited by the expert are lower than the current NAAQS levels for $PM_{2.5}$ of 12 $\mu g/m^3$.[286]

A 2010 scientific report from the American Heart Association reached similar conclusions.[287] The authors of that report included specialists in a wide range of disciplines including cardiovascular and environmental epidemiology and statistics, atmospheric sciences, cardiovascular and pulmonary medicine, basic science research, and public policy.[288] The report comprehensively reviewed studies, published between 2004 to 2009, on the relationship between particulate matter and heart health.[289] The report concluded that there "appeared to be no lower-limit threshold below which PM_{10} was not associated with excess [cardiovascular] mortality."[290] With regard to $PM_{2.5}$, the report stated that there appeared to be a linear concentration-response relationship between the small particles and mortality risk without a discernible safe threshold.[291] The report suggested that an area for future research was determining whether there is any safe PM threshold that protects both healthy and susceptible individuals,[292] but noted that current evidence reviewed supports the conclusion that there is overall no safe threshold.[293]

The American Thoracic Society (ATS) in a 2016 article likewise reported adverse health effects below NAAQS standards.[294] ATS recommended an annual standard for $PM_{2.5}$ of 11 $\mu g/m^3$, which is lower than the current NAAQS requirements. The report estimated the health impacts from PM exposure in places that violated the ATS annual standard, including places in compliance with EPA's requirements. The report found that relative to current particulate matter

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[282] *See id*. at 3-25. For the discussion of the difference between individual and population thresholds, see *supra* notes 123-125 and accompanying text.
[283] *See id*.
[284] *See id*. at 3-25, 3-26.
[285] *See id*. at 3-26.
[286] *See* National Ambient Air Quality Standards for Particulate Matter, 78 Fed. Reg. 3,086, 3,157 (Jan. 15, 2013) (to be codified at 40 C.F.R. pts. 50, 51, 52, 53 and 58).
[287] *See* Robert D. Brook, et al., *Particulate Matter Air Pollution and Cardiovascular Disease: An Update to the Scientific Statement from the American Heart Association*, 121 CIRCULATION 2331, 2338 (2010).
[288] *See id*. at 2332.
[289] *See id*.
[290] *Id*. at 2338.
[291] *See id*. at 2350-51.
[292] *See id*. at 2366.
[293] *See id*. at 2365.
[294] *See* Kevin R. Cromer et al., *American Thoracic Society and Marron Institute Report Estimated Excess Morbidity and Mortality Caused by Air Pollution Above American Thoracic Society-Recommended Standards, 2011–2013*, 13 ANNALS AM. THORACIC SOC. 1195, 1201 (2016).

levels across the country,[295] an estimated 2913 deaths and 5543 instances of morbidity would be avoided if the 11 μg/m^3 were met.[296] The report also noted that "this does not imply that further health benefits would not be achieved by still further reductions to pollution levels," relying in part on EPA's own statement that there is no epidemiological evidence of a threshold for PM.[297]

The Harvard School of Public Health "Six Cities Study"[298] and an American Cancer Society Study[299] are two key studies in the evaluation of particulate matter exposure health impacts, and both have been extensively relied upon by EPA in its particulate matter NAAQS rulemakings. Both studies include follow up research; the Six Cities study was originally published in 1993, with follow up research released in 2006 and again in 2012; the ACS study was released in 1995 and updated in 2002 and 2004.[300] These studies were cited by the Bush EPA in the 2006 particulate matter NAAQS,[301] by all experts solicited in the 2006 EPA expert solicitation,[302] and were also relied upon by the Obama Administration in the 2016 particulate matter NAAQS,[303] the Mercury and Air Toxics Standards,[304] the Clean Power Plan,[305] and the Cross Border Air Pollution Rule.[306] The Bush EPA noted that "these studies have found consistent relationships between fine particle indicators and premature mortality across multiple locations in the United States."[307] EPA summarized in the Cross Border rule that the authors of

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[295] Note that many parts of the United States violate the current NAAQS levels. *Id.* at 1196-97. As such these estimates reflect cumulative effects of current violations of NAAQS standards plus the benefits of lowering the $PM_{2.5}$ from the current 12 μg/m^3 to 11 μg/m^3, as recommended by the American Thoracic Society. *See id*.
[296] *See id*. at 1198.
[297] *Id*. at 1201
[298] Douglas W. Dockery et al., *An Association Between Air Pollution and Mortality in Six U.S. Cities*, 329 NEW ENG. J. MED. 1753 (1993).
[299] C. Arden Pope III et al., *Particulate Air Pollution as a Predictor of Mortality in a Prospective Study of U.S. Adults*, 151 AM. J RESPIRATORY & CRITICAL CARE MED. 669 (1995).
[300] *See* Environmental Protection Agency, *Regulatory Impact Analyses for the Final Revisions to the National Ambient Air Quality Standards for Particulate Matter*, EPA-452/R-12-005, at 1-12 (Dec. 2012), https://www3.epa.gov/ttn/ecas/docs/ria/naaqs-pm_ria_final_2012-12.pdf [hereinafter 2012 PM RIA] ("Since the proposed rule, the EPA has incorporated an array of policy and technical updates to the benefits analysis approach applied in this RIA, including incorporation of the most recent follow-up to the Harvard Six Cities cohort study (Lepeule et al., 2012)."); Environmental Protection Agency, *Regulatory Impact Analyses for the Review of Particulate Matter National Ambient Air Quality Standards*, at 5-27 (Oct. 6, 2006), https://www3.epa.gov/ttn/ecas/docs/ria/naaqs-pm_ria_final_2006-10.pdf [hereinafter 2006 PM RIA] ("The most extensive analyses have been based on data from two prospective cohort groups, often referred to as the Harvard "Six-Cities Study" (Dockery et al., 1993; Laden et al, 2006) and the "American Cancer Society or ACS study" (Pope et al., 1995; Pope et al, 2002; Pope et al, 2004)…").
[301] *See* 2006 PM RIA, *supra* note 300, at 5-27.
[302] *See* Industrial Economics, Inc., *Expanded Expert Judgment Assessment of the Concentration-Response Relationship Between $PM_{2.5}$ Exposure and Mortality*, *supra* note 279, at viii.
[303] *See* 2012 PM RIA, *supra* note 300, at 1-12.
[304] *See* MATS RIA, *supra* note 17, at 5-27.
[305] *See* Environmental Protection Agency, *Regulatory Impact Analysis for the Clean Power Plan Final Rule*, *supra* note 18, at 4-16, 4-17.
[306] *See* Environmental Protection Agency, *Regulatory Impact Analysis for the Federal Implementation Plans to Reduce Interstate Transport of Fine Particulate Matter and Ozone in 27 States; Correction of SIP Approvals for 22 States*, at 98-100 (June 2011), https://www3.epa.gov/ttn/ecas/docs/ria/transport_ria_final-csapr_2011-06.pdf; Environmental Protection Agency, *Regulatory Impact Analysis of the Cross-State Air Pollution Rule (CSAPR) Update for the 2008 National Ambient Air Quality Standards for Ground-Level Ozone*, EPA-452/R-16-004, at 5-11 to 5-13, https://www3.epa.gov/ttn/ecas/docs/ria/transport_ria_final-csapr-update_2016-09.pdf.
[307] 2006 PM RIA, *supra* note 300, at 5-27.

the 2012 Six Cities follow-up "found significant associations between $PM_{2.5}$ exposure and increased risk of premature all-cause, cardiovascular and lung cancer mortality" and concluded that "the [concentration-response] relationship was linear down to $PM_{2.5}$ concentrations of 8 $\mu g/m^3$."[308] This level is substantially lower than 12 $\mu g/m^3$, the current NAAQS annual standard for particulate matter.[309]

Experts outside of the EPA have also relied on the findings of the "Six Cities Study" and the American Cancer Society Study to support their holdings that particulate matter is a no threshold pollutant. In 2002, relying on the American Cancer Society Study, the National Research Council's Committee on estimating the Health-Risk-Reduction Benefits of Proposed Air Pollution Regulations[310] concluded that "there is no evidence . . . for any indication of a threshold" for particulate matter.[311] Additionally, the Health Effects Subcommittee of the Advisory Council on Clean Air Compliance Analysis relied on both the Six Cities Study and the American Cancer Society Study to conclude that it "fully supports EPA's use of a no-threshold model to estimate the mortality reductions associated with reduced PM exposure." [312] It reasoned that EPA's decision "is supported by the data, which are quite consistent in showing effects down to the lowest measured levels."[313] And, a 2008 follow-up to the Harvard Six Cities study, found that there was an eighty six percent probability that $PM_{2.5}$ followed a linear no-threshold model.[314] This report explained that a "key finding of this study is that there is little evidence for a threshold in the association between exposure to fine particles and the risk of death on follow-up."[315] Instead of reducing PM concentration by relying on "an arbitrary standard," such as a threshold model, the study recommended "reduc[ing] particle concentration everywhere, at all times, to the extent feasible and affordable."[316]

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[308] Environmental Protection Agency, *Regulatory Impact Analysis of the Cross-State Air Pollution Rule (CSAPR) Update for the 2008 National Ambient Air Quality Standards for Ground-Level Ozone*, *supra* note 306, at 5-13.
[309] National Ambient Air Quality Standards for Particulate Matter, 78 Fed. Reg. 3,086, 3,086 (Jan. 13, 2013) (to be codified at 40 C.F.R. pts. 50, 51, 52, 53 and 58).
[310] In 2000, due to Congressional concerns about EPA's method of estimating health benefits from air pollution reduction, the Senate appropriated funds to EPA and directed the agency to request a study from National Academy of Sciences on the EPA's methodologies. *See* National Academy of Science arranged from the National Research Council's Committee on Estimating the Heath-Risk-Reduction Benefits of Proposed Air Pollution Regulations to prepare a report in 2002 which reviewed and critiqued the EPA's benefit analysis. *See* COMMITTEE ON ESTIMATING THE HEALTH-RISK-REDUCTION BENEFITS OF PROPOSED AIR POLLUTION REGULATIONS, NATIONAL RESOURCE COUNCIL, ESTIMATING THE PUBLIC HEALTH BENEFITS OF PROPOSED AIR POLLUTION REGULATIONS 1-2 (2002).
[311] *Id.* at 109. The committee went on to recommend that if the EPA plans to base its benefit analysis on the assumption that a threshold exists, which is not proven in any scientific study, it should make its assumptions and reasoning clear. *See id.* at 111.
[312] Similarly to the National Research Council's Committee on Estimating the Heath-Risk-Reduction Benefits of Proposed Air Pollution Regulations call, *see supra* note 310, HES was tasked with drafting a report in order to provide the EPA with guidance on how it estimates benefits and uncertainties for particulate matter and ozone. *See* U.S. Environmental Protection Agency Advisory Council on Clean Air Compliance Analysis Health Effects Subcommittee, *Review of EPA's Draft Health Benefits of the Second Section 812 Prospective Study of the Clean Air Act*, at 2 (2010), https://yosemite.epa.gov/sab/sabproduct.nsf/0/72D4EFA39E48CDB28525774500738776/$File/EPA-COUNCIL-10-001-unsigned.pdf.
[313] *Id.* at 13.
[314] *See* Joel Schwartz et al., *The Effect of Dose and Timing of Dose on the Association between Airborne Particles and Survival*, 116 ENVTL. HEALTH PERSP. 64, 67 (2008).
[315] *Id.*
[316] *Id.*

The World Health Organization (WHO), a specialized agency of the United Nations,[317] in a report cataloguing the global impact of particulate matter pollution, noted that this pollution represents one of world's the biggest environmental health risks, killing around 3 million people annually worldwide.[318] The report explains that this pollution "has health impacts even at very low concentrations – indeed no threshold has been identified below which no damage to health is observed."[319] WHO recommends that countries set standards at the lowest concentrations possible, and has set guideline values for $PM_{2.5}$ at 10 μg/m^3 annual mean and 25 μg/m^3 24-hour mean,[320] well below the current NAAQS of 12 μg/m^3 annual mean and 35 μg/m^3 24-hour mean.

A recent study from the Harvard School of Public Health confirms these findings and strengthens the evidence of health effects from particulate matter exposure below the current NAAQS. The 2017 study, which included a cohort of all Medicare beneficiaries (approximately 60 million people) throughout the United States, focused specifically on measuring health effects below the current particulate matter and ozone NAAQS.[321] The researchers measured health effects for people residing in places where $PM_{2.5}$ concentrations ranged from 6.21 to 15.64 μg/m^3.[322] The study reported a relationship between $PM_{2.5}$, ozone, and all-cause mortality that was almost linear, with no sign of a threshold down to 5 μg/m^3 in annual exposure.[323] Moreover, the authors found that there was a "significant association between $PM_{2.5}$ exposure and mortality when the analysis was restricted to concentrations below 12 μg per cubic meter [the current NAAQS], with a steeper slope below that level."[324] This study, which contains a very large sample size representing a geographically and socioeconomically diverse cross section of the country, concludes that in the entire population studied "there was significant evidence of adverse effects related to exposure to $PM_{2.5}$ . . . concentrations below current national standards."[325] The study "found no evidence of a threshold value—the concentration at which $PM_{2.5}$ exposure does not affect mortality—at concentrations as low as approximately 5 μg per cubic meter,"[326] confirming a finding similar to those of other studies.[327]

B. Regulatory Treatment

EPA has consistently found over three decades, and under administrations of both parties, that there are health effects from particulate matter exposure at low levels, below the NAAQS. The agency has done so at different times by explicitly stating that there is no evidence of a threshold; by calculating benefits for reductions in particulate matter below the level of the

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[317] *See* WHO CONST. pmbl., July 22, 1946.
[318] *See* World Health Organization, *Ambient Air Pollution: A Global Assessment of Exposure and Burden of Disease*, at 11 (2016), http://apps.who.int/iris/bitstream/10665/250141/1/9789241511353-eng.pdf?ua=1.
[319] *Id*. at 20.
[320] *See id*.
[321] *See* Quan Di, et al., *Air Pollution and Mortality in the Medicare Population*, 376 NEW ENG. J. MED. 2513, 2514 (2017).
[322] *See id*. at 2515.
[323] *See id*. at 2518.
[324] *Id*. at 2520. A steeper slope at low levels indicates that the marginal health risk from additional exposure at low levels is actually higher than the marginal risk at higher levels of exposure.
[325] *Id*. at 2513.
[326] *Id.* at 2520.
[327] *See id.*

NAAQs; or both.

As early as 1984, EPA under President Reagan explicitly stated that there is no evidence of a threshold for particulate matter.[328] Specifically, the agency's 1984 Regulatory Impact Analysis stated that "the data do not . . . show evidence of a clear threshold in exposed populations. Instead they suggest a continuum of response with both the likelihood (risk) of effects occurring and the magnitude of any potential effect decreasing with concentration."[329] This language was reiterated verbatim in the 1987 final rule.[330]

In 1997, the Clinton EPA determined that "the available epidemiological studies provide strong evidence suggesting that PM causes or contributes to health effects at levels below the current standards"[331] and that "the level or even existence of population thresholds below which no effects occur cannot be reliably determined."[332] The agency also calculated benefits for reducing particulate matter below the level it ultimately selected. In the 1997 NAAQS revision, EPA set the annual average standard for $PM_{2.5}$ at 15μg/m^3, and the 24-hour limit at 65 μg/m^3.[333] In the accompanying RIA, EPA analyzed the costs and benefits of the level it chose along with a more stringent standard. The more stringent standard EPA reviewed was an annual standard set at 15μg/m^3, in combination with a lower 24-hour standard set at 50 μg/m^3.[334] At the level EPA eventually selected for the NAAQS standard, the agency found annual benefits from partial attainment[335] to be between $19 billion (low estimate) and $104 billion (high estimate).[336]

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[328] *See* Environmental Protection Agency, *Regulatory Impact Analysis on the National Ambient Air Quality Standards for Particulate Matter*, at VI-15 to VI-17, (Feb. 21, 1984), http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=9101HEPX.TXT

[329] *Id*. at VI-15. The 1984 RIA was also the first time EPA calculated the economic benefits for ambient air standards, and the agency also analyzed benefits from particulate matter at different levels. *See id*. at VI-1. While the agency did not analyze an alternative that was equally or more stringent for both the annual average and 24-hour standard, it did analyze an annual standard lower than the one it ultimately selected, paired with a 24-hour limit higher than what it chose. In the 1987 NAAQS, EPA selected a PM_{10} annual average limit of 50 μg/m^3 and a 24-hour limit of 150 μg/m^3. *See* Revisions to the National Ambient Air Quality Standards for Particulate Matter, *supra* note 300, at 24,634. However, in its RIA, EPA reviewed benefits from a PM_{10} annual limit of 48 μg/m^3 paired with a 24-hour limit of 183 μg/m^3. *See* Environmental Protection Agency, *Regulatory Impact Analysis on The National Ambient Air Quality Standards for Particulate Matter*, *supra* note 328, at VI-38. While EPA did not conduct an analysis of benefits at the level it ultimately selected, making it impossible to directly compare the two options, EPA did find benefits at the 48 μg/m^3 annual limit scenario. *See id*. at VI-37, VI-38.

[330] *See* Revisions to the National Ambient Air Quality Standards for Particulate Matter, 52 Fed. Reg. 24,634, 24,642 (July 1, 1987) (to be codified at 40 C.F.R. pt 50).

[331] National Ambient Air Quality Standards for Particulate Matter, 62 Fed. Reg. 38,652, 38,670 (July 18, 1997) (to be codified at 40 C.F.R. pt. 50).

[332] *Id.*

[333] *See id.* at 38,652.

[334] *See* Environmental Protection Agency, *Regulatory Impact Analyses for the Particulate Matter and Ozone National Ambient Air Quality Standards and Proposed Regional Haze Rule*, at EΣ−23, Table ES-3 (July 16, 1997), https://www3.epa.gov/ttn/ecas/docs/ria/naaqs-o3-pm_ria_proposal_1997-07.pdf (comparing annual costs and benefits of PM alternatives for 2010).

[335] The RIA refers to "partial attainment" rather than full attainment because the analysis "does not attempt to force its models to project full attainment of the new standard in areas not predicted to achieve attainment by 2010," the year selected for the baseline. *Id.* at EΣ−13. Instead, the RIA attempts to account for the probability that "counties with $PM_{2.5}$ levels above the standard will likely need more time beyond 2010; new control strategies (e.g., regional controls or economic incentive programs); and/or new technologies in order to attain the standard." *Id.* at EΣ−12. ("For the PM analysis, a $1 billion/μg/m^3 cut-off is used to limit the adoption of control measures. Control measures

However, EPA found greater benefits, a high estimate of $107 billion, under this more stringent level.[337]

In 2006, EPA under George W. Bush found that "effect thresholds can neither be discerned nor determined not to exist."[338] The agency also noted that "several new studies available in [its] review have used different methods to examine [particulate matter concentration-response relationships], and most have been unable to detect threshold levels in time-series mortality studies."[339] EPA again calculated benefits at a particulate matter standard more stringent than the one it ultimate chose for the NAAQS. The 2006 final rule established a $PM_{2.5}$ 24-hour standard of 35 μg/m^3 and retained the annual standard of 15 μg/m^3. The RIA also included an analysis of benefits from a more stringent annual standard of 14 μg/m^3 paired with the same 35 μg/m^3 24-hour limit.[340] Again, EPA found higher benefits for the more stringent standard. Using a 3% discount rate,[341] EPA found $17 billion in benefits at the 15 μg/m^3 standard, but $30 billion in benefits under more stringent the 14 μg/m^3 standard.[342] Again using a 3% discount rate, EPA also calculated benefits using a different methodology and found between $9 billion and $76 billion in benefits from the 15 μg/m^3 standard, but $17 billion to $140 billion in benefits for the 14 μg/m^3 standard.[343]

Further, the Bush EPA calculated additional health and welfare benefits under the more stringent standard. Under multiple valuation methods, EPA found that approximately twice as many deaths would be avoided under the 14 μg/m^3 standard compared with the 15 μg/m^3 standard it ultimately selected.[344] EPA found that chronic bronchitis effects would be reduced be reduced by 8700 cases under a more stringent standard but by 5000 under the standard it selected.[345] Hospital admissions for respiratory events would be reduced by 980 under the stricter level but by 530 under EPA's standard, and hospital admissions for cardiovascular events for people over 17 would decrease by 2100 under the stricter level but by 1100 under the standard selected.

In the most recent revision of particulate matter NAAQS standards under the Obama Administration, EPA expressed its clearest rejection of thresholds for particulate matter. The agency noted in the Final Rule updating NAAQS standards in 2013 that, because "there is no

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providing air quality improvements are less than $1 billion/μg/m^3 are adopted where the air quality model and cost analysis identify control measures as being necessary.").

[336] *See id*. These are annual gross benefits. *See id.*

[337] *See id*. The RIA does not provide a low estimate of annual benefits or annual costs for the more stringent 15μg/m^3 standard. *See id*.

[338] National Ambient Air Quality Standards for Particulate Matter, 71 Fed. Reg. 61,144, 61,152 (Oct. 17, 2006) (to be codified at 40 C.F.R. pt. 50, 51, 52, 53 and 58).

[339] *Id.* at 61,158.

[340] *See* 2006 PM RIA, *supra* note 300, at ES-1.

[341] As noted above, the 3% discount rate presents a more realistic figure for calculating the present value of benefits from reduction of future air pollution. *See* Newell, *Unpacking the Administration's Revised Social Cost of Carbon*, *supra* note 8.

[342] *See id*. at ES-7, Table ES-1 (comparing full attainment benefits with social costs through incremental attainment of the 1997 standards).

[343] *See id*.

[344] *See id*. at ES-8, Table ES-2 (estimating the reduction of adverse health and welfare effects associated with incremental attainment of alternative standards).

[345] *See id*.

discernible population-level threshold below which effects would not occur, . . . it is reasonable to consider that health effects may occur over the full range of concentrations observed in the epidemiological studies, including the lower concentrations in the latter years."[346] EPA also explicitly addressed comments from the American Petroleum Institute and the American Chemistry Council asserting that "there is a threshold in the PM-health effect relationship and that the log-linear model is not biologically plausible."[347] The agency countered that:

> "The EPA disagrees with this assertion due to the number of studies evaluated in the Integrated Science Assessment that continue to support the use of a no-threshold, log-linear model to most appropriately represent the PM concentration-response relationship. . . . [EPA's Clean Air Science Advisory Committee] likewise advised that '[a]lthough there is increasing uncertainty at lower levels, there is no evidence of a threshold.'"[348]

As in previous administrations, EPA again found additional benefits from a standard more stringent than the NAAQS. The 2012 RIA presents the benefits for the NAAQS levels EPA chose, a $PM_{2.5}$ 24-hour standard of 12 $\mu g/m^3$ and an annual average standard of 35 $\mu g/m^3$.[349] The agency also calculated benefits from an 11$\mu g/m^3$ standard, also paired with the 35$\mu g/m^3$ annual standard.[350] At a 3% discount rate, EPA found between $4 and $9.1 billion in benefits for the 12 $\mu g/m^3$ standard, but $13 to $29 billion in benefits at the more stringent 11 $\mu g/m^3$ level.[351]

C. Addressing Uncertainty

The preceding discussion should not be read to suggest that there is no uncertainty about the health effects of particulate matter at low levels of exposure. Exposure studies generally do not examine populations exposed to ambient levels down to zero. Rather, studies generally have a "lowest measured level" (LML), which is the lowest level of exposure studied.[352] EPA is

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[346] National Ambient Air Quality Standards for Particulate Matter, 78 Fed. Reg. 3,086, 3,148 (Jan. 15, 2013) (to be codified at 40 C.F.R. pts. 50, 51, 52, 53 and 58).
[347] *Id.* at 3,119.
[348] *Id.* Further, when EPA acknowledged in its Intregrated Review Plan for the 2016 PM NAAQS rulemaking that particulate matter lacks a threshold of effects, the Clean Air Science Advisory Committee affirmed that conclusion. Memo from Dr. Ana Diez Roux, Chair, Clean Air Scientific Advisory Committee, to Gina McCarthy, Administrator, Environmental Protection Agency, *CASAC Review of the EPA's* Integrated Review Plan for the National Ambient Air Quality Standards for Particulate Matter (External Review Draft), (Aug. 31, 2016), https://yosemite.epa.gov/sab/sabproduct.nsf/0/9920C7E70022CCF98525802000702022/$File/EPA-CASAC+2016-003+unsigned.pdf (noting that "[t]he approach in the last review to setting an annual standard when there is 'no discernible population level threshold' for health effects is clearly explained" and appropriate).
[349] *See* 2012 PM RIA, *supra* note 300, at ES-1.
[350] *See id*.
[351] *See id*. at ES-14, Table ES-2 (showing total monetized benefits, costs, and net benefits for full attainment by 2020).
[352] For example, the RIA for the proposed repeal of the Clean Power Plan states that "[e]stimates were calculated assuming that the number of $PM_{2.5}$-attributable premature deaths falls to zero at $PM_{2.5}$ levels at or below the Lowest Measured Level of each of two [long-term] epidemiological studies used to quantify $PM_{2.5}$-related risk of death (Krewski et al. 2009, LML = 5.8 $\mu g/m^3$; Lepeule et al. 2012; LML = 8 $\mu g/m^3$)." Environmental Protection Agency, *Regulatory Impact Analysis for the Review of the Clean Power Plan: Proposal*, at 10 (Oct. 2017), https://www.epa.gov/sites/production/files/2017-10/documents/ria_proposed-cpp-repeal_2017-10_0.pdf. EPA routinely deals with this issue for carcinogens as well. *See* Environmental Protection Agency, *Guidelines for Carcinogen Risk Assessment*, EPA/630/P-03/001F, at 1-14, 3-16, 3-17 (March 2005)

tasked with the difficult job of extrapolating a dose-response relationship below these levels, and it has acknowledged that uncertainty remains about the shape of that relationship.

One tactic of regulatory critics is to conflate this uncertainty with the existence of a threshold. For example, state and industry challengers to the Clean Power Plan emphasized EPA's admission that there is uncertainty about the scale of particulate matter health effects at very low exposure levels. These challengers asserted that NAAQS are "'precautionary and preventative' in nature . . . and intended to protect the most sensitive subgroups in the population, [yet] EPA did not have confidence that a level below 12 μg/m^3 was needed to provide the rigorous protections the Act requires."[353] The group further asserted that if EPA, in its 2013 NAAQS review of particulate matter, determined that the health benefits of reductions were "so uncertain that it [was] not appropriate to include exposures below 12 μg/m^3 within the 'adequate margin of safety' provided by the NAAQS," EPA should not later be able to claim that reductions below that same level will yield billions of dollars in benefits.[354]

However, over the course of several decades, EPA has consistently considered and incorporated uncertainty into its assessments of NAAQS standards on the basis of the relevant scientific research. In its 1997 Regulatory Impact Analysis for particulate matter, EPA noted that "one significant source of uncertainty is the possible existence of a threshold concentration below which no adverse health effects occur."[355] EPA addressed this uncertainty in its benefits calculations, providing a "high end" estimate, which assumed that health benefits from reductions in particulate matter occur "all the way down to background levels" for certain health effects.[356] EPA also provided a "low end" estimate which assumed that health benefits from particulate matter reductions occur only down to the level of the standard.[357]

In 2006, EPA acknowledged that there was a debate as to whether a threshold exists for particulate matter,[358] and addressed the uncertainty by assuming that the particulate matter concentration-response function was linear within the concentrations "under consideration," which EPA defined to be above an assumed threshold of 10 μg/m^3.[359] The agency also noted that

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https://www.epa.gov/sites/production/files/2013-09/documents/cancer_guidelines_final_3-25-05.pdf (describing the use of the "point of departure" method).

[353] Opening Brief of State and Industry Petitioners at 53, Murray Energy Corp. v. EPA, No. 16-1127 (D.C. Cir. filed Nov. 18, 2016). "Indeed, EPA explained any health benefits that may occur at $PM_{2.5}$ concentrations below 12 μg/m^3 are not merely 'less certain'—they are so uncertain that it is not appropriate to include exposures below 12 μg/m^3 within the 'adequate margin of safety' provided by the NAAQS. . . . EPA's lack of confidence in any such benefits was so low that a standard below 12 μg/m^3 'would not be warranted.'" *Id.* at 54.

[354] *See* Opening Brief of State and Industry Petitioners at 53, Murray Energy Corp. v. EPA, No. 16-1127 (D.C. Cir. filed Nov. 18, 2016). "EPA cannot justify its decision to regulate EGU HAPs under § 112 based on asserted public health benefits it only recently concluded did not justify regulation of those non-HAPs." *Id.* at 51.

[355] Environmental Protection Agency, *Regulatory Impact Analyses for the Particulate Matter and Ozone National Ambient Air Quality Standards and Proposed Regional Haze Rule*, *supra* note 334, at 12-14.

[356] *Id*.

[357] *See id*.

[358] *See* 2006 PM RIA, *supra* note 30, at 5-20.

[359] *See id.* at 5-7 ("The C-R function for fine particles is approximately linear within the range of ambient concentrations under consideration (above the assumed threshold of 10 μg/m^3). Thus, we assume that the [C-R] functions are applicable to estimates of health benefits associated with reducing fine particles in areas with varied concentrations of PM, including both regions that are in attainment with $PM_{2.5}$ standards and those that do not meet the standards."). However, EPA also examined several alternative thresholds in a sensitivity analysis. *See id.* at 5-44

its Science Advisory Board, which provides advice to EPA on benefits analysis methods, "model[ed] premature mortality associated with PM exposure as a non-threshold effect, that is, with harmful effects to exposed populations regardless of the absolute level of ambient PM concentrations."[360]

By 2012, a much larger number of studies had produced evidence of the health effects of particulate matter exposure. EPA still acknowledged uncertainty in the 2012 RIA, but both the language used by the agency and the assumptions it makes reflect the growing body of evidence that particulate matter has health effects at low levels. Specifically, EPA stated that it was "more confident in the magnitude of the risk [estimated] from simulated $PM_{2.5}$ concentrations that coincide with the bulk of observed PM concentrations."[361] EPA further acknowledged that it was "less confident in the risk we estimate from simulated $PM_{2.5}$ concentrations that fall below the bulk of the observed data in these studies."[362]

EPA likewise discussed uncertainties in developing the Mercury and Air Toxics Standards. EPA calculated particulate matter reduction benefits for the Mercury and Air Toxics Standards using studies measuring health impacts below the NAAQS levels, but above the zero exposure level. The LML of these studies helped inform EPA's analysis.[363] EPA calculated the benefits at LMLs of major PM studies and found that 11% of the estimated benefits from avoided premature deaths occur at or above an annual mean $PM_{2.5}$ level of 10 $\mu g/m^3$,[364] and 73% of the benefits at or above 7.5 $\mu g/m^3$.[365] EPA modeled benefits below the LML, in line with the agency's acknowledgement that particulate matter is not a threshold pollutant, but noted that the agency has lower confidence in the exact value of those estimates.[366] EPA also noted that it addressed uncertainties in the magnitude of effects by following the same approached used by

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("Five cutpoints (including the base case assumption) were included in this sensitivity analysis: (a) 14 $\mu g/m^3$ (assumes no impacts below the alternative annual NAAQS), (b) 12 $\mu g/m^3$ (c) 10 $\mu g/m^3$ (reflects comments from CASAC - 2005), (d) 7.5 $\mu g/m^3$ (reflects recommendations from SAB-HES to consider estimating mortality benefits down to the lowest exposure levels considered in the Pope 2002 study used as the basis for modeling chronic mortality) and (e) background or 3 $\mu g/m^3$ (reflects NRC recommendation to consider effects all the way to background).") For the more stringent 7.5 $\mu g/m^3$ and 3 $\mu g/m^3$ threshold cutpoints, the sensitivity analyses estimated increased benefits relative to the assumed 10 $\mu g/m^3$ threshold, albeit with increasing uncertainty at lower concentrations. *See id.* at 5-81, 5-82, 5-83, 5-84 (estimating greater reductions in mortality incidence and greater monetized benefits from reduced mortality risk for lower threshold cutpoints).

The 2008 RIA for PM reiterated the Science Advisory Board's discussion of PM exposure as a non-threshold effect and endorsed the use of a non-threshold model at low concentrations. *See* Environmental Protection Agency, *Final Ozone NAAQS Regulatory Impact Analysis*, at 6c-5 (Mar. 2008), https://www3.epa.gov/ttn/ecas/docs/ria/naaqs-o3_ria_final_2008-03.pdf ("For the studies of long-term exposure, . . . the most careful work on this issue . . . report[s] that the associations between $PM_{2.5}$ and both all-cause and cardiopulmonary mortality were near linear within the relevant ranges, with no apparent threshold. Graphical analyses of these studies . . . also suggest a continuum of effects down to lower levels. Therefore, it is reasonable for EPA to assume a no threshold model down to, at least, the low end of the concentrations reported in the studies.").

[360] *See* 2006 PM RIA, *supra* note 300, at 5-20.

[361] 2012 PM RIA, *supra* note 300, at 5-81.

[362] *Id*.

[363] *See* MATS RIA, *supra* note 17, at 5-98, 5-100.

[364] 10 $\mu g/m^3$ was the LML for a major 2006 study. *See id*. at 5-100.

[365] 7.5 $/m^{3,}$ was the LML for a prominent 2002 study. *See id*.

[366] *See id*.

the Bush EPA in the 2006 particulate matter NAAQS RIA.[367]

The fact that uncertainty remains does not mean there is evidence to conclude that particulate matter causes no health effects below a certain level. As EPA noted in the 2012 RIA, "[i]t is important to emphasize that 'less confidence' does not mean 'no confidence'. . . . [W]e still have high confidence that $PM_{2.5}$ is causally associated with risk at those lower air quality concentrations."[368] EPA went on to note that although it uses benchmarks as part of its analysis, including the LML, this does not mean that EPA views "these concentration benchmarks as a concentration threshold below which we would not quantify health benefits of air quality improvements."[369] In short, EPA has consistently acknowledged scientific uncertainty. Though EPA accounted for this uncertainty differently at various times, the agency has repeatedly noted the existence of and modeled health effects from particulate matter exposure at low levels.[370] And, EPA has found adverse health effects below the NAAQS nearly every time the agency has studied exposure effects below those levels.[371]

D. Adjusting Baselines

In addition to asserting that particulate matter reductions below the NAAQS yield no health benefits, critics of regulations also attack the methods EPA uses to measure these effects. Specifically, critics claim that EPA has not adjusted the baseline to account for prior regulation of particulate matter, effectively "double counting" particulate matter benefits.[372] This section addresses those criticisms, showing that, in fact, EPA practice has consistently accounted for emission reductions resulting from prior regulations in setting its basis of comparison.

A baseline is the status quo that would exist without a new regulation, and it is necessary to measure the benefits of the regulation. OMB Circular A-4 instructs agencies to "[i]dentify a baseline" so as to "evaluate properly the benefits and costs of regulations and their alternatives."[373] Baselines are straightforward in theory but quite complex in practice. For example, think of a rule that has already been promulgated but is not scheduled to go into effect immediately and will be rolled out over many years—or consider that the earlier rule may never be fully implemented if a later administration decides to repeal it. How should EPA measure that

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[367] *See id*. at 5-17.
[368] *Id*. at 5-81 to 5-82.
[369] *Id*. at 5-82.
[370] *See*, *e.g.*, Environmental Protection Agency, *Regulatory Impact Analyses for the Final Revisions to the National Ambient Air Quality Standards for Particulate Matter*, EPA-452/R-12-005, at ES-1 (Dec. 2012), https://www3.epa.gov/ttn/ecas/docs/ria/naaqs-pm_ria_final_2012-12.pdf; Environmental Protection Agency, *Regulatory Impact Analyses for the Review of Particulate Matter National Ambient Air Quality Standards*, at ES-1 (Oct. 6, 2006), https://www3.epa.gov/ttn/ecas/docs/ria/naaqs-pm_ria_final_2006-10.pdf; Environmental Protection Agency, *Regulatory Impact Analyses for the Particulate Matter and Ozone National Ambient Air Quality Standards and Proposed Regional Haze Rule*, at EΣ−23, Table ES-3 (July 16, 1997), https://www3.epa.gov/ttn/ecas/docs/ria/naaqs-o3-pm_ria_proposal_1997-07.pdf; Environmental Protection Agency, *Regulatory Impact Analysis on the National Ambient Air Quality Standards for Particulate Matter*, at VI-15 (Feb. 21, 1984), http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=9101HEPX.TXT.
[371] *See supra* Part III.B (cataloging EPA's consistent finding over three decades of adverse health effects from particulate matter below NAAQS levels).
[372] *See* Lesser, *supra* note 21, at 5.
[373] Circular A-4: Regulatory Analysis, *supra* note 54, at 2.

earlier rule? Should the agency include it in the baseline for a new regulation? EPA has developed standard methods for handling such questions to promote uniformity across regulations, which are discussed in this section.

Opponents argue that EPA is "double counting;" that is, inflating a regulation's purported benefits by failing to account for existing regulations that will achieve the same reduction of the pollutant. According to one critic, the agency "regularly flouts [a] basic principle of sound regulation by ignoring the $PM_{2.5}$ and ozone reductions it has already mandated, and counting those reductions again as benefits in new rules. The same ton of pollutant thus serves to justify multiple rules, even though the pollution can only be prevented once."[374] Tellingly, Trump EPA Administrator Scott Pruitt has expressed a commitment to ensuring that his agency will not "double count" benefits from existing regulations; he asserts that EPA "shouldn't take pollutants that we regulate under our [NAAQS] program and then count that as a benefit when we're already achieving that with other regulation and contribute it to . . . the Clean Power Plan cost-benefit analysis. And [the Obama Administration] did that because the costs were so extraordinary."[375]

These claims ignore the reality that EPA has maintained clear standards designed to prevent double counting. EPA's guidelines on baselines state that it is EPA's common practice "to assume full compliance with regulatory requirements"[376] which includes newly enacted but not yet implemented regulations.[377] This means that benefits from rules that are fully promulgated will be counted in the baseline – these benefits are not ignored and then used again for a later regulation. The agency specifically notes that this general rule allows EPA to focus on incremental economic effects of the new rule without double counting benefits and costs captured by analyses performed for earlier rules.[378]

EPA also explicitly discusses the ways in which it accounts for prior benefits achieved under the NAAQS. For the Mercury and Air Toxics Standards, EPA notes that its baseline accounts for "the emissions reductions of SOx, NOx, directly emitted PM, and CO_2 . . . consistent with application of federal rules, state rules and statutes, and other binding, enforceable commitments in place by December 2010,"[379] as well as "the Cross-State Air Pollution Rule (CSAPR) as finalized in July 2011."[380] Likewise, in the Clean Power Plan, EPA states that it included in its baseline all state and federal air regulations either in effect or enacted and clearly delineated at the time.[381]

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[374] C. Boyden Gray, *EPA's Use of Co-Benefits*, FEDERALIST SOCIETY, https://fedsoc.org/commentary/publications/epa-s-use-of-co-benefits (Sept. 24, 2015).
[375] Justin Worland, *EPA Head Scott Pruitt Says Oil and Coal Companies He Met With Aren't 'Polluters'*, TIME.COM, http://time.com/4990060/scott-pruitt-interview-epa-schedule-meetings (Oct. 20, 2017).
[376] Environmental Protection Agency, *Chapter 5: Baseline*, at 5-3 (Dec. 2010) *in* GUIDELINES FOR PREPARING ECONOMIC ANALYSES (updated May 2014), https://yosemite.epa.gov/ee/epa/eerm.nsf/vwAN/EE-0568-05.pdf/$file/EE-0568-05.pdf.
[377] *See id*. at 5-9.
[378] *See id*.
[379] MATS RIA, *supra* note 17, at 1-11.
[380] *Id*.
[381] *See* Environmental Protection Agency, *Regulatory Impact Analysis for the Clean Power Plan Final Rule*, *supra* note 18 at 1-5 ("Base Case v.5.15 includes the Cross-State Air Pollution Rule (CSAPR), the Mercury and Air Toxics Rule (MATS), the proposed Carbon Pollution Standards for New Power Plants, the Cooling Water Intakes (316(b))

EPA also notes in its Base Case, which documents the agency's calculations of the baseline used to measure the benefits and costs of new regulations, that the baseline includes "NAAQS to the extent that state regulations…contain measures to bring non-attainment areas into attainment."[382] EPA further notes that "[a]part from these state regulations, individual permits issued by states in response to NAAQS are captured [to the extent they are reported to EPA]."[383] Thus, EPA includes benefits from NAAQS requirements to the extent they are implemented by states. Such treatment makes sense in light of the regulatory structure created by the Clean Air Act. Under the Act, EPA sets the NAAQS, which are a national standard for allowable air pollution levels. However, the NAAQS are implemented by the states through State Implementation Plans (SIPs). States have a great deal of discretion in determining how to work toward achieving the NAAQS. As a result of this structure, when EPA promulgates the NAAQS and attempts to estimate the costs and benefits of these standards, the agency must make a number of assumptions about how states will ultimately chose to regulate pollution. The SIPs provide a much clearer picture of the actual costs and benefits of the NAAQS. Further, it is the SIPs, and not the NAAQS, which are actually enforceable. EPA used the SIPs as its baseline for the Mercury and Air Toxics Standards and the Clean Power Plan, which were promulgated to bring areas into attainment with the NAAQS.

EPA likewise accounts for rules that have the co-benefit of reducing NAAQS pollutants in its baseline for future NAAQS. Particulate matter is regulated directly under the NAAQS, but is also affected indirectly by rules like the Mercury and Air Toxics Standards and the Clean Power Plan that directly target other pollutants. In a subsequent update of the NAAQS standards for particulate matter, EPA stated that it included the Mercury and Air Toxics Standards in that baseline as well, noting that "[e]mission reductions achieved under rules that require specific actions from sources—such as Mercury and Air Toxics Standards—are in the baseline of this NAAQS analysis, as are emission reductions needed to meet the current NAAQS."[384]

The Trump Administration in its draft repeal of the Clean Power Plan also raises the issue of baselines. However, the agency takes a different approach than other critics of these regulations. Rather than arguing that EPA's 2015 Regulatory Impact Analysis for the Clean Power Plan double counts particulate matter benefits, the proposed rule points out that particulate matter could be regulated in other ways. This is, of course, the case; particulate matter is regulated directly under the National Ambient Air Quality Standards. From this fact, the Trump

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Rule, the Combustion Residuals from Electric Utilities (CCR), and other state and Federal regulations to the extent that they contain measures, permits, or other air-related limitations or requirements.").

[382] Environmental Protection Agency, *EPA Base Case v.5.14 Using IPM: Incremental Documentation*, at 1 (March 25, 2015), https://www.epa.gov/sites/production/files/2015-08/documents/epa_base_case_v514_incremental_documentation.pdf. The Base Case in place when the Mercury and Air Toxics Standards rule was promulgated in 2011 similarly include "ozone and particulate matter standards to the extent that some of the state regulations . . . contain measures to bring non-attainment areas into attainment." Environmental Protection Agency, *Documentation for EPA Base Case v.4.10 Using the Integrated Planning Model*, EPA #430R10010, at 1-1 (August 2010), https://nepis.epa.gov/Exe/ZyPDF.cgi/P100CF8G.PDF?Dockey=P100CF8G.PDF.

[383] *See id*. With regard to which permits are included, EPA specifically notes that permits are included "to the extent that they are reflected in the NOx rates reported to EPA under CSAPR, Title IV and the NOx Budget Program which are incorporated in the base case and . . . to the extent that SO_2 permit limits are used in the base case to define the choice of coal sulfur grades that are available to specific power plants." *Id*.

[384] 2012 PM RIA, *supra* note 300, at ES-18.

EPA presents the following hypothetical: "[H]ad those SO_2 and NOx [particulate matter] reductions been achieved through other means, then they would have been represented in the baseline for this proposed repeal (as well as for the 2015 Final [Clean Power Plan]), which would have affected the estimated costs and benefits of controlling CO_2 emissions alone."[385] The agency then presents calculations of the foregone benefits of repealing the Clean Power Plan, with all of the SO_2 and NO_X benefits removed.[386] The logic seems to be that because these benefits *could* be achieved through other regulations, the agency need not calculate the benefits of reducing the pollution through this regulation; rather, it can just assume the benefits have already been achieved through another regulation. Of course, such a regulation does not exist. EPA cannot wish away benefits by pretending we live in a world where the benefits have already been achieved, and courts tasked with overseeing EPA should not stand idly by while the agency attempts to do so. Not only does the Trump Administration's approach deviate from EPA's longstanding methodology for determining baselines, but its benefits calculations also depart from reality.

IV
CONSIDERING CO-BENEFITS

Particulate matter reductions are often co-benefits, or ancillary benefits, from rules targeting other types of pollution.[387] For example, the Mercury and Air Toxics Standards directly limit mercury emissions from power plants but would likewise have the effect of reducing particulate matter emissions. Similarly, the Clean Power Plan directly regulates carbon dioxide emissions from power plants because these well-known greenhouse gases contribute to global climate change.[388] However because the rule requires energy generators to internalize the cost of emissions, thus raising the cost of polluting, the rule will likely cause a shift in sources of energy production away from sources that produce large quantities of greenhouses gases, notably coal, to cleaner forms of energy. This shift will additionally have the effect of reducing particulate matter because coal-fired power plants are also significant sources of particulate pollution.

Critics of regulations argue that cost-benefit analyses for specific pollutants should not include co-benefits from reductions in non-targeted pollutants. They contend that only direct and quantifiable benefits resulting from the reduction of the specific pollutant at issue should be included in a rule's calculus. In their view, the consideration of co-benefits extends beyond the scope of the problems Congress intended to address, and instead is a "sleight of hand" to

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[385] Clean Power Plan Proposed Repeal, *supra* note 7 at 48,044 n.24.
[386] *See id*. at 48,044-45.
[387] Of course, for the NAAQS standards regulating particulate matter, benefits from PM reduction are the target benefits.
[388] *See, e.g.*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2013–THE PHYSICAL SCIENCE BASIS: WORKING GROUP I CONTRIBUTION TO THE FIFTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 467 (2014); NATIONAL RESEARCH COUNCIL ET AL., CLIMATE STABILIZATION TARGETS: EMISSIONS, CONCENTRATIONS, AND IMPACTS OVER DECADES TO MILLENNIA 3-4 (2011); Environmental Protection Agency, *Climate Change Science: Causes of Climate Change*, https://19january2017snapshot.epa.gov/climate-change-science/causes-climate-change_.html (last updated Dec. 27, 2016).

"circumvent the[] statutory limitations on [EPA's] authority."[389] According to regulation opponents, "[p]ermitting EPA to use such illusory and statutorily irrelevant co-benefits to justify the Rule would . . . amount to an unconstitutional delegation of legislative power."[390]

This theme arose prominently in *Michigan v. EPA,* where co-benefits were attacked as a means of "impermissibly enabl[ing EPA] to expand its authority to conduct additional $PM_{2.5}$ regulation without following the proper procedures of imposing such restrictions upon the country."[391] Critics argued that the agency "routinely takes credit for reductions of $PM_{2.5}$ caused by rules that address harms from other pollutants" as a "power grab" in order to regulate "outside the specific [statutory] authority under which they are acting"[392] and to obligate "further $PM_{2.5}$ reductions beyond those required under other Clean Air Act programs."[393] Mercury, the pollutant directly regulated by the Mercury and Air Toxics Standards, was deemed "a Trojan horse used to justify regulation under Section 112, when EPA's real focus was particulate-matter emissions by power plants, which the agency has targeted across numerous rulemakings in recent years."[394] Because they are not targeted by the section of the statute upon which the rule is based, critics argue that including co-benefits circumvents the Clean Air Act by additionally reducing pollutants that are directly regulated by other sections of the Act,[395] so as to "indirectly require further reductions in $PM_{2.5}$ emissions from power plants that EPA would be unable to require directly."[396] At oral argument in the *Michigan* case, Chief Justice John Roberts suggested that indirect benefits merely served as "an end run" around statutory restrictions.[397] Chief Justice Roberts also noted that he believed it was "good thing if your regulation also benefits in other ways. But when it's such a disproportion, you begin to wonder whether it's an illegitimate way of avoiding the different—quite different limitations on EPA that apply in the criteria program."[398]

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[389] Brief for the Cato Institute as Amicus Curiae in Support of Petitioners at 4, Michigan v. EPA, 135 S. Ct. 2699 (2015) (No. 14-46), 2015 WL 412058.
[390] Brief of 166 State and Local Business Associations as Amici Curiae in Support of Petitioners at 26, West Virginia v. EPA, Nos. 15-1363 et al. (D.C. Cir. filed Feb. 23, 2016).
[391] Motion For Leave To File Amicus Curiae Brief And Brief Of The Chamber Of Commerce Of The United States Of America As Amicus Curiae In Support Of Petitioners at 25, Michigan v. EPA, 135 S. Ct. 2699 (2015) (Nos. 14-46, 14-47, 14-49), 2014 WL 4075971.
[392] *Id.* at 15.
[393] *Id.* at 23.
[394] Brief for the Cato Institute as Amicus Curiae in Support of Petitioners at 22, Michigan v. EPA, 135 S. Ct. 2699 (2015) (No. 14-46), 2015 WL 412058.
[395] *See* Opening Brief of State and Industry Petitioners at 47, Murray Energy Corp. v. EPA, No. 16-1127 (D.C. Cir. filed Nov. 18, 2016).
[396] Brief of the Chamber of Commerce of the United States of America, the National Association of Manufacturers, the National Federation of Independent Business, and the National Association of Home Builders as Amici Curiae in Support of Petitioners at 16, Michigan v. EPA, 135 S. Ct. 2699 (2015) (Nos. 14-46, 14-47, 14-49), 2015 WL 428995.
[397] *See* Opening Brief of State and Industry Petitioners at 47, Murray Energy Corp. v. EPA, No. 16-1127 (D.C. Cir. filed Nov. 18, 2016). ("At oral argument in *Michigan*, Chief Justice Roberts described relying on co-benefits as 'an end run' around § 109's restrictions" and as an issue that "raises the red flag.") (internal citations omitted).
[398] Clean Power Plan Proposed Repeal, *supra* note 8, at 48,044 (quoting Chief Justice Roberts at oral argument in *Michigan v. EPA*).

Opponents contend that even if a rule yields co-benefits, those effects are essentially "irrelevant"[399] or mere "regulatory externalities"[400] that should play no part in a cost-benefit analysis. Critics of co-benefits have called their use a "well-worn accounting trick"[401] and "a controversial and legally dubious accounting method."[402] Petitioners in *Michigan v. EPA* argued that "ancillary co-benefits from lower $PM_{2.5}$ emissions are not *relevant* benefits for the purpose of deciding whether it is appropriate to regulate HAP emissions from electric utilities. Congress required EPA to determine whether reducing emissions of hazardous air pollutants (not $PM_{2.5}$) is 'appropriate.'"[403] Put differently, "[e]ven if Congress intended that EPA may consider cobenefits—a concept found nowhere in the statute—in setting technology-based standards, Congress certainly did not dictate that the purported cobenefits may force regulation of HAPs under Section 112(n)(1)(A) where the reductions of the HAPs themselves provide no relative benefits in comparison to the substantial costs of regulation."[404] Others have called co-benefits "inflated"[405] and "unlawful[,] . . . obscur[ing] the impact of the rule on the targeted pollutant (CO_2) and creates deliberate confusion regarding the Rule's costs and benefits."[406]

In the case of the Clean Power Plan, critics argue that "[w]ithout the artificial consideration of these purported co-benefits, the Rule's benefits would be seen for what they are: vastly exceeded by its costs."[407] The Trump EPA echoed this claim when, in announcing the repeal of the Clean Power Plan, it decried co-benefits as "essentially hid[ing]" the plan's true cost.[408] The Trump Administration EPA also described the Obama Administration's inclusion of co-benefits in the Plan as an area of "controversy and/or uncertainty,"[409] suggesting that the incorporation of these benefits is outside common EPA practice.

The arguments against considering co-benefits ring hollow, however, when looked at in context. EPA has consistently and over multiple presidential administrations considered both co-

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[399] Brief for the Cato Institute as Amicus Curiae in Support of Petitioners at 3, Michigan v. EPA, 135 S. Ct. 2699 (2015) (No. 14-46), 2015 WL 412058; Opening Brief of State and Industry Petitioners at 49, Murray Energy Corp. v. EPA, No. 16-1127 (D.C. Cir. filed Nov. 18, 2016).
[400] Brief of Amicus Curiae Cato Institute in Support of Petitioners at 4, Murray Energy Corp. v. EPA, No. 16-1127 (D.C. Cir. filed Nov. 18, 2016).
[401] Brief of 166 State and Local Business Associations as Amici Curiae in Support of Petitioners at 69, West Virginia v. EPA, Nos. 15-1363 et al. (D.C. Cir. filed Feb. 23, 2016).
[402] Brief of the Chamber of Commerce of the United States of America, the National Association of Manufacturers, the National Federation of Independent Business, and the National Association of Home Builders as Amici Curiae in Support of Petitioners at 3, Michigan v. EPA, 135 S. Ct. 2699 (2015) (Nos. 14-46, 14-47, 14-49), 2015 WL 428995.
[403] Brief for Petitioners Michigan et al. at 48, Michigan v. EPA, 135 S. Ct. 2699 (2015) (No. 14-46), 2015 WL 309090 (emphasis in original).
[404] Brief of the Chamber of Commerce of the United States of America, the National Association of Manufacturers, the National Federation of Independent Business, and the National Association of Home Builders as Amici Curiae in Support of Petitioners at 22, Michigan v. EPA, 135 S. Ct. 2699 (2015) (Nos. 14-46, 14-47, 14-49), 2015 WL 428995.
[405] Gray, *supra* note 21.
[406] Brief of 166 State and Local Business Associations as Amici Curiae in Support of Petitioners at 27, West Virginia v. EPA, Nos. 15-1363 et al. (D.C. Cir. filed Feb. 23, 2016).
[407] *Id.*
[408] *See* Environmental Protection Agency, *EPA Takes Another Step To Advance President Trump's America First Strategy, Proposes Repeal of "Clean Power Plan,"* (Oct. 10, 2017), https://www.epa.gov/newsreleases/epa-takes-another-step-advance-president-trumps-america-first-strategy-proposes-repeal.
[409] *See id.*

benefits and their mirror image, indirect costs, in evaluating the consequences of regulation. Removing co-benefits would mean systematically considering a narrower range of benefits than costs, because it would leave intact EPA's current practice of measuring indirect costs while ignoring co-benefits.[410] Were this not the case, critics would potentially have a valid point. Were it true that EPA only considers indirect effects that are benefits, then EPA arguably would be inflating benefits, as critics accuse.[411] However, because EPA does consider both indirect costs and benefits, what critics really want is to put a thumb on the scale against regulation by forcing EPA to ignore some indirect effects while embracing others. This Part examines the well-established use of co-benefits in cost-benefit analyses by presidential administrations, EPA, and the courts, as well as their endorsement in the academic literature.

A. Co-Benefits and Indirect Costs

The question of how to measure indirect costs and benefits arises in the context of cost-benefit analyses. Federal agencies have been required to perform these analyses since 1981, when President Reagan issued Executive Order 12,291.[412] Previous presidents had required some assessment of the impacts of proposed regulatory actions, but the Reagan Administration was the first to formalize this requirement.[413] EPA's early cost–benefit analyses focused only on the direct costs and benefits of regulations. However, substantial academic, administrative, and judicial attention turned to the consideration of countervailing risks in the 1990s with the publication of *Risk Versus Risk* by John D. Graham and Jonathan Baert Wiener.[414] The book outlined the leading framework for considering indirect costs, also known as countervailing risks: risk-risk analysis. The guiding principal of risk-risk analysis, as conceived by Graham and Wiener, is that regulations intended to minimize or eliminate certain health or environmental risks can have the perverse effect of promoting other risks, and thus a more comprehensive and accurate accounting of regulatory effects would consider these countervailing risks.[415]

Risk-risk analysis picked up traction among academics specializing in administrative law.

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[410] For a more detailed discussion of co-benefits as the "mirror image" of indirect costs, see Samuel J. Rascoff & Richard L. Revesz, *The Biases of Risk Tradeoff Analysis: Towards Parity in Environmental and Health-and-Safety Regulation*, 69 UNIV. CHI. L. REV. 1763, 1780-90 (2002).

[411] *See* Gray, *supra* note 21.

[412] *See* Exec. Order No. 12,291, 46 Fed. Reg. 13,193, 13,193-94 (Feb. 19, 1981).

[413] This order was later modified and expanded by President Clinton under Executive Order 12,866, which remains in effect today. *See* Exec. Order No. 12,866, 58 Fed. Reg. 51,735 (Oct. 4, 1993). President Obama reinforced the continued viability of this order and expanded it modestly under Executive Order 13,563, which modestly expanded the scope of cost benefit analyses to permit consideration of values that are difficult or impossible to quantify including equity, human dignity, fairness, and distributive impacts. *See* Exec. Order No. 13563, 76 Fed. Reg. 3,821 (Jan. 18, 2011).

[414] *See* RISK VERSUS RISK: TRADEOFFS IN PROTECTING HEALTH AND THE ENVIRONMENT (John D. Graham & Jonathan Baert Wiener eds., 1995). Graham and Wiener coined the term "risk tradeoff analysis." *See* John D. Graham & Jonathan Baert Wiener, *Confronting Risk Tradeoffs*, *in* RISK VERSUS RISK 1, 4.

[415] *See* RISK VERSUS RISK, *supra* note 414, at 270. For example, Graham examines Corporate Average Fuel Economy (CAFE) standards, a Department of Transportation regulation intended to improve automobile fuel standards and reduce attendant environmental and health harms, as potentially promoting countervailing risks in the economic, energy, and national security sectors. *See* John D. Graham, *Saving Gasoline and Lives*, *in* RISK VERSUS RISK 87-103. In a separate article, Wiener discusses how risk-risk analysis reveals a "bewildering array of countervailing risks that face efforts to prevent global warming." Jonathan Baert Wiener, *Protecting the Global Environment*, *in* RISK VERSUS RISK 193-225.

In addition to Graham and Wiener, Professor Cass Sunstein, a prominent administrative law scholar and the head of the Office of Information and Regulatory Affairs (OIRA) under President Obama, advocated at that time for broad application of risk-risk analysis.[416] W. Kip Viscusi, an administrative law scholar and leading proponent of cost-benefit analysis, also endorsed risk tradeoff analysis in the regulatory process.[417]

Judges at this time began to embrace risk-risk analysis as well. Justice Breyer, concurring in *American Trucking*,[418] agreed with the Court's unanimous ruling that the Clean Air Act prohibits the consideration of costs in setting the NAAQS but wrote separately to argue that the statute does permit "the Administrator to take account of comparative health risks."[419] Judge Stephen Williams of the D.C. Circuit was also a notable proponent of risk-risk analysis. For example, in a concurrence in *International Union, UAW v. OSHA*,[420] Judge Williams used risk-risk analysis to challenge what he viewed as the "casual assumption that more stringent regulation will always save lives."[421] He argued that the health-wealth connection[422] required consideration of negative economic effects of regulation and their purported effect on health: "More regulation means some combination of reduced value of firms, higher product prices, fewer jobs in the regulated industry, and lower cash wages. All the latter three stretch workers' budgets tighter. . . . And larger incomes enable people to lead safer lives."[423]

The growing focus on examining the broader range of regulatory effects ultimately led to Office of Management and Budget (OMB) Circular A-4, which was promulgated when John Graham served as Administrator of OIRA within OMB.[424] OIRA is responsible for overseeing regulatory efforts of administrative agencies and has the power to issue guidance which they must follow. Circular A-4 guides federal agencies in the cost-benefit regulatory analyses required under Executive Order 12,866,[425] "standardizing the way benefits and costs of Federal regulatory actions are measured and reported."[426] As part of this standardization, Circular A-4 explicitly requires the consideration of countervailing risks, enshrining the analysis of the type of risks Graham and Weiner identified. However, Circular A-4 goes a step further by likewise requiring consideration of ancillary benefits. The Circular instructs agencies to "look beyond direct benefits and direct costs . . ." and "consider any important ancillary benefits and

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[416] *See* Cass R. Sunstein, *Health-Health Tradeoffs*, 63 U. CHI. L. REV. 1533, 1537 (1996); Rascoff & Revesz, *supra* note 410, at 1764.
[417] *See* Rascoff & Revesz, *supra* note 410, at 1792
[418] 531 U.S. 457 (2001).
[419] *Id*. at 495. The D.C. Circuit opinion in that case examined a different countervailing risk: less protection from harmful ultraviolet radiation as a result of reducing ozone pollution. *See infra* notes 477-480.
[420] 938 F.2d 1310 (D.C. Cir. 1991).
[421] *Id.* at 1326.
[422] There is much evidence to suggest that the "health-wealth" effect, which asserts that less wealth causes worse health outcomes, is fallacious. For a detailed discussion of this criticism, see RICHARD L. REVESZ & MICHAEL A. LIVERMORE, RETAKING RATIONALITY: HOW COST-BENEFIT ANALYSIS CAN BETTER PROTECT THE ENVIRONMENT AND OUR HEALTH 67-76 (2008) (questioning the "health-wealth" effect and offering alternative explanations for both health and wealth—notably, education—as well as the potential for reverse causation (i.e., that worse health causes lower wealth)).
[423] 938 F.2d at 1326.
[424] *See* Circular A-4: Regulatory Analysis, *supra* note 54, at 1.
[425] *See id*. at 1.
[426] *Id*.

countervailing risks."[427] Further, it states that "[t]he same standards of information and analysis quality that apply to direct benefits and costs should be applied to ancillary benefits and countervailing risks."[428]

B. EPA's Practice

EPA has long acknowledged the relevance of co-benefits, and specifically has done so for regulations promulgated under the Clean Air Act. First, EPA's current guidelines for cost-benefit analyses, which were adopted in 2010 after extensive peer review, instruct the agency to assess "all identifiable costs and benefits,"[429] and state that an economic analysis of regulations should include both "directly intended effects . . . as well as ancillary (or co-)benefits and costs."[430] The aim of these analyses is to "inform decision making" and allow meaningful comparisons between policy alternatives.[431]

These guidelines build on principles applied in previous administrations. For example, the Bush EPA used similar language in its 2008 draft "Guidelines for Preparing Economic Analyses," declaring that "[a]n economic analysis of regulatory or policy options should present all identifiable costs and benefits that are incremental to the regulation or policy under consideration. These should include directly intended effects and associated costs, as well as ancillary (or co-) benefits and costs."[432] The proposed Bush guidelines also stated that "[f]or a regulation that is expected to have substantial indirect effects beyond the regulated sector, it is important to choose a model that can capture those effects."[433]

Likewise, the Clinton EPA's guidelines for conducting cost-benefit analyses endorsed the importance of considering indirect costs and benefits.[434] Issued in 2000, the Clinton guidelines included indirect costs as a component of its calculations for health and social costs.[435] Emphasizing that "[a] complete benefits analysis is also useful because it makes explicit the assumptions about the value of benefits embedded in different policy choices,"[436] the guidelines determined that indirect benefits are cognizable, focusing on indirect ecological benefits.[437] Moreover, the guidelines noted that "immediately following a net benefit calculation, there should be a presentation and evaluation of all benefits and costs that can only be quantified but not valued, as well as all benefits and costs that can be only qualitatively described."[438] The

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[427] *Id*. at 26.
[428] *Id*.
[429] Environmental Protection Agency, *Guidelines for Preparing Economic Analyses*, at 11-2 (Dec. 2010), https://yosemite.epa.gov/ee/epa/eerm.nsf/vwAN/EE-0568-05.pdf/$file/EE-0568-05.pdf.
[430] *Id.*
[431] *See id*. at 7-1.
[432] Environmental Protection Agency, "Guidelines for Preparing Economic Analyses (External Review Draft)," at 10-4 (Sept. 15, 2008) (on file with author).
[433] *Id.* at 8-17.
[434] *See* Environmental Protection Agency, *Guidelines for Preparing Economic Analyses*, at 67, 70, 81 (Sept. 2000), https://www.epa.gov/sites/production/files/2017-09/documents/ee-0228c-07.pdf.
[435] *Id.* at 82-83, 94, 114-15.
[436] *Id.* at 59.
[437] *Id.* at 70 (noting that "[e]cosystem services that do not directly provide some good or opportunity to individuals may be valued because they support off-site ecological resources or maintain the biological and biochemical processes required for life support").
[438] *Id.* at 177.

implication is that, even for effects that cannot be monetized, informed decisionmaking requires consideration of all benefits and costs, not just direct ones. In short, all three iterations of guidelines authored by EPA—the 2000 guidelines, the 2008 draft guidelines, and the 2010 guidelines—called for the use of co-benefits in cost-benefit analyses.

EPA's cost-benefit analyses for clean air rules have also long included co-benefits.[439] EPA began acknowledging these benefits in Clear Air Act rules all the way back in the 1980s. In 1985, EPA under President Ronald Reagan conducted an extensive analysis of co-benefits from reductions of non-target pollutants in its landmark 1985 regulation reducing lead in gasoline, including an analysis of benefits from reductions in ozone, nitrogen oxides, and hydrocarbons.[440] As part of this analysis, EPA found monetized co-benefits from reducing hydrocarbons, nitrous oxide, and carbon monoxide, benzene, and other non-targeted pollutants to be worth an estimated $222 million over just a one year period.[441] The Reagan-era EPA in also proposed to develop New Source Performance Standards for municipal waste combustors. As part of this proposal, EPA discussed the importance of considering indirect benefits from its regulation of toxic emissions from municipal waste combustors.[442] EPA explained that it would include "indirect benefits accruing from concomitant reductions in other regulated pollutants."[443]

Under President George H.W. Bush, EPA in 1991 justified performance standards in a proposed rule for landfill gases in part on "the ancillary benefit of reducing global loadings of methane."[444] Further, EPA examined countervailing climate change risks. The agency noted that carbon dioxide emissions under the proposed standard would increase, but justified regulation in part because of the climate change benefits from methane emission reductions.[445] EPA took into consideration both the ancillary benefits of methane reductions in reducing greenhouse gas pollution as well as the countervailing risk of increasing carbon dioxide emissions. EPA's judgment on how to regulate was guided by the full scope of effects.

EPA under President Bill Clinton in a 1998 rule establishing standards for hazardous air pollutant emissions from pulp and paper producers analyzed indirect effects, both co-benefits from reductions in emissions, and indirect costs from increases in emissions, for NAAQS criteria pollutants.[446] Though hazardous air pollutants (HAPs) were directly targeted by the rule, EPA

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[439] The Senate Report accompanying the 1990 Clean Air Act amendments indicated that EPA could take co-benefits into account when setting standards for hazardous air pollutants. It states that "[w]hen establishing technology-based standards under this subsection, the Administrator may consider the benefits which result from the control of air pollutants that are not listed but the emissions of which are, nevertheless, reduced by control technologies or practices necessary to meet the prescribed limitation." S. Rep. No 101-228, at 172 (1989).
[440] *See* Environmental Protection Agency, *Regulatory Impact Analysis of the National Ambient Air Quality Standards for Carbon Monoxide*, EPA-450/5-85-007, at VI-1 to VI-74 (July 1985), http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=2000NK80.TXT.
[441] *See id*. at E-8.
[442] *See* Assessment of Municipal Waste Combustor Emissions Under the Clean Air Act, 52 Fed. Reg. 25,399, 25,406 (July 7, 1987) (codified at 40 C.F.R. pt. 60).
[443] *Id*.
[444] Standards of Performance for New Stationary Sources and Guidelines for Control of Existing Sources: Municipal Solid Waste Landfills, 56 Fed. Reg. 24,468, 24,469 (May 30, 1991) (codified at 40 C.F.R. pts. 51, 52, and 60).
[445] *See id*. at 24,472.
[446] *See* National Emission Standards for Hazardous Air Pollutants for Source Category: Pulp and Paper Production; Effluent Limitations Guidelines, Pretreatment Standards, and New Source Performance Standards: Pulp, Paper, and

nonetheless analyzed the effects of its regulation on other air pollutants, including the criteria pollutants.[447] For the "Best Available Technology" standards which govern existing plants,[448] EPA estimated small increases in emissions of carbon monoxide, nitrogen oxides, and sulfur dioxides from the rule, but a significant decrease in particulate matter.[449] For the New Source Performance Standards which govern new sources of emissions, EPA concluded that in addition to decreasing HAPs, the rule would also decrease many criteria pollutant emissions including particulate matter.[450] Rather than ignoring some or all of these effects because they did not derive from the target pollutants, EPA estimated these effects and analyzed them as part of its rule-making process.

In 2005, EPA under George W. Bush noted that its Clean Air Interstate Rule, which targeted particulate matter and ozone emissions, would also reduce mercury emissions,[451] and included the benefits from mercury reductions in its cost-benefit analysis for the rule.[452] The Bush EPA also discussed co-benefits as part of a regulation governing hazardous air pollutants from mobile sources (primarily cars).[453] The agency noted that though the rule dealt with control of air toxics and not criteria pollutants including particulate matter and ozone, "this co-benefit . . . is significant."[454] EPA calculated that the standards would reduce exhaust emissions of direct particulate matter by over 19,000 tons in 2030 nationwide.[455] The agency also analyzed the effects of the rule on ozone emissions, concluding that overall ozone emissions reductions would be small, but some areas would have "non-negligible improvements in projected 8-hour ozone . . . ."[456] EPA further noted that it viewed "those improvements as useful in meeting the 8-hour ozone NAAQS."[457]

EPA has consistently examined a full range of effects from regulations. Rather than arbitrarily ignoring certain effects because they are ancillary or indirect, EPA discusses and analyzes indirect costs and co-benefits. The agency has done so through multiple presidential administrations of different parties, and in a wide range of clean air regulations. Indeed, Chris DeMuth and Judge Douglas Ginsburg, both Administrators of OIRA under President Reagan, summarize EPA's consideration of ancillary benefits this way: "EPA and other agencies frequently include ancillary benefits in their benefits estimates."[458] They also note that "OIRA

Paperboard Category, 63 Fed. Reg. 18,504, 18,504, 18,576 (Apr. 15, 1998) (codified at 40 C.F.R. pts. 63, 261, and 430).

[447] *See id*. at 18,576.

[448] *See id*. at 18,508.

[449] *See id*. at 18,576.

[450] *See id*. at 18,579.

[451] *See* Rule To Reduce Interstate Transport of Fine Particulate Matter and Ozone (Clean Air Interstate Rule); Revisions to Acid Rain Program; Revisions to the NOX SIP Call, 70 Fed. Reg. 25,162, 25,170 (May 12, 2005) (codified at 40 C.F.R. pts. 51, 72, 73, 74, 77, 78 and 96).

[452] *See id*. at 25,312.

[453] *See* Control of Hazardous Air Pollutants From Mobile Sources, 72 Fed. Reg. 8,428, 8,430, 8,461 (Feb. 26, 2007) (codified at 40 C.F.R. pts. 59, 80, 85, and 86).

[454] *Id*. at 8,461.

[455] *See id*. at 8,453.

[456] *Id*. at 8,458.

[457] *Id*.

[458] Christopher DeMuth & Douglas H. Ginsburg, *Rationalism in Regulation*, 108 MICH. L. REV. 877, 887 (2010) (reviewing RICHARD L. REVESZ & MICHAEL A. LIVERMORE, RETAKING RATIONALITY: HOW COST-BENEFIT ANALYSIS CAN BETTER PROTECT THE ENVIRONMENT AND OUR HEALTH (2008))

itself recommends that agencies account for ancillary benefits as well as countervailing risks."[459] Similarly, high-profile Obama-era EPA regulations like the Mercury and Air Toxics Standards and the Clean Power Plan reflect the requirement of OMB Circular A-4 that the agency consider co-benefits, and the requirement of EPA's own guidelines to consider "all identifiable costs and benefits."[460] The inclusion of co-benefits in these regulations is well in line with the longstanding practice of EPA to include co-benefits and countervailing risks in its assessment of clean air regulations.

C. Judicial Recognition

Courts are often asked to review the adequacy of an agency's cost-benefit analysis, and in this context they have addressed the issue of indirect benefits and costs.[461] Reviewing courts have frequently required agencies to include ancillary impacts. This section first discusses judicial decisions requiring the consideration of indirect risks, and then turns to the nascent case law on co-benefits.

In 1991, the Fifth Circuit rejected EPA's attempt to ban asbestos-based brakes under the Toxic Substances Control Act.[462] A central part of the court's holding was its finding that EPA needed to consider the indirect safety effects of other potential, non-asbestos options for car breaks.[463] The court determined that under the Toxic Substances Control Act, "EPA was required to consider both alternatives to a ban and the costs of any proposed actions and to 'carry out [the Act] in a reasonable and prudent manner [after considering] the environmental, economic, and social impact of any action.'"[464] The court noted with disapproval that the agency had not evaluated the harm from increased use of substitute products.[465] Because EPA did not account for "the dangers posed by the substitutes, including cancer deaths from the other fibers used and highway deaths occasioned by less effective, non-asbestos brakes,"[466] the agency's "failure to examine the likely consequence of the the regulation render[ed] the ban of asbestos friction products unreasonable."[467] In short, EPA's cost-benefit analysis did not, in the court's view, adequately address indirect costs and was therefore unsupported by substantial evidence as required under the statute.[468]

A year later the D.C. Circuit again struck down a regulation, this time promulgated by the National Highway Traffic Safety Administration (NHTSA), for failing to consider indirect costs.[469] NHTSA had attempted to increase fuel efficiency standards for cars.[470] The agency failed to consider the potential increased safety risks because smaller, more fuel efficient cars

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[459] *Id.*
[460] *See* Environmental Protection Agency, *Guidelines for Preparing Economic Analyses*, *supra* note 429, at 11-2.
[461] *See generally* Caroline Cecot & W. Kip Viscusi, *Judicial Review of Agency Benefit-Cost Analysis*, *supra* note 33 (collecting and analyzing cases where courts reviewed agencies' cost-benefit analyses).
[462] *See* Corrosion Proof Fittings v. EPA, 947 F.2d 1201, 1229-30 (5th Cir. 1991).
[463] *See id*. at 1225.
[464] *Id.* at 1215 (quoting 15 U.S.C. § 2601(c)).
[465] *See id*. at 1221.
[466] *Id.* at 1224.
[467] *Id.*
[468] *Id.* at 1207.
[469] *See* Competitive Enterprise Inst. v. Nat'l Highway Traffic Safety Admin., 956 F.2d 321, 323-35 (D.C. Cir. 1992).
[470] *See id*.

might be less protective in a crash.[471] The court admonished the agency and required NHTSA to "reconsider the matter and provide a genuine explanation for whatever choice it ultimately makes."[472] Without calculating these indirect costs, the court found that the agency had not met the requirement of reasoned decisionmaking.[473]

Other circuit court decisions have likewise addressed the issue of indirect costs and have rejected cost-benefit analyses that lacked an estimate of these effects. In 1993, the Seventh Circuit partially vacated an OSHA regulation putting standards in place to limit the transmission of communicable diseases.[474] The agency failed to consider the indirect health effects that might result if the rule increased health care costs and thus limited access to care.[475] OSHA's "consideration of the indirect costs of the rule is thus incomplete."[476] Similarly, the D.C. Circuit also rebuffed an EPA regulation revising the NAAQS standards for ozone and particulate matter in 1999 because in the court's view, the agency failed to consider the potential health detriments from lowering pollution.[477] Specifically, EPA failed to consider whether "ground-level (tropospheric) ozone—the subject of th[e] rule—has [an ultraviolet radiation]-screening function independent of the ozone higher in the atmosphere"[478] with indirect health benefits, such as reducing incidences of cataracts and skin cancers.[479] The court asserted that by ignoring these consequences, EPA looked only at "half of a substance's health effects";[480] as a result, the agency's interpretation of Title VI of the Clean Air Act[481] failed under the reasonableness standard laid out in *Chevron U.S.A. Inc. v. NRDC*.[482] In 2002, the D.C. Circuit also overturned two Federal Communications Commission rules for the agency's failure to consider the rules' indirect costs[483] in contravention of the language and objectives of the Telecommunication

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[471] *See id*. at 326-27.
[472] *Id*. at 327.
[473] *See id*. ("When the government regulates in a way that prices many of its citizens out of access to large-car safety, it owes them reasonable candor. If it provides that, the affected citizens at least know that the government has faced up to the meaning of its choice. The requirement of reasoned decisionmaking ensures this result and prevents officials from cowering behind bureaucratic mumbo-jumbo. Accordingly, we order NHTSA to reconsider the matter and provide a genuine explanation for whatever choice it ultimately makes.").
[474] *See* Am. Dental Ass'n v. Martin, 984 F.2d 823, 823-27, 830-31 (7th Cir. 1993).
[475] *See id.* ("OSHA also exaggerated the number of lives likely to be saved by the rule by ignoring lives likely to be sacrificed by it, since the increased cost of medical care, to the extent passed on to consumers, will reduce the demand for medical care, and some people may lose their lives as a result.").
[476] *See id.* (citing a comparison to *Competitive Enterprise Inst. v. Nat'l Highway Traffic Safety Admin*., 956 F.2d 321 (D.C. Cir. 1992)).
[477] *See* Am. Trucking Ass'ns v. EPA, 175 F.3d 1027, 1036-37 (D.C. Cir. 1999*), rev'd on other grounds sub nom.* Whitman v. Am. Trucking Ass'ns, 531 U.S. 457 (2001).
[478] *Id.* at 1052.
[479] *See id.* at 1051.
[480] *Id*. at 1052.
[481] Clean Air Act, 42 U.S.C. §§ 7671–7671q (2012).
[482] *See* Am. Trucking Ass'ns v. EPA, 175 F.3d at 1052 (citing *Chevron U.S.A. Inc. v. NRD*C, 467 U.S. 837, 843 (1984)).
[483] *See* U.S. Telecom Ass'n v. Fed. Commc'ns Comm'n, 290 F.3d 415, 424-25 (D.C. Cir. 2002). One rule required incumbent local exchange carriers to lease "unbundled network elements" to competitive local exchange carriers ("CLECs"), while the other rule unbundled the spectrum of local copper loops such that the CLECs would be positioned to offer competitive internet access. *See id.* at 417. However, the court found that the Commission "loftily abstracted away all specific markets" and did not take into account indirect cost differentials in different competitive markets. *See id.* at 423. Moreover, the agency "completely failed to consider the relevance of competition in broadband services coming from cable" and satellite companies, another crucial indirect cost. *Id.* at 428.

Act.[484]

The D.C. Circuit has also addressed the "mirror image" of indirect costs: co-benefits.[485] In 2016, the court's decision in *Sugar Corp v. EPA*[486] upheld EPA's consideration of co-benefits in regulating the effects of reducing hazardous air pollutants from boilers, process heaters, and incinerators.[487] Specifically, EPA decided not to adopt more lenient hydrogen chloride emission standards, reasoning that it could weigh additional factors such as the "cumulative adverse health effects due to concurrent exposure to other [hazardous air pollutants] or emissions from other nearby sources" and the "potential impacts of increased emissions on ecosystems." Industry challengers argued that EPA's consideration of these co-benefits in its decision to maintain the more stringent emissions standard rendered the agency's decision arbitrary and capricious under the Administrative Procedure Act.[488] EPA asserted that "its consideration of these co-benefits was not a regulation of other pollutants; rather, it was simply choosing not to ignore the purpose of the [Clean Air Act]—to reduce the negative health and environmental effects of HAP emissions—when exercising its discretionary authority under the Act."[489] The D.C. Circuit held that EPA acted within its legal authority when it considered not only the direct benefits of reducing hydrogen chloride, but also the co-benefits from that reduction—namely, indirect reductions of other hazardous air pollutants.[490] The court agreed that the use of co-benefits conforms with the Clean Air Act's purpose, finding that "EPA was free to consider potential co-benefits that might be achieved" from enforcing the more stringent standard.[491]

Courts that have examined cost-benefit analyses have acknowledged the logic of examining the indirect effects of regulations and using this information to guide the rule-making process. While more cases deal with indirect costs, modern cases address indirect benefits as well, and no court has said there is any reason to treat them differently. Courts are correct to do so; these terms are merely descriptors that helpfully depict whether effects are positive or negative and they provide no justification for focusing on some effects while ignoring others.[492] Further, as Ginsburg and DeMuth note, "[t]here appear to be no legal, political, or intellectual . . . impediments to treating ancillary benefits and countervailing risks equally in cost-benefit analysis and regulatory design."[493] It would therefore be incoherent to consider the negative indirect effects of regulations without also considering the positive indirect effects.

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[484] *See* U.S. Telecom Ass'n v. F.C.C., 290 F.3d at 427-29 (quoting *AT&T Corp. v. Iowa Utilities Board*, 525 U.S. 366, 388-89 (1999)) (The Federal Communications Commission "must 'apply some limiting standard, rationally related to the goals of the Act,' . . . [and] 'cannot, consistent with the statute, blind itself to the availability of elements outside the incumbent's network.'").
[485] *See* Rascoff & Revesz, *supra* note 410, at 1793 (noting that indirect costs and indirect benefits "are simply mirror images of each other").
[486] 830 F.3d 579 (D.C. Cir. 2016).
[487] *See id.* at 591, 625.
[488] *See id.* at 625.
[489] *Id*. at 624-25.
[490] *See id.*
[491] *Id*.
[492] *See* Rascoff & Revesz, *supra* note 410, at 1793 ("Risk tradeoffs and ancillary benefits are simply mirror images of each other. There is no justification for privileging the former and ignoring the latter.").
[493] Ginsburg & DeMuth, *supra* note 458, at 888.

CONCLUSION

Considering co-benefits from reductions in particulate matter and other criteria pollutants below the NAAQS is clearly supported by science and long-standing EPA precedent. It is also necessary in order to give the public an accurate understanding of the effects of regulation and deregulation. Critics of regulation seek to paint benefits below the NAAQS as illusory, and suggest their inclusion in rules targeting other pollutants is overreach by an overzealous regulator. In this Article, we have shown that this narrative rings hollow. EPA through multiple presidential administrations has calculated benefits from criteria pollutant reductions below the NAAQS, following established science. With regard to particulate matter reductions, which account for the bulk of criteria pollutant benefits in the Mercury and Air Toxics Standards and Clean Power Plan, and would likely be substantial for any regulation of greenhouse gases, the health and premature mortality reduction benefits are exceptionally well documented. EPA has acknowledged the lack of evidence of a particulate matter threshold for more than thirty years, and has calculated benefits from reductions below particulate matter NAAQS levels for two decades. The science on these benefits clearly indicates that no threshold can be identified, and shows that reducing this pollution at levels well below the current NAAQS will yield dramatic health benefits.

The Trump Administration has embraced these anti-regulatory stances in its efforts to repeal the Clean Power Plan. The Administration, and other regulation opponents, suggest that theirs a logical way to account for effects, arguing that including these benefits artificially inflates the positive effects of regulating. But what they advocate is a dishonest attempt to obscure the actual effects of regulations from the public.

Ideological differences about the appropriate role for government to play in the control of pollution are a natural part of democratic debate. But public participation is a key attribute of a vibrant democracy, and such participation is meaningful only if the public is given accurate information about the effects of different proposals. Hiding these substantial benefits obscures the real-world effects of deregulation. We encourage policy makers and the courts that oversee them to embrace sound science and economics, and to require transparent and accurate accounting of the benefits of air pollution regulations.