Designing More Effective Rules and Permits

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While enforcement is . . . essential . . . it is not realistic to think that enforcement alone will get us to the levels of compliance envisioned by our rules. We can get a bigger bang for the buck by working hard to make sure we design rules that will work in the real world—rules with compliance built in.

—Cynthia Giles[1]

Achieving the intended health and environmental benefits of rules and permits depends on widespread regulatory compliance. Today's compliance challenges require a modern approach with new tools while continuing to employ vigorous enforcement as the backbone of environmental protection. Based on the Next Generation Compliance strategy of the U.S. Environmental Protection Agency ("EPA"),[2] this Article describes five principles and sixteen tools for designing more effective regulations and permits[3] that are easier for government agencies to implement, promote routine high compliance among those regulated, and are more likely to deliver their intended health and environmental benefits. All of the principles and tools may not necessarily apply to, or be appropriate for, a given regulation. Even where a principle or tool could be effective, for example, the legal authority for a government agency to implement it may be lacking. Government agencies will therefore need to consider and apply the principles and tools based on their particular needs and constraints for addressing specific environmental problems.

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The views expressed in this Article are those of the Authors and do not necessarily represent official U.S. Environmental Protection Agency positions.

1. Cynthia Giles, *Next Generation Compliance*, Envtl. F., Sept.–Oct. 2013, at 22, 23, http://www2.epa.gov/sites/production/files/2014-09/documents/giles-next-gen-article-forum-eli-sept-oct-2013.pdf. Cynthia Giles is the United States Environmental Protection Agency's Assistant Administrator for OECA.

I. Factors Contributing to Noncompliance

Applying the principles and tools in this Article for effective regulations will require government agencies to consider and address multiple factors in the real world that collectively influence compliance. Summarized below are eight key factors that often contribute to noncompliance. Regulators can improve compliance in rules and permits by identifying their key compliance challenges upfront and addressing them by designing the regulations and permits to leverage applicable compliance drivers using the principles and tools described here.

A. Compliance Costs and Benefits

Economic theory views actors as rationally motivated to maximize profits and utilities.[4] Environmental pollution is an externality from which actors benefit personally while

2. *See generally Next Generation Compliance*, U.S. Envtl. Protection Agency, http://www2.epa.gov/compliance/next-generation-compliance (last updated Sept. 11, 2015) (describing the new strategy and providing additional resources via hyperlink).
3. In this Article, for simplicity, the Authors at times refer to regulations only. These references should be understood in context to apply to regulations and permits.
4. *See, e.g.*, Thomas S. Ulen, *Rational Choice Theory in Law and Economics*, *in* Encyclopedia of Law and Economics (Boudewijn Bouckaert & Gerrit De Geest eds., 2000).

imposing their social and environmental costs on others.[5] In his seminal 1968 article, Garrett Hardin explained this as a "tragedy of the commons" whereby individuals acting independently and rationally according to self-interest behave contrary to the long-term interests of the group by depleting common resources.[6] Social and biological scientists view remedying environmental problems as requiring human beings to undertake the difficult task of shifting our natural focus from avoiding immediate costs and obtaining short-term benefits to a longer term perspective that considers not just our own immediate needs but society's long-term needs.[7] Additionally, regulated entities may perceive that maintaining regulatory compliance negatively impacts profits by lowering product quality. Consequently, all else being equal, one would anticipate compliance to decline as the cost of compliance increases, with cost being measured in time and money and being relative to a facility's size and sophistication. In contrast, the objective of most rules and permits is to internalize pollution control costs and make them immediate to the regulated universe while delivering benefits to the public over longer time frames.[8]

B. Big Cultural or Social Changes

Culture or social change refers not to economic costs per se, but to the extent which regulated entities must alter their current practices and procedures to comply with laws, regulations, and permits.[9] Because there is a great deal of behavioral inertia associated with cultural norms, all other things being equal, the greater the intended culture change, the greater the likely resistance to change.[10] Culture change issues are exacerbated when accompanied by an actual or perceived cultural norm of noncompliance. In such cases, a rational actor may think, "Everyone else is breaking the rule—why shouldn't I?" In short, rules that aim to change customary patterns of behavior will often require a longer time to become the new norm and a vigorous enforcement program may be especially critical. In contrast, if the rule is shoring up existing norms, the compliance hurdle is likely to be much lower.[11]

C. Regulatory Complexity or Vagueness

Rules and permits must be sufficiently clear and understandable for regulated entities to know they are being regulated (commonly referred to as "applicability"), understand their obligations, and be able to determine how to comply. Rule complexity frustrates these outcomes. It can hinder regulators and the public, by preventing government personnel and citizens from readily determining who is regulated and whether they are complying. Nevertheless, there are often pressures on government to create laws, rules, or permits that acknowledge the uniqueness of members of the regulated universe. For example, regulatory complexity can be mandated by statute.[12] Regulators may attempt to maximize compliance benefits and minimize costs by incorporating flexibility into rules in the form of complicated conditions, exemptions, and exceptions.[13] This can produce complex or vague rules that are difficult to understand, implement, and follow.

D. Lack of Awareness

While "ignorance of the law" is not normally a defense,[14] in today's complicated world, being aware of and navigating every potentially applicable rule or permit may require sophisticated knowledge or reliance on costly experts for guidance. Such knowledge or expert assistance may be beyond the reach of portions of the regulated universe. This can promote noncompliance.

E. Disagreement With the Law

Regulated entities may disagree that there are, in fact, environmental problems that need to be addressed; that the rules in question are needed or appropriate to address the problems; or that that they, specifically, should be required to help remedy them. This may lead a regulated entity to believe it is entitled to violate the relevant rule. An illustrative analogy might be finding oneself on a broad, straight highway where the speed limit is only fifty-five miles per hour. It is tempt-

5. *See, e.g.*, Tom Tietenberg, Environmental and Natural Resources Economics 45 (4th ed. 1996).
6. Garrett Hardin, *The Tragedy of the Commons*, 162 Science 1243, 1244 (1968).
7. *See* Susan M. Koger & Deborah Du Nann Winter, The Psychology of Environmental Problems: Psychology for Sustainability 5 (3d ed. 2010).
8. *See generally* Tietenberg, *supra* note 5.
9. *See* Michael Watkins, *What Is Organizational Culture? And Why Should We Care?,* Harv. Bus. Rev. (May 15, 2013), https://hbr.org/2013/05/what-is-organizational-culture.
10. *See, e.g.*, Gerald Zaltman & Robert Duncan, Strategies for Planned Change (1977) (identifying eighteen factors impacting resistance to change in four categories: cultural, social, organizational, and psychological).
11. Franklin Zimring & Gordon Hawkins, *The Legal Threat as an Instrument of Social Change*, J. Soc. Issues, Spring 1971, at 33, 33–48 (1971).
12. For example, the Resource Conservation and Recovery Act ("RCRA"), Pub. L. No. 94-580, 90 Stat. 2795 (1976) (codified as amended at 42 U.S.C. §§ 6926–6992k (2012)), establishes the framework for the proper management of hazardous and non-hazardous solid waste. *See Resource Conservation and Recovery Act (RCRA) Laws and Regulations*, U.S. Envtl. Protection Agency, http://www.epa.gov/rcra (last visited Feb. 8, 2016). Section 1004(27) of RCRA defines the term "solid waste" to mean, among other things specified, "garbage, refuse, sludge . . . and other discarded material, including solid, liquid, semisolid, or other contained gaseous material" in addition to specifying materials not included as solid waste. 42 U.S.C. § 6903(27) (2012). EPA's corresponding regulatory definition of solid waste appears in section 261.2 of title 40 of the *Code of Federal Regulations*. 40 C.F.R. § 261.2 (2015); *see also id.* § 261.4(b) (establishing exclusions for seventeen solid wastes which are not hazardous). Recognizing the definition's complexity, EPA offers the public a variety of tools, compendiums, and other resources to navigate solid waste determination decisions. *Definition of Solid Waste for RCRA Subtitle C Hazardous Waste*, U.S. Envtl. Protection Agency, http://www3.epa.gov/epawaste/hazard/dsw (last updated Feb. 23, 2016).
13. U.S. Office of Mgmt. & Budget, *Regulatory Impact Analysis: A Primer*, White House 2 (n.d.), https://www.whitehouse.gov/sites/default/files/omb/inforeg/regpol/circular-a-4_regulatory-impact-analysis-a-primer.pdf ("Agencies should select the alternative that maximizes net benefits, while also taking into consideration distributive impacts and qualitative benefits and costs, unless a statute requires another approach."). In *Regulatory Impact Analysis: A Primer*, the U.S. Office of Management and Budget specifically discusses the use of delayed compliance dates or partial or total exemptions based on firm size, and setting different regulatory requirements for different geographic regions, as potential ways to maximize net regulatory benefits. *Id.* at 6–7.
14. Sharon L. Davies, *The Jurisprudence of Willfulness: An Evolving Theory of Excusable Ignorance*, 48 Duke L.J. 341, 342 (1998).

ing to rationalize the speed limit as unnecessary and ignore it. And even isolated or simple "disagreements with the law" can be exacerbated when they become politically charged.

F. Complying With the Spirit of the Law

Regulated entities may accept the need for a rule, generally, but interpret it in a way that meets their needs while ignoring the bigger picture. Based on interpretation of social psychology theory and research, the Authors refer to this approach as the "I'm special" mindset.[15] Returning to the speeding analogy, an individual may feel safe even though she is driving at an excessive speed. Similarly, an individual might feel the speed limit, while appropriate for most other drivers, is unnecessary for her because she deems herself to be an exceptionally competent driver in a justified rush. In a large regulated universe, where each individual entity's pollution contribution may be relatively small but the cumulative impact of the universe's combined pollution is severe, the "I'm special" mindset can be a significant driver of noncompliance and pollution.

G. Competitors Not Subject to the Rule

A regulated entity may believe, correctly or incorrectly, that some of its competitors are not subject to regulations it is required to follow. This may be because of inherent statutory or practical constraints in the law or regulatory structure. For example, the structure of our international economy is such that U.S. law may impose domestic controls on activities that are unregulated in other countries.[16] When some regulated entities in a market feel it is unfair they are being regulated while other competitors in the same market are not, it may drive noncompliance.

H. Inadequate Deterrence

The principle of deterrence underlies compliance monitoring and enforcement programs of the EPA and other governmental agencies. The EPA has consistently described its compliance and enforcement programs as providing both specific and general deterrence.[17] Specific deterrence occurs when compliance monitoring and enforcement identify specific violators and return them to compliance. General deterrence occurs when compliance monitoring and enforcement against specific entities also influence other similarly situated entities to achieve and maintain compliance.[18] Researchers have found that increases in inspections, enforcement, and penalties can enhance specific and general deterrence and improve compliance.[19] But the overall mix of inspections, enforcement actions, and penalties could be too infrequent or small to positively influence compliance. While strong criminal and civil enforcement is—and will continue to be—an essential part of agency environmental protection work,[20] it cannot by itself address all the noncompliance problems of the twenty-first century.[21] For example, when the government cannot determine the identities of the firms in a regulated universe due to missing or unreliable data, it may be difficult to increase its specific deterrence of the firms through targeted inspections or enforcement. Where violators cannot determine that a given rule applies to them, learning of monitoring and enforcement against others cannot be expected to prompt the classic general deterrence response of a perceived increased risk of discovery and punishment with corresponding compliance behavior improvements.[22]

In sum, designing effective rules and permits to produce routine high compliance will require government agencies to assess the factors most likely to contribute to noncompliance and structure rules and permits to overcome these factors by leveraging compliance drivers. The remainder of this Article describes the factors that can contribute to compliance. Five principles and sixteen tools are presented with examples illustrating their design, implementation, and effectiveness.

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15. *See, e.g.*, Elliott Aronson, The Social Animal (11th ed. 2012. The so-called "I'm special" mindset or rule is also related, conceptually, to special pleading. Special pleading is defined as "an unfair attempt to influence someone in authority to do something that will be of benefit only to you." *E.g.*, *Special Pleading—Definition and Synonyms*, Macmillan Dictionary, http://www.macmillandictionary.com/us/dictionary/american/special-pleading (last visited Mar. 16, 2016). The "I'm special" rule is cited in diverse contexts to explain why people sometimes act as though the same laws or standards applicable to everyone else do not apply to them. *See, e.g.*, Gary Alan Fine, *Weiner Redux: The "I'm Special" Rule—When Politicians Think the Rules Don't Apply, They're in Trouble*, Psychol. Today (June 6, 2011), https://www.psychologytoday.com/blog/the-global-grapevine/201106/weiner-redux-the-i-m-special-rule. Since the Authors, based on extensive environmental enforcement experience, began referencing the "I'm special" mindset as a driver of noncompliance with environmental regulations, other environmental practitioners have begun using it in this context, as well. *See, e.g.*, Jonathan D. Edwards, *Federal Directions in Radiation Regulations: Making the "Old" New Again*, 110 Health Physics 151, 151–57 (2016) (referencing EPA's OECA in identifying the "'I'm special' mentality" as a noncompliance driver).
16. *See generally* Foreign Corrupt Practices Act of 1977, Pub. L. No. 95-213, 91 Stat. 1494 (codified as amended at 15 U.S.C. §§ 78m, 78dd-1, 78dd-2, 78dd-3, 78ff (2012)) (containing provisions making it illegal for U.S. firms to bribe foreign officials in foreign countries whether or not it is illegal in those foreign countries).
17. *See, e.g.*, U.S. Envtl. Prot. Agency, EPA General Enforcement Policy GM-21, Policy on Civil Penalties 3 (1984), http://www2.epa.gov/sites/production/files/documents/epapolicy-civilpenalties021684.pdf ("The first goal of penalty assessment is to deter people from violating the law.").
18. Jon D. Silberman, *Does Environmental Deterrence Work? Evidence and Experience Say Yes, But We Need to Understand How and Why*, 30 ELR 10523 (July 2000).
19. *See* Wayne B. Gray & Jay P. Shimshack, *The Effectiveness of Environmental Monitoring and Enforcement: A Review of the Empirical Evidence*, 5 Rev. Envtl. Econ. & Pol'y 3 (2011).
20. Giles, *supra* note 1, at 22.
21. *E.g.*, U.S. Envtl. Prot. Agency, CWA Action Plan Implementation Priorities: Changes to Improve Water Quality, Increase Compliance and Expand Transparency 3 (2011) ("The [National Pollutant Discharge Elimination System] regulated universe has expanded from the roughly 100,000 traditional point sources to approximately one million dispersed and sometimes transient sources, such as [Concentrated Animal Feeding Operations], construction sites, and other types of stormwater dischargers. Many of these sources discharge pollutants that cause serious water quality problems.").
22. Positive compliance behavior modifications include actions taken by firms committed to compliance, for normative and reputational reasons, who tend to view themselves as responsible corporate citizens with no need to fear the social and economic costs that can be triggered by serious violations. For these firms, learning about penalties against other firms reminds them to continue to take positive steps to comply, while reassuring them that free-riders will be punished. *Cf.* Dorothy Thornton et al., *General Deterrence and Corporate Environmental Behavior*, 25 L. & Pol'y 262, 274–78 (2005).

II. A New Regulatory Design Paradigm

> *Protecting clean air and water, and ensuring our communities are safe from pollution, is more complex today than ever. Whether it's pollution that's not apparent to the naked eye or large numbers of small sources that collectively have a big impact on the environment, new challenges require us to innovate and improve.*
>
> —U.S. Environmental Protection Agency[23]

Legislators pass environmental laws authorizing regulators to issue rules that are intended to provide the public with air that is healthy to breathe, water that is safe for drinking or recreation, and land that can support a vibrant ecosystem and economy. These benefits, however, cannot be fully achieved without routine high regulatory compliance. Although compliance data are too often missing or incomplete, where data exist, substantial noncompliance is often evident.[24] As discussed above,[25] vigorous government monitoring and enforcement deters noncompliance, yet individual facility inspections and enforcement alone cannot assure full compliance. Thus, while robust compliance monitoring and enforcement will remain critically important for identifying and addressing violations and promoting deterrence, more is needed.[26]

Moving beyond the status quo to routine high compliance requires governments to develop more effective rules and permits that build in public accountability, self-monitoring, self-certification, electronic reporting, and other innovative methods to improve compliance. Specifically, this will require regulators to take the following actions.

First, regulators must design more effective regulations and permits that are easier to implement, drive improved compliance, and achieve better environmental outcomes. This may be accomplished by applying the principles and tools described in this Article.

Second, regulators must use and promote advanced pollutant detection technology so regulated entities, the government, and the public can more easily "see" pollutant discharges, environmental conditions, and noncompliance. By making "visible" pollution that is currently "invisible," the government-industry dialogue can change from, "Are there pollution problems?" to, "How we can collaborate to address the problems, perhaps even before they become violations?" Industry will become better able to prevent and reduce pollution, while often making their operations more efficient. Governments will be better able to target limited compliance and enforcement resources on remaining pollution and noncompliance problems.

Third, regulators need to expand transparency by making the information we have today more accessible, and making new information obtained from advanced emissions monitoring and e-reporting publicly available, to provide more accurate, complete, and timely information on pollution sources, pollution, and compliance. This will empower communities and the marketplace to play a more active role in compliance oversight and improve the performance of both the government and regulated entities.

Regulators can apply what research and experience teaches about driving better performance to achieve better results more efficiently by building compliance into rules and permits. Building these features into rules and permits can address the factors that might otherwise contribute to noncompliance.

III. Principles and Tools for Designing More Effective Rules and Permits

A. *Principle 1: Enable Government, Regulated Entities and the Public to Easily Identify Who Is Regulated and the Applicable Requirements*

> *[W]e should focus on greater simplicity and clarity. One of the principles we have learned over years of hard experience is that compliance is better when the rules are simple and clear. When you consider what will actually happen in the real world, the net environmental benefit of a simpler, clearer rule may trump a more detailed and in theory more protective standard. We need to think more carefully about balancing flexibility and simplicity when we write rules and permits.*
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> —Cynthia Giles[27]

Writing clear rules and "getting applicability right" (i.e., enabling regulated entities, regulators, and the public alike to readily determine who is regulated and the requirements that apply) are critical underpinnings to all of the rule effectiveness principles and tools in this Article. Regulated entities often cite rule complexity as among their key compliance challenges. Research suggests that ignorance of regulatory obligations by firms or individuals may indeed be a substantial reason for noncompliance and that the level of complexity in regulations contributes to this ignorance.[28] This comports with intuition and experience that simpler rules, which clearly identify who is regulated, what an entity must do to comply and how an entity should detect noncompli-

23. U.S. Envtl. Prot. Agency, Next Generation Compliance: Strategic Plan 2014–2017, at 1 (2014).
24. *See* Daniel A. Farber, *Taking Slippage Seriously: Noncompliance and Creative Compliance in Environmental Law*, 23 Harv. Envtl. L. Rev. 297, 303–05 (1999).
25. *See supra* Section I.H.
26. *See, e.g.*, Giles, *supra* note 1, at 22.
27. *Id.* at 24.
28. *See, e.g.*, Sarah L. Stafford, *Rational or Confused Polluters? Evidence From Hazardous Waste Compliance Contributions*, 5 Econ. Analysis & Pol'y 1 (2006). Stafford presents the "first national study to explicitly consider the role that complexity plays in the environmental compliance decision." *Id.* at 4. After developing a model for complexity using variables including firm size, whether a facility is multimedia, and whether the facility is part of a multi-plant company, Stafford inputs data from large quantity hazardous waste generators and management facilities in the United States in 1999. *Id.* at 4–16. The results indicate that both the rational polluter model and the complexity critique help explain noncompliance with RCRA requirements. *Id.* at 28. In support of the complexity critique, Stafford finds that the facilities subject to more complex regulations are more likely to violate, that facilities appear to learn from past inspections, and that they are less likely to violate in states with programs directed towards compliance assistance. *Id.* These effects were stronger for non-management violations than for management violations. *See id.*

ance, are not only easier for regulated entities to comply with, but also easier for governments to implement than more complex rules.

1. Tool 1a: Where Possible, Focus Regulatory Requirements on Fewer, Better-Defined "Upstream Sources" (Supply Chain) Rather Than Numerous Diverse or Diffuse "Downstream Sources"

The government can implement rules more effectively and efficiently when the universes of regulated sources are smaller and better-defined. This is because, other factors being equal, governments can more easily identify, monitor, and enforce against fewer, rather than more, entities. As one moves downstream in the supply chains for products or services, the number of entities generally increases—often substantially—and their management may become more decentralized, such as when a refiner licenses or franchises many gas stations that use the refiner's name but operate with a substantial degree of independence.[29] Consequently, upstream facilities are normally easier to monitor and enforce against relative to downstream facilities.

Whether to focus regulatory requirements on fewer, better-defined upstream sources in a given rulemaking will depend on the nature of the environmental or health problems and the characteristics of the supply chain. To identify opportunities for focusing rules on smaller sets of upstream sources, regulatory agencies should first determine the supply chain for the potentially regulated products, services, or activities. The resulting supply chain diagrams can then prompt inquiry into how the entities and their activities at each step of the chain contribute to the health or environmental problems of concern and help regulators to identify effective regulatory options.

For example, limiting markets to products manufactured to meet an applicable emission standard can obviate the need to regulate end users. The EPA took this approach in its rule for non-road diesel engines.[30] Where a large number of persons are using products with engines in a variety of pollution-generating activities but there are only a handful of engine manufacturers and importers, focusing on the manufacturers and importers by requiring all engines used or sold domestically to meet the applicable emission standards may be an effective regulatory approach.[31]

The regulation of reformulated gasoline ("RFG") is another example of regulating upstream. RFG is required in cities with high smog levels and is optional elsewhere. Under the Clean Air Act ("CAA"),[32] RFG must be blended to burn more cleanly than conventional gasoline to reduce smog-forming and toxic pollutants.[33] About thirty percent of gasoline sold in the United States is reformulated.[34] The upstream regulated universe for RFG consists of approximately 194 refiners and importers, and 95 finished-fuel pipelines. The downstream regulated universe includes roughly 1300 terminals, 8000 truck distributors, 155,000 retail outlets, and 100,000 fleet fueling facilities. Given these numbers, EPA structured the RFG program to place its every-batch sampling, testing, and attest audit requirements on the refiners and importers.[35]

2. Tool 1b: Consider Whether Simple Rules Promoting High Compliance Can Deliver More Actual Regulatory Benefits Than Complicated Rules With Low Compliance

Environmental agencies will often tailor regulations to recognize differences among the members of a regulated universe, maximize the regulated entities' compliance options or flexibility, or otherwise meet sector or facility-specific technical needs or problems. Consequently, rules may have complex applicability criteria, exemptions, exclusions and conditions. Such complex, tailored rules, while protective and cost-effective on paper, are not always beneficial in practice. Poor compliance can undermine complex rules. When circumstances suggest equivalent compliance under either simple or complex rules, the latter may be preferable because they provide tailored flexibility or for other reasons. Simplicity, however, should not be undervalued. Simple rules are easier for regulated entities to understand and for regulators to apply. Ultimately, relying on a simple rule may result in better overall compliance. Regulators should thus consider whether a simple rule, despite appearing less protective, might actually achieve higher compliance and greater environmental benefits.[36]

When regulated entities, regulators, and the public cannot easily determine who is regulated; understand requirements; and determine the regulated universe's compliance status; opportunities to leverage economic, social, and political pro-compliance pressures may be squandered. Even where regulations must be complex for statutory or technical reasons

29. *See* discussion *infra* Subsection III.A.1.
30. The Nonroad Diesel Engines rule reduces emissions from non-road diesel engines by integrating engine and fuel controls systematically to obtain significant overall emission reductions. Air pollution generated from the over 650,000 new non-road engines introduced into commerce each year contribute significantly to public health problems. These engines are used in a wide range of construction, agricultural, and industrial settings: tractors, bulldozers, forklifts, etc. The EPA could have tried to regulate the end users of the engines by making the vehicles subject to emissions limits and controls post manufacture. But instead, EPA regulated the much smaller number of engine manufacturers and importers by requiring all such engines sold in the United States, whether manufactured domestically or imported, to build in the pollution control equipment and design features needed to meet the emission standards. *See Nonroad Diesel Engines*, U.S. Envtl. Protection Agency, http://www.epa.gov/otaq/nonroad-diesel.htm (last updated Feb. 23, 2016).
31. *See infra* Subsection III.B.1.
32. Clean Air Act, Pub. L. No. 88-206, 77 Stat. 392 (1963) (codified as amended at 42 U.S.C. §§ 7401–7671q (2012)).
33. *See* 42 U.S.C. § 7545(k)(3)(B) (2012).
34. *Reformulated Gasoline*, U.S. Envtl. Protection Agency, http://www2.epa.gov/gasoline-standards/reformulated-gasoline (last updated Sept. 28, 2015).
35. The more numerous downstream parties are also regulated though their requirements are simpler. They are subject primarily to affirmative defense-related sampling/testing, product transfer, and recordkeeping requirements. *Id.*
36. *See* Martha G. Roberts, *Integrating Compliance and Regulatory Design in EPA Rulemaking*, 20 N.Y.U. Envtl. L.J. 545, 556–61 (2014).

(e.g., an authorizing statute requires a range of permit types or emission standards for discrete regulated universe subsets), regulators should consider whether it is possible to simplify aspects of the rule to improve compliance.

Regulatory thresholds may necessitate special considerations. There is not a "one size fits all" approach to setting and writing regulatory thresholds but, where possible, thresholds for applicability should be simple and not require complex data collection and analysis. For example, in lieu of complex thresholds that are difficult to understand and monitor, regulators could consider objective thresholds based on accumulation volumes, which may be easier not only for regulated entities to comply with, but also for government agencies to implement.

3. Tool 1c: Use Clear and Objective Regulatory Requirements and Applicability Criteria

Clear, objective regulatory requirements and applicability criteria are important to all—regulators, the regulated community, and the public alike.[37] Can facilities, regulators, and the public determine, practically speaking, to whom the rule applies, what regulated entities must do to comply, and the terms and specifics governing any conditions precedent, exemptions, or exclusions? If not, the rules are likely to be more open to misinterpretation, debate, and litigation.

Minnesota's new landowner buffer initiative exemplifies the benefits of clear and objective requirements by establishing a quantifiable, simple to apply threshold in lieu of requiring landowners to meet combinations of specific and complex protective practices.[38] To improve water quality, the law "designat[es] an estimated 110,000 acres of land for water quality buffer strips statewide."[39] For landowners abutting public waters, compliance is demonstrated by having a buffer strip of at least fifty feet, unless the farmer gets approval for an alternative approach. This buffer is thus Minnesota's new regulatory default.[40] While Minnesota's landowners are still allowed to seek alternatives by applying for a combination of vegetative, structural, engineering, and management practices in lieu of meeting the fifty foot requirement, landowners may be more likely to accept the simple default option than to develop and apply for more complex, customized alternative plans requiring local technical assistance, review, and approval.[41]

Whether a rule or permit is viewed as complex or simple will often depend on the intended end user. For example, a permit for a manufacturing facility with environmental engineers and consultants can be more complex than a permit controlling stormwater at a retail shopping center. Rules and permits should be intelligible to, and meet the needs of, facility managers and staff, and government inspectors.

Regulators, understandably, must ensure their regulations and permits satisfy the agency scientists and legal counsel, legislatures, or courts required to approve the rules as meeting applicable technical, policy, political, or legal criteria. But in doing so, regulators must not overlook the interests and needs of the plant manager and staff responsible for complying with the rules or permits and the government inspectors who will need to consult the rules or permits to determine compliance. If a rule or permit is too complicated for these end users, no matter how pleased the approvers and brokers are with it, it is less likely to be effective in driving compliance.[42] Agencies developing rules or permits thus need to focus on effectiveness and implementability, along with policy and legal defensibility, to ensure regulatory schemes that are comprehensible both to regulated sources and government inspectors.

An exposition of all of the considerations for writing clear and objective rules is beyond the scope of this Article. As an example, though, consider how using plain language can enhance clarity and enforceability. On January 18, 2011, President Barack Obama issued an Executive Order stating that agencies "must ensure that regulations are accessible, consistent, written in plain language, and easy to understand."[43] The EPA promotes the use of plain language to, among other things, "help increase compliance with regulations and decrease mistakes, frustration, and appeals, allowing us to serve American citizens more cost-effectively and efficiently."[44]

Plain language techniques can include using a question and answer format, logical organization and informative headings, illustrative information with tables/graphics, short sentences/sections, or an active voice incorporating personal pronouns ("you"). Simple language and clear language are not, however, necessarily identical. Even the flawed or imprecise use of commas can have regulatory consequences. Compare, for example, "Inspect your facility valves and flanges," with, "Inspect your facility, valves, and flanges." The first wording, lacking a comma between "facility" and "valves," invites a narrow interpretation of "facility" as an adjective modifying the two nouns, "valves" and "flanges." Only the valves and flanges must be inspected. The two commas in the

37. When citizens and stakeholders can easily determine who is regulated and when, they are empowered to better identify and focus their attention on regulated entities, which promotes enhanced public engagement by promoting compliance and accountability. In addition, the clearer and more objective such criteria are, the easier it is for the EPA, states, and tribes to share information on who is regulated with communities.

38. *See Buffer Mapping Project*, Minn. Dep't Nat. Resources, http://www.dnr.state.mn.us/buffers/index.html (last visited Mar. 16, 2016).

39. *2015 Buffer Legislation,* Minn. Board Water & Soil Resources, http://www.bwsr.state.mn.us/buffers (last visited Mar. 16, 2016).

40. Clear and objective defaults can be important drivers of behavior. As a leading behavioral economist observed, "The simplest example of a successful nudge is the default option." Richard H. Thaler, *Do You Need a Nudge?*, Yale Insights (Nov. 4, 2009), http://insights.som.yale.edu/insights/do-you-need-nudge; *see also* Richard H. Thaler & Cass R. Sunstein, Nudge: Improving Decisions About Health, Wealth, and Happiness (1st ed. 2008).

41. *See* Minn. Bd. of Water & Soil Res., Alternative Practice Options for Landowners—Governor's Buffer Initiative (2015), http://files.dnr.state.mn.us/features/buffers/alternative-practice-options.pdf.

42. *See* Ken Miller, We Don't Make Widgets—Overcoming the Myths That Keep Government From Radically Improving 62–68 (2006).

43. Exec. Order No. 13,563, 76 Fed. Reg. 3821 (Jan. 18, 2011).

44. Memorandum from EPA Administrator to Employees, Plain Language (June 13, 2003) (on file with authors).

second wording invite a broader interpretation of "facility" as a separate noun that is independently subject to the requirement to "inspect." When emphasizing simplicity, do not lose track of clarity.

B. *Principle 2: Structure Regulations to Make Compliance Easier Than Noncompliance*

> *[W]e are using what we have learned about compliance to make it easier to comply than to violate. . . . We know a lot about what drives compliance; we need to use that knowledge to structure programs that will work better and be more self implementing.*
>
> —Cynthia Giles[45]

Rules and permits can be structured to make compliance the behavioral default. There are two basic structural approaches for doing so. The rules can require physical designs that make it intrinsically difficult, expensive, or impossible for regulated entities to violate. Or, the rules can include features to improve the ability of regulators, sources, and stakeholders to detect and respond to noncompliance.[46] For rules structured in one or both ways, determined persons may still be able to avoid their obligations but most will choose to comply rather than undertake extra efforts to violate. Admittedly, structuring regulations to make compliance easier than noncompliance can be challenging. Nevertheless, regulators should strive to do so because structural approaches have proven to be effective in promoting compliance.[47]

To appreciate how powerful regulatory structure can be in improving compliance, again consider speed limits. Policing traffic shares with environmental monitoring and enforcement the characteristic that the regulated persons or entities are influenced by strong, countervailing forces that would depress compliance.[48] For example, in the traffic context, a driver's desire to go faster to save time can be quite compelling.

Speeding could be deterred by significantly increasing police presence or radar guns on highways. Increasing police presence may be analogized to increasing facilities inspections in that, in both situations, the emphasis from a law enforcement perspective is on directly observing the individuals or firms to identify and deter noncompliance. In both the traffic and environmental contexts, most regulated entities (individuals or facilities) would be expected to respond to direct observation by police or regulators by maintaining or improving their compliance. The police cannot station traffic cops on every street corner all the time, however, nor can EPA or states station "environmental cops" (inspectors) at every facility all the time. The costs associated with significantly increasing, or making routine, site-specific monitoring by inspectors at facilities in many sectors, may be too costly for jurisdictions to implement. Where increased monitoring is unrealistic or impractical, structural tools or physical design approaches can be used to improve regulatory compliance.

Police control speeding by maintaining a sufficient field presence to generate credible deterrence while augmenting their traffic control compliance toolkits with structural approaches for improving driving behavior. These structural approaches utilize technologies allowing for a less extensive routine police field presence.[49] Examples include automatic monitoring devices, (e.g., speed cameras to catch speeders and support expedited ticketing),[50] immediate feedback technologies (e.g., mobile or stationary speed displays to reinforce with drivers, in real time, that they are speeding and can be observed), and physical design speed suppression tools (e.g., speed bumps and deliberately engineered road curves to make speeding physically and psychologically uncomfortable to drivers).

Similar technology and structural approaches can be used to regulate environmental compliance in appropriate situations. Structural tools or physical design approaches do not necessarily have to be applied across-the-board to all of the entities or activities covered by a rule. Rule writers can target structural approaches in rules to address the most compelling compliance issues or potential violations. Structural approaches work best, however, when continuous and permanent. Structural solutions may have little effect if they are easily removed or intermittent. A continuously operating, permanent monitoring system is therefore more likely to drive sustained compliance than an intermittent, temporary one.

1. Tool 2a: If Possible, Build in Physical Structures and Product Designs to Make Noncompliance Difficult

When a rule is physically difficult to violate, entities tend to gravitate naturally towards compliance as the path of least

45. Giles, *supra* note 1, at 22–23.
46. *Cf.* Edward K. Cheng, *Structural Laws and the Puzzle of Regulating Behavior*, 100 Nw. U. L. Rev. 655, 678 (2006).
47. *Id.*
48. *See supra* Part I.
49. Immediate feedback devices have been shown in the traffic control context to promote enhanced regulatory compliance even where government agents are absent. Speed boards, for example, measure and display the speed of incoming vehicles, compare it to either vehicles directly in front of the target (mobile speed boards) or the speed limit (stationary speed boards), and display the information to drivers. A study determined that, in response to such boards, "drivers were driving slower, more carefully . . . and . . . traffic was calmer." Thomas Notbohm et al., Smart Work Zone Deployment Initiative Wisconsin Evaluations Summer 2001 Mobile/Stationary Speed Boards (You/Me Boards) i (2001), http://www.eng.mu.edu/~drakopoa/web_documents/You_Me/MobileSpeedboardwisconsin.pdf.
50. Red light traffic cameras are a traffic control example of a cost-effective automated monitoring technology. Red light cameras supplement traditional police traffic enforcement at key roads and intersections by photographing vehicles running red lights and providing the pictures to the police, often electronically. In addition to providing effective monitoring, they can promote expedited enforcement by enabling law enforcement authorities to mail citations to drivers photographed speeding or running red lights. According to a study conducted by the Insurance Institute for Highway Safety, while primarily targeting drivers running red lights, the "cameras [also] have a generalized effect on motorists' behavior at intersections that extends beyond running red lights." Wen Hu et al., *Effects of Red Light Camera Enforcement on Fatal Crashes in Large US Cities*, 42 J. Safety Res. 277 (2011), http://www.northfieldil.org/documents/police/IIHS_Study_2-1-11.pdf.

resistance.[51] Regulators are therefore encouraged to pose and answer this question in rule and permit design: Can the rule or permit be designed to increase the physical effort entities must expend to violate the rule or alter the physical environment in some manner so as to make compliance the default and reduce the risk of accidental violations?[52]

Using physical structure to assure compliance will become more common as regulators struggle with the need to promote routine high compliance even when resources and site inspections are scarce and regulated universes large. A classic example is EPA's CAA fuel nozzle regulations.[53] Certain CAA fuel regulations require equipment to be constructed to specifications which make dispensing the wrong type of fuel into an engine difficult. Section 211 of the CAA and the regulations at 40 C.F.R. Part 80 establish requirements for the quality of gasoline and diesel fuel.[54] Today, all gasoline is unleaded but as the EPA phased out leaded gas in the mid-1990s it was important to restrict use of leaded gas to older cars because newer cars were equipped with an emission control device, catalytic converters, which leaded gas rendered inoperative.[55] To accomplish this, EPA built physical structures and product designs into the regulations governing gasoline dispenser nozzle snouts and motor vehicle inlet restrictors. Specifically, EPA required pumps dispensing leaded gasoline to have nozzle spouts with a minimum diameter larger than the diameter required for nozzle spouts for pumps dispensing unleaded gasoline.[56] EPA then required the gas tank filler inlet restrictors on new motor vehicles to be smaller than the unleaded nozzle spout diameter.[57] This made it impossible to insert a leaded gasoline nozzle into a catalytic converter-equipped vehicle's gas tank. The physical structures—large nozzle spouts and narrow inlets restrictors—thus reinforced the legal requirements.

Two more examples of environmental rules employing physical design to prevent or minimize pollution are the EPA rules for (1) plumbing fixtures to minimize lead in drinking water and (2) automobile air pollution control equipment. First, lead-free water fixtures keep lead out of potable water sources by eliminating water fixtures as a potential lead source. The Safe Drinking Water Act ("SDWA")[58] makes it unlawful for any person to introduce into commerce any plumbing fitting or fixture that is not lead free.[59] Thus the pollution control feature is designed into the structure of the fittings. Covered plumbing fittings or fixtures dispensing water for human ingestion must contain less than eight percent lead and in addition, must comply with the performance-based standard contained in NSF International Standard 61, section 9. The devices specifically listed in section 9 include kitchen and bar faucets, lavatory faucets, water dispensers, drinking fountains, water coolers, glass fillers, residential refrigerator ice makers, supply stops, and endpoint control valves.[60] On January 4, 2011, Congress enacted the Reduction of Lead in Drinking Water Act[61] to amend section 1417 on the use and introduction into commerce of lead pipes, plumbing fittings or fixtures, solder, and flux.[62] The new law changed the SDWA definition of "lead-free" to require all pipes and potable water plumbing fixtures to have a weighted average of no more than 0.25% lead content.[63]

A structural approach was also used in federal emissions standards applicable to all new cars sold in America, whether manufactured domestically or imported.[64] The standard effectively requires the manufacturers and importers to "build in" specific air pollution control equipment such as catalytic converters.[65] Thus the pollution control equipment is designed into the structure of the vehicles. The EPA could have, in the alternative, placed the responsibility on car purchasers to have the equipment installed at after-market pollution control shops, but this approach would have been harder for government and buyers alike to implement and monitor effectively. Note how this example combines two design principles for highly effective regulations: (1) focusing regulatory requirements on fewer, better-defined upstream sources rather than numerous diverse or diffuse downstream sources; and (2) structuring regulations to build in physical structures and product designs to make compliance easier and noncompliance difficult.

51. Cheng, *supra* note 46, at 665, 716.
52. *See id.* at 703.
53. *See* 40 C.F.R. pt. 80, subpt. B (2015).
54. *Id.*
55. *Milestones in Mobile Source Air Pollution Control and Regulations*, U.S. Envtl. Protection Agency, http://www3.epa.gov/otaq/consumer/milestones.htm (last updated Feb. 23, 2016); *see* Jack Lewis, *Lead Poisoning: A Historical Perspective*, U.S. Envtl. Protection Agency (May 1985), http://www.epa.gov/aboutepa/lead-poisoning-historical-perspective ("Starting with the 1975 model year, U.S. automakers responded to EPA's lead phasedown timetable by equipping new cars with pollution-reducing catalytic converters designed to run only on unleaded fuel. Fittingly, a key component of these catalysts that were to be the undoing of lead was that noblest of noble metals, platinum.").
56. 40 C.F.R. § 80.22 (2015).
57. *Id.* § 80.24
58. Safe Drinking Water Act, Pub. L. No. 93-532, 88 Stat. 1660 (1974).
59. 42 U.S.C. § 300g-6(a)(3)(A) (2012) (SDWA section 1417(a)(3)). This statutory provision took effect on August 6, 1996, and also forbid the introduction of any pipe, pipe fitting, or pipe fixture into commerce that was not lead free. *Id.*
60. For more information, see *Commonly Asked Questions: Section 1417 of the Safe Drinking Water Act and the NSF Standard*, U.S. Envtl. Protection Agency, http://water.epa.gov/lawsregs/rulesregs/sdwa/lcr/lead_nsfstandard.cfm (last updated Nov. 23, 2015).
61. Reduction of Lead in Drinking Water Act, Pub. L. No. 111-380, 124 Stat. 4131 (2011).
62. *Summary of the Reduction of Lead in Drinking Water Act and Frequently Asked Questions*, U.S. Envtl. Protection Agency (Dec. 19, 2013), http://nepis.epa.gov/Exe/ZyPDF.cgi/P100M5DB.PDF?Dockey=P100M5DB.PDF.
63. EPA is crafting new regulations to implement the Reduction of Lead in Drinking Water Act. The rule may employ a third-party certification approach to monitor compliance with the new lead content standard.
64. *See* 42 U.S.C. § 7521.
65. *See generally Emissions Warranties for 1995 and Newer Light-duty Cars and Trucks Under 8,500 Pounds Gross Vehicle Weight Rating (GVWR)*, U.S. Envtl. Protection Agency (2015), http://nepis.epa.gov/Exe/ZyPDF.cgi/P100NNQH.PDF?Dockey=P100NNQH.PDF ("Catalytic converters are critical emission control components that have been installed on most cars and trucks manufactured since 1975. Since engines [do not] burn fuel completely during the combustion process, the exhaust contains a significant amount of harmful pollutants such as carbon monoxide, hydrocarbons, and oxides of nitrogen. The catalytic converter aids the conversion of these pollutants to less harmful substances such as carbon dioxide, water vapor, nitrogen, and oxygen before the exhaust is expelled into the environment.").

2. Tool 2b: Use Immediate Feedback Technology

Immediate feedback technology refers to devices providing regulated entities with accurate measures, in a standardized format, of deviations indicating that regulatory requirements are being, or may soon be, violated. Software combined with hardware can be used to stop or modify operations and send alerts—via e-mail, text messages, sounds, lights, etc.—of permit limit exceedences or performance issues. Regulated entities can receive real-time performance feedback and data intended to prompt, automatically or through user responses to the alerts, remedial actions to correct or prevent violations. And the immediate feedback technology can be combined with public disclosure to promote and leverage transparency and accountability.

The positive behavioral impacts of immediate feedback mechanisms stem in part from their ability to instill in the regulated entities an increased perception of being caught in non-compliance if current conditions continue. This is a classic deterrence response.[66] Immediate feedback technology can also serve important compliance-promoting "reminder" and "reassurance" functions. That is to say, by making regulated entities' noncompliance visible to themselves and potentially others, immediate feedback approaches can remind regulated entities of the importance of compliance and reassure them that the government is making a serious effort to detect and respond to noncompliance.[67]

Immediate feedback technology does not need to be complex and expensive. Consider a currently available consumer example—a Wi-Fi module for new residential hot water heaters sends text messages to the owners when they are leaking and, when properly connected to a compatible mobile app and product, can even allow the homeowners to turn off the heaters remotely to minimize damage.[68] The EPA's recent enforcement settlement with Total Petroleum Puerto Rico Corporation ("Total Petroleum") includes immediate feedback technology. The settlement requires Total Petroleum to install advanced electronic release detection monitoring equipment at over one hundred gas stations with underground storage tanks and state-of-the art centralized monitoring technology that will enable the company to provide around-the-clock surveillance of the gas stations from a central location.[69]

Threshold issues for the use of immediate feedback technology in regulations are whether legal authority exists to require its use, whether the technology exists for the compliance obligations of interest, and whether the technology is cost-effective. Immediate feedback technologies can be expected to be most effective when the feedback monitors can be configured to be constantly active, or active intermittently with frequent measurements. The goal is to provide continuous feedback to regulated entities while not becoming routine like white noise or annoyances to which one becomes acclimated or desensitized over time. In addition, immediate feedback devices must be constructed to appropriate specifications and properly installed and calibrated to applicable standards to ensure their results are accurate and reliable. Where immediate feedback technology is legally supportable, available, and cost-effective, requiring it in rules can provide facility personnel with compliance-enhancing information and incentives to comply.

3. Tool 2c: Build in Self-Implementing Regulatory Consequences to Deficiencies and Noncompliance

Rules can be designed to build in automatic consequences to deficiencies and violations. Deficiencies are noncompliance precursor events that, while not themselves regulatory violations, may lead to violations if unaddressed. Building in warnings or alerts can promote compliance by helping regulated entities to anticipate, prevent, or identify potential violations, thereby avoiding violations.

Building in regulatory consequences for violations can also be an effective way to promote positive outcomes by specifying unambiguous consequences that will result from violations. This is consistent with the concept of writing rules that are simpler to comply with and less costly for government and regulated entities to implement. To effectively build in regulatory consequences, rules should incorporate self-implementing or easy-to-implement provisions to minimize the type and number of violations that will require traditional, site-specific compliance monitoring and enforcement to address. Rules can be structured to anticipate, prevent, and provide for self-implementing ways for facilities to identify and address deficiencies before they become violations. Also, rules can be designed to deter violations through self-implementing regulatory consequences that cost violators more than the economic benefit of noncompliance they would gain from violations. This includes automatic or stipulated penalties that can conserve enforcement resources for violations best addressed through formal enforcement responses.

Building regulatory consequences for deficiencies and noncompliance into rules is distinct from exercising enforcement discretion or providing "no action assurances," which can raise fairness and other concerns.[70] When terms for when and how regulated entities must cure deficiencies or pay stipulated penalties are "hard-wired" into rules or permits, their implementation is regulatory, not discretionary.

To deter noncompliance while avoiding unnecessary litigation costs, EPA built self-implementing regulatory con-

66. *See, e.g.*, Silberman, *supra* note 18.
67. *See* Thornton et al., *supra* note 22, at 266 (analyzing the "reminder" and "reassurance" functions of environmental penalties).
68. *See, e.g.*, *Home Comfort WiFi Module for Select Rheem Performance Platinum Gas Water Heaters*, Home Depot, http://www.homedepot.com/p/Rheem-Home-Comfort-WiFi-Module-for-Select-Rheem-Performance-Platinum-Gas-Water-Heaters-REWRA631GWH/205310140 (last visited Sept. 8, 2015).
69. Press Release, U.S. Envtl. Prot. Agency, Total Petroleum Puerto Rico Corp. Agrees to Spend $1.6 Million to Improve Leak Detection in at Least 125 Gas Stations Across Puerto Rico and U.S. Virgin Islands (Mar. 9, 2015), http://yosemite.epa.gov/opa/admpress.nsf/0/D59F465F6F02135A85257E040052F6F2.
70. *See* Memorandum from Steven A. Herman, Assistant Adm'r, Office of Enf't & Compliance Assurance, U.S. Envtl. Prot. Agency, to U.S. Envtl. Prot. Agency Emps. (Mar. 3, 1995), http://www2.epa.gov/sites/production/files/2013-10/documents/proreq-hermn-mem.pdf.

sequences into the CAA Acid Rain Program.[71] The Acid Rain Program provides that sources must substitute conservative emission values for actual emissions data as available data drops below regulatory "cut points."[72] Because missing data are substituted for automatically, deficiencies do not necessarily become violations. As a result, sources and regulators save enforcement and litigation costs.[73] And because the substituted data increase emissions reported by facilities, sources have an incentive to properly maintain and quality-assure their monitoring equipment.[74] The Acid Rain Program also automatically penalizes excess emissions. Penalties are set at $2000 per ton, adjusted annually for inflation, and payable on demand without enforcement to the U.S. Treasury (in practice, this occurs after the end of year "true-up" in response to penalty demand letters sent by USEPA to the sources).[75] These penalties are generally higher per ton than the costs of purchasing allowances.[76] Excess emissions in the current year can also result in loss of emission allowances in the following year,[77] creating further incentives to comply.

C. *Principle 3: Require Regulated Entities or Third Parties to Assess Compliance and Take Steps to Prevent Noncompliance*

> *Requiring monitoring is . . . surprisingly effective at improving performance; a facility probably won't take steps to improve compliance if it doesn't even know it is violating. Requiring certifications of compliance can also transform compliance rates for some programs; certifications require someone to check, and increase the chances that problems are caught and fixed, creating good jobs and improving protection.*
>
> —Cynthia Giles[78]

The state of the science of compliance monitoring—"collecting and analyzing information on the compliance status of the regulated community"[79]—is evolving rapidly. Understanding and applying these changes are critical to effective regulatory design.[80] Historically, rule writers designed monitoring and reporting requirements to allow regulators and facilities to detect and correct violations, and provide regulators with compliance status information and evidence to bring enforcement actions and evaluate program outcomes.[81] Today, however, monitoring and reporting requirements are being designed increasingly to drive compliance proactively by identifying problems and deficiencies *before* they become violations. Monitoring and reporting provisions are also increasingly being used synergistically with disclosure and transparency to leverage accountability and drive high compliance as described below.

How is compliance monitoring evolving? First and foremost, advances in monitoring and information technology are allowing for more and better data to be generated—data that can "make the invisible visible" and transform the regulator-industry dialogue, as discussed earlier in this Article.[82] These advances are helping to transform monitoring from relying on "expensive, complex, stationary equipment [only], which limits who collects data, why data are collected, and how data are accessed," to a new paradigm characterized by "the materialization of lower-cost, easy-to-use, portable pollution monitors (sensors) that provide high-time resolution data in near real-time."[83]

The EPA and others are already using new monitoring equipment that allow air pollution leaks to be seen and reported, water quality data to be sent using cellphone technology, and near real-time data to be posted on the Internet. While many such approaches are not yet regulatory requirements per se, their development and use can be expected to inform future rule and permit development. In the air media, for example, infrared cameras allow users to see dark plumes that look like smoke when volatile organic compounds such as benzene are released to the air even though these emissions are invisible to the naked eye.[84] The EPA uses such cameras to identify methane and other compounds leaking from oil and gas wells, tanks, and other facilities.[85] Similarly, the EPA's New England Regional Laboratory operates two buoys in Massachusetts, on the Charles River and on the Mystic River, which have solar-powered water quality sensors that take measurements every fifteen minutes and upload the results to EPA's public website.[86] Parameters measured include: temperature, conductivity, pH, dissolved oxygen,

71. *See Acid Rain Program*, U.S. Envtl. Protection Agency, http://www2.epa.gov/airmarkets/acid-rain-program (last updated Sept. 25, 2015).
72. *See* John Schakenbach et al., *Fundamentals of Successful Monitoring, Reporting, and Verification Under a Cap-and-Trade Program*, 56 J. Air & Waste Mgmt. Ass'n 1576, 1577 (2006).
73. *Id.* at 1578.
74. *Id.* at 1577.
75. *Id.* at 1578. In practice, this occurs after the end of year "true-up" in response to penalty demand letters sent by EPA to the sources.
76. *Id.*
77. *Id.*
78. Giles, *supra* note 1, at 24.
79. Int'l Network for Envtl. Compliance & Enf't, *Chapter 6: Monitoring Compliance*, *in* Principles of Environmental Compliance and Enforcement Handbook (1st ed. 1992); *see generally Search Results for Monitoring and Reporting,* INECE, http://inece.org/?s=monitoring+and+reporting&x=0&y=0 (last visited Aug. 31, 2015) (containing information on compliance monitoring and reporting).
80. Portions of this Section III.C also appear in Jon Silberman & David Hindin, *Effective Environmental Monitoring and Reporting*, *in* Encyclopedia of Environmental Law (forthcoming 2016).
81. *See* Int'l Network for Envtl. Compliance & Enf't, *supra* note 79.
82. *See supra* Part II.
83. Emily G. Snyder et al., *The Changing Paradigm of Air Pollution Monitoring*, 47 Envtl. Sci. & Tech. 11,369, 11,369 (2013) (footnotes omitted).
84. For a video of vented gas, which appears as "smoke" billowing from the top of cylindrical metal oil storage tanks and from a pneumatic valve, as seen through an infrared camera, see U.S. Gov't Accountability Office, *Vented Gas Visible Through Infrared Camera*, YouTube (Nov. 30, 2010), https://www.youtube.com/watch?v=N7tLcPQk3PA. *See also* U.S. Gov't Accountability Office, GAO-11-34, Federal Oil and Gas Leases: Opportunities Exist to Capture Vented and Flared Natural Gas, Which Would Increase Royalty Payments and Reduce Greenhouse Gases 6 n.17 (2010) (citing the video). The video also shows the equipment as seen through the naked eye where the gas is invisible. The EPA and a private emission detection firm supplied the clips used to prepare the Government Accountability Office video.
85. *See* Andrew C. Revkin, *Two Ways Infrared Cameras Have Boosted the Case for E.P.A. Rules Cutting Methane Leaks*, N.Y. Times (Jan. 5, 2015, 2:22 PM), http://dotearth.blogs.nytimes.com/2015/01/05/two-ways-infrared-cameras-have-boosted-the-case-for-e-p-a-rules-cutting-methane-leaks/?_r=0.
86. *Id.*

turbidity, chlorophyll, and phycocyanin.[87] The buoy measurements do not directly indicate regulatory noncompliance but they can help support follow-up compliance monitoring or targeting. Another example is the Metropolitan Water Reclamation District of Greater Chicago's program allowing the public to sign up for daily e-mails or text messages when a confirmed combined sewer overflow event or diversion to Lake Michigan occurs.[88] And there are many more such examples.[89]

One outcome of the new advanced monitoring paradigm is that pollution problems that were previously unobservable or could be observed only through expensive equipment or site inspections can now be seen by facilities, regulators, and the public, often in real time. The EPA commonly refers to this as "making the invisible visible."[90]

Advanced monitoring is driving new opportunities to reduce and prevent pollution. Early and high-quality monitoring data can be used to trigger corrective action where predictive data shows a performance trend above a regulated unit's usual or preferred performance level, even when performance is still below the applicable regulatory limit.[91] Advanced monitoring also provides economic benefits to facilities beyond reducing potential enforcement liabilities and penalties. The infrared cameras described above, for example, allow users to see and eliminate releases of volatile organic compounds that represent not only pollution sources but the loss of valuable product. Such advanced monitoring can empower facilities to manage such risks and losses through a variety of cost effective responses such as confirming handles, valves, and flanges are properly closed, replacing worn gaskets, and ensuring seals are functional.

The regulator's toolbox contains many potential monitoring, certification, and reporting tools. Rules and permits can provide for, or support, self, third-party, or even community monitoring. Self-monitoring, self-certification, and reporting provisions in rules and permits can require regulated entities to accurately determine their compliance status and report the results to regulators and the public.[92] Third-party programs use independent entities to report information on regulated entities to the government or assess and verify whether the entities are meeting their regulatory obligations. In addition, rules can be designed to support citizen monitoring which engages members of the public in monitoring activities.[93] Government agencies should apply the best available tools and approaches to achieve, document, and deliver a given program's regulatory goals and benefits.[94]

1. Tool 3a: Require Regulated Entities to Perform Periodic Self-Monitoring and Self-Certification of Their Compliance-Related Activities and Outcomes

Self-monitoring, certification, and reporting provisions require regulated entities—directly or through their agents or contractors—to accurately determine their compliance status and report the results to regulators and/or the public. Regula-

87. Phycocyanin measurement is used to estimate the level of cyanobacteria, which results during harmful algae blooms. *See generally About the Mystic River Watershed*, U.S. Envtl. Protection Agency, http://www2.epa.gov/mysticriver/about-mystic-river-watershed (last updated Sept. 10, 2015); *Basic Information About the Charles River Buoy*, U.S. Envtl. Protection Agency, http://www2.epa.gov/charlesriver/basic-information-about-charles-river-buoy (last updated July 29, 2015); *Live Water Quality Data for the Lower Charles River*, U.S. Envtl. Protection Agency, http://www2.epa.gov/charlesriver/live-water-quality-data-lower-charles-river (last updated Nov. 9, 2015); *Live Water Quality Data for the Mystic River*, U.S. Envtl. Protection Agency, http://www2.epa.gov/mysticriver/live-water-quality-data-mystic-river (last updated Nov. 9, 2015).

88. *Combined Sewer Overflows*, Metropolitan Water Reclamation District Greater Chi., http://www.mwrd.org/irj/portal/anonymous/overview (last visited Aug. 31, 2015) (including information on how to sign up for notifications).

89. *See, e.g.*, *National Pollutant Discharge Elimination System Compendium of Next Generation Compliance Examples*, U.S. Envtl. Protection Agency, http://www2.epa.gov/compliance/national-pollutant-discharge-elimination-system-compendium-next-generation-compliance (last updated Oct. 2, 2015).

90. *See, e.g.*, Giles, *supra* note 1, at 24 ("One of the more powerful uses of [advanced monitoring] technologies is to make previously invisible pollution visible.").

91. The objective is to give the regulated entity information it can use to prevent violations or to fix violations early, before they become serious problems to be addressed by enforcement actions. Consider, for example, EPA's Petroleum Refinery Sector Risk and Technology Review and New Source Performance Standards final rule. Petroleum Refinery Sector Risk and Technology Review and New Source Performance Standards, 80 Fed. Reg. 75,177 (Dec. 1, 2015) (to be codified at 40 C.F.R. pts. 60, 63). This rule will control toxic air emissions from petroleum refineries and provide information about refinery emissions to the public. *Id.* The rule requires continuous fenceline monitoring of benzene concentrations to ensure the refineries appropriately manage emissions from fugitive sources such as leaking equipment and wastewater treatment. If a refinery's emissions exceed the action level established in the rule, the refinery is required to initiate a root cause analysis to identify the cause of the exceedance and determine and implement appropriate corrective action to reduce pollution in neighboring communities. *See* 40 C.F.R. § 63.658(g) (fenceline monitoring provisions). Importantly, the benzene action level is not an enforceable limit per se. Rather, it is the level at which a facility is required to report its elevated benzene levels to EPA as a deficiency and implement specified corrective steps to reduce the emissions.

92. Monitoring and reporting on compliance, defined as "collecting and analyzing information on the compliance status of the regulated community," has multiple goals. Int'l Network for Envtl. Compliance & Enf't, *supra*, note 79. Historically, monitoring and reporting has been designed to educate regulated entities on applicable regulatory requirements, allow regulators and facilities to detect and correct violations, and provide regulators with compliance status information and evidence to bring enforcement actions and evaluate program outcomes. *Id.*

93. Citizen monitoring occurs when members of the public are engaged in monitoring regulatory compliance. Citizen monitoring opportunities can be written into rules and permits. Crowd sourcing of data, also known as "citizen science," may be an element of citizen monitoring programs. Options available to regulators include reconfiguring preexisting or establishing new websites to accept public reports of alleged violations or environmental concerns and consolidate them onto a map. Community residents could access the maps to see how their actions are contributing to a broader community effort to oversee environmental compliance, further encouraging citizens to participate in compliance oversight. For example, the California State Water Control Board ("Board") monitors thousands of miles of creeks and streams. The Board utilizes "Creek Watch," an iPhone application developed by IBM that enables members of the public to help regulators monitor the health of their local watersheds. Participants are encouraged to use the Creek Watch app to take and upload pictures of their local waterways and report how much water and trash they see. IBM's research lab aggregates the data and shares it with local water control boards to help them track pollution and manage water resources. All data is shown on a map and table on a publicly accessible website. According to IBM, the Creek Watch application "is particularly valuable for the data it can provide on smaller, less prominent waterways, which comprise a crucial portion of most watersheds but are too numerous for water boards to monitor without help." *Snap a Picture. Save a Stream*, IBM, www.ibm.com/smarterplanet/us/en/water_management/article/creek_watch.html (last visited Mar. 4, 2016).

94. Effective monitoring and reporting requires understanding and addressing the six "w's" of compliance monitoring and reporting: why; who; what; which; where; and when. It is beyond the scope of this Article to delve into each in detail. *See* Silberman & Hindin, *supra* note 80.

tors can apply periodic self-monitoring, self-certification, and reporting provisions to emission or discharge standards, best management practices, or any other requirements. Monitoring must, however, be properly designed. While an in-depth review of all of potentially applicable monitoring criteria is beyond this Article's scope,[95] all successful monitoring and reporting requirements are characterized by four design features which function together to promote compliance:

(1) *Sufficiently robust and frequent monitoring to produce data that are valid and representative of the facilities' actual compliance status.* Where possible, avoid approaches relying on highly infrequent monitoring, at a date and time of the regulated entity's sole choosing, to demonstrate compliance. Such infrequent or selective monitoring may fail to accurately represent the monitored unit's operation under typical operating conditions.

(2) *Clear limits and established measurement methods*. The applicable emission or discharge limit should be clear and readily measurable and the associated methods should specify expressly how compliance is to be measured. This includes specifying the appropriate collection, sampling, and analysis methods. The measurement method should anticipate and proactively address potential defective or inaccurate sampling. The rule should not create an incentive to skip a required monitoring event if the regulated entity fears that actual monitoring at that time would reveal a violation.

(3) *Require responsible corporate officials to attest (certify), by signature and subject to civil and criminal penalties, to the accuracy of the monitoring and reporting*. Requiring a responsible corporate official to attest to the self-monitoring or reporting helps ensure appropriate officials are personally familiar with the reported information and reminds them of the penalties associated with knowingly submitting false information. Self-certifications are more likely to be effective when they are specific, based on objective standards, transparent, and readily verifiable.[96] Certifications have traditionally been submitted to regulators on paper forms but, in today's environment, may be electronic, photographic, or even video-supported.[97]

(4) *Criminal sanctions for misrepresentation or fraud.* Criminal enforcement, because it includes the potential for incarceration and fines, is a powerful deterrent tool. Certifications should state expressly state that the failure to certify accurately could bring criminal as well as civil penalties.

2. Tool 3b: Independent Third-Party Verification of Compliance and Information Reporting

Properly structured third-party reporting and verification in rules to complement or replace some government inspections can enhance accountability, improve compliance, and produce more and better compliance data, particularly for large universes of small sources unlikely to receive regular inspections. Relying on such third-party verification in lieu of, or to complement, government inspections, can "enable . . . regulatory agencies to focus their attention on a relatively small number of accredited verifiers rather than the large universe of regulated entities."[98] Such approaches can be successful, however, only if the third-party approaches are structured to ensure competency, independence, accuracy, and thoroughness.

There are potential roles, in rules and permits, for two types of independent third-party monitoring and reporting programs: information reporting and compliance verification. In third-party information reporting, a third-party reports information on a regulated source's performance directly to the regulator. Third-party information reporting reduces information asymmetries between what regulated entities know about themselves and regulators' knowledge about the entities.[99] Federal and state law provide examples of effective third-party information reporting.[100]

Third-party compliance verification, also referred to as "certification" or "attestation," occurs when an independent third party verifies to a regulator that a regulated entity is meeting its compliance obligations. Independent third-party audits or other forms of third-party compliance verification are required by a variety of proposed and final EPA rules to promote compliance with regulatory standards.[101]

95. *See generally id.* (containing further information and resources on designing effective environmental monitoring, certification, and reporting provisions).

96. A certification with specific, objective statements, such as a check list that includes monitoring data collected pursuant to established standards or is accompanied by test results, may be more likely to encourage regulated entities to engage in compliant behaviors and remind them to reconfirm compliance over time.

97. *See, e.g.*, Oil and Natural Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews, 77 Fed. Reg. 49,489, 49,498 (Aug. 16, 2012). Subpart OOOO of the rule requires photographic, date-stamped records of "green completions." Specifically, the rule requires the well operator to retain "a digital image of each [Reduced Emissions (i.e., "green") Completions] in progress. The image must include a digital date stamp and geographic coordinates stamp to help link the photograph with the specific well completion operation." *Id.*

98. Lesley K. McAllister, *Regulation by Third-Party Verification*, 53 B.C. L. Rev. 1, 28 (2012).

99. Leandra Lederman, *Reducing Information Gaps to Reduce the Tax Gap: When Is Information Reporting Warranted?*, 78 Fordham L. Rev. 1733, 1738 (2010).

100. *See, e.g.*, 1 Colo. Code Regs. § 204-10, r. 7 (LexisNexis 2010) (requiring both the insurers of the applicants for motor vehicle registration and the motor vehicle registrants to independently provide proof of insurance); Internal Revenue Serv., U.S. Dep't of Commerce, Reducing the Federal Tax Gap: A Report on Improving Voluntary Compliance (2007). U.S. tax law requires certain income, such as interest and dividends, to be independently reported to the Internal Revenue Service ("IRS") by the payers of the income. Because the required third-party information must be identical to that reported by the taxpayers themselves, the government can compare the dual disclosures for consistency. A 2001 study by the IRS's National Research Program showed that income that is subject to "little or no" third-party information reporting is much more likely to be underreported to the IRS than income subject to "some" or "substantial" third-party information reporting. Internal Revenue Serv., *supra* note 100, at 13, fig.4.

101. McAllister, *supra* note 98, at 6–12; *see generally* Leslie K. McAllister, Third-Party Programs to Assess Regulatory Compliance (2012) (prepared for the consideration of the Administrative Conference of the United States).

The EPA's CAA wood stoves rule is one such example.[102] Third-party verification and certification approaches are also employed in a variety of state regulatory settings. Examples include the CAA Title II vehicle inspection, maintenance, and emissions programs in authorized states,[103] California's mandatory greenhouse gas reporting program,[104] and Massachusetts Underground Storage Tank third-party inspection program.[105]

Third-party programs present design challenges. Perhaps the most critical is to ensure third-party verifiers are truly independent from their clients and perform competently. For example, independence often means that for some specified time period before, during, and after the third-party review, the verifier can have no other preexisting, current, or anticipated future business relationships with the regulated entity.[106] Past business relationships—and personal and familial relationships, as well—create a risk of bias or "capture" due to the third-party verifier identifying or aligning his interests too closely with those of the client.[107] Present and future relationships create a risk that the third-party will be influenced in her auditing by a desire to "cross sell" other products and services to the client now or in the future[108] or seek future employment.[109] As the following studies illustrate, when true independence is lacking, compliance problems can result.

A randomized control design field experiment in the State of Gujarat in India, for example, revealed major weaknesses in its third-party regulatory audit system, leading third-party auditors to systematically report false pollution levels, often just below applicable regulatory standards.[110] The study's authors identified and tested a series of market-based alterations to improve auditor accuracy.[111] The experimental enhancements included randomly assigning auditors to plants, paying them from a central pool, and conducting randomly-assigned follow-up visits.[112] These steps significantly improved the truthfulness of the third-party auditors' reports.[113] Very importantly, once the plants understood that their auditors would henceforth be reporting more accurately to state officials, they reduced their pollution emissions.[114] In addition, a pair of 2013 studies of independent third-party vehicle emission testing in New York that also considered factors impacting third-party independence found a relationship between testing facilities' opportunities to "cross sell" other products and services to car owners and the accuracy of the test results.[115] This research was based on millions of emission test results from thousands of test facilities. The researchers found that, in pursuit of customer loyalty, facilities with more cross-selling opportunities were incentivized to "pass" cars that facilities with fewer cross-selling opportunities would not.[116] Further evidence suggests that many, if not most, of some types of financial audits are flawed due to insufficient auditor competence/independence and/or public transparency.[117]

102. *FACT SHEET: Summary of Requirements for Woodstoves and Pellet Stoves*, U.S. Envtl. Protection Agency, http://www2.epa.gov/residential-wood-heaters/fact-sheet-summary-requirements-woodstoves-and-pellet-stoves (last updated Feb. 4, 2015).
103. *See, e.g.*, Mo. Dep't of Nat. Res. & Mo. State Highway Patrol, *First Annual Oversight Report of the Decentralized Gateway Vehicle Inspection Program*, Mo. Dep't Nat. Resources (2008), http://www.dnr.mo.gov/gatewayvip/docs/enforcementrpt.pdf.
104. Cal. Code Regs. tit. 17, § 95132(b)(4) (2010); *see also id.* tit. 17, § 95132(b)(1) (describing the firm requirement of having a lead verifier); *id.* tit. 17, § 95132(b)(2) (describing the lead verifier requirements).
105. *Third-Party UST Inspection Program*, Mass. Dep't Envtl. Protection, http://www.mass.gov/eea/agencies/massdep/toxics/ust/third-party-ust-inspection-program.html (last visited Mar. 5, 2016).
106. Jodi L. Short & Michael W. Toffel, *The Integrity of Private Third-Party Compliance Monitoring* (Harvard Kennedy Sch., Working Paper RPP-2015-20, 2015), http://www.hks.harvard.edu/content/download/78659/1765209/version/1/file/RPP_2015_20_Short_Toffel.pdf. For an example of third-party verification with strong independence provisions, see EPA's March 17, 2015, *Finding of Violation and Administrative Order on Consent* in the *In re Mann* administrative action. *In re Mann Distribution LLC*, Docket Nos: RCRA-01-2015-0028, CAA-01-2015-0029 (Mar. 13, 2015). This administrative order addresses RCRA hazardous waste and CAA section 112(r)(1) general duty clause violations. The order includes the following auditor competence, independence, reporting, and oversight provisions: engage a third-party inspection team and submit their members' resumes and qualifications to EPA; the team shall have at least one person with chemistry expertise acceptable to EPA, one expert in environmental compliance auditing, and one expert in chemical process safety management; no team member may have previously performed work for the respondents; no team member shall be allowed to work for the respondents or any of respondents' officers for five years after the inspections are complete; once the team gives the respondents notice of the first upcoming inspection, the team may no longer communicate with its respondents unless EPA is copied on the communication (communications during on-site inspections are excepted); follow-up inspections shall be unannounced with no notice to respondents but with advance notice to EPA; the respondents shall have no control over the timing of any of the follow-up inspections; EPA and/or the local fire department shall have the right to accompany the team on any inspection; within fifteen days of each inspection, the team must simultaneously submit to EPA and the respondents an inspection report, photographs, and digital video of the inspection; and the respondents shall not have the opportunity to review any draft or final inspection report before its submittal to EPA.
107. *See, e.g.*, Max H. Bazerman, George Loewenstein & Don Moore, *Why Good Accountants Do Bad Audits*, Harv. Bus. Rev., Nov. 2002 ("People are more willing to harm strangers than individuals they know, especially when those individuals are paying clients with whom they have ongoing relationships. . . . And their biases will grow stronger as their personal ties deepen. The longer an accounting partner serves a particular client, the more biased his judgments will tend to be.").
108. *See* Lamar Pierce & Michael W. Toffel, *The Role of Organizational Scope and Governance in Strengthening Private Monitoring*, 24 Org. Sci. 1558 (2013).
109. *See, e.g.*, Karla M. Johnstone et al., *Antecedents and Consequences of Independence Risk: Framework for Analysis*, 15 Acct. Horizons 1, 6 (2001) ("[A]n auditor seeking future employment with the client might not aggressively pursue errors discovered during audit sampling out of a desire not to offend client management.").
110. *See* Esther Duflo et al., *Truth-Telling by Third-Party Auditors and the Response of Polluting Firms: Experimental Evidence From India*, 128 Q.J. Econ. 1499, 1499 (2013).
111. *See id.* at 1501.
112. *See id.*
113. *See id.* at 1502.
114. *See id.*
115. *See* Victor Manual Bennet et al., *Customer-Driven Misconduct How Competition Corrupts Business Practices*, 59 Mgmt. Sci. 1725, 1726 (2013); Pierce & Toffel, *supra* note 108, at 1559.
116. Bennet, *supra* note 115, at 1726; Pierce & Toffel, *supra* note 108, at 1559.
117. Third-party auditing is a linchpin of financial reporting. But when the Public Company Accounting Oversight Board ("PCAOB") released its third annual report on audits of broker-dealers registered with the U.S. Securities and Exchange Commission ("SEC"), the PCAOB found audit deficiencies in portions of seventy of the ninety audits. Independence problems were found in twenty-one of the ninety audits where, contrary to SEC rules, firms helped with the bookkeeping or preparation of the financial statements they audited. *Third Progress Report on PCAOB Inspections of Broker and Dealer Auditors Shows Continued High Number of Findings*, Pub. Company Acct. Oversight Board (Aug. 18, 2014), http://pcaobus.org/News/Releases/Pages/08182014_Interim_BD_Report.aspx. In 2014, the New York State Department of Financial Services ("NYDFS") fined PricewaterhouseCoopers ("PwC") $25 million, suspended it for twenty-four months from accepting consulting engagements at regulated financial institutions, and required it to implement a series of reforms after PwC improperly altered a report submitted to regulators on sanctions and

Analyses such as these show that when third-party programs lack true verifier independence, the programs risk being incapable of driving routine high compliance. Without true independence, third parties could have financial or relationship-based associations with their clients making their efforts more akin to self-monitoring or second-party (supply chain) monitoring than independent third-party monitoring. When appropriately designed, however, with provisions to eliminate facility-auditor conflicts of interest and support effective oversight of the accreditation and verification processes by regulators and the public, third-party involvement may improve compliance and produce better compliance data than could otherwise be obtained.[118]

3. Tool 3c: Require Continuous Emission Monitoring Systems

Continuous emission monitoring systems ("CEMS") are most commonly used to monitor compliance by large facilities with air pollutant emission standards, particularly criteria pollutants. They are also increasingly being developed for a broader range of air emissions, including toxic substances, and water pollutants.[119]

CEMS measure emissions sufficiently frequently to provide a representative measure of the monitored unit's continuous emission levels under the applicable rules. CEMS refer to the total equipment necessary for determining gas or particulate matter concentrations or emission rates.[120] EPA's highly successful Acid Rain Program is an example where the use of CEMS technology proved instrumental in ensuring that the Program's mandated reductions of sulfur dioxide and nitrogen oxides were achieved.[121]

Continuous (or hourly) monitoring, unless not technologically or cost effective, has many advantages over periodic (e.g., monthly or quarterly) monitoring, especially in ensuring the monitoring is representative of actual conditions and identifies problems or violations more quickly so they can be fixed sooner. Consider using CEMS where the technology is feasible and could promote substantial emission reductions, keeping in mind that as advanced monitoring technology continues to develop and drop in cost, CEMS may be feasible for use in a broader range of regulatory settings.

4. Tool 3d: Use Fenceline Monitoring and Other Remote Emissions/Pollutant Monitoring

Fenceline monitoring is the strategic placement of monitoring equipment at locations along or adjacent to facility property lines to detect, identify, and quantify pollutant releases from point sources and fugitive emissions at regulated facilities. Environmental monitoring traditionally occurs within facility fencelines where the physical locations of the monitors correspond to stacks, sources, units, and equipment subject to standards or limits. Today, however, concerns have increased regarding impacts regulated facilities may have on surrounding communities and public health due to excess emissions, undetected releases (planned or unexpected), or noncompliance, generally, with all of a facility's regulatory requirements. Due to these concerns, regulators and sources are increasingly employing fenceline, remote, and ambient monitoring alongside, adjacent to, or further outside facility property lines.

Fenceline monitoring can help ensure that acceptable risk levels for acute and sub-chronic health effects or environmental pollutants are not exceeded, particularly when configured in rules to serve as triggers for further monitoring or corrective actions by the facilities. It may be particularly useful at large facilities or industrial sites with multiple facilities where complex gaseous emission mixtures are present and it is difficult to ascertain the source of the emissions. Fenceline monitoring data can be also used to assess the potential impact of facility releases on the surrounding environment and communities, especially when combined with ambient information such as meteorological data for air pollutants, or ambient water quality data for water pollutants.[122]

anti-money laundering compliance at Bank of Tokyo Mitsubishi ("BTMU" or "Bank"). Under pressure from BTMU executives who received an advance draft to review, PwC removed a warning in an ostensibly "objective" report to regulators surrounding BTMU's scheme to falsify wire transfer information for Iran, Sudan, and other sanctioned entities. Benjamin M. Lawsky, the Superintendent of Financial Services for NYDFS said, "When bank executives pressure a consultant to whitewash a supposedly 'objective' report to regulators—and the consultant goes along with it—that can strike at the very heart of our system of prudential oversight." Specifically, at BTMU's request, PwC ultimately removed the original warning language from the final report the Bank submitted to regulators and inserted a passage stating the exact opposite conclusion. Moreover, also at the Bank's request, PwC removed other key information from drafts of the report, including deleting the English translation of BTMU's wire stripping instructions, deleting a regulatory term of art that PwC used throughout the report in describing BTMU's wire-stripping instructions and replacing it with a nondescript reference that lacked regulatory significance, and deleting most of PwC's discussion of BTMU's wire-stripping activities. PwC also deleting information concerning BTMU's potential misuse of Office of Foreign Assets Control screening software in connection with its wire-stripping activities. Press Release, N.Y. Dep't of Fin. Servs., NYDFS Announces PricewaterhouseCoopers Regulatory Advisory Services Will Face 24-Month Consulting Suspension; Pay $25 Million; Implement Reforms After Misconduct During Work at Bank of Tokyo Mitsubishi (Aug. 18, 2014), http://www.dfs.ny.gov/about/press/pr1408181.htm.

118. *See* McAllister, *supra* note 98, at 46.

119. *See* 40 C.F.R. § 122.48 (1983) (NPDES regulation requiring state and EPA permit writers to "specify required monitoring including the type, intervals, and frequency sufficient to yield data which are representative of the monitored activity, including, when appropriate, continuous monitoring"). Continuous measurement technology currently exists for flow, total organic carbon, temperature, pH, specific conductivity, residual chlorine, fluoride, and dissolved oxygen. Permit writers may specify the use of continuous monitoring, as appropriate, for these parameters, for applicable regulated effluent discharges. The methods which NPDES and Industrial User permittees may use for compliance monitoring appear in the EPA regulations at part 136 of title 40 of the Code of Federal Regulations.

120. *See Technology Transfer Network Emission Measurement Center, Continuous Emissions Monitoring—Information, Guidance, etc.*, U.S. Envtl. Protection Agency, http://www.epa.gov/ttn/emc/cem.html (last visited Jan. 26, 2016). CEMS use pollutant analyzer measurements and a conversion equation, graph, or computer program to produce continuous results in units of the applicable emission limitation or standard. Performance specifications, including quality assurance procedures, are used for evaluating the acceptability of the CEMS at the time of (or soon after) installation and whenever else specified in the regulations.

121. *See generally* Schakenbach et al., *supra* note 72, at 1578 (providing information on the EPA Acid Rain Program and its regulatory components and outcomes).

122. Ambient monitoring is the monitoring of pollutant levels in the ambient environment, as opposed to the monitoring of regulated emissions or discharges from specific regulated emission units or discharge points. It has historically

For example, in September, 2015, the EPA issued a final rule to further control toxic air emissions from petroleum refineries and provide information about refinery emissions to the public and neighboring communities.[123] The rule requires continuous fenceline monitoring of benzene concentrations to ensure the refineries appropriately manage emissions from fugitive sources such as leaking equipment and wastewater treatment. If a refinery's emissions exceed the action level established in the rule, the refinery is required to initiate a root cause analysis to identify the cause of the exceedance and determine and implement appropriate corrective action to reduce pollution in neighboring communities."[124] The EPA has also required fenceline monitoring in recent CAA enforcement settlements.[125]

Whole Effluent Toxicity ("WET") sampling exemplifies a fenceline monitoring-like approach to water pollution discharges under the Clean Water Act ("CWA").[126] It is one way the EPA implements the CWA's prohibition against discharging of pollutants in toxic amounts. WET refers to "the aggregate toxic effect to aquatic organisms from all pollutants contained in a facility's wastewater (effluent). . . . WET tests measure wastewater's effects on specific test organisms' ability to survive, grow and reproduce."[127] A permit may include a trigger for the permittee to conduct accelerated WET testing followed by a toxicity reduction evaluation or the regulator can require both through an enforcement action.[128] A facility required to perform WET testing must provide to its permitting authority any information on the cause of toxicity and written details of any required toxicity reduction evaluation it has conducted.[129] When the permitting authority determines that a discharge causes, has the reasonable potential to cause, or contributes to an in-stream excursion above the numeric criterion for WET or an applicable state water quality standard narrative criterion, the permit must contain WET effluent limits.[130]

D. Principle 4: Leverage Accountability and Transparency by Providing the Government and Public With Real-Time Access to Quality Information on Regulated Entities' Emissions, Discharges and Key Compliance Activities and Outcomes

> *Public disclosure is another underutilized tool; there is powerful evidence that publishing information about company performance drives better behavior, as pressure is applied by customers, neighbors, investors, and insurers.*
>
> —Cynthia Giles[131]

The public has a right to know whether regulated entities are complying with their regulations and how the government is performing in implementing environmental programs. Rules can be made more effective by designing them to help provide governments, the public, stakeholders such as customers, the financial services sector, academia, non-governmental organizations ("NGOs"), and the regulated entities themselves with useful and reliable performance and compliance information.

Public knowledge of facilities' performance can add incentives for regulated entities to improve their compliance whether they are frequently or rarely inspected. Transparency improves compliance by helping facilities understand and address their environmental impacts. It enables communities to have data-rich conversations with their industrial neighbors, thereby empowering them to hold facilities accountable and advance environmental justice.[132] Most facilities presumably want to be good neighbors. Data on facility performance can be used by facilities to address community concerns and by community members, neighboring facilities, and other agencies to assess and respond to the impacts. Data tied to geographic information can provide insights into ambient

been done by governments or communities but future rules may include it. Ambient monitoring can be used to help assess systematic, long-term pollution by measuring the quantity and types of pollutants in the surrounding outdoor air or water. *Ambient Air Monitoring and Emissions Measurement,* U.S. Envtl. Protection Agency, http://www.epa.gov/oaqps001/aqmportal/management/monitoring.htm (last updated Feb. 23, 2016); *Watersheds, Monitoring and Assessing Water Quality*, U.S. Envtl. Protection Agency (Dec. 3, 2013), http://water.epa.gov/type/watersheds/monitoring/index.cfm. It may be combined with fenceline monitoring to assess the impact of industrial activities on the surrounding environment and communities.

123. Petroleum Refinery Sector Risk and Technology Review and New Source Performance Standards, 80 Fed. Reg. 75,177 (Dec. 1, 2015); s*ee also Consolidated Petroleum Refinery Rulemaking Repository*, U.S. Envtl. Protection Agency, http://www.epa.gov/ttn/atw/petref.html (last updated Feb. 23, 2016).

124. 40 C.F.R. § 63.658(g) (2015) (Fenceline monitoring provisions); *see also Fact Sheet: Final Petroleum Refinery Sector Risk and Technology Review and New Source Performance Standards Overview*, U.S. Envtl. Protection Agency (n.d.), http://www3.epa.gov/ttn/atw/petrefine/PetRefFactSheetfinal.pdf.

125. For example, as a result of a 2012 enforcement settlement with EPA, BP North America, Inc. agreed to pay an $8 million penalty and invest more than $400 million to install state-of-the-art pollution controls and cut emissions from BP's petroleum refinery in Whiting, Indiana. Press Release, U.S. Envtl. Prot. Agency, BP Agrees to Add More than $400 Million in Pollution Controls at Indiana Refinery and Pay $8 Million Clean Air Act Penalty (May 23, 2012), http://yosemite.epa.gov/opa/admpress.nsf/d0cf6618525a9efb85257359003fb69d/7edc0a75afdd90eb85257a07006719cd!OpenDocument. In addition, BP agreed, pursuant to a supplemental environmental project, to "install, operate[,] and maintain a $2 million fence line monitoring system at the Whiting [R]efinery and . . . make the data collected available to the public by posting the information on a publicly-accessible website." *Id.* The fenceline monitors continuously monitor for "benzene, toluene, pentane, hexane, sulfur dioxide, hydrogen sulfide, and all compounds containing reduced sulfur." *Id.*

126. Clean Water Act of 1977, Pub. L. No. 95-217, 91 Stat. 1566 (codified as amended at 33 U.S.C. §§ 1251–1387 (2012)).

127. *Whole Effluent Toxicity*, U.S. Envtl. Protection Agency, http://water.epa.gov/scitech/methods/cwa/wet (last updated June 18, 2014).

128. *See* Memorandum from Rebecca W. Hanmer, Acting Assistant Adm'r, U.S. Envtl. Prot. Agency Office of Water, to Reg'l Adm'rs, Whole Effluent Toxicity Basic Permitting Principles and Enforcement Strategy (Jan. 25, 1989), http://www.epa.gov/sites/production/files/documents/effltoxprincstrgy-mem.pdf.

129. 40 C.F.R. § 122.21(j)(5)(x).

130. 40 C.F.R. § 122.44(d)(iv)–(v).

131. Giles, *supra* note 1, at 24.

132.

> Environmental Justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. EPA has this goal for all communities and persons across this Nation. It will be achieved when everyone enjoys the same degree of protection from environmental and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, and work.

What Is Environmental Justice?, U.S. Envtl. Protection Agency, http://www3.epa.gov/environmentaljustice (last updated Feb. 22, 2016); *see also* U.S. Envtl. Prot. Agency, Guidance on Considering Environmental Justice During the Development of a Regulatory Action (2015).

environmental conditions and significant pollutant loadings, sometimes in real time. Transparency, accountability, and public pressure can likewise influence governments to perform better.

1. Tool 4a: Electronic Reporting to the Government

E-reporting at the EPA is part of an Agency-wide shift away from outdated paper reporting toward e-reporting that is easier, more efficient, and less costly for both facilities and regulatory agencies. Electronic systems are used in the modern era for almost every kind of transaction. For the user, these systems offer speed, convenience, and expanded information choices and filing capabilities. For government, they offer the ability to increase transparency and an opportunity to improve the ability to spot pollution and compliance issues and respond quickly to emerging problems. Indeed, EPA policy now states that e-reporting is the default assumption for new regulations.[133]

E-reporting promotes compliance by giving regulators—and through regulators, the public—timely access to high quality, complete, and consistent compliance information. To be substantively effective and cost effective, e-reporting must be developed and implemented thoughtfully. E-reporting is not just converting paper into electronic media. It is rather a system that guides the user through the reporting process with integrated compliance assistance and data quality checks. E-reporting is most effective when there is an intelligent software tool to guide the regulated entity through the reporting process.[134]

EPA and the states have already built much of the foundation to support e-reporting through the National Environmental Information Exchange Network. This Network established data standards—documented agreements on representations, formats, and definitions of common data—to facilitate the electronic exchange of environmental information.[135] Effective e-reporting also requires reliable and strong electronic signature requirements. For EPA, they are established by the Cross-Media Electronic Reporting Regulation ("CROMERR").[136]

E-reporting can reduce transaction costs associated with creating, mailing, entering, and processing paper reports and enable regulators to deliver compliance assistance more effectively and efficiently. E-reporting can also allow regulated entities, government agencies and the public to more quickly identify violations, and then more quickly address them. For example, the available data on Ohio's wastewater program mandating electronic reporting for discharge monitoring reports ("DMRs") suggests it has significantly reduced violations, data errors, and staff needed to run the program.[137] In September 2015, EPA issued the final National Pollutant Discharge Elimination System ("NPDES") Electronic Reporting Rule. This rule makes e-reporting of CWA NPDES DMRs the norm nationwide, with millions of dollars of benefits over time beginning one year after rule promulgation.[138]

2. Tool 4b: Public Accountability Via Websites, Paper or Electronic Mailings, and Other Ways to Provide the Public and Stakeholders With Compliance Information[139]

The mandatory disclosure of information to the public is an increasingly pervasive and important regulatory tool that has become "one of the most striking developments in the last generation of American law."[140] Public disclosure of regulatory performance and compliance information can be a powerful driver of facility behavior by encouraging regulated entities to comply and motivating and empowering individuals, stakeholders, and communities to make sound health,

133. Memorandum from Bob Perciasepe, Deputy Adm'r, U.S. Envtl. Prot. Agency, E-Reporting Policy Statement for EPA Regulations (Sept. 30, 2013), https://www.epa.gov/sites/production/files/2016-03/documents/epa-ereporting-policy-statement-2013-09-30.pdf.

134. For example, EPA's intelligent reporting tool, TRI-ME, inspired by the federal tax e-reporting tools, TurboTax® and H&R Block at Home®, has reduced TRI reporting errors. *See 2007 TRI-MEweb Delivers Results for the TRI Program*, U.S. Envtl. Protection Agency 1 (n.d.), https://www.whitehouse.gov/sites/default/files/omb/assets/fea_docs/EPA_TRI-MEweb_success_2008.pdf.

135. *See What We Do*, Envtl. Info. Exchange Network, http://www.exchangenetwork.net/about/what-we-do/ (last visited Sept. 1, 2015).

136. *Cross-Media Electronic Reporting Regulation (CROMERR)*, U.S. Envtl. Protection Agency, http://www.epa.gov/cromerr (last updated Sept. 8, 2015) (setting performance-based, technology-neutral standards for systems that states, tribes, and local governments use to receive electronic reports from facilities they regulate under EPA-authorized programs and requires program modifications or revisions to incorporate electronic reporting. CROMERR also addresses electronic reporting directly to EPA).

137.

> A case study of the efforts of the Ohio Environmental Protection Agency [("Ohio EPA")] to require electronic reporting of DMRs highlights how a successful implementation of a mandatory electronic reporting system can dramatically improve the way a state, tribe, or territory manages its NPDES program. As of 2011, Ohio has achieved a [ninety-nine] percent electronic reporting rate for DMRs. Ohio's system uses electronic reporting to allow permittees to report their discharge measurements quickly and easily online. The automated compliance tools within the state's [electronic DMR] system inform permittees if their discharges exceed their authorized permit limits or if there are data errors. As a result, errors have dropped by [ninety] percent (from approximately 50,000 per month to [5000] per month), giving the Ohio EPA more accurate and complete data. This improved data quality allows Ohio EPA to better allocate its resources to respond to significant noncompliance and water quality concerns, further improving Ohio's enforcement and compliance program.
>
> Prior to use of its [electronic DMR], Ohio EPA needed five full-time staff members to support the DMR program. By switching to an [electronic DMR] program, however, Ohio EPA was able to shift its staffing responsibilities to run the program without any full-time staff members, effectively redirecting its resources to address the most important water pollution problems in Ohio.

NPDES Electronic Reporting Rule, 78 Fed. Reg. 46,006, 46,015 (proposed July 30, 2013) (citations omitted).

138. In the preamble to the final rule, EPA determined "the overall economic effect of this rule is a net cumulative savings of $156 million over the ten years of the [costs and benefits] projection." National Pollutant Discharge Elimination System (NPDES) Electronic Reporting Rule, 80 Fed. Reg. 64,064, 64,065 (Oct. 22, 2015) (to be codified at 40 C.F.R. pts. 9, 122–124, 127, 403, 501, 503).

139. Memorandum from Cass R. Sunstein, Adm'r, Office of Mgmt. & Budget, to Heads of Exec. Dep'ts & Agencies, Disclosure and Simplification as Regulatory Tools (June 18, 2010), http://www.whitehouse.gov/sites/default/files/omb/assets/inforeg/disclosure_principles.pdf (issuing guidance describing principles to assist agencies in using information disclosure to achieve regulatory objectives).

140. Cass R. Sunstein, *Informational Regulation and Informational Standing: Akins and Beyond*, 147 U. Pa. L. Rev. 613, 613 (1999).

environmental, and financial choices. There is now a large and growing body of academic literature on the uses and the effectiveness of transparency as a regulatory tool to improve compliance and performance.[141] The public disclosure of compliance information by regulated entities to customers, ratepayers, or stakeholders has been shown to reduce pollution and improve compliance. Studies have linked public information disclosure to, among other things, pollution reductions,[142] improved water pollution control practices,[143] and reduced air emissions and improved environmental regulatory compliance.[144]

Mandatory information disclosure can be employed as a discrete regulatory strategy, (e.g., EPA's Toxic Release Inventory ("TRI") program),[145] or as a component in more traditional forms of regulation that combine disclosure with emission or discharge limits or other forms or regulation, (e.g., the SDWA Consumer Confidence Rule,[146] and the CAA Disposal of Coal Combustion Residuals from Electric Utilities Rule[147]). Under both scenarios, regulators must address three variables, the first and second of which are normally closely related: (1) whether to require full disclosure of comprehensive information or summary disclosure of highlighted or "processed" information; (2) whether to require disclosure at a specific place and/or time to directly influence an imminent decision *(normally, summary disclosure*) or more generally, for citizens or intermediaries to use to support research and future decisionmaking (*normally, full disclosure*); (3) whether to require disclosure directly to the public or first to regulators for quality control or processing/repackaging and then to the public.

Summary information is often disclosed at or near the point in time when the consumers of the information will be making decisions related to it—e.g., buying a product such as cars or major appliances or choosing to enter a restaurant.[148] Summary disclosures highlight the information most relevant to its users, often in the form of scales or ratings, to increase the likelihood that they will see it, understand it, and act on what they have learned.[149] EPA's fuel economy (mileage) ratings for new automobiles are an example of summary disclosure of information to consumers at the point of purchase.[150] In May 2011, EPA and the National Highway Traffic Safety Administration unveiled redesigned labels to "provide the public with new information on vehicles' fuel economy, energy use, fuel costs, and environmental impacts."[151] The labels include a new Quick Response ("QR") code feature on the bottom right. QR codes can pro-

141. *See generally* Archon Fung et al., *Transparency Policies: Two Possible Futures*, Harv. U. Taubman Ctr. Pol'y Briefs, May 2007 [hereinafter Fung et al., *Transparency Policies*], http://www.transparencypolicy.net/assets/two%20possible%20futures.pdf (overview of transparency principles); *see also* Archon Fung et al., Full Disclosure: The Perils and Promise of Transparency (2007) (providing more detailed information).

142. Lori S. Bennear & Sheila M. Olmstead, *Impacts of the "Right to Know": Information Disclosure and the Violation of Drinking Water Standards*, 56 J. Envtl. Econ. & Mgmt. 117 (2008) (finding that when larger utilities were required to mail annual Consumer Confidence Reports on water-supplier compliance pursuant to the 1998 Safe Drinking Water Act amendments, those utilities' total violations were reduced by thirty to forty-four percent and more severe health violations by forty to fifty-seven percent); *see also* Linda T.M. Bui, *Public Disclosure of Private Information as a Tool for Regulating Environmental Emissions: Firm-Level Responses by Petroleum Refineries to the Toxics Release Inventory* (Ctr. for Econ. Studies, U.S. Census Bureau, Working Paper No. 05-13, 2005), ftp://ftp2.census.gov/ces/wp/2005/CES-WP-05-13.pdf; Shameek Komar & Mark A. Cohen, *Information as Regulation: The Effect of Community Right to Know Laws on Toxic Emissions*, 32 J. Envtl. Econ. & Mgmt. 109 (1997).

143. David Wheeler, *Information in Pollution Management: The New Model*, *in* Brazil: Managing Pollution Problems, the Brown Environmental Agenda (World Bank ed., 1997) (finding that Indonesia improved facilities' ratings pursuant to a color-coded scheme).

144. *See* Jérôme Foulon et al., *Incentives for Pollution Control: Regulation and Public Disclosure* 5 (World Bank Policy Research Working Paper No. 2291, 2000), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=629138.

145. Bui, *supra* note 142. The TRI program requires facilities to disclose detailed information on toxic chemical releases. Specifically, section 313 of the Emergency Planning and Community Right to Know Act and other related rules require industrial facilities to report annually to EPA and states on releases and transfers of toxic chemicals. EPA then compiles the data, performs some QA/QC, and makes the data publicly available through the Web. The disclosed information, as a practical matter, may be too complex for most ordinary citizens to use directly but it is analyzed and repackaged by a range of stakeholders for many purposes. Some studies have linked the public availability of TRI data to improved compliance and reduced pollution. For example, using a micro-level data set linking TRI releases to plant-level Census data, one researcher found that state and local government use of TRI disclosures helped induce firms to become cleaner. Komar & Cohen, *supra* note 142 (finding that the top forty firms with the largest drop in stock price following their disclosure of TRI emissions subsequently reduced their average emissions more than other firms in their industry, including the top forty firms with the largest TRI emissions per thousand dollars in revenue; these firms both significantly reduced their average emissions and made significant attempts to improve their environmental performance by reducing the frequency and severity of chemical and oil spills).

146. *See* Bennear & Olmstead, *supra* note 142.

147. The Disposal of Coal Combustion Residuals from Electric Utilities Rule establishes a comprehensive set of requirements for the safe disposal of coal combustion residuals, commonly known as coal ash, from coal-fired power plants. Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities, 80 Fed. Reg. 21,302 (Apr. 17, 2015) (to be codified at 40 C.F.R. pts. 257, 261). To help ensure transparency, provide citizens with information about regulated units in their states, and provide citizens and states with information to fully engage in the rule's implementation, regulated entities must, among other things, notify the states of specified decisions and maintain a publicly accessible website of compliance information. Examples include annual groundwater monitoring results, corrective action reports, fugitive dust control plans and closure completion notifications. *Fact Sheet: Final Rule on Coal Combustion Residuals Generated by Electric Utilities*. U.S. Envtl. Protection Agency (Dec. 2014), http://www.epa.gov/sites/production/files/2014-12/documents/fact-sheet_ccrfinal_2.pdf.

148. Some studies have shown restaurant grading programs to be effective at improving restaurant grades, Melissa R. Wong et al., *Impact of a Letter-Grade Program on Restaurant Sanitary Conditions and Diner Behavior in New York City*, 105 Am. J. Pub. Health 81 (2015), and associated with decreased foodborne-disease hospitalizations, Paul A. Simon et al., *Impact of Restaurant Hygiene Grade Cards on Foodborne-Disease Hospitalizations in Los Angeles County*, 67 J. Envtl. Health 32 (2005). *But see* Daniel E. Ho, *Fudging the Nudge: Information Disclosure and Restaurant Grading*, 122 Yale L.J. 574 (2012) ("Despite grading's great promise, we show that the regulatory design, implementation, and practice suffer from serious flaws: jurisdictions fudge more than nudge. In San Diego, grade inflation reigns. Nearly all restaurants receive 'A's. In New York, inspections exhibit little substantive consistency. A good score does not meaningfully predict cleanliness down the road. Unsurprisingly, New York's implementation of letter grading in 2010 has not discernibly reduced manifestations of foodborne illness. Perhaps worse, the system perversely shifts inspection resources away from higher health hazards to resolve grade disputes. These results have considerable implications, not only for food safety, but also for the institutional design of information disclosure.").

149. Memorandum from Cass R. Sunstein, *supra* note 139, at 4–5.

150. *Id.*; *see Fuel Economy*, U.S. Envtl. Protection Agency, http://www.epa.gov/fueleconomy (last updated Feb. 23, 2016).

151. *A New Generation of Labels for a New Generation of Vehicles*, U.S. Envtl. Protection Agency, http://www.epa.gov/otaq/carlabel/index.htm (last updated Feb. 23, 2016) (displaying both written and video overviews of the newly designed labels).

vide additional useful information to users with cell phones configured to read the codes.[152]

Full disclosure, by definition, is comprehensive. It tends to include data on multiple variables, underlying or supporting data, and/or data extending over long periods of time. This allows a variety of individuals and organizations to view the large data sets in their entirety, analyze them, and release or repackage the data to best suit their interests, audiences, or clients. It may take advantage of emerging technological capacities such as social media and smart phone applications. The footnote at the end of this sentence links to a video showing how a private organization downloaded and re-formatted public data from EPA's Greenhouse Gas Reporting Program for its constituents.[153] The EPA was not involved in producing this video. It is presented solely as an example of an NGO analyzing, repackaging, and releasing information from a large public data set for its audience.

Public disclosure of information can occur directly from regulated entities to the public. Regulated entities can also disclose information to the government first, with the regulators performing additional quality control and analysis before releasing the information to the general public in more readily understandable or usable formats. Examples of potentially disclosable information include operational information (helps firms identify and address practices that cause environmental harm), information responsive to investor preferences (helps investors identify good or bad performers), consumer preferences (helps consumers identify and support or buy green firms and products), or community preferences (prompts citizens and organizations to support or target facilities based on performance).[154]

To be effective, transparency-based regulatory approaches must be developed and implemented thoughtfully to produce high quality information while avoiding unintended negative consequences.[155] Summary disclosures, in particular, may be ineffective when ratings or scores are highly resource-intensive for regulators to generate, sufficiently controversial as to invite frequent high-cost challenges, or difficult for audiences to readily understand and use.[156] The disclosures are more likely to succeed when employing accurate, comprehensible metrics that allow users to readily compare and respond to the applicable products, services, or outcomes.[157] And we should recognize that diverse audiences may receive and react to disclosures differently based on discrete interests, capacities, and resources. Standard regulatory approaches such as requiring all facility permits to contain uniform, enforceable emission or discharge standards may be preferable to disclosure-only approaches when achieving a high certainty of uniform risk reduction for all citizens is a critical policy goal.[158] Finally, the combination of emission/discharge standards coupled with transparency approaches is often the best way to create an effective regulation or permit.

E. Principle 5: Leverage Benefits, Market Forces, and Other Incentives That Promote Effective Regulations

> *[M]arket strategies that set standards but allow companies to decide how best to get there can be simple and effective in the right circumstances, reducing costs and providing flexibility for industry while achieving better results. We saw that approach work in the acid rain program, where an integrated system of pollution allowances, continuous monitoring, electronic reporting, and market trading got fast and efficient results and very high levels of compliance.*
>
> —Cynthia Giles[159]

Designing rules to leverage market forces, both positive and negative, can promote better regulatory compliance. For many firms,

> the deterrent impacts which penalties generate may pale in comparison with the potential individual or cumulative impacts of market forces such as consumer demand, shareholder loyalty, declining stock prices in response to pollution liability fears, poor eco-efficiency that shareholders relate to reduced profitability, liabilities such as tort judgments, citizen suits, or cleanups, adverse publicity, or community pressure. This is because market forces are capable of generating financial pressures orders of magnitude greater than those posed by most penalties.[160]

Market-based tools can be employed independently or in tandem with the preceding principles and tools. Below are several tools for leveraging market-based regulatory approaches.

1. Tool 5a: Motivate and Empower the Local Community to Encourage Compliance

Community actions can affect a regulated entity's reputation and market perception. Many, if not most, regulated entities would prefer to maintain positive relationships

152. *Id.*
153. The Daily Conversation, *America's Top 10 Polluters*, YouTube (Feb. 2, 2012), http://www.youtube.com/watch?v=5rdSSeomIho; *see also* Linda K. Breggin & Judith Amsalem, *Big Data and the Environment: A Survey of Initiatives and Observations Moving Forward*, 44 ELR 10984, 10987–91 (Nov. 2014) (describing other data-gathering and disbursement initiatives to bring environmental awareness to the public).
154. Jay Shimshack, *Economic Perspectives on Environmental Information Disclosure*, in Benefits of Environmental Information Disclosure Proceedings 172 (2011), http://yosemite.epa.gov/ee/epa/eerm.nsf/vwAN/EE-0567-01.pdf/$file/EE-0567-01.pdf.
155. *See, e.g.*, Jay P. Shimshack & Michael B. Ward, *Mercury Advisories and Household Health Trade-Offs*, 29 J. Health Econ. 674, 674–85 (2010) (finding that the Food and Drug Administration's prominent mercury in fish advisory may inadvertently have harmed public health by reducing mercury loadings at the expense of substantial reductions in healthful omega-3 fatty acids).
156. *See* Fung et al., *Transparency Policies: Two Possible Futures*, *supra* note 141, at 6 (characterizing a color-coded terrorist threat warning system as hard to understand and generally ignored by the American public).
157. *Id.* at 4.
158. *Id.* at 3 (noting that Congress could have chosen to require labeling of lead levels in gasoline instead of imposing a national ban on leaded gasoline but concluded that only the latter would protect all communities equally).
159. Giles, *supra* note 1, at 24.
160. Silberman, *supra* note 18, at 10527.

with their communities. They would prefer to avoid adverse publicity or consequences that could harm their reputations or profitability. Observant community members may contact facilities directly concerning noncompliance, inform regulators when they suspect that a facility is violating environmental requirements, or ask the government to investigate. Community pressure can thus help motivate regulated entities to comply with regulatory requirements while assisting regulators to monitor and implement environmental programs.

Community pressure is most likely to act as a compliance motivator when a regulation addresses a significant local public health or environmental issue and applies to facilities of concern to the community. Making compliance information publicly available can enable the affected public to hold regulated entities and regulators accountable for improved compliance but the information must be appropriate to the audience. Few people will wade through large amounts of complex environmental monitoring data—even when readily available—unless they have a strong, often professional, reason for doing so. To enable communities to take an active role in regulatory implementation, rules and permits should produce compliance information that is user-friendly and formatted to meet communities' needs. This reinforces the first principle of designing effective rules and permits[161]: enable government, regulated entities and the public to easily identify who is regulated and the applicable requirements. In addition, the delivery of the information should match where and how concerned citizens would normally seek to obtain it, as described further above under Principle 4: leveraging accountability and transparency.

To ensure affected members of the public are aware when a facility submits key compliance information to regulators, consider requiring regulated entities to post the information publicly or even contact members of the public directly, via e-mails or text messages, to notify them of key events.[162] Offering the public an opportunity to participate in environmental monitoring can also engage citizens in helping to implement environmental requirements. These opportunities can be written into the rules directly or supported by related programs.

The Virginia Department of Environmental Quality's ("Virginia DEQ") citizen water quality monitoring program exemplifies this type of approach.[163] The State of Virginia provides grants to help fund citizen monitoring equipment, volunteer training, lab analysis of monitoring results, and stream monitoring in locations where Virginia DEQ is not currently collecting water quality samples.[164] Virginia DEQ uses the citizen-supplied data to list and delist impaired waters under section 303(d) of the CWA, identify sources for total maximum daily load development for waters already listed as impaired, track progress toward the restoration of waters, target waters for future Virginia DEQ monitoring, and educate land owners on water quality impacts of land use activities.[165]

2. Tool 5b: Show Investors and Consumers When Products and Services Are Compliant

Consumers and investors, when they have access to compliance information, can play a powerful role in rewarding or punishing firms for their environmental performance.[166] Consumers who care about the environment may be more likely to select products from manufacturers who comply with regulatory obligations.[167] Investors may prefer to invest in companies with good environmental reputations and avoid firms with violations that present legal, financial, or reputational liabilities.[168] Rules and permits can be designed proactively to generate the types of information needed to support such determinations and responses.

Product labeling requirements can harness consumer and investor preferences to improve regulatory compliance. One method of informing consumers of whether a product or manufacturer satisfies environmental or health standards is to establish a product labeling or certification system. Many product-labeling programs are geared towards demonstrating that a product or manufacturer is meeting a voluntary standard, such as standards on "organic" food[169] or "sustain-

161. *See supra* Section III.A.

162. This is the approach taken by the New York State Sewage Right to Know law. Under this law, publicly owned treatment works ("POTWs") and publicly owned sewer systems ("POSSs") must, initially, notify the NYS Department of Environmental Conservation ("DEC") and Department of Health within two hours of discovery of untreated and partially treated sewage discharges. The information will be made available to the general public and neighboring municipalities on DEC's Sewage Discharge Reports web page. The statutory record indicates the law's backers intended it to decrease the likelihood of such discharges, enable the public to respond to discharges with healthy lifestyle and recreational choices, and enhance public support generally for investments in water infrastructure repairs and upkeep. *Sewage Right to Know Law*, Riverkeeper, http://www.riverkeeper.org/campaigns/stop-polluters/sewage-contamination/srtk (last visited Mar. 5, 2016). The second part of the law requires POTWs and POSSs to directly notify the public of discharges within four hours of discovery. *Sewage Pollution Right to Know*, N.Y. Dep't Envtl. Conservation, http://www.dec.ny.gov/chemical/90315.html (last visited Mar. 5, 2016). New York residents may sign up online with GovDelivery, a company-provided communications platform, to receive information about sewage overflows and bypasses, public sewage systems, and updates on the implementation of the Sewage Pollution Right to Know law via e-mail. *GovDelivery Signup*, N.Y. Dep't Envtl. Conservation, https://public.govdelivery.com/accounts/NYSDEC/subscriber/new (last visited Mar. 5, 2016).

163. *Citizen Water Quality Monitoring*, Va. Dep't Envtl. Quality, http://www.deq.state.va.us/Programs/Water/WaterQualityInformationTMDLs/WaterQualityMonitoring/CitizenMonitoring.aspx (last visited Sept. 1, 2015) (describing Virginia DEQ's citizen monitoring program).

164. *Citizen Monitoring Grant Opportunities*, Va. Dep't Envtl. Quality, http://www.deq.state.va.us/Programs/Water/WaterQualityInformationTMDLs/WaterQualityMonitoring/CitizenMonitoring/GrantOpportunities.aspx (last visited Oct. 20, 2015).

165. *See Citizen Monitoring Guidance*, Va. Dep't Envtl. Quality, http://www.deq.state.va.us/Programs/Water/WaterQualityInformationTMDLs/WaterQualityMonitoring/CitizenMonitoring/Guidance.aspx (last visited Sept. 1, 2015).

166. Sarah L. Stafford, *Private Policing of Environmental Performance: Does It Further Public Goals?*, 39 B.C. Envtl. Aff. L. Rev. 73, 83 (2012).

167. *Id.*

168. *Id.*

169. "Organic is a labeling term for food or other agricultural products that have been produced using cultural, biological, and mechanical practices that support the cycling of on-farm resources, promote ecological balance, and conserve biodiversity." *About the National Organic Program*, U.S. Dep't Agric. 1 (May 2015), http://www.ams.usda.gov/sites/default/files/media/About%20the%20National%20Organic%20Program.pdf. The National Organic Program of the U.S. Department of Agriculture ("USDA") mandates that any operation that produces or handles agricultural products intended for sale,

ably harvested" timber.[170] Labels can be employed similarly in regulatory programs to inform the public when products or manufacturers are compliant.

Disclosure to investors is especially likely to motivate compliance by reputation-sensitive and publicly traded companies.[171] A publicly available compliance database attracting the attention of investors interested in firms' environmental performance can be supported by rules or permits that require, or support the development and publication of, such information. For example, financial investors make use of the TRI database, which provides information on the type and amount of toxic chemicals facilities release into the air, water, and land.[172] EPA's Enforcement and Compliance History Online database, which provides facilities' compliance histories, is another potential resource to investors and communities.[173]

3. Tool 5c: Harness Market Forces Such as Emission Reduction Credits or Tradable Allowances to Promote Compliance

Rules can be "premised on the idea that it is possible to confront private firms, individuals, and even other levels of government with the same kinds of incentives they face in markets for labor, capital, and raw materials . . . [putting] the powerful advantages of markets to work in service to the environment."[174] This is known as market-based regulation. Unlike command-and-control regulation, in which the government requires regulated entities to comply with specific pollution limits or utilize particular pollution control technology, a market-based approach establishes the regulatory target, (e.g., total air emissions from the regulated sector), and provides regulated entities with flexibility to meet that goal, often using cost-effective means of compliance.[175]

A well-designed market-based rule may be able to deliver greater public health and environmental benefits with less required government monitoring and enforcement than an equivalent, traditional, command-and-control rule.[176] The CAA Acid Rain Program is perhaps the premier example of a highly successful market-based program. As discussed above under Principle 2, the Acid Rain Program's regulations include self-implementing mechanisms to address issues such as missing data and interim emission exceedences with no need for formal enforcement.[177] These provisions drove very high compliance with the Program, allowing the Office of Management and Budget ("OMB") to determine that the acid rain "cap and trade" program "accounted for the largest quantified human health benefits . . . of any major federal regulatory program implemented in the last ten years, with benefits exceeding costs by more than 40:1."[178] It did so by promoting "public confidence in the programs, highly accurate and complete CEMS emissions data, and a high compliance rate (>99% overall)."[179]

4. Tool 5d: Provide and Highlight Benefits to Regulated Entities From Compliance

Rules and permits may be designed to provide financial incentives for regulated entities to comply. Such incentives leverage the profit-seeking nature of corporations to promote better compliance. The incentives can be positive or negative. Positive incentives reduce costs or increase profits for complying entities such as through energy efficiency measures or waste reduction.[180] For example, a regulation might be structured such that complying facilities save money as a direct compliance outcome. Or it could be designed to support regulators, the financial services sector, or NGOs in identifying and rewarding sources that achieve and maintain compliance. Such publicity can enhance a company's reputation with customers, making it more competitive in the marketplace, while improving relations with regulators, investors, lenders, insurers, local communities, or other stakeholders. Negative incentives do the opposite—they increase costs or financial risks for non-complying entities and/or induce regulated entities to avoid financial impacts or risks, (e.g., avoiding liability for cleanup costs or reputational damage).[181]The EPA's CAA New Source Performance Standards for Crude Oil and Natural Gas Production, Transmission, and Distribution rule[182] exemplifies building an economically advantageous compliance option into a rule. The rule allows owners/operators of certain affected sources to use manufacturer-tested control devices. The manufacturers demonstrate that their control devices meet the performance requirements of the rule by submitting the performance test results to EPA for review. The performance test results are posted on the

labeling, or representation as organic must obtain certification from an accredited third-party certifying agent and subsequently self-certify its products as organic. This program, however, is not without its design weaknesses. A 2011 report from the USDA Inspector General found, among other things, "major noncompliances" on farms that had been certified as organic by third-party certifiers. Office of Inspector Gen., U.S. Dep't of Agric., Audit Report 01601-03-Hy, Oversight of the National Organic Program 28 (2010).

170. The Forest Stewardship Council administers a voluntary certification program designed to ensure that wood products come from well managed forests that provide environmental, social, and economic benefits. *See FSC Certification,* Forest Stewardship Council Int'l, http://www.fsc.org/certification.4.htm (last visited Sept. 1, 2015).

171. Stafford, *supra* note 166, at 86.

172. *Toxic Release Inventory (TRI) Program*, U.S. Envtl. Protection Agency, http://www.epa.gov/toxics-release-inventory-tri-program (last updated Jan. 21, 2016).

173. *Enforcement & Compliance History Online (ECHO)*, U.S. Envtl. Protection Agency, https://echo.epa.gov (last visited Mar. 5, 2016).

174. Paul R. Portnoy, *Market-Based Approaches to Environmental Policy: A "Refresher" Course*, Resources for Future, Summer 2003, at 15, 15.

175. Lisa Heinzerling, *Selling Pollution, Forcing Democracy*, 14 Stan. Envtl. L.J. 300, 301 (1995).

176. Nicholas C. Franco, *Corporate Environmental Disclosure: Opportunities to Harness Market Forces to Improve Corporate Environmental Performance*, at 3 (presented at the American Bar Association Conference on Environmental Law, Keystone, CO, Mar. 8-11, 2001).

177. *See supra* Subsection III.B.3.

178. *Cap and Trade: Acid Rain Program Results*, U.S. Envtl. Protection Agency 1 (n.d.), http://www3.epa.gov/captrade/documents/ctresults.pdf.

179. Schakenbach et al., *supra* note 72, at 1576, 1578.

180. Rena I. Steinzor, *Reinventing Environmental Regulation: The Dangerous Journey From Command to Self-Control*, 22 Harv. Envtl. L. Rev. 103, 154–55 (1998).

181. *Id.* at 155.

182. Oil and Natural Gas Sector: Emission Standards for New and Modified Sources, 80 Fed. Reg. 56,593 (proposed Sept. 18, 2015) (to be codified at 40 C.F.R. pt. 60).

Office of Air Quality Planning and Standards oil and gas website so all regulators and regulated entities know which devices meet the performance criteria.[183] The rule provides a benefit to regulated entities that purchase and use these devices because, in certain cases, they do not have to perform an initial on-site performance test and are allowed to do less periodic monitoring. The compliance option thus provides a saving to the sources that use compliance-ready devices. At the same time, the regulatory option is easier and less costly for the regulator to implement because EPA will not have to review as many performance test results.[184]

Another CAA rule provides complying facilities with a benefit along with setting limits on the flow rate of fuel gas directed to refinery flares.[185] The economic analysis for this rule concluded that, for typical gas streams, the cost of installing and operating a fuel gas recovery unit to comply with the new flow rate limit would be offset completely by the value of the recovered fuel gas.

IV. Integrating the Principles and Tools

Oftentimes, the whole is greater than the sum of its parts. While the principles and tools in this Article for designing effective rules can be employed individually, regulators are encouraged to look for opportunities to fashion integrated regulatory systems that are practical and effective for the regulated community and government to implement. For example, the effectiveness of self-monitoring or independent third-party verification approaches can be bolstered by combining them with public disclosure of compliance information to communities and stakeholders. Combining self or third-party monitoring with disclosure better informs the public of the facilities' compliance status, enabling public responses to noncompliance. Monitoring plus transparency can work proactively, too. When facilities know their compliance status is transparent, they may be better influenced to achieve, maintain, and improve compliance.

Some existing rules already combine multiple rule effectiveness principles and tools. For example, the CAA Acid Rain Program, discussed previously, combines market-based approaches, CEMS, self-implementing regulatory consequences, and e-reporting. CAA Title II state vehicle emission inspection programs also integrate multiple rule effectiveness principles and tools such as third-party verification and e-reporting.[186] In Missouri, for example, emissions analysis systems are connected to the internet to provide direct feedback and include a camera to photograph license plates, Vehicle Identification Numbers, and odometers while a built-in fingerprint scan system permits the systems to work only for verified inspectors.[187]

V. Designing Rules and Permits to Promote Outcome Measurement

Historically, regulators have been effective in identifying the health and environmental problems their rules are intended to address. But they have not routinely determined, during rule design, how they and their stakeholders will assess if the rules are actually achieving their projected benefits following implementation.

Because achieving and documenting compliance is a prerequisite to achieving and documenting regulatory benefits, designing rules to promote and measure compliance supports these rule effectiveness objectives. Regulators should therefore proactively identify the performance measures their agencies and the public will use to assess whether their rules are achieving their intended benefits and structure the rules to produce the required data. A rule that clearly identifies who is regulated (accurate identification of the regulated universe) and supports measuring their compliance status (overall and with specific requirements) will be easier for regulators and the public to assess its effectiveness.

VI. Conclusion

Creating an effective regulation is a mix of science and art. It starts with determining the health or environmental problem to be addressed, analyzing why a regulation may not be effective in achieving the compliance necessary to address the environmental problem,[188]and then using the principles and tools in this Article to build compliance drivers into the rule. Indeed, as described herein, federal and state rule and permit writers are already applying these principles and tools but more work is needed to make their consideration and use routine in rule and permit writing. The EPA's Next Generation Compliance strategy exemplifies such ongoing work.[189]

The twenty-first century brings with it new types of advanced monitoring, information technology, and opportunities for transparency. Designing rules and permits to leverage these advances can overcome the factors that often contribute to noncompliance. Effective regulations can motivate the regulated community to better comply with environmental laws and inform the public about their performance. Thus effective regulatory design can help ensure that all citizens are protected from significant health and the environment risks and have access to the information they need to more fully engage in promoting environmental protection.

183. *Proposed Updates to Requirements for Storage Tanks Used in Oil and Natural Gas Production*, U.S. Envtl. Protection Agency, http://www3.epa.gov/airquality/oilandgas/pdfs/20130328fs.pdf (last visited Oct. 19, 2015).
184. *See Oil and Natural Gas Air Pollution Standards*, U.S. Envtl. Protection Agency, http://www.epa.gov/airquality/oilandgas/index.html (last updated Mar. 10, 2016).
185. Standards of Performance for Petroleum Refineries, 73 Fed. Reg. 35,838, 35,855 (June 24, 2008) (to be codified at 40 C.F.R. pt. 60).
186. 42 U.S.C. § 7521(m) (2012) (CAA section 202(m)).
187. *See* Mo. Dep't of Nat. Res. & Mo. State Highway Patrol, Pub. No. 2487, Annual Gateway Vehicle Inspection Program Report—Fiscal Year 2013 (2014).
188. For a discussion of factors contributing to noncompliance, see *supr*a Part II.
189. Giles, *supra* note 1, at 22.