1. Introduction

The central problem for twenty-first-century environmental policy is how to develop new strategies for attacking new environmental problems, how to develop better strategies for solving the old ones, and how to do both in ways that are more efficient, less taxing, and engender less political opposition. (Donald Kettl, *Environmental Governance*, 2002, p. 6.)

For scholars and policy practitioners alike, the early 1970s – ushered in by the first nationwide Earth Day celebration – marked the beginning of serious environmental regulation in the United States. Forty years later, Americans with any serious green penchant are engaging in some profound soul-searching about our environmental regulations. Did the nation make enough progress, given the gravity and reach of environmental problems? Did American environmental policy perform as well as that of other developed countries? Were the costs acceptable? Did the extensive American green state – to use Klyza and Sousa’s (2008) term – select the most appropriate policy instruments? Were these tools applied properly? More fundamentally, to what extent did American environmental regulation transform the way we manufacture, build, consume and move people or goods?

Until recently, these questions could be raised but not answered, at least not very well. We either had scant evidence with which to explore them or we had not lived with our regulatory programs long enough to see results. The passage of time has reduced both of those obstacles. Accordingly, in this book I am able to show that, despite enormous gains achieved with the regulatory apparatus implemented after 1970, American environmental policy has stalled.

At the same time, a fundamental timidity now characterizes many American environmental regulations. Whether it’s pollution abatement or habitat conservation planning, American environmental policy rarely requires or aggressively encourages thorough transformation of environmentally damaging activities. Instead, American environmental regulators commonly do their level best to preserve, intact, the way we produce energy, use land, manufacture goods, build structures and move ourselves around – provided the worst abuses of power are mitigated, reduced or contained. I call this the compliance-abatement-mitigation approach
American environmental policy
to environmental problems. It accomplished much in the first epoch of
modern environmental policy, especially in light of ineffectual 1960s-style
pollution abatement, but was predicated on an inherently limited model of
transformation. The limits of compliance-abatement-mitigation seemed
far off when this approach was first launched, but now threaten to undo
hard-won accomplishments and thwart future gains in environmental
quality. Although my criticisms will be numerous, my aim in this book is
a constructive scrutiny of American environmental policy shortcomings
accompanied by insights and proposals for developing truly transforma-
tive policy in the 21st century.

Many thoughtful commentators have reached similar conclusions over
the years, pointing to the substantial gap between legislative goals and
what is actually achieved on the ground (Dryzek, 1997), what Fiorino
(2006) calls an “implementation deficit” (p. 82). Environmental policy
scholars commonly state that classic American environmental regulation
has run its course (Metzenbaum, 1998; Kettl, 2002; Davies and Mazurek,
1998; Fiorino, 2006; Cohen, Kamieniecki and Cahn, 2005; Kraft, Stephan
and Abel, 2011; Mazmanian and Kraft, 2009).

Much of the environmental policy literature draws attention to the
ebb and flow of political support for environmental policies, the struggle
between corporate and environmental interests or the public’s under-
standing of environmental quality. My goal here is synthesis, critique and
reform – not theoretical innovation or a political autopsy of failed legis-
lation. I do rely on valuable theoretical frameworks from several fairly
disparate literatures, but I am not proposing a new theory of environmen-
tal regulation. Fortunately, public policy, political science, economics,
industrial ecology, engineering and the environmental sciences provide us
with all the conceptual tools needed to make sense of our environmental
achievements and shortcomings. Using these tools, I take aim at several of
the most problematic environmental policy tools and their implementa-
tion, relying on far more of the latest environmental science and engineer-
ing than is usually the case in contemporary policy studies. By engaging
deeplly with several scientific literatures, we can much better appreciate
our environmental management successes, failures and limits. We can also
see more clearly how specific environmental policies generate particular
environmental outcomes. In a regulatory era when the low-hanging fruit
has already been picked, an equally important contribution of the book
is to articulate an environmental policy approach that employs tools and
instruments appropriate to the mature administrative apparatus of the
21st century.

Much of this book analyzes important environmental management
tools to illustrate our regulatory shortcomings. These examples are not
meant to be exhaustive, but rather to demonstrate some of the more consequential ways in which environmental regulations miss the mark. Before providing an overview of the book’s plan, I want to present the working definition of regulatory failure that guides my selection and evaluation of these cases.

WHAT IS REGULATORY FAILURE?

Public administration scholars have filled journals and books with policy evaluation studies and frameworks for analyzing policy catastrophes or successes. Most policy scholars agree that objective, technical, uncontested criteria by which to judge the successes and failures of all policies or regulatory programs simply do not exist and never will. Taken to its extreme, however, a purely relativistic position holds that there are no empirically observable regulatory failures, since “success” and “failure” are simply in the eye of the beholder (Sunstein, 1990, p. 75).

But here I adopt a narrower scope, one that is more amenable to empirical verification. Regulations can be deemed successes or failures to the extent that they produce outcomes called for in their enabling legislation. In its purest, simplest form, environmental law seeks to prevent or reduce pollutant loads, to protect species and ecosystems, and to restore degraded landscapes or waterways. Legislators and their administrative agents often express these goals with numerical standards, so failure can most readily be recognized as a violation of these limits. But defining failure as any violation, no matter how small or infrequent, would be absurd.

Instead, the term “failure” should be reserved for regulatory shortcomings that allow or cause exceptional, ongoing danger to public and environmental health (see Table 1), especially when we have examples of alternative policy tools that can work unambiguously. For instance, the rare cases in which the US banned certain compounds outright – like lead in gasoline and paints, phosphorus in detergents, and persistent organic pollutants (POPs), including DDT, dieldrin and PCBs – all demonstrated government’s ability to decisively remove public and environmental health threats (Commoner, 1987; Kehoe, 1992; Weimer and Vining, 1999).

In invoking this limited meaning of “failure,” I adopt an approach similar to that of Moran’s (2001) policy catastrophes topology. He proposed five different kinds of political action or events that led to policy catastrophes, illustrated by “...five cases that, at least from the vantage point of 2001, are uncontested catastrophes” (p. 415). By this standard, I propose five forms of regulatory failure in environmental programs, listed in Table 1.1.
POSSIBLE MECHANISMS OF REGULATORY FAILURE

How do the regulatory failures in Table 1 happen? The various regulatory literatures tend to organize the mechanisms of failure with respect to the agents of such failures. Thus for example, Cass Sunstein (1990) distinguishes between poor statutory language and bad implementation, thereby blaming legislators and agency officials separately.

A voluntaristic view of implementation failure holds that policymakers deliberately ignore their duties or address problems incorrectly (Bovens and ’t Hart, 1996); their actions are thus purposeful and the consequences intended (Stone, 1997). A more deterministic view holds that external forces and constraints unintentionally visit implementation failures upon regulatory programs. However, Coglianese (2012) cautions that we should not reflexively invoke regulatory failure in explaining catastrophes visited upon highly regulated industries, like mining or deepwater oil exploration. Some accidents simply cannot be prevented by even the best regulatory designs.

Market failure, a major preoccupation of the regulatory economics literature (see Anthoff and Hahn, 2010), usually shares this deterministic, mechanical agency: markets are machines that perform as designed, but cause harm unless modified. Many economists view regulation (e.g., one-size-fits-all command and control rules) as a cure worse than the disease (market failure in the form of negative externalities, monopolistic or oligopolistic abuses); thus, failure resides in the original policy tool employed (Alleman and Rappoport, 2005).

Cohen, Kamieniecki and Cahn (2005) situate failure not necessarily in the policy tool, but in the strategic approach (or lack thereof) used to implement regulation. The rare success stories occur at the confluence of

Table 1.1 Varieties of failure in American environmental regulation

<table>
<thead>
<tr>
<th>Varieties of Failure</th>
<th>Examples</th>
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<tr>
<td>Catastrophic harm</td>
<td>Deepwater Horizon oil spill, 2010</td>
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<tr>
<td>Ongoing or chronic harm</td>
<td>Nonattainment with Clean Air Act standards</td>
</tr>
<tr>
<td>Detection and information breakdown</td>
<td>Guadalupe Oil Field spill, San Luis Obispo County, California, 1997–2002</td>
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<tr>
<td>Inadequate restoration</td>
<td>Surface mine reclamation under SMCRA</td>
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<tr>
<td>Unintended (usually cross-media)</td>
<td>Methyl tertiary butyl ether (MTBE) in groundwater; recycling as solid waste management rather than industrial feedstock</td>
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three factors: the regulated community’s capabilities, its motivations and the feasibility of regulations themselves.

Moreover, like any human endeavor, regulations age. As they grow older, some programs succeed at addressing their mandates, developing supportive constituencies along the way even as they impose costs on regulated interests. Other programs evolve toward failure. Either way, there may be little in the way of active human agency involved.

As with the failure typology I developed above, I propose three general mechanisms in Table 1.2 as useful heuristics for explaining how regulatory programs fail. I offer illustrative examples within each general category. I stop short of presenting empirical evidence, except where the literature provides some; instead, this typology of mechanism is designed to guide further theorizing and empiricism.

In some of these mechanisms, failure occurs through intentional obstruction; in others, there is no agent willfully inciting failure, but policy tools may be inadequate to resolve problems, as the following sections suggest.

**REGULATORY FAILURE THROUGH SLIPPAGE**

Regulatory programs often “slip” or “drift,” eventually resulting in implementing agencies facing changed mandates, or at least implementing to fairly different outcomes than the ones in original legislation. Regulatory slippage also has negative consequences for environmental management (Farber, 1999) as well as positive results (see what Klyza and Sousa, 2008, call “green drift”); here I will focus on failures rather than gradual improvements.

<table>
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<tr>
<th>Mechanism</th>
<th>Agents</th>
<th>Examples</th>
</tr>
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<tbody>
<tr>
<td>Negative regulatory slippage over time</td>
<td>Legislators and regulators</td>
<td>The “low-hanging fruit” problem; gradual changes in rule content or enforcement; use of waivers</td>
</tr>
<tr>
<td>Obstruction</td>
<td>Regulated community</td>
<td>Capture, information bottlenecks or “filter failure,” lawsuits, protests, reduced penalties</td>
</tr>
<tr>
<td>Policy instrument mismatch</td>
<td>Legislators, regulators</td>
<td>End-of-pipe controls under high growth conditions; Nonpoint source programs for water quality, MTBE; Deepwater oil drilling; single-stream (commingled) recycling</td>
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</table>
In Farber’s formulation, negative slippage occurs when either federal or state agencies fail to adopt standards – as mandated by enabling legislation – or when agencies fail to enforce existing rules adequately. Negative slippage also occurs when the regulated community simply doesn’t comply with what might otherwise be good rules. These factors are all related, of course. The regulated community will continue flouting rules while administrative agencies fail or refuse to enforce them.

Reasonably strong regulatory programs can also drift “. . .when rules remain formally the same but their impact changes as a result of shifts in external condition” (Mahoney and Thelen, 2010, p. 17). This is a major source of failure in the main pollution abatement laws, which are now entering their fifth decade of implementation. After Congress passed tough amendments to federal clean water and clean air laws, dramatic improvements in pollution abatement occurred very rapidly, in large part because previous standards had been lax or non-existent. In the 1970s it was easy to find side-by-side pictures of smokestacks belching dark smoke before passage of the 1970 Clean Air Act, contrasted with the same smokestacks emitting nearly invisible emissions thanks to the Act’s particulate matter controls.

Congress recognized that abatement costs increase the more one tries to remove pollutants, which is why the CAA and the CWA gradually phased in ever more stringent controls, with some astonishingly ambitious end goals. Indeed, the 1972 CWA amendments actually stated that “It is the national goal that the discharge of pollutants into the navigable waters be eliminated by 1985” (33 U.S.C. § 1251).

It makes sense that initial abatement efforts will be relatively easy, while higher costs and quite possibly very different kinds of technological controls will be required to abate the latter fractions of remaining pollution (e.g., from 70 percent to 90 percent removal). The simple s-curve in Figure 1.1 illustrates this “low-hanging fruit” phenomenon.

Regulators understand that technologies for removing, say, the “first” 75 percent of a pollutant stream – e.g., through secondary water effluent standards or flue-gas desulfurization – are likely very different from processes and equipment for removing pollutants at higher efficiencies. Indeed, reaching 100 percent abatement through end-of-pipe controls is really an oxymoron: truly complete abatement can only be achieved through completely redesigning industrial processes.

Moreover, regulators have historically not required the highest removal efficiencies. Instead, the much stricter standards come years or even decades after initial legislation was passed, sometimes as a result of new health findings (which in recent years prompted the EPA to revise most of its ambient air standards). By then, the legislative champions who passed
initial laws have long since moved on – in essence, leaving a political vacuum into which arrive well-organized opponents of tougher standards.

Sometimes regulatory programs themselves are to blame for preventing greater pollution abatement. For example, the best available control technology (BACT) approach employed by EPA required very specific technologies and processes for a wide variety of industries. When initially implemented, BACT resulted in improvements (the low-hanging fruit), but also froze abatement performance, technological innovation and change at a specific point in time. Until Congress passed the 1990 CAA amendments, Midwestern power plants had little incentive to exceed SO$_2$ removal levels mandated by earlier versions of the Act (90 percent removal, which nearly half the plants didn’t regularly reach anyway). After EPA implemented the SO$_2$ tradable permit system, no plants failed to reach the 90 percent removal rates; by 1997 nearly 80 percent of the plants had exceeded 95 percent removal rates (Popp, 2003).

Why is the low-hanging fruit phenomenon a case of regulatory failure? It is regulatory failure because policy tools adopted at the onset of regulatory programs cannot force pollution reductions after initial gains have been achieved by picking the low-hanging fruit. Yet, the same policy approaches continue to be applied to the problem, leaving it unsolved (e.g., out of attainment with clean air standards) for decades. The built-in limitations of the end-of-pipe, low-hanging fruit approach make it hard to achieve further gains using the same regulatory approach (Kraft, Stephan and Abel, 2011, p. 4). Diminishing returns even apply to recycling if consumption grows faster than materials collection (Geiser, 2001, p. 235).
In sum, 1) regulators lack the political support for tougher standards, while 2), pollution removal rates through end-of-pipe controls encounter hard technical limits, and 3) population growth swamps the per-unit improvements, thereby vitiating the end-of-pipe approach.

REGULATORY FAILURE THROUGH OBSTRUCTION

As a rule, regulation is acquired by the industry and is designed and operated primarily for its benefit. (Stigler, 1971, p. 2)

Many interests oppose regulation and learn to parry regulatory efforts through a variety of mechanisms. I raise here the specter of regulatory capture, but before proceeding any further, I acknowledge that environmental agencies can be unduly influenced at least as much by environmentalists as they can by the regulated community (Wilson, 1980). While environmentalists don’t tend to pressure agencies to promulgate weak regulations, their influence can result in regulatory delay, increased costs (beyond what would efficiently reduce the same amount of pollution) and impractical, hard-to-implement programs. California’s proposed climate change tradable permit program was delayed longer by environmental groups than industry opponents. In this case, the Association of Irritated Residents (AIR), argued the program would result in pollution “hot spots” concentrated in poor and minority neighborhoods (Egelko, 2011).

What makes capture an instance of failure as opposed to “the workings of an acceptable political process,” as Peter Strauss (1991, p. 924) would put it? Strauss’s answer is to include only “interest-group transfers masquerading as regulation. . . and . . . [the] inevitable and permanent imbalance of cost and benefit” (p. 923). Similarly, Croley (2008) points out that regulatory failure can be defined by its alternative, “public interested” regulation, which “. . . delivers no rents or, if it does, the gains for those who benefit from the regulatory decision outweigh any losses to the rest of society. . . it is Kaldor-Hicks efficient” (Croley, p.11). Interest-group transfers occur when regulation is adopted to address a genuine market failure with a policy that does not work very well, but transfers wealth to, or protects the wealth of, powerful private interests. The classic environmental case of this concerns air pollution from power plants. Until the 1990 CAA amendments were promulgated and enforced, Appalachian coal mining companies benefited from rules that pushed sulfur scrubbers onto electric-generating facilities rather than promoting the use of low-sulfur western coal (Sunstein, 1990; pp. 84–85; Ackerman and Hassler, 1981).
In other words, taking statutory language at face value, laws like the Clean Air Act, the Clean Water Act and the Comprehensive Environmental Response, Compensation and Liability Act (the Superfund law) specifically intend to provide environmental protection, but different choices about how to attain environmental quality goals can result in enormous windfalls or costs. For example, oxygenating gasoline with MTBE opens up a huge market for American and Canadian chemical manufacturers; using ethanol provides a windfall to Midwestern corn growers and ethanol producers.

Setting aside instances whereby legislators write their hostility toward environmentalist objectives into statutes, regulations can fail through outright obstruction, which can be overt or quite discreet. A vast literature refers to regulatory obstruction by many names, some of them falling under the “capture” rubric. They can generally be grouped into categories including 1) information capture and filter failure, 2) weakened enforcement, 3) revolving-door appointments, and 4) delay.

Wagner’s (2010) anatomy of information capture shows how Congress’s well-intended impulse to invite (if not require) a maximum amount of information input to the regulatory process has backfired. Today, environmental regulations require enormous amounts of information, but administrative law does not make clear provisions for managing the flow of such information, especially as to whether and how to filter it, thereby distinguishing between what is useful and legitimate, and what is irrelevant or deliberately provided merely to gum up the works. Stakeholders (especially in the regulated communities) have an incentive to overwhelm administrative agencies and courts with information (Laffont and Tirole, 1991). The result is that decision-making becomes more obscure and very few participants have the wherewithal to manage the information.

Interest-group transfers – Strauss’s principal concern with regulatory failure – can be caused when the regulated community engages so deeply in the rule-writing enterprise that it can be fairly credited for authoring the very content of regulations (Rosenbaum, 2011). This has happened with transportation policy (Etzioni, 2009), the underground storage tank (UST) rules that led to methyl-tertiary butyl ether (MTBE) contamination (McGarity, 2004), monitoring leaks on the seals of petrochemical tanks (Wagner, 2010) and the new source review provisions of the Clean Air Act (Barcott, 2004).

Even excellent rules fail if regulators don’t enforce them. Makkai and Braithwaite showed that inspectors who had held senior management positions in industry were less “tough” than their counterparts lacking industry experience (1992). This is a finding echoed many times by investigative reporters examining state and federal environmental rule
enforcement (see Duhigg, 2009 for a recent multi-part series in the New York Times), scholars tracking variations in state enforcement (e.g., Hunter and Waterman, 1996) and federal watchdog agencies like the General Accountability Office, which demonstrated that funding has not kept pace with inflation and enforcement responsibilities (Forgacs, 2010).

Sometimes enforcement loses its bite when the regulated become the regulators, through what’s known as a revolving door between industry and government (Heyes, 2003; Dal Bó, 2006). Many scholars and political observers would agree that the revolving doors are real and that the phenomenon probably has an influence on policy outputs and outcomes. Indeed, the phenomenon is real enough that the federal government restricts former government employees from ever representing their private sector clients on matters in which the former employee “personally and substantially” participated while in government (5 C.F.R. § 2637.201). The Procurement Integrity Act bars, for one year, a former government employee who participated in procurement contracts in excess of $10 million from serving as an employee or consultant with the contractor (48 C.F.R. § 3.104–1–11).

These restrictions still leave a lot of room for mischief, but how should undue influence be measured? If a former government employee goes to work for the industry he or she once regulated, is that a *prima facie* case of undue influence that will result in regulatory failure? Again, investigative reporters have made more headway with this topic than scholars, finding anecdotal evidence for rule-writing by regulated industries, private meetings and lobbying activities by former government officials (see Barcott (2004) for an example).

It’s easier to measure regulatory obstruction through what Sunstein (1990) calls “administrative delay and torpor.” Kosnick (2005) found that dam operators whose federal licenses were up for renewal made strong efforts to delay the process, most likely because doing so would postpone “...costly environmental mitigation requirements that go along with a relicense. The longer the delay, the greater the chance of avoiding the costly requirements altogether—but if nothing else, delay will certainly subject these costs to greater discounting” (pp. 279–280).

Ando (1999) found a similar interest-group influence effect on the Fish and Wildlife Service’s endangered species listing process. Generally speaking, when legislators (especially those with Fish and Wildlife Service regulatory and/or budget oversight responsibility) and stakeholders opposed listing species as endangered or threatened, listing decisions were delayed, sometimes to the point of inaction.

Regulation can fail through delay because of rigid procedural require-
ments that force agencies to spend more time and money developing and issuing rules. (Sunstein, 1990, p. 100). The small community of Los Osos, California, illustrates how due process can stymie rulemaking. This 15,000-resident community on the southern end of the Morro Bay estuary uses septic tanks to treat its municipal sewage. Unfortunately, the small, narrow lots and sandy soils prevent septic tanks from functioning properly, resulting in nitrate groundwater contamination. Although the community has been under orders from the state to stop discharging nitrates into groundwater since 1988, which effectively means building a sewer and connecting residents to it, twenty-five years later, a functioning sewage treatment facility was still a long way off.

Delay also results when agencies face tremendous uncertainties and must work with incomplete information. For nearly a generation, the US EPA failed to regulate air toxics as required by the 1970 Clean Air Act in its NESHAPs program, because of extraordinary complexity in determining risks and setting scientifically defensible air standards that were also technologically feasible.

Ultimately, regulatory capture is a situational phenomenon, which helps to explain the frequent failure of systemic reforms such as limits on revolving door appointments. (Makkai and Braithwaite, 1992).

REGULATORY FAILURE THROUGH MISMATCH

Regulations can fail because particular policy tools simply cannot address problems for which they were not designed. But if the tools don’t work, why are they adopted? Deborah Stone’s (1997) well-known policy paradox concept helps us see that it has been politically rational for the nation to substantially abate pollution without fundamentally changing industry. Political communities form around specific policy tools, making their adoption and implementation possible – even if such tools cannot possibly solve a problem over the long run.

Worse yet, real environmental policy paradoxes actually cause precisely the opposite of their intended purposes. Sunstein (1990) offers three such examples applicable to environmental policy; I add illustrative cases to each:

1) “To require the best available technology is to discourage technological development” (p. 106). Forced to favor compliance over performance, companies lock in, for example, manufacturing, power generation or pollution abatement technologies rather than pursue innovations (Chertow and Esty, 1997; Popp, 2003).
2) “To regulate new risks in the interest of health and safety is to perpetuate old ones, and thus to reduce health and safety” (p. 106). As I’ll discuss further in Chapter 3, the Acid Rain Program, adopted to combat new concerns over surface water acidification and tree mortality in the Adirondacks and Appalachia, likely resulted in differential health benefits to the public. That’s because the program shifted SOx emissions from relatively under-populated rural areas to more urbanized parts of the country, where more people were exposed to these pollutants (Henry, Muller and Mendelsohn, 2011).

3) “Strict regulatory controls produce underregulation, at least when the regulator has prosecutorial discretion” (p. 106). American regulators have at their disposal all the authority they need to curb the most dangerous hazards, like those posed by some toxics, but very rarely exercise their discretion because of the damage they might pose to particular industries. The result is that regulators match “wait-and-see” approaches for far too many risks that really require banning a chemical (e.g., DDT) or practice (e.g., land disposal of hazardous wastes) outright (see Commoner, 1987 and Kehoe, 1992).

These regulatory paradoxes, along with policy legacies from the 1960s and 1970s, ensure that environmental policy mismatches abound. Sometimes regulations adequate for one system (shallow water oil drilling) fail spectacularly in another (deepwater oil drilling, as the country learned with the BP Gulf oil spill in 2010). In some cases, regulators simply can’t keep up. As Goodin, Rein and Moran (2006) put it, “[p]olicy is simply sometimes taken over by events. Whole swathes of policy regulating obsolete technologies become redundant with technological advances” (p. 26). Rapidly-unfolding booms in new economic activity associated with technological advances commonly overwhelm regulatory agencies. Recently, these include deepwater oil drilling, mountaintop mining with valley fills and hydraulic fracturing for natural gas. In still other instances, an ambient management approach fails spectacularly to control nonpoint sources of pollution, as is the case in water quality (Houck, 2002).

The compliance-abatement-mitigation approach favors end-of-pipe pollution controls based on the assumption that removing nearly all the pollution from some source will usually be good enough. End-of-pipe controls end up as policy mismatches simply because the number of pollutant sources grows enough to overwhelm the per-unit emissions or effluent reductions.

The Los Angeles basin provides a good illustration of this failure. In the 1940s, when the smog problem became well-defined and mobile sources were implicated in its cause, there were about 2.5 million mobile sources
in the basin; by 2005, the number had grown to more than 10 million (Mazmanian, 2006). Today’s cars emit 89 percent less NOx per mile, 96 percent less CO and 98 percent less hydrocarbons, but the LA basin is still far, far out of attainment with ambient clean air standards. A 2010 report by the Environment California Research & Policy Center pointed out that a new car purchased in 1960 could be expected to emit one short ton (2,000 pounds) of smog-forming compounds during 100,000 miles of travel, while today’s vehicles emit 10 pounds of pollutants over the same distance. Despite being 99 percent cleaner, vehicles still account for 20 percent of California’s smog-forming compounds (Madsen et al., 2010).

In order to eventually comply with ozone standards, the South Coast Air Quality Management District (SCAQMD), charged with enforcing state and federal clean air laws, estimates that daily NOx emissions need to come down by 192 tons by 2014 and 383 tons by 2023 (SCAQMD, 2007). Currently, all on-road mobile sources in the basin (passenger vehicles, light and heavy duty trucks) contribute over 400 tons of NOx per day. Thus, cars and trucks would have to reduce their NOx emissions another 50 to nearly 100 percent if regulators sought attainment through mobile source controls alone.

A big part of the problem is the LA basin’s topography, of course, but a larger population of vehicles is also much to blame. Consider the following hypothetical: how many tons of NOx would LA basin mobile sources emit, per day, if the same number of cars were on the road today as in 1978 (by which time EPA’s mobile source standards had been adopted), but with today’s emissions standards?

The California Air Resources Board’s Emission Factors (EMFAC) model makes this thought experiment possible. EMFAC estimates on-road mobile source emissions using different population and emissions factor inputs using the following:

\[
\text{Emissions factor} \times \text{correction factor} \times \text{travel activity} = \text{Emissions in tons per day}
\]

Using the EMFAC model with actual vehicle populations from 1978–2008, but current tailpipe standards, yields the daily NOx emissions depicted in Figure 1.2. The key difference lies in the daily NOx emissions between the number of vehicles on the road in 1978 (220 tons) and the number of vehicles in 2008 (460 tons). The difference – 240 tons per day – is very close to the emissions reduction target the SCAQMD set for all

\[\text{The actual NOx emissions from mobile sources are higher than what this model run estimates, because the model here assumed that all mobile sources on the road complied with the latest standards. In reality, there is always a mix of old and new vehicles, so the older vehicles drive up the total emissions burden.}\]
American environmental policy between 2014 and 2023. Of course, I am not seriously suggesting that the LA basin population should not have grown at all between 1978 and 2008, but this model illustrates the hard limits all end-of-pipe control strategies must reach. Something eventually has to give, either the number of sources or the basic technology itself.

Recycling in America makes for another of the most disappointing environmental policy mismatches, painfully illustrating the law of unintended consequences. After 40 years of cultural change, spurred on by legions of righteous school children and vigorous ad campaigns, Americans have raised recycling to the level of a moral act. And so, millions of us wheel our carts out to the curb every week, certain that we are doing our part for sustainability. How ironic, then, that so many of these recyclables are either too contaminated to reuse or so hopelessly co-mingled that it has become economically impractical to sort them here in the US. Sadly, much of what gets recycled at the curb ends up in a landfill or on a slow boat to China.

Municipalities around the country opted for co-mingled curbside recycling as a way of increasing public participation. The public did participate more, but co-mingled (also known as “single-stream”) recycling was the right policy for the wrong problem (Morawski, 2009). Cities and counties around the country thought they were going to run out of landfill space, especially since nobody wanted new landfills in their backyards. States mandated solid waste diversions, so local governments had real incentives (albeit negative ones) to reduce trash shipments to their local landfills.

The right problem is not waste, it’s running out of materials and the damage incurred through using materials wastefully (MacBride, 2011). In the ultimate end-of-pipe mentality, American environmental policy took a four-decade break from the laws of thermodynamics. We live on
one, finite planet, but consume as if we had many more. Had we thought of waste as a materials management problem, we might have designed recycling programs so that they provided much better industrial feedstock.

We need look no further than Europe for plausible examples of better – not ideal – materials management. Europeans generally do a better job of end-of-pipe recycling and materials management, albeit with a lot of room for improvement. European countries tend to recycle much more container glass than Americans—the average is 65 percent for the EU 15 and as high as 86 percent for Germany in 2005 (OECD Environmental Data Compendium, 2008). Americans only reached 28 percent recycling for container glass in 2006 (Container Recycling Institute, 2011).

Similarly, Europeans recycle high percentages of aluminum containers (63 percent for beverage cans) and more than 90 percent of aluminum used in the building, construction, automotive and transportation sectors (European Aluminium Association, 2011). In 2008, 34 percent of total US aluminum supply came from recycled (secondary) sources; for beverage cans, the figure was about 65 percent in 2011 (The Aluminum Association, 2009, 2012). Ninety percent of automobile aluminum components are recycled (Jupiter Aluminum, pers. comm., 2009).

Plastics recycling is relatively poor all over the world, but again, Germans do better than the US. In 2006, Americans recycled 23.5 percent of PET bottles; Germans recycled 47 percent of all plastics in its waste streams (CRI, 2011; ETC/SRP Working Paper, 2009).

Once American industries recover materials, how well do they recycle them? Chapter 3 reviews the American experience with flue-gas desulfurization (FGD); many other industrialized countries rely on FGD systems. As a result of all this scrubbing, power plants around the country produce vast quantities of what are called “coal combustion products.” In 2009, American facilities produced 16.3 million metric tons of FGD gypsum; the EU 15 countries produced about 10.8 million metric tons in the same year. FGD gypsum can be used in agriculture, gypsum panel products, highway construction, mining applications, cement production, water treatment and glass making. FGD gypsum recycling in the US in 2011 was 47.2 percent (American Coal Ash Association, 2012) and considerably higher in the EU 15, at 83 percent (European Coal Combustion Products Association, 2012; www.ecoba.org).

Construction and demolition sites recently became the new frontier for recycling. Demolition, in particular, produces enormous amounts of waste aggregate that can be productively put to use in road building and as fill for other construction purposes. Construction and demolition waste (C&DW) recycling in the EU 15 averaged 20 percent in recent years, but ranged from less than 5 percent in countries like Ireland and Portugal to
more than 80 percent in countries like Denmark, the Netherlands and Belgium (cited in del Rio Merino et al., 2011).

The best C&DW recycling data are on cement recycling. According to the Construction Materials Recycling Association, about 140 million tons of cement are recycled in the US every year, which is a greater than 80 percent recycling rate; Germany had an 89 percent recycling rate (World Business Council for Sustainable Development, 2009). Old cement is not primarily used to make new cement, but rather as aggregate for roadbeds and construction fill.

Americans generally lead the world in steel recycling, partly because the US boasts so many electric arc furnace “mini-mills,” which rely on scrap steel (of which there is a great amount, given the size of the American economy). In addition, different steel grades can be sorted easily, and the high cost of transporting steel makes regional recycling a cost-effective alternative. Consequently, the US steel industry relies on scrap for 55 percent of its production, much more than any other country (Yellishetty et al., 2010).

In the years since the environmental legislation heydays of 1969–76, older industrial economies greatly increased their recycling rates, but most nations still vary tremendously in their materials recovery patterns. The US, relative to other advanced industrial nations, tends to recycles less, use more energy and produce higher waste per dollar of GDP than the best-performing European countries.

In summary, this chapter has outlined a number of recurring shortcomings in American environmental regulatory process; these serve as the basis for the critique I lay out in Chapters 2 to 5. They can be summarized as:

1) A focus on compliance and technology rather than on performance. This is just as true of scrubbers placed on industrial boilers as it is on best management practices (BMPs) adopted for agricultural pollution prevention.
2) Very limited ability to handle population effects, i.e., most end-of-pipe limits work only if the number of polluting sources doesn’t get too large.
3) A failure to connect policy outputs to their consequent environmental outcomes.
4) Very limited incentives to reduce virgin raw material inputs (either through process efficiencies or materials recovery of recyclables).

Old, mismatched regulations fail because the low-hanging fruit has been picked, but polluting sources continue to grow in size and number (Kraft,
Introduction

Stephan and Abel, 2011), resulting in extraordinarily high marginal costs for further pollution abatement. Our voluntaristic, clearinghouse-based approach to efficiency in general – and materials recovery in particular – hobbles any serious attempts at harmonizing environmental, labor, trade and tax laws into an integrated industrial policy (Fiorino, 2006, pp. 19, 65, 81). Consequently, American industrial efficiency falls further behind that of industrial sectors in other industrialized nations. Cutting across all environmental policies, since administrative agencies lack systematic, long-term indicators with which to establish performance benchmarks and changes, inadequate or anecdotal environmental data collection and reporting hamper reform efforts (Metzenbaum, 1998 and Metzenbaum in Kettl, 2002; Kettl, 2002; NAPA, 2000).

A POLICY TOOLS AND OUTCOMES APPROACH

I adopt a systems-oriented, policy tools and outcomes approach to assessing modern American environmental policy and regulation, one focused on the deterministic failure mechanisms described above (regulatory slippage, policy mismatches). I leave political or ideological obstruction for others to evaluate. In addition to critique, I offer a way forward based on science and altered incentives (see Fiorino, 2006, p. 20).

How does a tools-and-outcomes approach work? A first step is to shift the focus of analysis from government agencies or programs to the policy tools themselves (Salamon, 2002). Taking a cybernetic view of government, we further draw our attention to three control activities common to policy tools: a director to set standards or targets, a detector to observe state changes relative to adopted goals and an effector, which brings a system in line with targets if it swings off limits (Hood, 2007).

These elements require detailed understanding of tool designs and their operating characteristics. Following Salamon (2002), this understanding includes:

...the players [that policies]...engage, and how they structure the play...how to match tools to the problems being addressed in light of the objectives being sought and the political circumstances that exist...and knowledge about how best to operate the new instruments to achieve these objectives in the most effective fashion (p. 39).

Most policy scholars forego any concerted effort to connect environmental regulations (outputs) to their associated bio-physical or other material outcomes. The causal linkages are exceedingly difficult to establish, even with the best data and many years into a regulatory program’s life. But
policy analysis without outcomes is an unsatisfying endeavor, all critique without consequence. We can know in exquisite detail who struggled to adopt what rules and how they justified their choices without ever learning how this regulatory politics changed our material reality (Hood, 2007, p. 141).

If the work is difficult, it is not impossible, however – especially today. Although environmental data need to improve significantly (a point I develop fully in Chapter 2), we have nearly a half-century of environmental science and indicators that can help us tie policy outputs to outcomes and many models for doing so (Dunn, 1994; Metzenbaum, 1998; Milon and Shogren, 1995; Knaap and Kim, 1998; Hamilton and Cook, 2010; Press, 2007; Michigan Sea Grant and Graham Environmental Sustainability Institute, 2009). Doing so will provide much greater meaning than the conventional wisdom regarding the book’s cases: acid rain, nonpoint source water pollution, toxic releases and industrial recycling.

THE PLAN OF THE BOOK

Using case studies, Chapters 2 to 5 show how and why contemporary US environmental regulation falls far short of its mandated goals and its obligations to the American public. Each of these chapters opens with an in-depth examination of the empirical evidence demonstrating regulatory shortcomings. The environmental science, the relevant trade data and long-term monitoring results all confront us with worrisome trends, but what do the data mean? Each chapter answers this question through in-depth interviews and engagement with a wide range of relevant literatures. Chapter 6 proposes policy reforms designed to correct these shortcomings, drawing on regulatory experiments from the US states and overseas.

THE CASES

Chapters 2 to 5 provide an eclectic mix of cases illustrating how compliance-abatement-mitigation fails. Widespread acclaim for the programs or activities discussed in each chapter unites all of these cases. Conventional wisdom holds the Toxics Release Inventory, the Clean Water Act, the Acid Rain Program and paper recycling in high regard, but I will show that these favorites of American environmentalists, regulators and the general public actually perform far less well than widely believed. But if these exemplars of environmental success really don’t meet our expectations,
then it does not bode well for the many other, generally less well-regarded regulatory programs.

I begin with Chapter 2, “Measuring Pollution,” which confronts the state of the nation’s environmental information. First-rate, longitudinal environmental data are a necessary element for any good regulatory program. Unfortunately, regulators far too often cannot confidently convey the environmental consequences of their regulatory programs. Consequently, it is exceedingly difficult to hold the policy community—regulators, dischargers and other stakeholders—accountable for their actions.

A big part of the problem here is that environmental regulations do not or cannot avail themselves of evidence demonstrating a causal link between policy instruments and environmental outcomes. There are also pathologies of information use—what Wendy Wagner (2010) calls “filter failure”: regulations fail to provide mechanisms to parse information effectively, thereby preventing meaningful participation by a wide range of interests.

Chapter 2 explores the evidentiary problem primarily using the US Toxic Release Inventory (TRI) as the illustrative case. I begin by examining the data—in this case, trends in how toxic releases are estimated. The data show that industries actually measure relatively few of their reported releases, which calls into question what we can confidently say about trends in American toxics. The rest of the chapter answers this question, drawing on various literatures and interviews with respondents from the US EPA, industry and non-governmental organizations.

The next three chapters take up the end-of-pipe theme, each from a different point in the progression from raw material to pollution. Chapter 3, “Failure at the end of the pipe,” fully develops the end-of-pipe critique by examining the 1990 US Clean Air Act Amendment’s Title IV, also known as the Acid Rain Program (ARP). I selected this program precisely because it is widely considered the model of effective and economically efficient regulation, especially for large, stationary pollution sources (Kraft, Stephan and Abel, 2011; Fiorino, 2006; Davies and Mazurek, 1998). In 2009, the US House of Representatives modeled the landmark Waxman-Markey cap-and-trade climate change bill (HR 2454) on the ARP even though a carbon tax is widely thought to be a better policy tool for curbing greenhouse gas emissions (Nordhaus, 2008). Despite conventional wisdom, the ARP has not ended the acid rain problem and will not do so by further end-of-pipe curbs on coal-fired power generation. As expected, given the thermodynamic limits to emissions scrubbers, further acid deposition reductions will only be achieved by changing the way we generate electric power.

Chapter 4, “Failure when there is no pipe,” demonstrates how US
regulators and policymakers applied end-of-pipe approaches even to nonpoint sources – that is, cases where there are no highly controllable, distinct discharges (i.e., no pipes). The best examples of nonpoint source failures come from state and federal water quality laws and programs. The Clean Water Act has often been praised for its ambitious application of technology standards and waste discharge permits, along with generous federal largess. These successes notwithstanding, Chapter 4 provides evidence showing that too much of the United States’ waters remain heavily polluted. Nonpoint sources of water pollution – urban development, agriculture, logging, mines – now impair the nation’s waterways far more than point sources. US waters are literally overwhelmed with toxic chemicals (including pesticides, herbicides and nutrients from fertilizers), metals and sediments, along with nitrates and fecal coliform bacteria from concentrated animal feedlot operations (CAFOs).

Drawing on a wide variety of environmental science, technology, engineering and law literatures, I show that regulators focus far more on how difficult it is to lay the blame for poor water quality on millions of diffuse sources than on truly regulating them. “Nonpoint” has become synonymous with “too complex” and “politically impossible;” in effect, “nonpoint source” has morphed into not a source at all. Consequently, regulators treat nonpoint sources as if they were somehow categorically impossible to control with the suite of tools – standards based on performance and technology, outright bans, incentives – long employed for point sources in all media.

My critique of American environmental regulation culminates in Chapter 5, “Failure before the end of the pipe,” and focuses on paper recycling, an activity that stirs great pride in Americans and regularly finds its way into grade school classroom activities and lesson plans (Macbride, 2011). Chapter 5 chronicles the missed opportunities for pollution prevention that occur long before the end-of-pipe, that is, in industrial materials use. This chapter faults policymakers for failing to help transform the country’s industries in ways that reconcile trade, environmental and employment objectives. I build this argument around industrial materials recovery and reuse trends. A few commentators have already noted that the US, relative to other advanced industrial nations, recycles less, uses more energy and produces high waste per dollar of GDP. Industrial materials recovery provides an excellent example of American regulatory underperformance, or perhaps more fairly, the consequences of going without an integrated, active industrial policy for many decades.

Chapter 5 provides an in-depth analysis of recycling in the US pulp and paper sector, with particular emphasis on the industry’s missed opportunity for greater materials recovery and economic growth (including
employment). Using data on recovered paper exports and emissions factors for sea, rail and truck freight transport, I examine the environmental consequences of our failure to make substantial use of recovered paper. Drawing on trade, engineering and economics literatures along with in-depth interviews, the rest of Chapter 5 plumbs the reasons for our country's low utilization rate.

Chapter 6 draws on the many findings of the prior chapters to propose a suite of environmental policy reforms, which could either be applied piecemeal to the different media-by-media statutes or in an omnibus environmental bill. Some could also be pursued without new legislation. The reforms include improvements in environmental data collection and reporting, better and wider use of "polluter pays and precautionary principles" (including supplemental environmental projects and performance bonding) and so-called triple bottom line policies that reconcile environmental, economic and labor objectives (Paehlke, 2003).

Common themes unite all of these reforms: an insistence on accountability and evidence, the importance of strategic regulation, and a preference for source reduction and performance-based approaches over end-of-pipe or minimal compliance. Taken as a whole, these reforms comprise what Fiorino (2006) calls a reflexive legal strategy, a set of incentives and procedures "...that induce people to continually assess their actions...and adjust them to society's goals, for example, by creating less pollution, using fewer resources, or protecting endangered species" (p. 19).

Chapter 6 closes with a brief discussion of the politics of environmental policy reform. Much has changed in the politics of environmental policymaking; what are today's prospects for reform? Today's partisanship and political vitriol creates unprecedented legislative gridlock in American statehouses as well as the US Congress (Sussman, 2004). The American green state does not lack for policy experiments, what Klyza and Sousa call "paths within and around existing rules," but these remain vulnerable and sporadic without statutory reforms (Klyza and Sousa 2008, p.8).

The very purpose of environmental protection is also in flux, in some instances from a focus on environmental protection for personal safety, as Andrew Szasz argues so powerfully in his Shopping Our Way to Safety (2007). The consumer safety and environmental movements use voluntarism and labeling, which are widely implemented policy tools, but can be singularly ineffective if they draw attention away from a regulatory response to environmental protection.

Worsening or persistently poor environmental conditions lead to public frustration with government and demands for greater oversight and accountability. But legislative gridlock means that generating political support for new or modified policy initiatives requires shared
responsibility. This proliferation of implementing agents, in turn, often creates an unwieldy mode of governance with unclear responsibilities and numerous veto points. These conditions favor policy tools that are relatively invisible, indirect (i.e., implemented by private third parties) and automatic (e.g., tradeable permit systems that use existing stock exchanges) (Salamon, 2002). As Salamon (2002) puts it so well:

Such tools have the advantage of defusing political opposition to governmental action, recruiting new talents and resources to the tasks of public problem-solving, and avoiding the enlargement of the public sector. At the same time, however, they have the disadvantage of vastly complicating the tasks of public management and risking the subversion of public purposes. In a sense, we seem caught in a vicious circle in which disappointment with public action yields forms of such action that seem most likely to further disappoint. Clearly, the future of collective efforts to respond to public problems will remain gloomy unless this paradox can be resolved (p. 37).

Lest this circle seem too vicious, there are numerous recent instances of every type of policy reform discussed in Chapter 6. Although the particular circumstances in which a state may succeed in innovating – for example, by banning a chemical like the plasticizer bisphenol-A (BPA) – I draw on a large enough set of models to offer some promising political strategies and narratives for reform.

REFERENCES


