

The Benefits and Costs of Environmental Information Disclosure: What Do We Know About Right-to-Know?

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Abstract

Following the attacks of September 11, 2001, the Environmental Protection Agency and other government agencies removed information from their websites that they feared could invite attacks on critical public and private infrastructure. Accordingly, the benefits and costs of environmental information disclosure programs have come under increasing scrutiny. This paper provides a framework for examining these benefits and costs, and illustrates the framework through three brief case studies of information disclosure programs: risk management planning, materials accounting, and the Sector Facility Indexing Program. The paper closes by using these three cases to outline what we know and still need to find out about information disclosure programs.

Key Words: disclosure, Toxics Release Inventory, risk management planning, materials accounting, Sector Facility Indexing Project, right-to-know

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Thomas C. Beierle*

Introduction

As fires still burned in the collapsed World Trade Center and the south wall of the Pentagon from the devastating air attacks of September 11, 2001, administrative agencies scrambled to remove data from their websites that could possibly provide information for terrorists. At the Environmental Protection Agency (EPA), staff made the decision to pull down information on chemical risk management plans, which included brief descriptions of the worst-case consequences of chemical accidents at industrial facilities around the country. Such information, they feared, could provide targeting information for terrorists bent on using chemical plants as weapons of mass destruction.

Agencies' efforts to remove information from the Internet, and their extensive review of all information posted on their websites after September 11, have thrown into the spotlight the benefits and risks of broadly disclosing facility-specific environmental data. Debates about such risks and benefits are not new. Indeed, concerns about terrorist attacks had significantly circumscribed the chemical risk management program long before September 11.

Although the debates are not new, events are forcing into perspective questions about the appropriate line between the right to know and the need to keep secret. More than ever before, agencies will be forced to seek a balance between the legitimate societal risks and benefits of disclosure programs. However, there is little systematic understanding of where to draw this line because of incomplete knowledge of what disclosure's benefits are, what threats it may pose, and how different approaches to program design affect the benefit–cost calculus. This paper seeks to clarify these issues

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and identify what we know and what we still need to find out about information disclosure.

The approach taken here is somewhat unusual in the literature on environmental information disclosure in that the analysis does not focus on the Toxics Release Inventory (TRI). The most recognized and copied information disclosure program in environmental management, TRI was established by Congress after a devastating chemical accident at a Union Carbide plant in Bhopal, India in 1984. Originally intended to improve understanding of potential risks from industrial facilities, TRI surprised many by revealing that the releases it profiled were declining dramatically each year—by a total of 46% in the first 11 years of the program. It appeared that exposing information about releases could cause firms to reduce them. EPA came to call TRI “one of the most effective environmental programs ever legislated by Congress and administered by EPA” (Graham and Miller 2001).

TRI launched EPA to the forefront of efforts to use information provision as a regulatory tool and established the paradigm for information disclosure programs that followed. This paper focuses on the most prominent among these post-TRI efforts: risk management planning (RMP), which would provide detailed information on chemical accident risks and prevention; materials accounting (also known as chemical use reporting), which would provide information on how chemicals traveled through processes at industrial facilities; and the Sector Facility Indexing Project (SFIP), which would consolidate enforcement, compliance, and other data into a package of environmental performance indicators.

These post-TRI programs are ideal for examining the benefits and costs of information disclosure because the issues were so clearly exposed in political debates. In contrast to TRI, which was passed with a very low profile and quite low expectations, stakeholders debating RMP, materials accounting, and SFIP had a clear picture—gleaned mainly from their experience with TRI—of what potential benefits or risks information disclosure posed for their interests. The trade-offs arrived at by the political process also offer an opportunity to evaluate options for balancing benefits and costs.

Section 1 contains a general framework for describing the benefits and costs of information disclosure. Benefits are organized into normative, substantive, and instrumental categories that reflect the many overlapping visions and rationales advanced by supporters of disclosure. The discussion of costs focuses on arguments that arose

most frequently in political debates about information disclosure: direct costs to firms, misplaced public priorities, and the unintended use of disclosed data.

Section 2 contains brief case studies of the three information disclosure programs, highlighting arguments about benefits and costs and outlining the impact of policy decisions meant to strike a balance. Drawing on the cases, Section 3 describes what we know and what we don't know about information disclosure. In cases where we don't know what we should, it outlines important future research questions and approaches.

The paper's conclusion provides insights into the future of information disclosure, arguing for a focus on environmental goals and the conscious crafting of information policies to achieve them. This final section points out issues to keep in mind in crafting such policies, drawing on the theoretical framework and the lessons from the case studies.

1. The Benefits and Costs of Information Disclosure

The literature on public participation suggests a structure for examining the benefits of information disclosure. Analysts typically cite three types of rationales for public involvement: normative, instrumental, and substantive (Fiorino 1990, Perhac 1996). Each defines a category of potential benefits.

The principal *normative* rationale for information disclosure is summed up in the term "right to know." Namely, these policies recognize an individual's right to self-protection and therefore the community's right to information about the risks residents face. Until large reductions in emissions became apparent, EPA regarded TRI primarily as a right-to-know program that was outside of the agency's core mission of setting and enforcing emissions standards (Graham 2002).

Substantive rationales for information disclosure argue that such programs produce data that lead to new insights and understanding of environmental problems and how to remedy them. As Graham (2002) says of TRI: "Disclosure derived its power ... from the simple fact that numbers were added up for the first time and linked to identified sources." Internal to the firm, the process of collecting information may reveal unrecognized opportunities for improving environmental performance, one reason that some programs require top management to sign off on disclosure reports. Information shared with government agencies can allow regulators to better tailor their programs. For example, EPA's air office used TRI to help strengthen the air toxics component of the Clean Air Act Amendments (CAAA) of 1990, cross-check emissions data from industry,

allocate monies to states for implementation of CAAA, and develop regulatory standards for air toxics (the maximum achievable control technologies or MACT standards), among other things (Greenwood and Sachdev 1999). Information shared with the public can support more informed problem-solving when facilities, government, and the public sit down to work out problems.

Instrumental rationales argue that disclosure improves environmental performance. No information disclosure program is simply about the normative appeal of providing neighbors with risk information or the substantive appeal of generating useful data. All programs are intended to force change in some manner or another, be it reduced emissions, increased accident safety, pollution prevention, better regulatory compliance, or some other goal. TRI's much-lauded instrumental benefit, for example, is the 46% reduction in toxic releases in 11 years.

In the conceptual model of information disclosure, instrumental benefits—defined here in terms of firm-level environmental performance—generally derive from normative and substantive benefits. Analysts describe the linkage as a “shock and shame” dynamic by which new, comprehensive risk information shocks citizens, the media, agencies, and markets into driving change externally and shames companies themselves to drive change from within (Stephan 2002). It is important to note, however, that normative and substantive benefits can be important in and of themselves, even if they don't lead directly to improvements in facility environmental performance. Greater community awareness of risks may lead neighbors to plan more effectively for accidents or mitigate their exposure—both obvious benefits from a public health perspective—even if it doesn't cause a facility to reduce emissions. Better information on environmental problems may help agencies make better use of limited resources or allow them to evaluate and improve traditional regulatory programs. In the short term at least, the gains may be in bureaucratic efficiency, not in environmental quality.

Three costs of information disclosure comprise the other side of the ledger. First is the cost of *information collection and reporting*. In debates over TRI, industry used such arguments to win the right to estimate TRI releases rather than monitor emissions directly (Graham 2002). Other than small business exemptions, concerns about these direct costs have subsided for TRI (Wolf 1996), but they have reappeared in other information disclosure debates.

Second is the *unpredictability and loss of control* involved in having the public, rather than government managers, determine what facilities should do. In the information

disclosure paradigm, according to Fung and O'Rourke (2000), "environmental 'standards' are not determined by expert analysis of acceptable risk, but are effectively set at the levels informed citizens will accept." Some charge that, with information disclosure programs, EPA is abdicating its authority to pursue rational goals, instead leaving policy up to an unknowing and irrational public (Gray 2000). Integral to such criticisms is a fear that the public will be misled by incomplete, biased, or inaccurate information and will react based on perceptions of risk rather than "real" risk (Gowda and Fox 1998).

The third type of cost is *unintended use of information*. Disclosure on the Internet, in particular, creates vast new opportunities for communication, but it also makes information access geographically boundless and anonymous. Most salient since September 11 is the fear that disclosed information may be used by terrorists. Other concerns have arisen as well, including fears of corporate spying.

The nature of the benefits and costs in any particular program depends on the type of disclosure that occurs. To simplify, policymakers contemplating information disclosure policies can choose from among four levels of information sharing.

First is full disclosure following the TRI approach, in which there is a free exchange of information among firms, government, local communities, interest groups, the media, and anyone else who may be interested. All modern models of disclosure involve the Internet. Unlike previous approaches to disclosure—such as availability of information through the Freedom of Information Act (FOIA)—the Internet provides un-intermediated public access, easy linkages with other databases and contextual information, and geographic presentation of data. Any desktop computer now provides information that used to be accessible only in dusty basement rooms in Washington, DC. Of course, Internet availability provides access to those who may use it in unwanted ways, be they business competitors seeking confidential information, terrorists looking for vulnerabilities, or others.

Short of the full disclosure model, information can be shared locally with surrounding communities or, in a more general sense, only to those directly at risk. Using a variety of approaches, such as community advisory committees, proactive communication, facility tours, and the like, firms communicate with neighbors to bolster community trust and confidence in facility operations. For example, in 1988 the Chemical Manufacturers Association adopted its Responsible Care program, which, among other things, committed companies to a "good neighbor" arrangement involving

disclosure as a basis for “openness and community dialogue” (Erekson and Johnson 1999).

Information sharing can be circumscribed even further and shared only with regulatory agencies. This is the traditional regulatory relationship of compliance reporting bolstered by periodic inspections and enforcement. Most such information is, strictly speaking, available to the public through FOIA. In practice, however, it is difficult to obtain, compile, and use, except by specialists. Exemptions to FOIA, particularly since September 11, are increasingly being discussed for issues such as corporate environmental audits and voluntary disclosure of possible weaknesses in critical infrastructure. Without disclosure requirements, the argument goes, business will be more likely to share information with government.

Finally, information can be held within firms and not disclosed at all. Firms routinely generate environmental information for their own use, and some policies encourage or require firms to do so. For example, some states require that firms employ Environmental Management Systems (EMS) as a condition of qualifying for more flexible environmental permitting programs (Davies 2001). Producing proprietary information as part of an EMS may encourage firms to find opportunities, ideally cost-saving or otherwise innovative ones, for voluntarily improving environmental performance. Such information, however, rarely makes it past the facility fence line. The most widely used EMS standard is the international ISO 14001, and it involves no requirement for public disclosure (Coglianese and Nash 2001).

The design of all information disclosure programs revolves around which of these four levels of information sharing is the correct one for the type of data produced. What types of data should firms be required to collect but not necessarily share? What data should be reported to agencies or to local communities? What data should agencies post on the Internet? Answering these questions should involve balancing the costs and benefits of disclosure.

Table 1 summarizes issues raised about the benefit-cost calculus when information sharing moves from one level to another. Concerning normative benefits, there is now a widespread political consensus, even among industries, that local communities should have information about operations that put them at risk. There are remaining questions, however, about what constitutes adequate information about risk. Additionally, there is debate about whether a normative basis exists for placing risk

information on the Internet and making it available to all communities, nongovernmental organizations (NGOs), the media, and others not put at direct risk.

Substantive benefits may arise at any level of information sharing. Two questions remain, however, about the importance of newly generated data. First is how useful data is to firms themselves, and whether new planning and reporting requirements reveal new opportunities for environmental improvement. Second is the extent to which information—whether provided locally or over the Internet—is an important trigger for encouraging dialogue between communities and local firms, as suggested by information disclosure proponents.

Like substantive benefits, instrumental benefits can accrue at any level of information sharing, but moving up through the levels increases the number of parties who can apply pressure on firms. Of critical importance is knowing the effectiveness of pressure at each level. When is voluntary action by firms sufficient? Can local communities apply pressure without the involvement of intermediaries?

Like benefits, issues of costs change from level to level. Changing least are the direct costs of information collection and reporting, which accrue even if information is never shared beyond a regulatory agency. However, costs driven by public reaction to disclosed information have the potential to increase substantially as information is shared ever more broadly. Poor quality and fragmentary data, as well as tendencies in public risk perception, create opportunities for public over- or under-reaction. These reactions are highly dependent on who information intermediaries are and how they craft their messages. What is not known is the extent to which anxieties about public reaction are supported by actual experience.

Costs of unintended use of data also increase as information is shared more broadly. Concerns about protection of confidential business information are largely tractable, while issues raised by the threat of terrorism are not yet well-understood.

Table 1: Benefit and Cost Considerations for Different Approaches to Information Sharing

	Firm Only	Firm-Government	Community Disclosure	Full Disclosure
BENEFITS				
Normative: Fulfilling a “Right to Know”	Not applicable	Not applicable	Right to know generally accepted for local communities	Right to know not necessarily accepted for NGOs, media, and others
Substantive: Creating an Information-rich Decision Environment	Firm-level problem identification and inter-firm comparisons.	Targeting and evaluating programs, enforcement, and compliance assistance	Supporting community partnerships in decision-making	NGOs and media agenda setting; markets comparing performance
Instrumental: Improving Environmental Performance	Voluntary environmental improvements	Traditional regulation (e.g., permitting)	Community-level pressure	NGO, media, and market pressure
COSTS/RISKS				
Costs of Collection and Reporting	Collection costs only	Collection and reporting costs	Collection and reporting costs	Collection and reporting costs
Risk of Misplaced Priorities	Not applicable	Not applicable	Firms control message and process	Competition over message from many sources
Risk of Unwanted Use	Not applicable	Not applicable	Use can largely be controlled	Geographic reach and anonymity limit ability to control use

2. Three Case Studies of Information Disclosure

EPA's success with TRI spawned a number of disclosure initiatives, and the three most prominent are discussed here in order to illustrate the benefits and costs of actual programs. The risk management program called on facilities to plan for and disclose information about risks of chemical accidents and steps taken to prevent and mitigate them. The materials accounting initiative sought to move TRI "inside the fence line" to allow the public to track how chemicals were actually being used at facilities. Finally, the Sector Facility Indexing Project sought to disclose information on facility compliance.

Risk Management Plans

The RMP program was intended to prevent unintentional chemical releases to the environment from industrial accidents. Section 112(r) of the 1990 Clean Air Act Amendments required that facilities using threshold amounts of certain flammable and toxic substances develop a risk management program and submit a summary of it (the RMP) to EPA and other entities. Due by June 1999, the RMPs were to describe the possibility of chemical accidents and plans for preventing and responding to them.

An aspect of the legislation requiring that facilities develop "worst-case" chemical accident scenarios, called Offsite Consequence Analyses (OCA), and make them publicly available triggered the program's greatest controversy. The OCAs described the geographic extent of harms to surrounding populations from catastrophic chemical accidents. The modeled plumes of airborne hazardous chemicals in some cases extended over populations of a million people or more.

EPA and other disclosure proponents used normative, substantive, and instrumental rationales to justify Internet distribution of RMP information, including the OCAs. Most salient was the normative rationale—that local communities had a right to know about releases that could put them in danger. Substantive rationales suggested both the benefits to firms of improving their internal risk management practices and the external benefits of allowing a more informed public to engage in "a dialogue with industry to reduce risk" (EPA 1996). Supporters pointed to an instrumental rationale as well, arguing that public access to RMP data would reduce death and injury from accidents by driving facilities to better prevent and control accidental releases and, ideally, switch to inherently safer technologies. Supporters were buoyed

by a similar New Jersey law that encouraged 80% of water treatment facilities in the state to eliminate hazardous chlorine gas or reduce their use of it below threshold levels (Shinn 2001).

EPA quickly became embroiled in a controversy about the possible utility of OCAs for terrorists. Over the course of four years, disagreements between industry and environmentalists on EPA's stakeholder advisory committee spread to interagency fights among EPA, the FBI, and other security agencies. Sensitized by the 1993 attack on the World Trade Center and the 1998 embassy bombings in Kenya and Tanzania, opponents worried that the compilation of information, and the ability to access it from anywhere in the world easily and anonymously, would make OCAs a roadmap for terrorists. Ultimately, Congress settled the debate between opponents and proponents of disclosure in 1999 with highly prescriptive legislation implemented through rules developed jointly by EPA and the Department of Justice (EPA and DOJ 2000).

The final outline of the program shifted RMP from a full-blown information disclosure model to one focused only on local communities. Although much of the less controversial RMP information would still be broadly available on the Internet, the OCAs would only be available locally. After showing identification, community members could read, but not remove or copy, a limited number of paper versions of OCAs in approximately 50 federal reading rooms around the country and at state and local emergency planning agencies. Firms were required to conduct public meetings to explain the RMPs, including OCAs, to local communities.

The decision to pull OCA data off of the Internet and make it available only locally significantly limited the normative right-to-know benefits of the program. To a great extent, the program's final architecture severed the communication channels running from advocacy groups and the media to local communities. EPA and local emergency planning committees (LEPCs) did not play much of a liaison role to local communities either. Indeed, most LEPCs reported having no requests for RMP information from citizens (Starik et al 2000, NICS 2001). Although there were certainly some local public meetings held by firms that could be characterized as "dialogues with industry to reduce risk," they appear not to have been the norm (Erekson and Johnson 1999, NICS 2001, EPA and DOJ 2000).

The principal substantive benefits of the program were limited to facilities themselves, involving whatever they learned about their own accident prevention and other risk management efforts through RMP planning. EPA has done little with the information collected beyond a few efforts to report compiled data (Belke 2000, Kleindorfer et al. 2000).

For many firms, particularly those with poorly attended public meetings, the only significant source of pressure for facility-level changes was self-imposed. Although information

on accident rates is too poor to document the impact of RMPs, there is some evidence that the program is driving some firms toward inherently safer technologies, which are less prone to accidental or catastrophic releases (Ashford et al. 1993). In the water treatment sector, for example, improving inherent safety often involves switching from elemental chlorine, which can be released as a toxic gas, to sodium hypochlorite. According to data from the American Water Works Association, there has been a decline in chlorine gas use: 91% of facilities used chlorine gas in 1978, 87% in 1989, and 84% in 1998. At the same time, use of sodium hypochlorite has risen from 6% in 1978 to 7% in 1989, and then to 20% in 1998. (The combined number of facilities using chlorine gas and sodium hypochlorite in 1998 exceeds 100% because some facilities use more than one disinfectant.) Many suggest that these changes in treatment technologies are due to companies seeking to avoid reporting under the RMP program altogether (Belke 2002, Leason and Mathews 2000). What is not known is whether more public disclosure of OCAs would have driven such trends more strongly. After September 11, a number of continuing chemical safety vulnerabilities at industrial sites were revealed.

Materials Accounting

As the large amount of emissions reductions attributed to TRI became clear, EPA considered ways to expand the program. Taking its lead from programs in Massachusetts and New Jersey, the agency resurrected an aspect of TRI dropped in the compromise version of the Emergency Planning and Community Right-to-Know Act (EPCRA). It would take TRI “inside the fence line” by requiring facilities to track what chemicals were coming into a facility, how they were being transformed into waste and products, and what was coming out of facilities at the end.

As in the case of RMPs, EPA’s vision for disclosing materials accounting data covered normative, substantive, and instrumental rationales. EPA posited a normative right-to-know argument, stating, “exposure is the key to risk, and use is an important surrogate for exposure” (EPA 1994). More central to EPA’s vision of materials accounting were the program’s substantive benefits. These covered information revealed to firms themselves and information revealed to communities that could bring “pollution prevention into the mainstream of environmental dialogue at the community level” (EPA 1995). The program was also seen as promoting the instrumental goal of pollution prevention by creating incentives to move reductions in pollution upstream from “end-of-the-pipe” controls.

Industry opponents saw the potential benefit of tracking materials accounting information for firms' own use. What vexed them, however, was that EPA had not adequately justified the benefits of releasing materials accounting data to the public. Industry argued that to generate data of such dubious public utility would be very expensive, and it risked revealing confidential business information. The proliferation of data on the Internet, industry argued, would allow competitors to piece together disparate data elements to form a revealing "mosaic" of facility operations.

EPA developed its outline of a proposed chemical use reporting program in 1993 and got a boost for the program in 1995, when the White House called for "an expedited, open, and transparent process for" pursuing it (Clinton 1995). EPA developed its vision through an iterative process of issues papers and public comments, and issued an Advanced Notice of Proposed Rulemaking in 1996 (EPA 1996b). External stakeholders provided 40,000 comments on the plan. The volume of comments, the vehemence of the opposition to the program, Congressional involvement, other priorities, and increasing questions about EPA's statutory authority for the program led to ever-longer delays in the project. Ultimately, EPA decided to discontinue its pursuit of the program in mid-1998.

To judge the extent to which materials accounting at EPA would have produced some of its hoped-for benefits, it is necessary to analogize it to the experiences in Massachusetts and New Jersey. It is important to note that materials accounting disclosure in both states was accompanied by extensive pollution prevention planning. Much of the information generated in the planning process was kept within the firm or shared only with government. Only summary data was publicly disclosed.

Little is known about the normative right-to-know benefits from state materials accounting disclosure. However, until recently, it has been difficult for the general public to access the data in Massachusetts, and it remains difficult in the New Jersey program.

The Massachusetts and New Jersey programs can point to more prominent substantive and instrumental achievements. Compiling the materials accounting data and undergoing the pollution prevention planning processes revealed opportunities for improving environmental performance. Many firms saw, for the first time, data on the volumes of chemicals flowing through their processes and how chemicals were transformed into products and waste. Such revelations may well be responsible for many of the early instrumental benefits of the program, in which both states exceeded the national norm in reducing emissions and waste generation.

Interestingly, Much of this reduction in releases and waste in both states occurred *before* information was analyzed and made broadly available to the public, primarily through NGO reports.

Sector Facility Indexing Project

Developed by EPA's Office of Enforcement and Compliance Assurance (OECA), SFIP discloses compliance records of regulated facilities, emissions and spill records, and information on production capacity and surrounding demographics. The original plan for SFIP called for it also to include a "risk indicator," which would characterize toxic releases in terms of their relative toxicity. Launched in 1998, it covered around 625 facilities in five industrial sectors: pulp manufacturing, petroleum refining, automobile assembly, iron and steel manufacturing, and primary smelting and refining of nonferrous metals. Federal facilities have since been added and a related program covering vastly more facilities was launched in late 2002.

EPA offered multiple and overlapping rationales for the SFIP program (EPA 1997). By tying facility noncompliance to risk information, it would provide normative right-to-know benefits. EPA saw substantive benefits in using an integrated, cross-sectoral database to target its compliance and enforcement efforts. Environmentalists would be able to focus on facilities and states with poor records of compliance and enforcement, and citizens would be more informed participants in decisionmaking with government and with industry. The principal instrumental benefit envisioned by SFIP was to improve facility performance, implicitly defined as improved compliance, reduced local risks from spills and TRI emissions, and less pollution per unit of production.

While EPA and environmentalists saw a program that could accomplish many goals, industry saw an unfocused program with a number of potential costs (EPA 1997). Industry found an unlikely ally in state environmental agencies, which worried about new resource burdens and the potential that enforcement data would put their programs in a poor light. States and industry argued that SFIP provided misleading and inaccurate data that would create a public relations nightmare and cause them to waste money on problems of little real concern. Much of the data in SFIP, they argued, was simply incorrect. Industry and the states leveled particularly intense criticism at the risk indicator, claiming that it was not based on sound science.

OECA announced that it would initiate SFIP as a pilot project in 1995 and quickly found itself embroiled in a major effort to quality assure the data. For the next three years, states, individual facilities, and EPA reviewed and corrected data, and EPA faced various legal and

political challenges to the program. Along the way, the agency's principal concession was to drop the risk indicator. EPA launched the site in 1998, while the agency was still in the midst of a great deal of opposition to the program.

SFIP's ability to produce information disclosure benefits has been mixed. The absence of the risk indicator was a considerable blow to its normative right-to-know justification, although compliance and other data in SFIP have their own right-to-know value. The expected (or feared) public reaction to SFIP data has not occurred, and many point to a lack of public awareness about the program. In discussion sessions held for a 1999 evaluation of the program, industries and states said they had not been contacted by citizens regarding SFIP information. Much of the use of the agency's website appears not to come from facility neighbors surfing for information on local risks, but from a dedicated set of frequent users, many probably in industry checking on the accuracy of EPA's data for their facility. In fact, SFIP is extremely hard for the casual browser to find on EPA's website.

Substantive benefits have been more prominent. EPA enforcement staff use SFIP for a variety of purposes, mainly because it is more user-friendly than other data systems at the agency. NGOs have used SFIP to highlight compliance problems and to lobby state and federal governments (Coequyt et al. 1999; Coequyt et al. 2000).

It is difficult to argue that SFIP has produced much in the way of instrumental benefits, however. A comparison of compliance rates from the early months of the program to the most recent periods reveals that, while compliance has improved for some sectors in some areas, it has stayed the same or worsened in more (Beierle 2002). Interestingly, compliance has not obviously improved in even those areas highlighted by NGO lobbying efforts. For most of the sectors profiled by SFIP, reductions in TRI releases have not exceeded the national trend either.

3. What do We Know About Right-to-Know?

The RMP program, materials accounting, and SFIP reflect a variety of disclosure models. They range from proprietary materials accounting planning at the firm level, to a community disclosure arrangement for the RMP program, and full disclosure for SFIP. All of the programs have interesting patterns of success across the normative, substantive, and instrumental arenas of benefits, and they provide insights into the various costs of these programs. Below, the three cases are used to elucidate what we know about information disclosure after TRI as well as what we still need to find out.

Normative Benefits: A Right to Know About Risks

In the political debates about information dissemination policies, there is relative consensus on all sides that local communities have a right to know about the risks they face. Even in the heated fights over risk management plans, industry frequently championed local communities' right to know. Important questions remain, however, about the comprehensiveness of risk information provided and the role that intermediaries play in educating local communities about risks.

A technical understanding of risk involves identifying a number of elements, including a hazard's source, the probability of release, the number of people exposed to the release, the dose they receive, and the toxicity of the hazardous substance. The information disclosure programs profiled here generally provided only one or two of these elements of risk, and even then only imperfectly.

Interestingly, the two items that generated the most controversy and were never broadly disclosed—OCAs in the risk management program and the risk indicator in the SFIP program—provided the most information approximating a risk paradigm. The demise of these elements of disclosure, along with controversies surrounding other EPA efforts to provide more sophisticated pictures of risk, suggests strongly that there are political limits to how much risk characterization EPA can actually provide.

Beyond the issue of what constitutes adequate information about risk is how such information is communicated to local communities. Specifically, is there a normative argument for disseminating risk information to those not directly put at risk? The strongest such argument relates to the role played by interest groups and the media as information intermediaries (Lynn and Kartez 1994). Local communities may never know about local risks without the intervention of advocacy groups and the media. The RMP program is the strongest case in point. Restricting access via the Internet and allowing only paper-based local distribution of OCA data largely cut out—by intent or neglect— all intermediaries except companies themselves. If communities have a right to know about risk information, then intermediaries need to be able to bring that information to them.

There is still much we don't know, however, about the general public's knowledge about risks and the utility of information disclosure to increase that knowledge. How much more do local communities know about risks because of information disclosure? Where do they get their information? Who uses the information? The greatest research need for answering these questions is for surveys of local communities.

Substantive Benefits: Who Uses the Data and How?

Across all of the cases, the substantive benefits of generating and combining data in new ways was obvious at each level of information sharing. Companies learned more about themselves, agencies used data to tailor their programs, and NGOs identified lobbying priorities. Materials accounting revealed gaps in TRI reporting, and the compilation of SFIP sectors revealed a number of problems with EPA's approach to facility identification. The list of substantive benefits could go on. Even if all of this information has had no effect on environmental quality, we can confidently say that it has helped usher in a more information-rich environment in which to make decisions. Two critical issues about the utility of new data to particular actors, however, remain.

First is the extent to which useful information is revealed to firms when government mandates data collection. Karkkainen (2001) argues that TRI succeeded, in part, by giving firm managers a new and consistent metric for understanding and tracking pollution performance. There is some evidence from the three case studies to support Karkkainen's view. The best evidence comes from the materials accounting experiences in Massachusetts and New Jersey. Seventy percent of 434 firms responding to a survey said the process of developing toxic use reduction plans led them to identify toxic use reduction opportunities (81% said they already had implemented, or would implement, at least a few of the projects identified in their plans) (Becker and Geiser 1997). In the RMP program, there is anecdotal evidence that at least some companies made operational changes based on data generated in developing their RMPs. And, one argument about why SFIP has not been effective is that it requires no new firm-level data generation and therefore reveals nothing new for managers to act on.

The second important question about the substantive benefits of information disclosure is the extent to which information empowers local communities. EPA saw the RMP program as a way to help the public engage in "a dialogue with industry to reduce risk" (EPA 1996) and materials accounting was a way to bring "pollution prevention into the mainstream of environmental dialogue at the community level" (EPA 1995). However, increased information will do little to enhance the community role in environmental dialogues with firms if the broader mechanisms for public participation are not working well. The primary formal method by which local communities influence firms' behavior is through permitting. Here, however, public participation is hampered by what Davies (2001) calls "the complexity and relative invisibility of the ... process." Local groups don't have the resources to track the highly convoluted and

technical process, and none of the information disclosure programs profiled here provide much assistance.

Of course, local communities may confront industries outside of formal processes, taking direct or political action. Here again, however, the barriers to action are often organizational rather than informational. Local communities—even if they know about risks—have only limited ability to do much about them on their own. To be effective, they need to join with larger networks of state and federal advocacy groups—to essentially move away from “environmental dialogue at the community level” to state and national efforts.

Information, in and of itself, may be a necessary condition of local involvement, but it is clearly not sufficient. The role for research is to tease out just how necessary it is. By what channels can local communities affect firms’ behavior? How important is disclosed information in enhancing those channels? What kind of information is most useful?

Instrumental Benefits: Are They Real?

Each of the three programs had instrumental goals aimed at environmental improvement. Although information is sparse, the RMP program appears to have helped drive some switches to safer technologies. How much more apparent such changes would be if information were more broadly disclosed we do not know. State-level materials accounting also appears to be linked to greater environmental performance. However, many more forces than public disclosure appear to be in play. SFIP has seemingly had little effect on compliance rates or TRI releases for the sectors covered despite broad disclosure.

Conclusions about the instrumental benefits of information disclosure in the three cases are only preliminary. More research is needed to tease out the impacts of information disclosure from all of the other forces in play. Analyses will have to control for economic changes, changes in production, industry composition, other regulatory programs, and a variety of other exogenous factors. For some programs, such as RMP and SFIP, it may be necessary to allow more time for instrumental results to become evident.

Cost of Collecting and Reporting Information

All information disclosure policies—whether information is kept within the firm or distributed on the Internet—involve costs of collection, and most involve some costs of reporting. Studies suggest that these costs vary from program to program and facility to facility,

but they also suggest that some stakeholders dramatically overestimated costs in political debates.

In the EPA materials accounting debate, industry charged that data collection costs would be very high. The Chemical Specialties Manufacturing Association reported that one company in Massachusetts spent 150 hours of staff time reporting on one chemical and the Chemical Manufacturers Association estimated costs for a large chemical manufacturer at around \$1.5 million for the first year and \$800,000 after that (EPA 1995). However, a 1993 New Jersey Department of Environmental Protection study of 14 facilities found much lower costs, and a follow-up 1995 study confirmed the lower numbers. (NJDEP 1995, EPA 1995). In Massachusetts and New Jersey, direct reporting costs averaged around \$10,000 for initial planning efforts and \$3,000 for the first year of reporting (Currier and Van Atten 1997; Kerr, Greiner, Anderson and April, Inc 2000). These costs translate into 124 person hours for plan preparation and 41 hours for annual reporting, which is similar to the 50 person hours required for annual TRI reporting (Graham 2002).

Costs for the RMP program appear to have been quite a bit higher than for materials accounting, however. Interviews with 10 companies found that compiling the RMP data took from 200 hours for small companies to 3,000 hours for large ones (Kleindorfer et al. 2000). Assuming a similar person-hour rate for RMPs as materials accounting, the large companies may have spent around \$235,000 on RMP planning.

Regardless of the cost of generating and reporting information, it is the one topic in this paper where the issue of whether information is fully disclosed (e.g., on the Internet) or not matters only indirectly. The greatest cost of these programs is in planning and data collection, costs that would be incurred even if government only mandated firms to generate the information for proprietary purposes. Additional reporting costs kick in if facilities have to report to agencies. However, moving information dissemination out to a community disclosure arrangement or onto the Internet adds little to direct costs.

Basic research is still needed on the data collection and reporting costs across programs in order to identify the factors that contribute to higher costs and why costs differ across programs and facilities. Also needed are creative approaches to streamlined planning and reporting, particularly those that make better use of information technology.

Cost of Dealing With Public Reaction

A conflict at the core of information disclosure is the desirability of bottom-up environmental priorities driven by local values and perceptions or top-down environmental priorities driven by expert analysis. The conflict is exacerbated if the public reaction is thought to be driven by poor-quality or misleading information.

Most easily dealt with is the issue of data quality. Many information disclosure laws require companies to produce the information that will be disclosed. TRI data, RMP plans, and materials accounting information all originate with firms, and it is in firms' best interest to produce accurate data. One program, SFIP, disclosed compliance and enforcement information generated by agencies, and it aroused the greatest controversy over data quality. Even the SFIP data, however, proved to be largely accurate. An intensive review by facilities revealed that only about 10% of records needed correcting. SFIP also spurred the agency to introduce a data collection procedure that is now the model for such processes throughout the agency. Data quality is largely a tractable problem, and methods for resolving such problems are being implemented.

A more difficult issue is data that causes the public to misinterpret risks and their origins. As previously discussed, information disclosure programs generally provide only a few pieces of the risk assessment puzzle, a fact for which agencies, environmentalists, and industry all have to take some blame. Fragmentary information, in combination with common patterns of public risk perception, may lead the public to react more or less strongly to risk information than would be supported by a technical assessment of risk (Slovic 1992).

While public misunderstanding of information may be an argument for more restricted information sharing, it can also constitute an argument for broader sharing. Fragmentary risk information is useful to groups on all sides of environmental debates willing to portray risks to local communities in a way that suits their ends. This intermediation creates a difference between information sharing models. In a community disclosure arrangement, the local public hears only from firms, giving the sources of risk considerable ability to control the messages citizens receive about those risks. With full disclosure, there are many competing voices, and NGOs, the media, and companies have to vie for the attention and trust of local communities.

Although fragmentary information, risk perception issues, and manipulation of information by intermediaries create ample room for public over-reaction to risk information, there is actually little evidence that it is a widespread problem in practice. Indeed, when looking across the three programs detailed here, one is tempted to ask, "Where is the angry public?"

There has been little local demand for RMPs. Evaluations of the Massachusetts and New Jersey materials accounting programs conclude that there has been very little use of the data by the general public (Kerr, Greiner, Anderson and April, Inc. 2000). In the evaluation of the SFIP program, states and companies admitted that, far from their initial fear of a deluge of concerned calls, they had received little interest. Ironically, some state participants thought, “the public may not be sufficiently aware of SFIP to derive its full benefit” (EPA 1999).

The apparent lack of public reaction diminishes claims on both sides of information disclosure debates. For opponents, it suggests that fears of money and effort spent on misplaced priorities are overblown. For proponents, it suggests that information disclosure is far less than a revolutionary alternative to top-down command and control. However, there is much we still don't know. More research is needed on risk perception and actual cases of decisionmaking. How do people interpret disclosed information and perceive related risks? What do people do once they have identified a perceived risk, and how do these subsequent activities clarify their understanding of that risk? What do existing case studies reveal about the role of inaccurate or misleading disclosed data?

Cost of Unintended Use of Data

Two primary fears of unwanted use of data dominated the case studies: corporate spying and terrorism. Both fears were triggered by information sharing on the Internet: what was once only local had become global, and those with access to the information had become anonymous. Other, more circumscribed models of information sharing did not trigger significant concerns about corporate spying or terrorism.

Fears of corporate spying loomed largest in the debates over materials accounting data. Information on the types and amounts of chemicals used, companies argued, might provide competitors with important information about production volumes, product content, and other trade secrets. A burgeoning business in “competitive intelligence” might allow companies to piece together data from disparate sources to create a revealing “mosaic” of facility operations. In contrast to the political salience of these issues, however, all disclosure programs have provisions for the protection of confidential business information (CBI). Moreover, CBI claim rates in the Massachusetts and New Jersey programs were only around 1% to 2% of all reporting facilities (EPA 1995). Although the issue of competitive intelligence is still being debated, a 1999 GAO report found that those who practiced competitive intelligence for a living regarded

disclosed environmental information as of relatively low value and easily obtainable from other sources (GAO 1999).

Risks of terrorism are both more alarming than those of CBI and less well-studied. Terrorism was the dominant concern in the RMP program, where companies and security agencies feared that those with ill intent anywhere in the world could anonymously access an Internet site and get all of the information needed to target facilities. As the RMP program progressed, there were two principal studies to assess terrorism risks, one in 1997 by Aegis Research Corporation and another in 2000 by the Justice Department (Aegis 1997, DOJ 2000). Both studies concluded that RMP data would increase the likelihood of a terrorist attack. Although assessing the quality of these studies is beyond the scope of this paper, it is important to note that there were strong critiques of the Aegis study that apply to the DOJ study as well (Commerce Committee Democratic Staff 1999). Most significantly, the Aegis study failed to establish the baseline risk of an attack (since no terrorist attack on a chemical facility had occurred), and therefore the incremental increase from releasing OCAs couldn't be calculated. If a risk is already miniscule, doubling it is not a large concern. Even a vice president of one of the firms that conducted the Aegis study argued, "the significance of relative risk, in the absence of a measure of absolute risk, is unknown" (Commerce Committee Democratic Staff 1999).

The balance struck in the RMP program may have put a bump in the road for terrorists, but it clearly destroyed many of the disclosure benefits of the program. Striking a more effective balance would have involved better identification of information that is of little use to terrorists while at the same time useful to a public concerned about risks. A framework used by EPA to review the sensitivity of information provided on its website after September 11 provides a good starting point. EPA based its assessment on four criteria: the type of information (e.g., chemical name or amount stored), the level of detail provided, the degree to which the data could be combined with other data to create complete scenarios, and EPA's control over the release of the information (Stanley 2001). More effort needs to go into operationalizing and refining these criteria so that agencies have an assessment mechanism they can use early on in designing disclosure programs.

Conclusion

After a few years of experience with TRI, information disclosure programs were given much more scrutiny by both opponents and proponents, generating the debate over the three programs profiled here. September 11 has increased scrutiny again, with much more attention to

the potential costs as well as benefits of disclosure. This article has discussed normative, substantive, and instrumental benefits of disclosure as well as collection and reporting costs, the costs of public reaction, and the risk of unintended use. It has shown how different levels of information sharing can affect the benefit–cost calculus, and has discussed what we know and don’t know about the effectiveness of efforts to strike a balance between the two.

Future information disclosure efforts at EPA and elsewhere need to be about focus and strategic design, with agencies deciding what goals they want information disclosure to achieve and tailoring programs to achieve those goals. Thus far, information disclosure has been opportunity-driven, not demand-driven. Graham’s description of the rise of disclosure systems generally, rings true for environmental disclosure specifically: “separate initiatives have percolated up through the legislative process as pragmatic approaches to diverse problems during a time characterized by regulatory retrenchment and frequent policy stalemate” (Graham 2002). Even TRI suffers from a lack of specific goals, leading the agency to do what is politically and bureaucratically easy (e.g., focus on only major sources) rather than what might more readily improve environmental quality (Pederson 2001).

There are many possible goals agencies could pursue: improving compliance or encouraging firms to go beyond compliance, encouraging pollution prevention, increasing community understanding of risks, and many others. Different goals will emphasize some types of information disclosure benefits over others, and pursuing those benefits will raise concerns about some information disclosure costs over others. Balancing benefits and costs will require decisions about what information should be kept within firms, what should be shared with government, what should be communicated to local communities, and what should be made available to anyone with a computer and Internet connection.

If the primary purpose of information disclosure is to enhance communities’ right to know, programs will have to overcome the political barriers to providing more complete risk information in a manner that is consistent with the best practices of risk communication and its sensitivity to public perceptions of risk. Moreover, such programs will have to ensure that future risk communication programs are more visible and accessible to local communities than the ones profiled in this paper. Doing so necessarily involves information intermediaries, such as interest groups and the media.

If the primary purpose of information disclosure is substantive, then agencies have many more options, determined principally by who needs the data. It is important to keep in mind, however, that the information is often only one of the needs for policymaking. Particularly in

relation to local involvement, actual opportunities for participation—whether formalized in regulatory processes or reflecting collective action—are equally, if not more, important. Future information dissemination programs can do a much better job of ensuring that they are relevant to actual opportunities for involvement in regulatory activity.

Like substantive goals, instrumental goals may be achieved at all levels of information sharing. Pressure can come from within firms, from agencies, or from external constituencies, such as local communities, interest groups, trade associations, or markets. There are no guarantees, however, that even full-blown disclosure on the Internet will drive instrumental change. Although TRI can likely claim some of the large reductions in toxic emissions over the last decade, SFIP's failure thus far to improve compliance is the counter-example.

All new information disclosure policies will have to confront costs. Least relevant for program design are direct collection and reporting costs, some of which will be incurred even if data never make it past the facility fence line. That said, new programs may lead to widely different information collection and reporting costs, and a more systematic understanding of what drives costs is needed.

Much more tricky are issues of public reaction to disclosed information. Better quality data and more comprehensive risk information can go a long way toward correcting misunderstanding. However, at the core of the policy choice between information dissemination and other means of regulatory control is the conflict over whether policy should be driven from the bottom up by community values or from the top down by agency analysis. This is a conflict that has to be worked out in the political process.

There are probably good opportunities for dealing with the unwanted use of data. CBI issues are largely tractable, while terrorism issues are not well-studied. Beyond the Aegis and DOJ studies conducted for the RMP program, much more analysis is needed. In the absence of analysis, very understandable risk aversion on the part of agencies may hamper future efforts toward improving information disclosure programs.

Moving forward, the era of experimentation and ad hoc disclosure policies will have to give way to a clearer focus on goals and a conscious effort to employ the various information-sharing options available. Only through a better understanding of how information disclosure works can we realize the power of information and make disclosure a more familiar part of the environmental policy mix.

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