

INFORMATION IN POLLUTION MANAGEMENT:

THE NEW MODEL

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Table of Contents

1. Introduction.....	1
2. Information in Formal Regulation	1
2.1 Monitoring	2
2.2 Technical Analysis.....	4
2.3 Policy Analysis.....	5
3. Stakeholder Input	5
3.1 Complaints	6
3.2 Feedback	6
4. The Power of Informal Regulation	7
5. Information in Action: Two Cases.....	8
5.1 Integrating Environmental Information for Rio de Janeiro State.....	10
5.2 Rating Environmental Performance: Indonesia's PROPER program.....	12
6. Information in Pollution Regulation: Five Principles	17
7. References.....	19

1. Introduction

This report describes the expanded role of information in new models of pollution management. Timely, accurate and appropriately-packaged information is the key to several features of the new approach: Tracking environmental quality; measuring and publicly rating the environmental performance of polluters; and comparing the benefits and costs of alternative approaches to pollution control. Information has become more important in regulation for three main reasons. First, it has become much cheaper to gather, process and distribute environmental information. Secondly, rising levels of public education and political representation in many countries have widened the circle of participation in environmental management. These new constituencies need appropriate information in order to participate effectively. Finally, rising acceptance of cost-benefit analysis has increased the demand for information which contributes to the systematic assessment of regulatory policy options.

Section 2 provides an overview of information in regulatory operations, with a particular focus on systems for monitoring ambient quality and emissions. It stresses the value of appropriate information in establishing and achieving environmental quality objectives. Sections 3-5 examine new roles for regulatory information in the public domain. Section 3 describes ways in which information systems can strengthen agency operations by promoting effective input from stakeholders. Section 4 considers the role of public information in 'informal regulation' -- the complex set of interactions between polluters and non-governmental agents whose influence on environmental performance may be as powerful as that of formal regulation. Section 5 uses a major environmental policy reform in Indonesia to illustrate the new approach. Finally, Section 6 concludes the report by identifying several key principles for effective use of information systems in pollution regulation.

2. Information in Formal Regulation

To illustrate the development of an information system for modern regulation, it is useful to consider a simplified case of river basin management. Figure 1 sets the stage, depicting a pattern of diverse activities along the river: A large factory, numerous small ones, a farming district, and a riverside community. Pollution from each activity has at least some adverse consequences for its downstream neighbors. The basic task of environmental management in the river basin is to assure that overall environmental damage is reduced to the point where the social benefits and costs of regulation just balance at the margin.

2.1 Monitoring

While easy to state, this principle is difficult to implement because the basin is home to multiple actors, with diverse economic incentives, environmental interests, and willingness or ability to pay for pollution reduction. In practice, sound environmental management must be a continual process of information gathering and dissemination, negotiation, and adjustment by the interested stakeholders. Although much of the process should be participatory, the regulatory agency plays a leading role in the gathering and analysis of technical information about environmental quality and pollution sources.

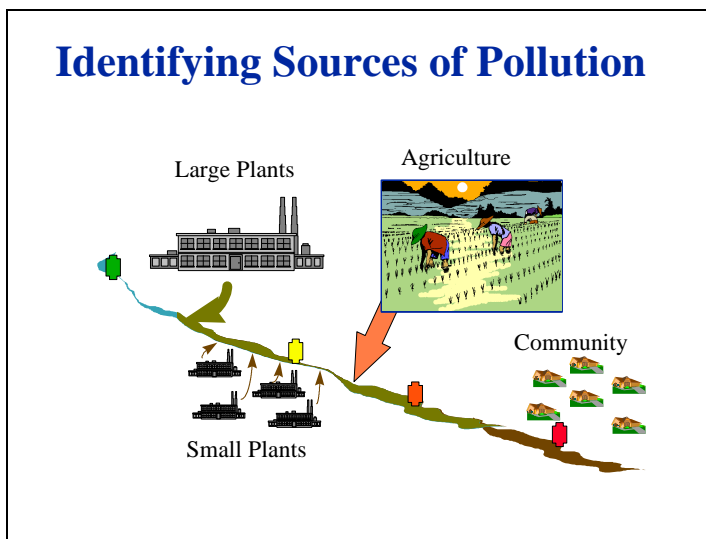


Figure 1

Part of its technical role is to discipline regulation by focusing on pollutants which are the most serious threats to human or ecosystem health. Once these have been selected, environmental monitoring can focus on frequent and accurate measurement. Figure 1 represents initial establishment of agency monitoring at several points for four pollutants: Heavy metals, fecal coliforms, biological oxygen demand (BOD), and phosphorus. The first and second pollutants can pose serious threats to human health, while the third and fourth can cause significant damage to ecosystems by reducing dissolved oxygen and promoting eutrophication. In this illustration, a change in the summary monitoring index from Green to Red reveals a pattern of progressive decline in water quality as the river flows downstream.

Having established a pattern of potentially-damaging pollution, the next task of the information system is to identify and analyze its sources. These may include industrial facilities, households, and farms. Analysis involves monitoring to measure their relative contribution to different problems, and identification of characteristics which will have a bearing on cost-effective pollution control strategies. Included among the latter are location, sector of activity, operating scale, current pollution control efforts, and the likely cost of further abatement.

Information about pollution sources is gathered in a variety of ways. Self-reporting is a critical part of the system: All significant polluters are expected to submit periodic reports on emissions which have been certified by outside auditors. The auditors' business is dependent on a reputation for accuracy and acceptance by the regulatory agency. They will be unlikely to distort information for one polluter, since any short-term financial advantage would be outweighed by the risk of discovery, agency 'blacklisting,'

and exclusion from further business. The agency keeps the probability of discovery at credible levels with its own program of random, surprise inspections and monitoring of emissions. Furthermore (more about this later), systems for receiving citizen complaints and publishing ratings of polluters' performance assure that the risk of cheating will be minimal. Other important information on plant characteristics is entered in the system as part of standard licensing procedures for plant operation.

Figure 2 illustrates the operation of the full reporting and monitoring system. Monitors in the river and emissions reports from each source provide data which are indexed as Green (no problem), Yellow (cautionary), Orange (serious) and Red (potentially critical). The source indices measure potential for damage; the actual impact of pollution on river quality depends on the assimilative capacity of the river itself (a function of flow rate, volume, temperature, etc.).

Upstream, the first monitor reads all 'Green' – no significant pollution of any kind. Downstream from the monitor, a large food processing plant is pumping effluent into the river. The plant reports a heavy BOD load, but no significant volumes of other pollutants. Somewhat further downstream, reports from a complex of small tanneries and textile mills indicate substantial volumes of heavy metals and some additional BOD. The second river monitor shows that these discharges are significantly affecting water quality: BOD is now Orange, and metals are Yellow. Below the industrial area, several large farms abut the river. Analysis of runoff reveals a heavy phosphorus load from large-scale application of fertilizer to some of the crops. Further downstream, the third river monitor indicates some assimilative action for BOD, which has retreated to Yellow. However, metals are now Red and phosphorus is Orange.

Finally, the river flows past a community which is discharging untreated sewage. This contains heavy concentrations of BOD and fecal coliforms, along with phosphorus from household detergents. At the fourth monitoring station, BOD and coliforms become Red, from the community effluent; the metals reading improves to Orange, because no further metals have entered the stream and some have settled to the bottom (later to appear in the tissues of fish caught in the area); phosphorus is Red from the combination of agricultural runoff and community sewage.

To summarize, establishment of the monitoring system has revealed a serious situation. As the river leaves the monitored area, it is for all practical purposes 'dead': Contaminated by pathogens, it is dangerous to drink or swim in; its dissolved oxygen level is too low to support many species of fish, and the metals content is too high for safe consumption of those which remain. Eutrophication is well-advanced, and the color and odor of the water are both strongly affected by the growth of algae. Communities further downstream are inheriting a very costly legacy from their neighbors' uncontrolled pollution.

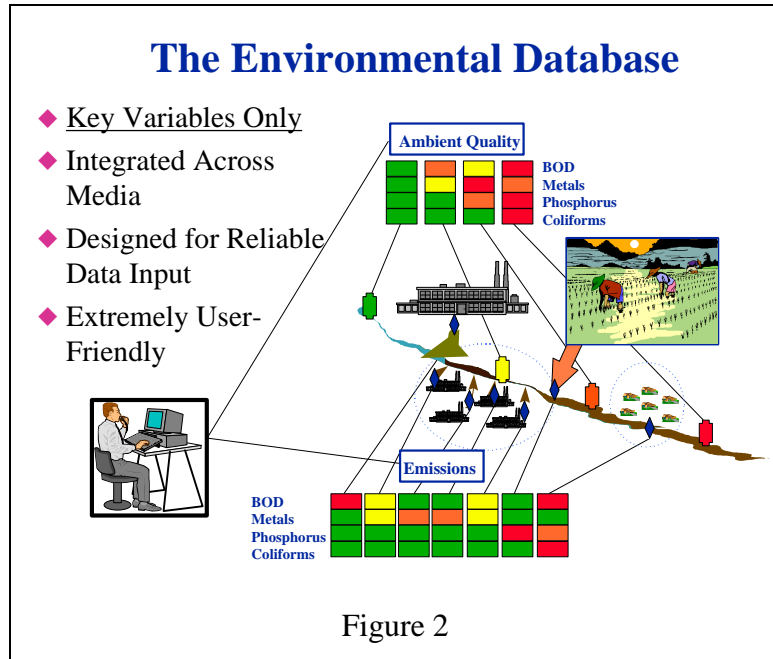
The regulatory information system has now discharged its first three responsibilities: Identification of major pollution sources, measurement of their effluent, and registration of the effect on ambient environmental quality. As shown in Figure 2, all relevant

information is stored in a system of networked PC's using standard, user-friendly software. The system is focused only on the important problems; it is not designed to be an unwieldy catalog of all possible environmental data. Pollution reporting software is integrated with a Geographic Information System, and simple 'point/click' queries call up tables or maps which can report ambient quality at each point on the river, and trace excessive pollution back to its sources. Information on these sources can be called up with equal ease, and the system is geared to track compliance with regulations so that inspections and enforcement activity can be targeted on the worst problem cases.

2.2 Technical Analysis

Monitoring of sources and ambient quality provides the 'raw material' for regulatory action.

However, these materials go through a process of refinement and analysis before serving as the basis for policy implementation. Figure 3 illustrates some critical steps in the process. First, the agency's technical team uses the information for building a dispersion model, which relates



monitored emissions to river quality. This provides the basis for rapid identification of sources' contributions to pollution problems. Secondly, the team uses its own information and the best available impact models to estimate the cost of pollution to the community: Human health damage, and losses in aquatic life, economic output and recreational amenities. Third, the team uses the available data on pollution source characteristics to identify polluters which can respond rapidly and at low cost to tighter regulation.

2.3 Policy Analysis

Figure 3 also tracks the information flow to the next stage of regulation – policy analysis. At this level, critical decisions are made about valuation, priorities and trade-offs. It is not economically feasible to eliminate all pollution, and the cost of abatement differs greatly across pollutants and polluters. Some pollution sources are large local employers, so regulatory decisions are affected by local political and economic considerations. Pollutants also differ in their impacts on health, ecosystems and environmental amenity, so different actors in the river basin will experience very different effects from alternative policy packages.

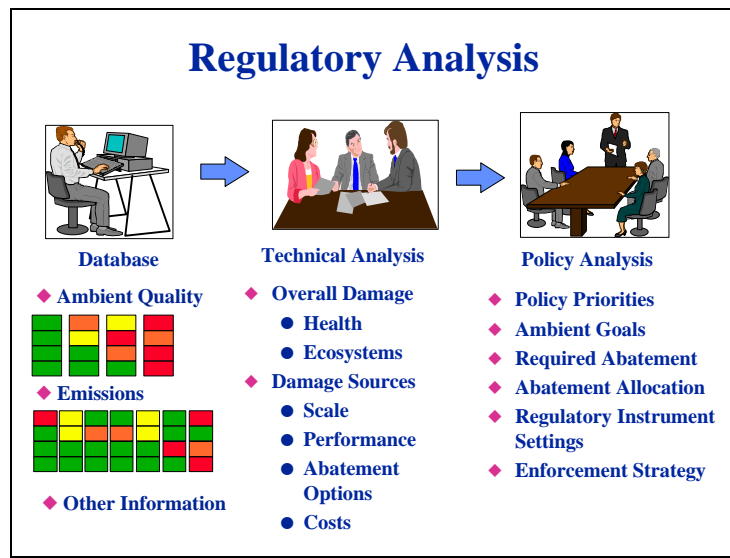


Figure 3

The policymakers are faced with a complex set of decisions as they weigh all of these factors. Conceptually, their task is to set regulations so that incremental social benefits and costs are just balanced for the river basin community. To the extent possible, they use the available information to fulfill this task. Inevitably, some of their ‘ideal’ solutions will be modified by the process of political consensus-building and implementation. Nevertheless, at the end of the day, the policymakers’ job is to use the available information to develop clear statements about the current state of the environment; ambient quality goals; a timetable for reaching them; the pollutants which will be regulated; and the instruments which will be applied.

The final step in formal regulation is implementation: Applying the regulations case-by-case to polluting factories, farms and communities. The regulatory instruments may be pollution charges, tradable permits, or quantity-based emissions standards. While the market-based instruments are generally preferable on efficiency grounds, none of these approaches can function well unless the information system has laid the foundations for effective policies. Constant feedback from the system is also necessary for judging whether implementation is having the desired effect.

3. Stakeholder Input

The preceding description of information and regulation has stressed the ‘technical’ side of the system. As Figure 4 shows, however, an equally important part of effective regulation is input from stakeholders – polluters, pollutees, interested citizens, academics,

scientists, NGO's, etc. The second major task of the information system is therefore to promote effective communications with these stakeholders. The river basin community, and the larger community in which it resides, have access to many kinds of information which cannot be collected and processed directly by the regulatory agency. The agency's information system is structured to receive and utilize these inputs.

3.1 Complaints

Damaging pollution will often be apparent to local citizens even if the environmental monitors haven't recorded it. To tap this information, the agency's system provides facilities for rapid communication and routing of citizen complaints about pollution. Traditionally, the telephone has been the primary instrument in this context. However, the agency has also developed a PC-based reporting system, in which local community centers have sites for menu-driven online entry. The system provides automatic logging, categorizing, routing and storage of information about complaints. Digital storage and retrieval make it much easier for the agency's technical team to identify significant patterns. The user-friendly system also encourages citizens to engage in the process.

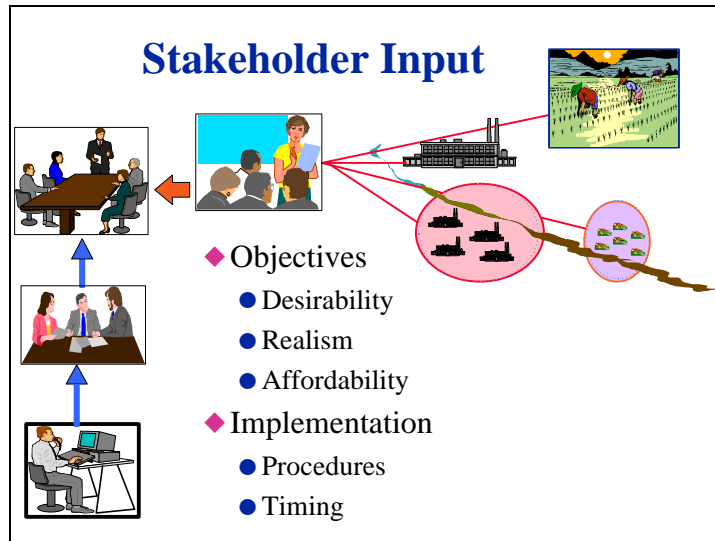


Figure 4

3.2 Feedback

A regulatory plan reflects assumptions about community values, modes of behavior, and implementation costs. Any of these assumptions can easily be wrong, and continuous feedback from stakeholders provides a good basis for in-course correction. Polluters are, of course, likely to provide self-serving feedback, but inappropriate regulation may damage them in ways which affect the community's economic interests. Victims of pollution may also perceive problems which have escaped the notice of the technical team; scientists, academics, NGO's and concerned citizens frequently have insights which have not occurred to the regulators. For these reasons, and because consensus ultimately depends on voice, the information system also includes facilities for entering, summarizing and channeling diverse forms of community feedback to the regulators.

4. The Power of Informal Regulation

The agency works better with information from stakeholders, but it also provides them with information. To participate effectively in environmental management, the public needs to be fully informed about the same factors which motivate regulatory policy: Environmental quality trends, goals, sources of pollution, damages, compliance records, and abatement costs. Therefore, the flow of information in Figure 3 does not stop with the policymakers; it passes through to the public, in easily digested form.

What happens when the public has information about polluters and their effect on the environment? Figure 5 summarizes what we know about the impact of public information. Recent research has shown that this information becomes an important part of ‘informal regulation’ – the pervasive process by which communities and markets influence polluters’ behavior even if formal regulation is absent. Factories in developing countries exhibit great variety in environmental performance despite the widely acknowledged weaknesses of their regulatory systems. Even in the poorest countries, some plants would satisfy OECD emissions standards.

In countries as different as China, Brazil, Mexico and Indonesia, local communities find many ways of enforcing their environmental norms.¹ Where formal regulators are present, they use the political process to influence the tightness of enforcement. Where formal regulators are absent or ineffective, ‘informal regulation’ is implemented through community groups or NGOs. The agents of informal regulation vary from country to country -- local religious institutions, social organizations, community

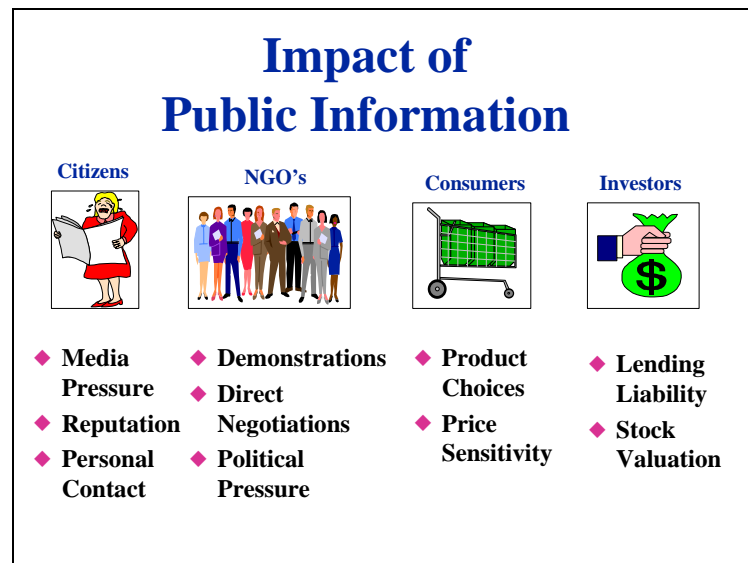


Figure 5

¹ For evidence from Asia, see Pargal and Wheeler (1996), Hettige, Huq, Pargal and Wheeler (1996), Huq and Wheeler (1993), and Huq, Hartman and Wheeler (1996). Evidence from Brazil and Mexico can be found in Wheeler and Witzel (1995) and Hettige and Witzel (1996). Most of these papers can be found at PRDEI's Internet Website, WWW.WORLDBANK.ORG/NIPR/.

leaders, citizens' movements or politicians -- but the pattern is similar: Factories negotiate directly with local communities, responding to social norms and/or threats of sanctions if they fail to reduce the damages caused by their emissions.

Market forces are also powerful determinants of environmental performance under some conditions. Evidence from both the OECD and developing countries suggests that environmental reputation matters for firms whose expected costs or revenues are affected by judgments of environmental performance by customers, suppliers, and stockholders.² For reputationally-sensitive companies, public recognition of good or bad performance may translate to large expected gains or losses over time. These can affect lending decisions by bankers, who may also be concerned about legal or financial liability for polluters who are not complying with regulations.

Once informal regulation is recognized as an important force, regulatory agencies experience a change of role. While retaining ultimate responsibility for monitoring and enforcement, they assume new importance as sources of environmental information.

Figure 6 illustrates the effect of public information on activities in the river basin: As full information about environmental quality and polluters' performance is released to the public, communities and market agents began to operate. Polluters find it impossible to 'hide' from so many interested parties, and a complex set of new relationships and negotiations is established. Pollution declines significantly in some areas, even though the regulatory agency takes no additional measures.

5. Information in Action: Two Cases

The preceding sections have provided a simple illustration of an integrated information system which can support both formal and informal regulation of pollution. Is this just a hopeful concept, or is there some prospect that environmental agencies in developing countries can actually implement such a system? In fact, several agencies are now putting these ideas into practice. In

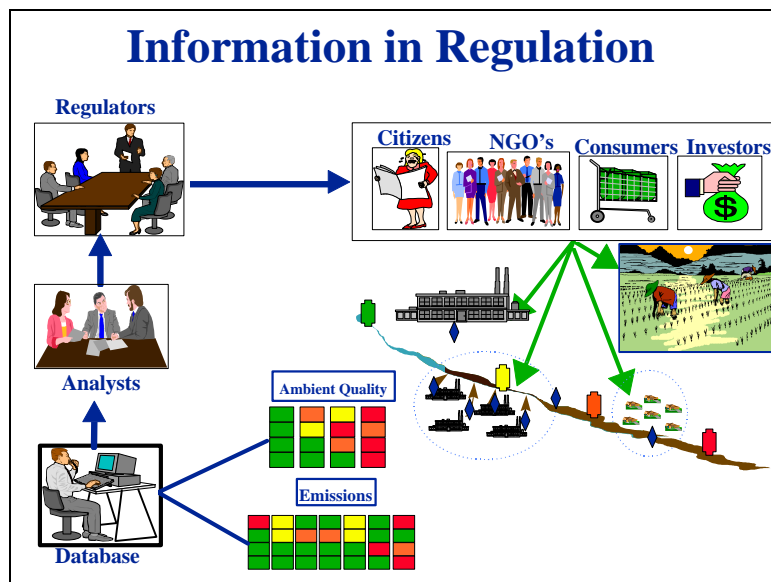


Figure 6

² See Hettige, et. al. (1996) and Laplante and Lanoie (1994).

this section, we provide concrete examples from Brazil and Indonesia.

5.1 Integrating Environmental Information for Rio de Janeiro State³

During the past two years, the government of Rio de Janeiro State has developed a new structure for environmental management. Part of the restructuring has involved integration of environmental information at FEEMA, the State's pollution control agency. FEEMA's new information system provides a concrete illustration of many features described in the earlier sections of this paper.

Supporting Regulatory Policy Analysis

Integrated information is the key to regulatory policy analysis, as depicted in Figure 3.

An appropriate information system should monitor ambient quality and emissions from major polluters, along with their compliance records. FEEMA's new system was planned to provide supporting information in all three dimensions. When development began in 1995, sufficient data existed in the agency to establish a profile of ambient quality, an inventory of emissions sources, and a record of inspections and complaints for each major source. Since the data were scattered across departments within FEEMA, however, the primary task was to develop an integrated information system.

Networking the Agency

Before the new initiative, FEEMA's regulatory planning and implementation were hampered by the division of planning, monitoring and enforcement tasks among several departments, with little information-sharing or coordination of activities. The difficulties were compounded by the lack of an integrated digital information system. Paper files were maintained separately by each department, or stored in separate computers with different data formatting standards. Much of the agency's critical information on pollution sources was stored on an archaic minicomputer which could not communicate directly with the agency's scattered PC's.

Without common digital hardware and software standards, FEEMA's managers had great difficulty in analyzing environmental conditions, tracing problems to pollution sources, and effectively targeting their limited monitoring and enforcement resources. The new initiative attacked this problem directly, by developing and installing a PC network based on low-cost hardware and standard commercial software. As the system came online, it became possible for different departments to store records in a common database which could be accessed by any unit in FEEMA. Agency managers began asking for reports which required integrated analysis, and most department managers quickly perceived the political importance of participation in the network. The demand for PC's expanded

³ This section draws heavily on the experience of a World Bank team which collaborated with the Rio State Government on restructuring environmental management. For a detailed study of the restructuring issue, see Von Amsberg (1996).

rapidly, and all departments began entering new data in a standard format. Agency technical staff experienced a jump in effectiveness, as it became much easier to analyze levels and trends in emissions, community complaints, inspection reports, and air/water quality readings from many monitoring stations.

Integration with GIS

To regulate effectively, FEEMA needed geographic information -- on pollution sources, air- and watersheds, transport networks, and exposed populations. A Geographic Information System (GIS) was the right tool for supplying this information, so GIS capability was developed at the outset. Three examples will serve to illustrate the potential of the system after only a few months of development:

- (1) Combined display of major water pollution sources (industries, population centers) and readings from water monitoring stations provided a systematic basis for addressing critical pollution problems in the State's rivers and coastal bays;
- (2) Combined display of major air pollution sources, major transport arteries and affected populations provided similar capability for critical air pollution problems;
- (3) Once the GIS was integrated with FEEMA's environmental information, it became possible to move to a new level of monitoring and enforcement capability. For example, the GIS provides 'point-click' access to information on any data source which is identified on the geographic display. A GIS map can be used to identify all large emissions sources in an area with a particular symbol. A click of the cursor on one of these symbols brings up the data file on that source: its emissions, facility characteristics (e.g., sector, employment, output, use of raw materials, energy use, etc.); inspection data; outstanding complaints; and enforcement actions. Equipped with this kind of information, agency managers are in a much better position to target their scarce monitoring and enforcement resources.

Involving the Community

FEEMA's system can also provide much better environmental information to the public. The State's new approach to environmental management stresses community participation in planning and implementing pollution regulation. To play an effective role, the community needs good information about ambient quality, goals for the future, progress toward those goals, and the regulatory status of major pollution sources. FEEMA is now positioned to provide this information, through reports which plot trends in ambient quality and emissions against objectives, and maps which convey detailed information about ambient quality, emissions sources and affected populations.

FEEMA also has the capability to prepare and publish detailed profiles or performance ratings for major pollution sources in the State. Such performance ratings are proving

quite effective as a new tool for pollution control. In the following section, we describe a successful initiative on performance ratings at BAPEDAL, Indonesia's national pollution control agency.

5.2 Rating Environmental Performance: Indonesia's PROPER program⁴

Setting the stage

Environmental agencies in developing countries have a mandate to regulate industrial pollution, but they often lack institutional capacity. Although equipped with conventional options such as regulatory standards and/or market-based instruments (e.g., pollution taxes, tradable permits), they remain hard-pressed to achieve substantial results. A good example is provided by BAPEDAL, Indonesia's Environmental Impact Management Agency. During the late 1980's, BAPEDAL introduced several measures to counter rapidly-increasing pollution from the manufacturing sector. However, monitoring and enforcement problems frequently limited the agency to voluntary agreements, out-of-court settlements and other ad hoc approaches.

This set the stage for experimentation. In 1993, BAPEDAL's Deputy for Pollution Control began to develop the Program for Pollution Control, Evaluation and Rating, now known as PROPER. In PROPER, the agency would receive pollution data from factories, analyze and rate their performance, and disseminate the ratings to the public. The initiative signaled a bold move toward transparency by recognizing the new power of the media and public participation in a rapidly-industrializing economy. BAPEDAL hoped that public performance ratings would recruit two major allies in its effort to reduce pollution. *Local communities*, worried about health consequences, would pressure poorly-rated neighboring plants to pollute less. In *financial markets*, access to capital or stock values would fall for firms whose low ratings increased the risk of liability suits, regulatory shutdowns, or reduced product demand. By mobilizing these agents, BAPEDAL hoped to strengthen the regulatory 'stick' faced by heavy polluters. But the program was also designed to recognize excellent performance, in the hope that this would promote the adoption of clean technologies and development of in-house environmental management capabilities.

⁴ This section draws heavily on the work of the PRDEI: the Environment, Infrastructure and Agriculture Division of the World Bank's Policy Research Department. During the past two years, PRDEI has provided technical assistance to the PROPER project. We gratefully acknowledge the support and inspiration provide by Mr. Nabil Makarim, Deputy for Pollution Control in BAPEDAL, who has directed PROPER from its inception. This section has been prepared in collaboration with Shakeb Afsah, Benoit Laplante and David Shaman. Detailed information on public disclosure as a regulatory tool can be found at PRDEI's Internet Website, WWW.WORLDBANK.ORG/NIPR/.

Getting started

When it ‘goes public’ with performance ratings, an agency invites close scrutiny by many interested groups, including, of course, those who receive poor ratings. From the beginning, it was obvious that PROPER had to focus on data integrity – in collection, verification and analysis. One bad mistake in the first implementation might well undermine the entire program by destroying public credibility, or by inciting a successful lawsuit by a firm whose reputation was wrongly damaged.

The first critical decisions concerned selection of pollutants and factories for initial rating. While it had very limited information on air pollution or hazardous waste, the agency had plentiful data on industrial water pollution from two sources: its Clean River Program (PROKASIH), which was introduced in 1989, and its regulatory monitoring and enforcement activity (JAGATIRTA). Given its relative depth of experience with regulation of water pollution, BAPEDAL decided to focus on compliance with water regulations in the first phase of PROPER. Air and toxic pollution would be incorporated in the next stage of development. Combined with self-monitoring reports from polluters, the information from PROKASIH and JAGATIRTA was judged sufficient for a careful compliance assessment in Phase I. The PROPER team designed a data management system for the program, and tailored it to help field teams organize and quantify results of on-site inspections and monitoring activities. The system also incorporated a broad range of information on economic activity, emissions control equipment and in-house pollution monitoring.

In February 1995, the PROPER team sent survey questionnaires to approximately 350 factories. The pilot group included plants from thirteen Indonesian provinces, and from all fourteen industry sectors which had effluent discharge standards. In response, 176 plants provided sufficient data for BAPEDAL to perform an initial rating. Eleven other factories volunteered to take part in the program, bringing total first-round participants to 187. The team supplemented the survey information with a rigorous inspection program to verify the data *on site*.

Going public

Since PROPER is a *public* performance rating system, its disclosure strategy has also been a primary focus of attention. Certain problems had to be confronted at the outset. First, the grading system adopted by the agency had to accommodate polluters with widely different characteristics. Second, the ratings had to be simple and their implications easily understood by the public. Third, the system had to clearly discriminate between firms in compliance with the regulations and those out of compliance. Finally, the program had to provide incentives for progressive firms to go beyond compliance. BAPEDAL settled on the five-color scheme shown in Figure 7. Its color-coding is a simple but effective format for communicating environmental information about individual plants to the public, media, judicial system and financial markets. The colors

of the rating system are easily identifiable and, in the Indonesian cultural context, symbolic of the polluters' environmental performance.

For its first disclosure, BAPEDAL decided on a sequential strategy which would publicly recognize the best performers at the outset and give others a chance to improve before bad ratings were revealed. This approach was intended to serve several objectives. First, it would promote an image of fairness in the business community by allowing time for adjustment to the new program.

Second, it would develop a new alliance between the regulatory agency and firms whose good performance was publicly recognized. The latter, having already invested in costly abatement, could be counted on to support PROPER because it would 'level the playing field.' Finally, and perhaps most critically, BAPEDAL wanted time to gauge the possibility of extreme reactions to Red- or Black-rated plants by neighboring communities.

PERFORMANCE LEVELS	PERFORMANCE CRITERIA
GOLD	Clean technology, waste minimization, pollution prevention, conservation, etc.
GREEN	Above standards & good maintenance, housekeeping, sludge management, etc.
BLUE	Efforts meet minimum standards
RED	Efforts don't meet standards
BLACK	<ul style="list-style-type: none"> •No pollution control effort, •Serious environmental damages

Figure 7

Initial impact

PROPER PROKASIH was introduced in June 1995, and was extensively covered in the national and international press. Five factories were publicly awarded the Green rating (no factories were rated Gold). For the remaining 182 plants, only the distribution by color rating was disclosed: 61 were Blue, 115 were Red and 6 were Black. This announcement was, in itself, a remarkable exercise in self-criticism. By announcing that almost two-thirds of the plants were non-compliant, BAPEDAL was confessing its own previous ineffectiveness to the Indonesian public.

BAPEDAL gave plants rated Black or Red until December 1995 to improve their performance before their names and ratings were publicly disclosed. Under the threat of public disclosure, ten factories managed to improve their rating to Red or Blue within six months. The primary driving force behind these improvements was probably concern about potentially strong responses from local communities and markets. In December, PROPER was fully implemented: A sequenced disclosure campaign was launched by industry sector, with new announcements at regular intervals to keep the media interested. Disclosure included the color ratings, the locations and names of the plants, their managers, and their parent companies.

Figure 8 shows the evolution of ratings for PROPER's original 187 factories during the first fifteen months of the program. The movement of firms from non-compliance to compliance is impressive. In June 1995, 65% of the factories were rated Black or Red. By September 1996, non-compliant plants had dropped to 47%. Since it is highly unlikely that other Indonesian polluters improved at the same rate, this reaction suggests that PROPER is creating strong new incentives for pollution control.

PROPER's Impact			
	<u>June 1995</u>	<u>Dec 1995</u>	<u>Sept 1996</u>
GOLD	0	0	0
GREEN	5 (3%) →	4 →	5
BLUE	61 (33%) →	72 →	94
RED	115 (61%) →	108 →	87
BLACK	6 (3%) →	3 →	1

Figure 8

While reputational incentives are obviously at work, it is interesting to note that PROPER was frequently the means by which factory owners first learned about the environmental performance of their plants. In direct consultations between BAPEDAL and the owners, it became clear that PROPER performs a valuable educational function, both by increasing the awareness of owners, managers and employees and by providing guidelines for improved performance.

It is also interesting to note that factories volunteering to participate in PROPER doubled from June to December of 1995 (from 11 to 23). Clearly, these factories expected disclosure to enhance their market position. This illustrates a primary strength of the approach: Unlike many previous environmental initiatives, PROPER supplies incentives to polluters to move beyond compliance and toward attainment of higher performance ratings. By improving a firm's reputation in the competitive marketplace, higher ratings can raise expected profitability.

PROPER has also had an important impact on BAPEDAL itself. The need for accuracy in the ratings has compelled the agency to increase its factory inspections, and to improve the quality and reliability of its data collection and verification. The information collected through PROPER also provides BAPEDAL with solid evidence of a factory's compliance status, supporting stronger action in cases where conventional enforcement action is appropriate.

The lessons of PROPER

BAPEDAL's initiative reflects growing international recognition of public disclosure as a regulatory tool. Commonly known as Public Performance Auditing (PPA) systems, programs which develop and disclose performance indicators can provide powerful incentives for reducing negative externalities from private or public activities. A well-designed PPA system can increase both the transparency and accountability of public institutions. It can improve resource allocation by reducing transactions costs and encouraging socially desirable behavior. It can also induce improvements from private agents whose poor performance would otherwise require costly enforcement activity and/or litigation.

The PROPER experience suggests four important principles for successful implementation of PPA:

Starting Small: While PPA provides many advantages, developing a credible system is not an easy task. Once public confidence in performance ratings is lost, it will be hard to regain. Therefore, it is crucial that a regulatory agency undertake a pilot program before committing itself to a full PPA. The pilot could be confined to a geographical area, a particular medium, an industry sector or a limited set of critical polluters. The important thing is to gain experience with careful data-gathering, validation, analysis, strategies for public communication, and mechanisms for learning from experience. In the course of a pilot program, the agency can gain experience in dealing with multiple stakeholders, managing a core PPA team, and effective public communications. The pilot will also provide the opportunity to weigh the benefits of PPA against the costs of developing and maintaining the system.

Integration: A successful PPA system requires all relevant agencies to integrate their information systems and cooperate in pollution management. Because they reveal existing compliance levels, public performance ratings also provide an indicator of the regulators' own performance. Greater requirements for data reliability give regulators a strong incentive to operate more efficiently. In addition, the need to verify, process and analyze comprehensive information for public performance ratings will substantially increase the technical and analytical skills of agency staff members. Given budgetary limitations, the positive pressure from public performance ratings will also give regulators a good reason to adopt the most cost-effective regulatory tools.

Simplicity: A crucial element of a good PPA program is simplicity. Although the supporting information should cover all major environmental performance factors, it should be processed using a simple, pre-determined methodology and provided to the public in a very clear summary format. The details should be available to those who are interested, but it is critical that the summary information be easily understood by local communities, business managers, investors and other interested parties. Experience to date with PROPER suggests that simple color coding of performance categories may be the most effective approach.

Public Acceptance: A PPA will succeed in improving environmental performance only if the public accepts and supports it. Inevitably, some subjectivity will be introduced into performance evaluations even when data and methods are treated very carefully. At critical moments in the development and operation of the system, a supporting public consensus will be essential. For this reason, the PPA system should be developed in close consultation with community leaders, industrialists and concerned academics. Maximum transparency and continued consultation will be essential to long-term public support of the system.

Conclusions

This new approach to regulation in Indonesia is showing that local communities and market forces can be powerful allies in the struggle against excessive industrial pollution. PROPER's ratings are designed to reward good performance, and to call public attention to polluters who are not in compliance with the regulations. Armed with this information, local communities can negotiate better environmental arrangements with neighboring factories; firms with good performance can advertise their status and earn market rewards; investors can accurately assess environmental liabilities; and regulators can focus their limited resources on the worst performers. Moreover, transparency is increased because the environmental agency itself is opened to public scrutiny. By committing itself to a public disclosure strategy, it chooses to reveal its own ability to process information reliably and enforce the existing regulations.

Public disclosure seems to be having an important impact on industrial pollution in Indonesia. Encouraged by program results to date, BAPEDAL plans to rate 2000 plants by the year 2000. Other countries have also been inspired by this example of public information in action. Philippines has already launched its ECOWATCH program, which is quite similar to PROPER; Colombia and Mexico are moving rapidly toward development of their own public disclosure programs.

6. Information in Pollution Regulation: Five Principles

This report has highlighted the importance of information in modern systems of pollution regulation. It is not difficult to manage pollution more cost-effectively once regulators have high-quality information, more integrated information systems, more internal capacity for priority-setting, and stronger public participation. This new approach also implies a new role for regulators as public information agents. Although the state can and should have a continuing role in the regulation of pollution, the importance of providing information to communities and markets must also be recognized.

When these two sets of factors are taken into account, a new model of pollution management emerges. It incorporates five key principles for the use of information in regulation:

1. **Focus on Information Products:** Effective pollution management is impossible unless regulators have reliable data, integrated information systems and the capacity

to set priorities which reflect comparative benefits and costs. Markets and communities need timely, accurate, public information to make appropriate assessments of factories' environmental performance. An effective regulatory agency will therefore allocate fewer resources at the margin to conventional enforcement and more to the generation and distribution of appropriate information products.

2. **Orchestrate, Don't Dictate:** A pollution control agency is only one player in the environmental performance game. Agency activities which influence polluters *indirectly*, through other agents, may be as important as direct enforcement. Potentially high-leverage programs include community environmental education; public disclosure of factory performance ratings; and technical training programs for environmental personnel in polluting factories.
3. **Encourage Public Participation:** Equipped with appropriate information, regulatory agencies can play a key role in facilitating negotiations between local communities and neighboring factories. This role includes provision of reliable information on emissions and local ambient quality; technical advice on abatement alternatives; and the transfer of experience from other locations.
4. **Learn from Policy Experiments:** Environmental policy implementation is a complex business, which will inevitably be subject to many uncertainties. Because it is difficult to know exactly what will work in advance, new policy initiatives should emphasize structured learning. Rather than pre-committing to broad-based programs, agencies should initiate a variety of pilot projects, use their information systems to monitor developments, and build larger programs as experience accumulates.
5. **Use Flexible Instruments:** Newly-industrializing economies can experience rapid changes in ambient quality across air- and watersheds. Since regulation should primarily serve environmental quality objectives, it should be focused on adaptation to these rapid changes. Regulators should be empowered to counter environmental degradation by tightening existing regulations. On the other hand, the system should minimize disruption for investors. Meeting both objectives implies:
 - Transparent adjustment rules, linked to publicly-available data from the agency information system on ambient quality and emissions;
 - Adjustment which is, to the extent politically possible, automatically triggered by deterioration of ambient quality below mandated levels. Again, the information system will play a critical role in successful implementation of this principle.

7. References⁵

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⁵ Most of these papers can be downloaded from PRDEI's Internet Website: WWW.WORLDBANK.ORG/NIPR/.