SUSTAINABLE DEVELOPMENT

Small is Not Necessarily Beautiful: Coping with Dirty Microenterprises in Developing Countries

Allen Blackman

AUGUST 2002 · ISSUE BRIEF 02–14

Resources for the Future
1616 P Street, NW
Washington, D.C. 20036

Telephone: 202–328–5000
Fax: 202–939–3460
Internet: http://www.rff.org

Issue Briefs are short reports designed to provide topical, timely information and analysis to a broad nontechnical audience.

Urban clusters of small firms in developing countries can generate enormous amounts of pollution. To control it, policymakers have a number of practical, if unconventional, strategies at their disposal.

Large cities in developing countries typically host thousands of microenterprises that engage in pollution-intensive activities such as leather tanning, metalworking, ceramics, textiles, and food processing. Collectively, these firms, which are often located in poor, densely populated neighborhoods, can have devastating environmental impacts. Nevertheless, pollution control efforts in developing countries have generally focused on big industrial sources. This bias stems from an enduring misperception that small-scale sources are relatively unimportant and from the difficulty of applying conventional regulatory tools to microenterprises. Many small firms are unlicensed and unregulated and therefore difficult to identify or sanction. Also, microenterprises are costly to monitor because they are so numerous. Finally, such firms usually sustain the poorest of the poor and may appear to both regulators and the public as inappropriate targets for regulation.

Yet recent RFF case studies of small-scale brick kilns and leather tanneries in Mexico demonstrate not only that cutting microenterprise pollution yields large benefits, but also that the barriers to pollution control are far from insurmountable. Policy makers have at their disposal a number of cost-effective and practical—if unconventional—pollution control strategies.

Brick Kilns in Ciudad Juárez

In Mexico, small-scale traditional brick kilns fired with cheap highly polluting fuels like scrap wood, plastic refuse and used tires are a notorious source of urban air pollution. Ciudad Juárez—a sprawling industrial city on the U.S.-Mexico border with some of the worst air pollution in North America—is home to approximately 350 such kilns clustered in eight brickyards.

A study of the benefits and costs of controlling emissions of particulate matter smaller than 10 microns (PM10)—a pollutant responsible for a large share of the non-carcinogenic adverse health impacts from air pollution—clearly demonstrates that the Ciudad Juárez's brick kilns inflict significant harm. Because these kilns do not have smoke stacks, over 90% of their PM10 emissions are deposited less than a third of a mile away, a critical problem since most kilns are situated in residential neighborhoods. Partly as a result, the kilns are responsible for over a dozen cases of premature mortality and hundreds of cases of respiratory illness each year (see the Table on page 3), impacts that are valued at between $20 million to $150 million. By contrast, the annual costs of pollution control programs that would virtually eliminate these impacts are estimated at less than $300,000.

Although brick kilns are widely recognized to be a leading source of air pollution in Ciudad Juárez and its sister city, El Paso, Texas, a number of factors make it politically difficult to require brickmakers to bear the full costs of pollution control: brickmaking provides over 2,000 jobs, most brickmakers are impoverished (profits per kiln average $100 per month), and most belong to a trade association or other local organization that can lobby against pollution control efforts.

Despite these obstacles, efforts to control brick kiln emissions had considerable success in the early 1990s. In 1989, the municipal environmental authority initiated a "clean technology" project aimed at substituting propane for dirty fuels. The next year, the propane initiative was handed off to the *Federación Mexicana de Asociaciones Privadas de Salud y Desarrollo Comunitario* (FEMAP), a private non-profit social services organization. FEMAP was able to attract considerable funding and participants from both sides of the border including local propane companies, universities and Los Alamos National Laboratory.

Leaders of the propane initiative used a number of carrots and sticks. First, they subsidized various costs associated with adopting propane. Mexican propane companies provided most of the requisite equipment and training free of charge. To make propane more attractive despite the fact that it was more expensive than traditional fuels, engineers at Los Alamos National Laboratories designed new energy-efficient kilns. Unfortunately these kilns proved prohibitively expensive and complicated.

Second, the initiative's leaders worked to ratchet up pressures on brickmakers to adopt propane. Most importantly, they convinced brickmaker trade unions in several brickyards to prohibit their members from using dirty fuels. Also the city government banned the use of particularly dirty fuels and set up a telephone hotline to register complaints about brickmakers violating

TABLE 1

ANNUAL HEALTH EFFECTS FROM UNCONTROLLED BRICK KILN PM10 EMISSIONS
(NUMBER OF CASES; MEAN VALUES AND 95% CONFIDENCE INTERVALS)

Health Endpoint	Ciudad Juárez			El Paso		
	Low	Mean	High	Low	Mean	High
Mortality	2.6	14.5	33.4	0.5	2.8	6.4
Respiratory hospital admissions	0	266	807	0	38	116
Emergency room visits	0	617	1,708	0	89	246
Work loss days	0	3,267	9,690	90	471	1,397
Respiratory symptom days	93,280	387,400	814,800	15,650	64,990	136,700
Restricted activity days	3,737	142,400	395,900	539	20,530	57,070
Asthma attacks	159	43,500	112,300	23	6,272	16,190
Childrens' chronic bronchitis	3	1,652	4,560	0	179	495
Childrens' chronic cough	0	1,908	4,993	0	207	542
Adult bronchitis cases	1	97	264	0	16	44

Source: Blackman, Newbold, Shih, and Cook, 2000

the ban. Enforcement teams with the power to jail and fine violators were dispatched in response to complaints.

Third, FEMAP initiated an educational campaign to raise brickmakers' awareness of the health hazards associated with dirty fuels. Finally, project leaders tried to reduce competitive pressures for brickmakers to use cheap dirty fuels by organizing a boycott of bricks fired with dirty fuels. However, the boycott was quickly undone by rampant cheating.

By the end of 1993, over half of the Ciudad Juárez brickmakers were using propane. Unfortunately, this success proved short-lived. In the early 1990s, as part of a nationwide economic liberalization program, the federal government was phasing out long-standing propane subsides. As propane prices continued to rise in 1994, propane users switched back to dirty fuels. By 1995, only a handful of brickmakers were still using propane. However, the propane initiative has had some lasting impacts: local organizations and city officials continue to enforce a ban on particularly dirty fuels such as tires and plastics.

Leather Tanneries in León

The city of León in north-central Mexico produces about two-thirds of the country's leather. Of the 1,200 tanneries in the city, about half employ fewer than 20 workers. Virtually all of León's tanneries dump untreated toxic effluents directly into municipal sewers where they flow untreated into the Turbio River. The resulting pollution has contaminated ground water, destroyed irrigated agricultural land, and caused serious health problems. Regulations governing water pollution have been on the books for decades, but most are simply not enforced. By all accounts, the main reason is that, as one of the city's principal employers, tanners have considerable political power.

Concerted efforts to control pollution from tanneries in León began in 1986. Tannery representatives signed a *convenio* (voluntary agreement) with regulators in which they agreed to comply with written regulations within four years. But when it became apparent in 1990 that the tanners had not taken any action, they were given a second four-year grace period. At the end of this second grace period, tanneries still had made no progress, so they were granted yet another grace period. This cycle has continued until today.

In addition to the succession of *convenios*, there has also been an attempt to control pollution by relocating the tanneries. In the early 1990s, the city built the infrastructure for a tannery industrial park with a common wastewater treatment facility. Tanners were required to purchase land and build new facilities in the park. In consideration, they were to be provided with subsidized loans and tax credits. However, tanners ultimately refused to foot these costs, and today the industrial park stands empty.

Perhaps the most successful means of controlling tannery emission in León has been the largely voluntary adoption of clean tanning technologies, including sedimentation tanks that allow particulate matter to settle out of waste streams; low-chemical tanning recipes; enzymes that substitute for sulfur compounds used to rid hides of hair; recycling tanning baths; and chrome recovery. Estimates of the percentage of tanneries using these technologies range from 90% for sedimentation tanks which are required by law (this law appears to be enforced), to less 5% for chrome recovery.

In view of the proven political and economic constraints on relocation and conventional regulation, clean technologies currently represent the best hope for controlling tannery pollution. To

assess the barriers to and incentives for adoption of clean technologies, a team of researchers from RFF and the University of Guanjuato in Mexico recently administered a detailed survey to about 170 tanneries. Preliminary analysis of the survey data suggests that for most technologies, firm size is not determinative: small tanneries are just as likely to adopt as large ones. Rather, access to information about the technology as well as the education of tannery managers appears to be critical. Many of clean technologies are simply not well-known or well-understood by tanners. Surprisingly, key sources of information and assistance are private sector entities, including chemical supply companies, fellow tanners, and the tannery trade associations.

Another finding is that adopters of certain technologies tend to be spatially clustered suggesting that demonstration effects are important. In the case of one technology—sedimentation tanks—laws requiring installation are clearly driving adoption. Finally, even though most of these technologies lower materials costs (and sometimes labor costs), several entail significant set-up which act as a significant barrier to adoption.

Lessons Learned

Political constraints. In both Ciudad Juárez and León, city regulatory authorities have been able to enforce regulations that impose minimal costs on polluters—for example in León, they have compelled tanneries to install sedimentation tanks—but they have not been able to consistently enforce more burdensome regulations. A key reason is that brickmakers in Ciudad Juárez and tanners in León are numerous and well-organized and, as a result, have the power to block enforcement. In general, when dealing with severe pollution problems created by microenterprises, political considerations are likely to be quite important, if not paramount. Severe pollution problems arise when small polluters are numerous, and when polluters are numerous, they are bound to have political power. Consequently, successful policies will need to accommodate polluters' concerns about the costs of pollution control by offering subsidies and inducements.

Informal regulation. The case studies suggest that so-called "informal" regulation—pressure generated by private sector actors that have day-to-day contract with polluters—is probably the most important ingredient of a successful microetnerprise pollution control program. In Ciudad Juárez, brickmakers trade unions played a critical role in promoting propane by enforcing prohibitions on the use of traditional fuels in some brickyards. Also, citizen complaints facilitated enforcement of a municipal ban on dirty fuels. In León, pollution control efforts have been stymied by the absence of such private sector pressure.

There are a number of explanations for the lack of informal regulation in León. Most households in the city depend on the leather industry for their livelihood so it is difficult to generate public support for measures that raise tanners' production costs. Also, tannery emissions are less noticeable than those of brick kilns, and their health and environmental impacts are less immediate. Hence, informal regulation would seem to be easier to generate when polluters are not the mainstay of the local economy and when emissions are easy to detect and have immediate adverse health impacts.

Clean technological change. Given the barriers to regulating microenterprises by conventional means, clean technological change represents a particularly promising pollution control strategy. In both cities, technical assistance spurred clean technology adoption and, in Ciudad Juárez, a campaign to educate brickmakers about the health impacts of dirty fuels also appears to have had

some impact. Surprisingly, both case studies suggest that private-sector organizations, such as the equipment suppliers and the trade associations can be the principal purveyors of technical information, an encouraging prospect given chronic constraints on resources available for public sector initiatives.

The Ciudad Juárez case study also demonstrates that clean technologies need not be "win-win" propositions, that is, they need not reduce production costs as well as polluting emissions. The majority of brickmakers adopted propane and continued to use it for over a year even though it significantly increased production costs. Part of the explanation may have to do with the interplay between competition and informal regulation. The market for bricks is highly competitive and, as a result, brickmakers that use high-cost clean fuels are liable to be undercut by competitors using dirty fuels. Thus, initially competition in the market for bricks discouraged adoption. But once diffusion has progressed past a certain stage, competition appears to have worked *in favor* of adoption because those who had adopted have an incentive to ensure that their competitors adopt as well. Moreover, adopters generally had some leverage over competitors who were neighbors and/or fellow union members. As a result, once an initial cadre of brickmakers adopted, neighbors and fellow union members quickly followed suit. This suggests that if a critical mass of microenterprises can be convinced by hook or crook to adopt a cost-increasing clean technology, eventually diffusion can become self-perpetuating.

Finally, the failure of efforts to successfully diffuse costly complicated energy-efficient kilns in Ciudad Juárez demonstrates the well-established principal that that in developing countries, new technologies must be appropriate, that is both affordable and consistent with existing levels of technology.

The promise of private-sector-led environmental initiatives. The relatively successful Ciudad Juárez experience suggests that private-sector-led initiatives hold considerable promise as a means of addressing microenterprise pollution problems. They would seem to enjoy a number of advantages over state-run programs. First, the willingness of the majority of the Ciudad Juárez brickmakers to cooperate with the project suggests that private-sector-led initiatives may be best suited to engage unlicensed firms that by their nature are bound to be wary of sustained contact with regulatory authorities. Second, the public enthusiasm that the propane initiative generated suggests that private-sector-led projects may be able to draw more freely on public sympathy for environmentalism than top-down bureaucratic initiatives. And finally, the projects' success at consensus building among a diverse set of stakeholders suggests that private-sector-led-initiatives may be better able to sidestep the politics and bureaucracy that often plague public-sector-led initiatives.

By contrast, the León efforts to establish *convenios* have been rife with such problems. The qualified success of the propane initiative however, does not imply that small-scale pollution problems are best left to private sector organizers. In all likelihood, the propane initiative would not have had as much success without unusually strong public sector support.

Boycotts. In Ciudad Juárez, the attempt to organize a boycott of the brickmakers still using dirty fuels was an utter failure. Buyers simply continued to buy bricks from whoever was selling at the best price. This experience suggests that in most cases, contravening market forces—especially in informal or lightly regulated markets—simply does not work. Monitoring is too difficult and cheating is too easy.

Further Readings

A. Blackman, S. Newbold, J.-S. Shih and J. Cook. 2000. "The Benefits and Costs of Informal Sector Pollution Control: Traditional Mexican Brick Kilns" *Resources for the Future Discussion Paper No. 00-46* (www.rff.org/CFDOCS/disc_papers/PDF_files/0046.pdf, accessed July 22, 2002).

A. Blackman. 2000. "Informal Sector Pollution Control: What Policy Options Do We Have?" *World Development.* Vol. 28, No. 12. Forthcoming.

A. Blackman and G. J. Bannister. 1998. "Community Pressure and Clean Technology in the Informal Sector: An Econometric Analysis of the Adoption of Propane by Traditional Mexican Brickmakers." *Journal of Environmental Economics and Management.* Vol. 35, No. 1, 1-21.

Allen Blackman is a RFF fellow