Voluntary Pollution Control Agreements in Developing Countries: The Case of the Leather Tanning Industry of León, Mexico

Allen Blackman, Research Fellow
Resources for the Future
1616 P Street, N.W.
Washington, D.C. 20036
Voice: 202-328-5073
Fax: 202-939-3460
blackman@rff.org

Nicolas Sisto, Assistant Professor
Department of Economics, ITESM
Ave. E. Garza Sada 2501 Sur,
C.P. 64849,Monterrey, NL, México
Voice: +52 (818) 358-2000, Ext. 4305
Fax: +52 (818) 358-2000, Ext. 4351
sisto@itesm.mx

Draft: November 17, 2003

Abstract

This paper analyzes a series of four voluntary pollution control agreements struck between the leather tanning industry of León, Mexico, and municipal, state and federal authorities, over the 1987-2000 period. It has been argued that voluntary agreements present effectiveness and efficiency advantages over conventional policy instruments, such as standards or taxes. While some case studies carried out in developed countries lend limited support to that position, there is no consensus on the matter. For the case at hand, we observe few concrete outcomes from the agreements; the whole process, in fact, has been mostly a failure. We explain the causes of that failure in terms of the agreements' faulty design, the weight of the industry in municipal politics, and most importantly, severe institutional shortcomings at all levels of government. Our analysis sheds light on the preconditions necessary for effective environmental policy, and casts doubt on whether voluntary agreements are likely to be effective in developing countries in general.

1. Introduction

In León, Guanajuato—Mexico's tanning and leather goods capital—hundreds of tanneries release untreated effluents into the municipal sewer system. During the 1980s and 1990s, authorities initiated a series of pollution control initiatives aimed at cleaning up the severely polluted local river. These initiatives centered on a series of four voluntary pollution control agreements between authorities and tanners.

Voluntary environmental agreements may allow authorities to tackle a given environmental problem more rapidly than through a regulatory approach, by avoiding the legislative and administrative processes necessary to introduce new effluent standards or new taxes (OECD 2003). Voluntary agreements could represent a valuable short-cut for environmental policy, especially for developing countries, where environmental problems may urgently need to be addressed, while the regulatory capacity required for the development, introduction and enforcement of conventional environmental policy instruments may be weak, incomplete or non-existent (Development Research Group 1999).

This paper tests this idea with the case of the León agreements. Our analysis draws upon a variety of sources, including an original survey of 164 tanneries, interviews with stakeholders, legal documents and articles from the local press. The remainder of the paper is organized as follows. Section 2 presents a brief economic, technological and environmental profile of León's tanning industry. Section 3 identifies with a simple model the main issues surrounding the choice of policy instruments for pollution control, reviews the effectiveness and efficiency properties of conventional instruments (standards, emissions taxes and tradable emissions permits) and summarizes the pertinent literature on voluntary agreements. Section 4 analyzes the four voluntary agreements between authorities and tanners in León, in terms of their objectives, design features, and outcomes. Section 5 explains observed outcomes in terms of the agreements' design, politics, and institutional factors, and offers some general conclusions.

2. Leather tanning in León, Mexico

2.1. Industry profile

The state of Guanajuato (North-Central Mexico) hosts the country's largest tanning and footwear industry, accounting for about 65% of national output of all leather goods (INE 1996). Mostly concentrated in León (a sprawling industrial city of 1.1 million), the industry spills over into the smaller neighboring municipalities of San Francisco del Rincón and Purísima del Rincón (population 100,000 and 45,000, respectively). Tanning and footwear dominate economic activity in León, employing about half of the municipality's active population (INEGI 2001).

León supports about 800 tanneries (Villalobos 1999; CIATEC 2000). These tend to be small-scale: over three-quarters of 164 tanneries surveyed in January 2000 (RFF/U. de G. 2000) reported 15 or fewer employees; nonetheless, the industry also contains some

large operations employing more than 50 workers (see Table 1 in appendix). A sizable concentration of tanneries is found in or near the city's center, but many small clusters are distributed in patchwork fashion throughout León.

Three trade associations represent the tanneries: the *Cámara de la Industria de la Curtiduría del Estado de Guanajuato* (CICUR), the *Asociación Nacional de Curtidores* (ANACU), and the *Asociación de Químicos y Técnicos del Cuero de León* (AQTCL). CICUR, with a membership of up to 400, is by far the biggest and a vocal and effective lobby for its members.

2.2. Production technology and wastes

Leather tanning consists of two meta-processes: wet blue production and finishing. The former consists of removing unwanted substances (salt, flesh, hair and grease) from a raw hide, trimming it, treating it to obtain the desired grain and stretch, and soaking it in a chromium bath - the resulting semi-finished hide is called a "wet blue" because of the bluish tint chromium imparts it. Finishing consists of splitting, shaving, re-tanning and dying the wet blue. The wet blue and finishing processes are technologically and economically separable: many tanneries in León specialize in one or the other.

Wet blue production generates 90% of all tanning effluents. Three sub-stages of this process are particularly dirty: rinsing of salt-preserved raw hides, de-hairing in a lime and sodium sulfide bath to dissolve hair and flesh, and tanning in a chromium bath to render hides biologically inert.

Table 2 (see appendix) describes effluents released by a typical León tannery using no pollution control, by step of the tanning process. The tanning industry generates a total of 1,605.80 m^3/d of wastewater (CEASG 1999:93): combining this estimate with figures from Table 2, we estimate yearly emissions of about 138 tons of chromium and 7,326 tons of salt (assuming that rinsing accounts for half of total wastewater generated by a typical tannery). These estimates may be conservative: Bartone and Benavides (1997) propose a figure of 483 tons of chromium per year.

In addition to effluents, tanneries generate solid wastes (sludge, trimmings and fleshings). Sludge, which collects in sedimentation tanks used to remove solids from the waste stream, contains chromium VI, a highly toxic by-product of the chromium III used by tanners, as well as other pollutants (see Table 3 in appendix). Tanneries produce in total 12 tons of sludge per day (Maldonado et al. 2001).

The vast majority of León's tanneries do not treat their effluents. The survey mentioned earlier found none with effluent treatment equipment, apart from sedimentation tanks (RFF/U. de G. 2000). About a third of sampled tanneries reported having adopted at least one "clean" production technology over the five years prior to the survey, for example tanning bath recycling. These technologies reduce pollutant loads in effluents, but the motive for adoption

seems to have been mostly economic, i.e. input costs reductions and/or product quality improvement (Blackman and Kildegaard 2003).

Up until 2000, León did not have a municipal wastewater treatment plant and discharged all its domestic and industrial wastewaters directly into the local Turbio river, part of one of Mexico's most important river basins, the Lerma-Chapala. Like most Mexican cities, León has no disposal facility for hazardous wastes, such as tannery sludge, and tanker trucks contracted to empty sedimentation tanks have traditionally unloaded their contents into the river or its banks (see e.g., Correo de Hoy, May 21 2000).

2.3. Environmental impacts

The Turbio river, with average levels of BOD and COD of 500 mg/l and 800 mg/l respectively, as well as high levels of salinity and chromium VI (CEASG 1999: 91), is considered "excessively contaminated" for human consumption and wildlife, and "strongly contaminated" for agricultural, industrial, and recreational uses (CEASG 1999:83). Authorities have recorded, at one of several informal dumping sites for tannery sludge on the river's banks, levels of chromium III from 40 to 14,040 times the maximum federal standard of 0.05 mg/l, and levels of chromium VI from 63 to 343 times the maximum federal standard of 0.016 mg/l (PROFEPA 1997).

Farmers on the outskirts of León irrigate approximately 600 hectares of land with raw river water (CEASG 1999:98). The high salt content of the water degrades land quality and pollutants may migrate to aquifers on which the city depends for nearly 100% of its water supply. Chromium VI has been found in 72% of León's wells (Hernández 1987).

The Turbio sub-basin is an important habitat for about 30 species of migratory birds from the U.S. and Canada, as well as numerous native species. In November 1994, a massive bird die-off of between twenty to forty thousands individuals occurred at the Presa de la Silva (a small, shallow irrigation reservoir located in San Francisco del Rincón. A report by the Commission for Environmental Cooperation linked the die-off to tannery effluents, based on test results indicating elevated levels of chromium in the reservoir's sediment (CEC 1995).

Historically however, municipal authorities have been mostly concerned by the accumulation in the municipal sewer system of solids found in tanneries' effluents (such as hair, grease, and small cuttings), which caused clogging and occasioned costly repairs. The January 2000 survey mentioned earlier found nearly universal use of sedimentation tanks, a simple and inexpensive control technology (RFF/U. of G. 2000).

3. Choice of policy instruments for pollution control: the main issues

3.1. Effectiveness and efficiency of policy instruments for pollution control

Two types of pollution control instruments have traditionally been analyzed in the environmental economics literature: command-and-control instruments and economic instruments. The former obligates sources to adopt specific abatement technologies (technology standards), or to engage in abatement (emissions standards). Typically, it punishes non-compliance with a fine. The latter (emissions taxes, abatement subsidies and tradable emissions permits) modifies the cost of abatement relative to release, but leaves individual sources free to react to the incentives created. A third type of instrument has emerged relatively recently: voluntary environmental agreements, whereby instead of obligating or economically motivating polluters, authorities negotiate with them a consensus on environmental goals and the means to achieve them.

The following model illustrates the relative effectiveness and efficiency characteristics of policy instruments for pollution control. Let x_i, represent the unabated quantity of pollutant (e.g. chromium) released by source "i"; A_i, the quantity of pollutant abated - through effluent treatment (e.g. sedimentation tank), production process changes (e.g. recycling of the tanning bath), or output reduction; and E_i, the quantity of pollutant released (i.e. not abated). By definition, $A_i = x_i - E_i$. Now let $AC_i = AC_i(A_i,\gamma)$ and $RC_i = RC_i(E_i,\mu)$ represent the source's abatement and release cost functions, respectively, where γ and μ are vectors of relevant abatement and release cost determinants. The efficient abatement-release decision for a cost-minimizing source (given γ and μ) is such that:

$$\frac{\partial AC_i(A_i;\gamma)}{\partial A_i} = \frac{\partial RC_i(E_i;\mu)}{\partial E_i} \qquad (1)$$

i.e. at the margin, the cost of abating must be equal to the cost of releasing. If sources can release whatever quantity of pollutant at no cost, cost-minimizing leads to the corner solution:

$$\begin{aligned} A_i &= 0 \\ E_i &= x_i \\ RC_i + AC_i &= 0 \end{aligned} \qquad (2)$$

i.e. sources undertake no abatement, release all the pollutant they generate, and do not bear any cost from that decision - the conditions prevailing in León until relatively recently (see 2.2 above).

Because of the damages resulting for society at large (see 2.3 above), solution (2) is unlikely to be socially optimum: some level of abatement, although privately costly for sources, would be socially beneficial. In the case of León's tanneries, abatement cannot

no occur autonomously: the "pays to be green" hypothesis tested by King and Lennox (2001), Konar and Cohen (2001), Arora (2001), and others, does not apply, since tanneries are not listed on the stock market, nor do they have access to a premium market based on a "green" labeling scheme for tanned hides. Therefore, authorities need to use an instrument in order to modify tanner behavior. Let:

$$E^* = a\sum_{i=1}^{n} E_i, 0 \le a \le 1 \tag{3}$$

represent the (socially optimal) emissions target, and:

$$\sum_{i=1}^{n} AC_i + \sum_{i=1}^{n} RC_i + \sum_{i=1}^{n} IC_i \tag{4}$$

represent total instrument cost for tanners, where the first two terms (aggregate abatement cost and aggregate release cost) capture the release and abatement effects of the instrument, and IC_i is the instrument's administrative cost (e.g. paperwork, such as an emissions registry). Total (net) instrument cost for authorities (GNC) is:

$$GNC = GC - GR \tag{5}$$

where GC is gross instrument cost (design, legislative approval, publication, implementation, monitoring, enforcement, administration) and GR is instrument revenue (e.g. from fines, emissions taxes, or the sale of emissions permits). Adding up (4) and (5), GR cancels outs with the second term of (4) and we obtain net social instrument cost:

$$\sum_{i=1}^{n} AC_i + \sum_{i=1}^{n} IC_i + GC \tag{6}$$

How do the various instruments described earlier perform in terms achieving the target (effectiveness) and minimizing net social instrument cost (efficiency)? Emissions taxes and tradable emissions permits are efficient, in the sense of generating the lowest possible aggregate abatement cost – the first term of (6). Let "t" be a per-unit emission tax so that $RC_i = RC_i(E_i,t) = tE_i$. Sources react by seeking out and selecting the cheapest abatement options and the cost-minimizing condition (1) becomes:

$$\frac{\partial AC_i}{\partial A_i} = \frac{\partial RC_i}{\partial E_i} = t \tag{7}$$

Equalization of individual marginal abatement costs across sources minimizes aggregate abatement cost. Moreover, the (static) efficiency of the tax is enhanced by the permanent incentive it creates to reduce emissions, i.e. to seek out new and cheaper abatement options (dynamic efficiency). The same efficiency results (static and dynamic) hold for tradable emissions permits; to see this, let "t" in (7) be the equilibrium price of

permits resulting from trading between sources with relatively high abatement costs and sources with relatively low abatement costs.

In contrast, an emissions standard does not minimize aggregate abatement cost. With this instrument the individual solution (2) becomes (assuming the expected value of the fine for non-compliance is sufficiently high):

$$\begin{aligned} A_i &= (x_i - E_i^*) \\ E_i^* &= ax_i \end{aligned} \qquad (8)$$

where $0 \leq (1\text{-}a) \leq 1$ is the mandatory percentage reduction in emissions. Although sources have the freedom to choose the cheapest abatement options in order to meet the standard, the solution does not equalize individual marginal abatement costs and therefore does not minimize aggregate abatement cost, unless sources have identical abatement cost functions. With non-identical abatement cost functions, authorities would need full knowledge of all individual abatement cost functions in order to determine a set of site-specific standards that equalizes individual marginal abatement costs. Dynamic efficiency, compared to an emissions tax or tradable emissions permits, is also reduced: releasing is free (up to the limit imposed by the standard), so sources may only economize on their abatement cost and not their release cost. The efficiency of a technology standard is even lower, as it shares all the problems of the emissions standard and additionally does not give sources (presumably better informed than authorities) the freedom to select the cheapest abatement options.

As (6) shows, aggregate abatement cost is only part of net social instrument cost - however difficult to speculate about the relative cost to authorities of different instruments: for example, whether the cost of supervising and regulating a permit market is lower than administering an emissions tax collection system, or a fines system, is an empirical question.

Effectiveness is ensured for tradable emissions permits by distributing among sources exactly enough permits so as to attain the target; for emissions standards, by selecting the appropriate "a" in (3). For emission taxes however, determining the value of the tax that results in the attainment of the emissions target would require full knowledge of all individual abatement cost functions. In the case of a technology standard, effectiveness would only result if the equipments installed happened to produce the correct level of aggregate abatement.

In contrast to conventional instruments, voluntary agreements have no fixed structure. Since they result from negotiations between authorities and sources, their efficiency and effectiveness properties depend on their specific design features; the next section briefly reviews the pertinent literature.

3.2. Effectiveness and efficiency of voluntary environmental agreements

Why do voluntary environmental agreements occur? Theoretical investigations on voluntary agreements have focused on the self interest of the parties involved in negotiated agreements. It has been argued that regulators rely on negotiated voluntary agreements in situations where conventional regulation is particularly costly in the near to medium term (for political, technological or institutional reasons), while polluters participate in such agreements either because regulators offer inducements or threaten sanctions. For example, in Blackman and Boyd (2002), firms participate in site-specific negotiated voluntary agreements because these agreements offer an important "carrot"—an opportunity to use less costly methods of cutting emissions than allowed under existing regulations. Other models focus instead on regulatory "sticks"—firms participate to head off or weaken future formal regulation. For example, in Maxwell, Lyon, and Hackett (1998), polluters collectively volunteer for self-regulation in order to preempt more restrictive mandatory standards. Likewise, in Segerson and Miceli (1998), a "background legislative threat" motivates polluters to participate in voluntary agreements. It is notable that in such models, firms' incentives to comply with the voluntary environmental agreements are weakened to the extent that the threat of future mandatory regulation is not credible.

Voluntary environmental agreements have enthusiastic supporters. For example, according to the Business and Industry Advisory Committee (BIAC) to the OECD, "agreements between industry and public authorities have proved cost-effective…ways of achieving environmental goals…(by allowing) those with the best knowledge about their own business to propose and execute measures that are cost-effective…Voluntary approaches can help governments avoid costly processes and transaction costs and allow design and implementation roles to remain within the private sector." (BIAC, 2003:21-22)

The evidence however on the effectiveness of voluntary agreements is weak. Based on a number of original case studies and an exhaustive review of the available empirical literature, the OECD (2003:62) identifies "only a few examples where a voluntary policy approach is deemed to have contributed significantly to the fulfillment of a given target".

This may be due to agreement design weaknesses, in particular the lack of sufficient compliance-inducing mechanisms. Moreover, voluntary agreements may suffer from "regulatory capture", which complicates the interpretation of effectiveness measures: cost-minimizing polluters have an incentive to negotiate agreement goals down to the "business-as-usual" scenario, i.e. what would have happened anyway without the agreement. For authorities preoccupied with economizing scarce budgetary resources and while still demonstrating achievements, an agreement on no more than a "business-as-usual" scenario may still have value.

With respect to efficiency, voluntary agreements would minimize aggregate abatement cost only if they contain features that would promote equalization of marginal

abatement costs. While voluntary agreements do give polluters the freedom to choose abatement options (see BIAC's argument above), this flexibility is in fact common to *all* instruments *except* technology standards (see 3.1 above). In terms of instrument cost to authorities and polluters, the OECD (2003) concludes that the preparation, negotiation and administrative costs of voluntary agreements are too variable to draw general conclusions. Note however that all their evidence originates from developed-countries case studies in the US, Canada, Western Europe and Japan.

Notwithstanding the preceding, voluntary agreements may speed up pollution control: "a potential benefit of voluntary approaches…is that they can require less preparation…than regulatory approaches…one could start to address a given environmental problem more rapidly through voluntary approaches than if one were to go through all the preparations to put in place…new legislation or new taxes." (OECD, 2003:11). Voluntary agreements could represent a valuable short-cut for environmental policy, especially for developing countries, where environmental problems may urgently need to be addressed, while the regulatory capacity required for the development, introduction and enforcement of conventional environmental policy instruments may be weak, incomplete or non-existent (Development Research Group 1999). The next section tests this idea with the case of the León agreements.

4. The case of the voluntary pollution control agreements in León

National concerns over water quality in the severely polluted Lerma-Chapala river basin (Webster et al. 2002) provided an important initial motivation for getting León to clean up its effluents. The issue surfaced in the 1984-1988 *Programa Nacional de Ecología*, a broad six-year blueprint of the federal government's environmental goals, which viewed León - the largest population and industrial center in the northern section of the basin - as a significant contributor to the problem (Hernández 2002, Oliverio 2002, Oyarvides 2002).

By early 1987, the *Secretaría de Desarrollo Urbano y Ecología* (SEDUE, the federal urban affairs and environmental authority), had developed a national urban planning program that introduced the concept of relocating industries away from urban zones to industrial parks, presumably to facilitate the segregation and treatment of their effluents and other wastes. The reaction in León was overwhelmingly negative: the *Dirección de Desarrollo Urbano y Obras Públicas* (León's urban affairs and public works authority), the *Laboratorio Regional de Salud Pública* (a laboratory part of the state public health system) and ANACU all coincided that pollution from tanneries was not a problem (El Nacional, April 17 1987), and CICUR's president rejected categorically any plan to relocate tanneries (El Nacional, April 21 1987). The SEDUE delegation in Guanajuato however insisted that tanneries that did not relocate would be fined or even shut down, and that it was both the municipal government's obligation as well constitutional prerogative to implement the relocation program; in response, the municipality offered to not authorize any new urban tanneries (El Nacional, April 24 1987). CICUR and ANACU reiterated publicly several times they would not relocate to industrial parks and that the proposal, apart from unnecessary, was for them financially

prohibitive (e.g. El Nacional, April 27 1987). León's mayor, seeking to defuse the confrontation, proposed that tanneries only relocate wet-blue production, the most polluting part of the tanning process (see 2.2 above), and be given a year to do so – but insisted pollution from tanneries was not severe (El Nacional, May 5 1987a). All parties involved quickly agreed to negotiate an agreement on pollution control for tanneries.

4.1. First agreement: 1987

4.1.1 Basic features and objectives of the 1987 (first) agreement

The *Convenio Realizado para Prevenir y Controlar la Contaminación de la Industria Curtidora en León, Gto. y su Área Metropolitana* (Agreement for the Prevention and Control of Pollution from the Tanning Industry in León, Guanajuato and its Metropolitan Area), signed on July 8 1987, brought together a total of thirteen participants from government (municipal, state and federal), industry, and civil society. The agreement's substantive objectives consisted of fourth sets of commitments:

1) ***Effluents regulations***.
The SEDUE in conjunction with the *Secretaría de Agricultura y Recursos Hidráulicos* (SARH, the federal agricultural and water authority) and the *Secretaría de Salud* (the federal public health authority) committed to establish standards applicable to discharges into federal waters (such as the Turbio), as well as standards applicable to discharges into sewer systems. The *Sistema de Agua Potable and Alcantarillado de León* (SAPAL, León's water and sewerage board) committed to comply with the former with respect to discharges from its sewer system into the river, and enforce the latter with respect to tanneries' discharges into the sewer system. The process was to be completed within five of months of the signing of the agreement. CICUR and ANACU committed to have their members comply with regulations.

2) ***In-house effluents abatement***.
CICUR, ANACU and AQTCL committed to carry out an audit of sedimentation tank use in the industry within one month of the signing of the agreement. Tanners not so equipped would install them within three months. Moreover, tanners would adopt tanning bath recycling and implement a chromium-recycling program over the following seven months. Finally, tanners would install, by February 1989, whatever additional in-house pollution control equipment would be needed to comply with effluent regulations – CIATEC (a local tanning and shoe-making research center) would provide them with technical assistance for this endeavor.

3) ***Solid wastes regulations***.
SEDUE committed to establish standards for the management, treatment and disposal of solid wastes. CICUR and ANACU committed to have their members comply.

4) ***Solid wastes disposal***.
SEDUE, the state government, CICUR, ANACU and AQTCL, jointly agreed to implement within a 9-month period a disposal solution for tanneries' solid wastes.

The *Comité Regional de Promoción y Asesoría Técnica* (a committee that included all agreement participants) would monitor and enforce the agreement, as well as receive and evaluate pollution control proposals from tanners and "facilitate" in unspecified ways their funding. The committee would report to the SEDUE and the SAHR, who would have the final say on proposals.

4.1.2 Effectiveness and efficiency mechanisms of the 1987 (first) agreement

The agreement lacked compliance-inducing mechanisms for tanners. First, the committee in charge of enforcement was not given any means to punish tanners who did not comply, or to reward those who did. Second, tanners' associations had no more enforcement powers than the committee: they could only persuade their members to respect the commitments contracted on their behalf. Third, the agreement only covered tanners represented by the associations (less than half of the industry's total) and thus implicitly exonerated non-affiliated tanners, as well as all other industrial sources, such as the footwear industry. Fourth, at the time of the signing of the agreement, authorities did not dispose of a coercive instrument they could brandish at tanners: the only "background legislative threat" at their disposal was in fact their commitment to produce regulations. Fifth, it made little sense for tanners to begin investing in specific abatement measures *before* they knew what exactly the regulatory requirements would be. The effectiveness of the agreement would thus be severely compromised, as almost all substantive pollution control expenses had been assigned to tanners.

The agreement also failed to specify important budgetary matters, which impeded its effectiveness even more. First, the joint commitment between authorities (federal and state) and tanners to implement a solid waste disposal solution did not establish a cost-sharing scheme. Second, the agreement did not specify how SAPAL, recently established in 1985, would find the resources necessary to meet effluent standards on discharges from its sewer system into the river: a sizable investment in municipal wastewater treatment would be necessary whether or not tanners complied with their commitments – according to SAPAL, tanneries represented only 10% of the city's water consumption (El Nacional, May 5 1987b) and hence a correspondingly small percentage of total wastewaters volume.

Reflecting on the agreement's poor design, several participants were not assigned any commitments or financial obligations: the municipalities of San Francisco del Rincón and Purísima del Rincón, the *Universidad de Guanajuato*, and *Química Central de México S.A. de C.V.* – and the latter seriously lacked in credibility. QCM, based in San Francisco del Rincón, is Mexico's largest supplier of chemical inputs for the tanning industry and famous for the 500,000 tons of hazardous wastes informally stored on its premises (El Economista, Novmber 4 2003).

The agreement contained only one, albeit implicit, emissions target: the zero-emissions target for chromium implied by the proposed adoption of tanning bath recycling and chromium recycling. That target, which was not set with reference to the costs and benefits of chromium abatement, was unlikely to be socially efficient. The

agreement did not contain any features that would have tended to minimize aggregate abatement cost, as it mostly mandated the adoption of specific abatement measures.

4.1.3 Outcomes of the 1987 (first) agreement

The first effluent standard applicable to tanneries (NTE-CCA-021/88) only came into effect on August 5 1988 (DOF, 1988) – following the publication earlier that year of the enabling federal environmental law (*Ley General del Equilibrio Ecológico y la Protección al Ambiente*). The delayed publication of the standard, eight months after the five-month period contemplated in the agreement naturally produced a wait-and-see attitude among tanners. The standard, consisting of concentrations limits for pollutants in tanneries' effluents, did away with the agreement's zero-emissions target for chromium, and did not prescribe the adoption of any specific abatement measures. More importantly, the standard (one of a very large set of industry-specific effluent standards produced around that time) only applied to effluents discharged by tanneries *directly into federal waters*, while almost all tanners discharged into the sewer system, not the river. It therefore had little weight as a coercive measure.

By 1990, federal authorities had still not published standards for discharges into sewer systems, or by sewer systems into federal waters, and no solid waste disposal facilities had been built. Tanners had not undertaken the in-house abatement measures prescribed by the agreement, with one (partial) exception. Data from the survey mentioned before demonstrates that the frequency of sedimentation tank use expanded during the 1987-1991 period: about 30% of sampled tanners reported having adopted the technology during that period.

Solid wastes regulations promised in the agreement had not been produced either. According to state level regulators in León, hazardous waste law at that time was piecemeal, confused and unenforceable (Hernandez 2002). Wastes problems actually increased with the expansion of sedimentation tank use and informal sludge disposal by tanners (see 2.2 above).

In the face of the agreement's breakdown, in 1990 local stakeholders proposed the ECO-AZUL project, based on the concept of a common treatment facility for tannery effluents. Backed by several signatories of the 1987 agreement, including SEDUE, CICUR, CIATEC, and QCM, the proposal involved relocating all wet blue production away from León to a large, common plant in the neighboring municipality of San Francisco del Rincón. The plant would segregate and separately treat the various tanning effluent lines with state-of-the-art facilities, allowing treated wastewater to be re-used for irrigation. By 1991, construction of the plant was 80% complete.

While this achievement could be interpreted as a positive flow-through effect of the 1987 agreement, the ECO-AZUL project failed too and was abandoned in 1991, for three reasons. First, most tanneries had no interest in relocating. In addition, farmers in San Francicso del Rincón were concerned about the potential hazards of irrigating their fields with treated wastewater. Finally, the residents of San Francisco del Rincón strongly

opposed locating a large new tannery in their municipality and staged a number of protests. Ultimately, the city's leadership withdrew its support and the project died (Oliverio 2002).

4.2. Second agreement: 1991

The second agreement's purpose was to resurrect efforts to control tannery pollution after four years of inaction and the failure of the ECO-AZUL project: its preamble stated explicitly the need to "determine the actions necessary to follow up on the first agreement" given that there had been so far "no significant advances".

4.2.1. Basic features and objectives of the 1991 (second) agreement

Signed on October 24 1991, the agreement brought together a shorter and different list of participants. New participants included the *Comisión Nacional del Agua* (CNA, the federal water authority created in 1989) and two state government departments: Health and Social Security, and Development and Public Works. Signatories to the first agreement who did not participate in the second one included the federal health department, the municipal governments of San Francisco del Rincón and Purísima del Rincón, QCM, CIATEC, AQTCL and the *Universidad de Guanajuato*. The agreement's substantive objectives consisted of three sets of commitments:

1) ***Relocation and in-house effluents abatement***.
CICUR and ANACU committed to have tanneries relocate wet-blue production away from the city to existing industrial-zoned areas or industrial parks or any other industrial park that would be authorized in the future, within five years and according to two options: a-relocation within a year, in which case tanneries would be given three years to comply with effluent standards; or b-delayed relocation, in which case tanneries would be given only one year to install the abatement equipment needed to comply with effluent standards.

3) ***Solid wastes disposal***.
CICUR and ANACU agreed to have tanneries pre-treat and dispose of sludge according to applicable regulations. Moreover tanners would present within 90 days a proposal for the construction of a disposal facility for fleshings.

4) ***Municipal wastewater treatment plant***.
SAPAL committed to design a municipal wastewater treatment plant within one year, and to build it within the following two years.

4.2.2. Effectiveness and efficiency mechanisms of the 1991 (second) agreement

The second agreement, like the first, suffered from a lack of compliance-inducing mechanisms for tanners, particularly with respect to relocation. First, tanners were meant to formally register with the municipality their intention to choose a relocation option within 30 days of the signing of the agreement, but no penalties were specified for those who did not. Second, the incentive to relocate promptly (two additional years to comply with effluent standards) was weak and difficult to evaluate, given that at the time of the signing of the agreement, standards applying to discharges into the sewer system had yet to be published. Third, while the agreement shifted the responsibility for solid waste disposal entirely onto tanners, authorities at that time had yet to publish the regulations for their management, as promised in the first agreement.

SAPAL's commitment to build a wastewater treatment plant signaled that authorities would at least undertake concrete action of their own. But at the time of the signing of the agreement though, federal authorities had not established standards applicable for discharges from sewer systems - meanwhile, SAPAL would obviously not be able to specify the design parameters of its plant, much less build it.

The second agreement improved efficiency-wise on the former by doing away with the adoption of specific in-house effluents abatement measures. The original SEDUE proposal to have tanneries relocate lox, stock and barrel, was also improved upon, by limiting relocation to wet-blue production. Nonetheless, the agreement did not contain any features that would have tended to minimize aggregate abatement cost.

4.2.3. Outcomes of the 1991 (second) agreement

Two years after the signing of the second agreement, authorities made progress towards fulfilling commitments they had contracted six years earlier with the *first agreement*. On October 19 1993, came into effect the first standard for non-domestic discharges into sewer systems: NOM-CCA-031-ECOL/1993 (DOF, 1993b). The standard applied to all industrial and service-sector sources, but proved unworkable and was never enforced, as explicitly recognized in the preamble of its successor, NOM-002-ECOL-1996 (DOF, 1998) - which only came into effect almost five years later. Also on October 19 1993, NOM-CCA-021-ECOL/1993 (DOF, 1993a) for discharges from the tanning industry into federal waters came into effect, replacing the earlier NTE-CCA-021/88 and introducing stricter concentrations limits for tanneries' discharges into federal waters.

In 1992 SAPAL emitted a request for tender for the construction of a wastewater treatment plant, but only awarded a contract in 1994, to the private German-Mexican firm ECOSYS III S.A. de C.V. (Naya, 1996); federal authorities at that time had yet to establish a standard for discharges from sewer systems into federal waters, so that the final design of the plant could obviously not proceed. The standard was finally published as NOM-067-ECOL-1994 (DOF, 1995) on January 6 1995. It established two sets of concentration limits: one for municipalities of less than 80,000 inhabitants, and another (much stricter) for those of more than 80,000 inhabitants. The standard did not cover any

metals or toxics such as sulfur or chrome, referring the matter to another standard, NOM-CCA-001-ECOL, which had been developed specifically for conventional thermal power plants. These arrangements proved so unsatisfactory that the standard was never enforced, and would be replaced by a new standard two years later. Therefore, more than three years after the signing of the second agreement, there was still no municipal wastewater treatment plant in sight.

Authorities not complying with their commitments certainly did nothing to motivate tanners who, pending the publication of relevant regulations, were making no progress towards wastes management (in particular, no disposal facility for fleshings was ever built). Finally, on October 22 1993, the *Instituto Nacional de Ecología* (INE, the federal environmental authority in charge of research and standard setting created in 1992) published the first federal regulation defining hazardous wastes, NOM-052-ECOL-1993 (DOF, 1993). The regulation identified hazardous wastes for 18 industries and 144 industrial processes: in the case of the tanning industry, *all* wastes from tanning as well as finishing were classified as hazardous, thus requiring special management. These management requirements, simultaneously published with the standard, meant that in the short-term and in the absence of local facilities, tanners would need to ship their sludge and all other wastes 700 kilometers away to Mina, Nuevo León – the nearest approved disposal facility. Nevertheless, this sledgehammer regulation also contained a provision (article 5.2) that allowed waste generators, on an individual basis, to have their hazardous wastes de-classified. The procedure for de-classification would presumably involve the presentation of laboratory tests establishing the wastes' characteristics, but this was not established in detail by the regulation – which only mentioned that the final decision would be according to the PROFEPA's "criteria". This produced much confusion and in the end the INE promised tanners to produce a special *Manual* laying down with finer detail the procedures for the classification and management of their various types of wastes (see 4.3.1.below).

Tanners were not relocating to the city's industrial parks, either. In the hope of luring tanneries away from the city, federal, state and municipal authorities authorized and provided seed capital in late 1992 for a new industrial park reserved exclusively for tanneries: the *Parque Industrial Ecológico de León* (PIEL) project. Like ECO-AZUL, the park would include segregated effluent lines and a sophisticated industrial wastewater treatment plant, and authorities planned on recouping their investment from the sale of lots to tanneries. By 1994, the only concrete action had been the purchase of a plot of unimproved agricultural south of the city (Oliverio 2002). By that time, efforts to control tannery pollution had stalled and the second agreement was moribund. The massive bird die-off at the Presa de la Silva bird die-off towards the end of 1994 (see 2.3 above) re-energized the process.

4.3. Third agreement: 1995

4.3.1. Basic features and objectives of the 1995 (third) agreement

On February 9 1995, at the height of the Presa de la Silva controversy, federal, state and municipal authorities, the tanners's associations and PIEL, created the *Programa de Saneamiento Integral del Río Turbio*, an initiative meant to jump start efforts to clean up tannery pollution in León (Oliverio 2002, CEC 1995). The commission in charge of the program met four times in spring and early summer to hammer out a third agreement: titled *Acta de la Quinta Sesión Ordinaria de la Comisión para el Saneamiento Integral del Río Turbio,* it was signed on June 16, 1995.

Signatories included several recently-created actors: at the federal level, the *Secretaría de Medio Ambiente, Recursos Naturales y Pesca* (SEMARNAP, the new environmental authority created in 1994) and its enforcement arm, the *Procuraduría Federal de Protección al Ambiente* (PROFEPA); at the state level, the *Comisión Estatal de Agua y Saneamiento de Guanajuato* (CEASG, the state water authority created in 1992); and at municipal level, the trust representing PIEL (see 4.2.3. above), and SAPAF (the water and sewerage authority of San Francisco del Rincón, created in 1992). The local delegation of the *Camára Nacional de la Industria de la Transformación* (CANACINTRA, one of the country's largest manufacturers association) also participated, representing León's other industries, in particular the footwear industry. The third agreement, larger and more complex than the previous two, consisted of four sets of substantive commitments:

1) ***Effluent standards***.
The CNA committed to establish specific standards for discharges into the Turbio river by June 30, 1995 (within two weeks of the signing of the agreement) and SAPAL agreed to comply regardless of the quality of the wastewater that would feed its wastewater treatment plant. State authorities committed to carry out the legal reforms necessary to empower water and sewerage boards to monitor and enforce standards for discharges into sewer systems. Municipal authorities committed to establish administrative systems and rates that would discourage the release of untreated non-domestic effluents into the sewer system. CANACINTRA, CICUR and ANACU committed to have their members comply with regulations.

2) ***Common industrial effluents treatment plants and relocation***.
León's municipal government and SAPAL jointly committed to construct and operate sewer mains and treatment plants for all industrial parks in León, except PIEL, which committed to build and begin operating its own treatment plant by July 1997. The municipality of León committed to guaranty the financing of PIEL's plant "subject to applicable authorizations and requisites", as well as to "support" the relocation of tanneries to the park.

3) ***Solid wastes***. SEMARNAP and state and municipal authorities jointly committed to determine final disposal sites for tanneries' wastes. CANACINTRA, CICUR and

ANACU committed to have their members register as solid waste generators with the INE, and tanners would comply with the guidelines of the *Manual* for the management of their wastes (see 4.2.3 above).

4) ***Municipal wastewater treatment plants***. SAPAL and the Municipality of León committed to building a municipal wastewater treatment plant, and SAPAF and the municipal governments of San Francisco del Rincón and Purísima del Rincón agreed to build a joint municipal wastewater treatment plant. Both plants were to be completed by June of 1996 and to begin operating by October 1996. The state committed to financially help municipalities' initiatives to treat municipal wastewaters.

4.3.2. Effectiveness and efficiency mechanisms of the 1995 (third) agreement

The third agreement presented a major innovation in comparison to the previous two agreements, by including industries other than tanneries. These industries had until then remained completely outside of the process, generating the belief that tanners were being unfairly singled out and picked on. Additionally, federal, state and municipal authorities assured tanners and other industries that the fulfillment of their commitments would be "monitored in a spirit of fairness", in order to alleviate fears that León was being put at a competitive disadvantage vis-à-vis the rest of the country (clause 2-d of the agreement).

The agreement re-took the second agreement's plan to have individual sources register with local authorities their choice of option for compliance with effluent standards. This time, SAPAL offered tanners an additional option apart from in-house abatement or relocation: the elimination of wet-blue production from their premises. Although the agreement again did not specify penalties for those who did not register, by early 1996, 500 industrial plants in León had completed the registration process, including 217 tanneries and 145 footwear factories (Naya, 1996). In the case of tanneries, about 50% opted for eliminating wet blue production, 45% for relocation, and only 5% to implement in-house abatement, either through effluent treatment or production process changes. This revealed that the majority of tanners perceived the costs of in-house abatement or relocation as prohibitive, and that important differences in perceived abatement costs existed within the industry. In contrast, two thirds of shoe factories chose as their option to implement significant process changes and not relocate. Given these differences within and between industries, authorities by offering more abatement options had improved efficiency over earlier agreements. Moreover, municipal authorities' commitment to establish rates that would discourage the release of untreated non-domestic effluents into the sewer system seemed like a step towards measures tending to equalize marginal abatement costs. The agreement however fell short of laying down any specific details on these rates.

The agreement did not clarify important technical and budgetary considerations. PIEL at the time was only a field with no infrastructure and thus did not offer tanneries a viable relocation option. The municipal government's commitment to "guaranty the financing" of PIEL's treatment plant left the question open as to where the funds would

come from, and did not cover all other necessary prior investments, such as an electricity supply. The agreement gave no details about the common treatment facilities SAPAL would build to service industrial parks: would they send partly treated water to the municipal wastewater treatment plant or discharge into the river? Moreover, it did not specify how SAPAL would find the resources for that project.

At the time of the signing of the third agreement, the INE had still not produced the *Manual*, complicating the implementation of wastes management solutions.

4.3.3. Outcomes of the 1995 (third) agreement

The CNA's commitment to produce a specific standard for the Turbio river had a legal basis in Article 5.2 of standard NOM-067-ECOL-1994 (see 4.2.3 above), which established the concept of "specific discharge standards" for *particular water bodies*. This allowed the CNA to introduce those as a stop gap measure for León's discharges into the Turbio, meanwhile a successor to the unworkable general standard was being developed. The specific standard proved irrelevant however with respect to León's commitment to build a wastewater treatment plant. On January 6 1997, the new standard for discharges into federal waters came into effect: NOM-001-ECOL-1996 (DOF, 1997). Covering all types of discharges, it replaced all previous source-specific standards, such as the NOM-067-ECOL-1994 for municipal sewer discharges into federal waters and NOM-CCA-021-ECOL/1993 for tanning industry discharges into federal waters. It gave all municipalities of more than 50,000 inhabitants (such as León) until January 1 2000 to comply, i.e. to build a wastewater treatment plant, and all industrial sources at least until January 1 2000 to comply, but possibly until January 1 2010 for those with relatively light loads of BOD and suspended solids in their effluents. As for standards for discharges into sewer systems, no replacement for the inadequate NOM-CCA-031-ECOL/1993 (see 4.2.3 above) was introduced between the signing of the third and the following fourth agreement.

By the time of the signing of the next, fourth agreement, the INE had still not published the *Manual* for tanneries' solid wastes. In the meantime, CICUR and ANACU contracted in 1995 the American firm Metalclad Corporation to evaluate hazards from tanneries' wastes. According to CICUR's president at that time, Metalclad's report demonstrated that the vast majority of wastes generated by tanneries were non-hazardous and should therefore be de-classified (Dínamica de la Curtiduría, May 1996). The INE did not accept these results. In this atmosphere of uncertainty and confusion, waste management in the industry was of course not progressing.

Progress on improving and selling the land PIEL had acquired in 1994 was slow. The first lots were sold only in 1996, following the installation of a highway off ramp and access roads. By July 1997, PIEL had not constructed its treatment plant as agreed to in the agreement – which had already been superceded by the following fourth agreement of March 1997. By that time, SAPAL had not built its municipal wastewater treatment plant or the treatment plants for León's industrial parks, and the two other municipalities had not built their joint plant, either.

4.4. Fourth Agreement: 1997

4.4.1. General features and objectives of the 1997 (fourth) agreement

The fourth agreement, signed on March 7 1997, was the product of the same *Comisión* which has produced the third agreement. Titled "Convenio de Coordinación y Concertación", it stated once again the participants' aim to clean up the Turbio river and its watershed. Participants included several newcomers: the INE (SEMARNAP's research arm); two new state regulatory authorities (both recently created in 1996): the *Instituto de Ecología del Estado de Guanajuato* (IEEG, the state environmental authority) and the *Procuraduría de Protección al Ambiente del Estado de Guanajuato* (PPAEG, its enforcement arm); and the municipal government of Purisima del Rincón and its water and sewer authority (SAPAP, created in 1995). CANACINTRA this time around did not join the process. The 1997 agreement is more detailed and complex than any of the earlier ones; its 16 clauses and numerous sub-clauses however repeat many commitments contracted earlier. The agreement's substantive objectives consisted of five sets of commitments:

1) ***Effluents regulations***.
Authorities committed to finish promulgating effluents regulations. In particular, state authorities (again) agreed to undertake the legal reforms needed to empower municipalities to monitor and enforce regulations on sewer system use; municipalities agreed to formulate these regulations within 180 days and to establish "administrative and rates policies that give an incentive for the treatment of non-domestic discharges into the sewer system", as well as "differentiated wastewater treatment rates" for industry. SAPAL committed to comply with federal regulations on discharges from municipal sewer systems NOM-001-ECOL-1996, irrespective of the quality of the wastewater fed to its municipal wastewater treatment plant.

2) ***Solid wastes regulations***.
The INE committed to produce, jointly with the IEEG and tanners, the *Manual* for the management of their solid wastes, within 30 days of the signing of the agreement. CICUR and ANACU agreed to have their members submit to INE within 30 days of the completion of the *Manual* their plans for the storage, treatment or disposal of hazardous wastes. Tanners however would have the option to challenge the classification of their wastes on an individual basis, based on results from approved laboratories.

3) ***Solid waste disposal***.
The State and INE committed to "promoting the creation" of a center for disposal of industrial solid and hazardous wastes within three months.

4) ***Common industrial effluents treatment plants and relocation***.
SAPAL committed to build three sets of sewer mains to separately collect salty, sulfuric and chromic wastewaters from industrial parks, as well as a specialized treatment plant for each of these effluent lines, and to have the whole system operating by July 1 1999; tanners would contribute financially through the payment of "contributory charges", and

the municipality would grant a 40 hectare block in the industrial park *Ciudad Industrial* for the construction of the salty wastewater treatment plant. CICUR and ANACU committed to have their members register with SAPAL their chosen option for compliance, either: (i) stop producing wet blues within one year (although they could petition PROFEPA to extend the deadline by a year), (ii) relocate to industrial parks with two years, or (iii) install the abatement equipment needed to meet SAPAL's forthcoming standards for discharges in the sewers. PIEL committed to finish the minimum infrastructure necessary for relocation within 90 days of receiving the necessary funds from the state.

5) ***Municipal wastewaters treatment plant***.
The municipality of León and SAPAL committed to have their plant come on-line by January 1 1998; San Francisco del Rincón and Purísima del Rincón committed to have a joint plant operating by the end of 1997.

4.4.2. Effectiveness and efficiency mechanisms of the 1997 (fourth) agreement

The fourth agreement contained some provisions meant to promote compliance. First, for the first time individual tanners were invited to join the agreement – but were only given 30 days from the signing to do so. The incentive to join consisted in the commitment contracted by both the PROFEPA and the PPAEG, to consider adhesion to the agreement as an "attenuating circumstance" when carrying plant inspections, i.e. enforcement would be less stringent for joiners – but no explicit penalties were specified for those who did not join.

Second, the agreement included for the first time a compliance instrument with legal foundations. The *Instructivo para la presentación, vigilancia y seguimiento de programas de acciones para mejorar la calidad de las aguas residuales* (DOF, 1997b), published by SEMARNAP and CNA a few days before the signing of the agreement, established that sources not in compliance with standards for discharges into federal waters could gain exemption from fines by registering with the CNA a plan for improving the quality of their effluents, using a form called *Compromiso de Saneamiento Ambiental*. For SAPAL however that meant nothing, since at that time it had already been granted a waiver for compliance until 2000 (see 4.3.2 above); as for the tannery industry, the initiative also meant little, since a very small percentage of tanners discharged into federal waters – a grand total of 52 plants, as explicitly mentioned in the agreement.

The agreement improved somewhat the determination of budgetary matters, by specifying that the state government would support municipal wastewater treatment initiatives with resources from Ramo 00026 – a specific budget line item for federal transfers to states. The agreement again assigned the responsibility of shared industrial effluent treatment plants and associated infrastructure to SAPAL and specified the technical aspects the previous agreement had left in blank – but did not establish the extent of tanners' "contributory charges" towards the building of these facilities. Most importantly, although relocating tanneries to industrial parks continued to be the centerpiece of the clean-up strategy, it was still not clear who would pay for the

relocation expenses – as the state and municipal governments, SAPAL and PIEL had all committed to "supporting" relocation with no indication of whether that included a financial component.

4.4.3 Outcomes of the 1997 (fourth) agreement

Making good on its commitment to produce regulations on the use of its sewer system, albeit six months after the period agreed to, the municipal government of León on February 3 1998 published the *Reglamento de Uso de la Red de Alcantarillado de León, Gto*. (POEG, 1998a). The regulation applied to all non-domestic effluents and designated SAPAL as the enforcement agency. It established maximum allowed limits for various effluent characteristics, including metal concentrations, and gave all sources until January 1 1999 to comply. Four months later, on June 3 1998, the federal standard for non-domestic discharges into sewer systems, NOM-002-ECOL-1996 (DOF, 1998) finally came into effect, in replacement of the earlier NOM-CCA-031-ECOL/1993, explicitly recognized as unworkable for "technical reasons" in the preamble of the new standard. The standard gave local authorities wide latitude in fixing their own standards; obviously, by then the federal authorities' priority was with standards on sewer system discharges into federal waters (NOM-001-ECOL-1996, see 4.3.3. above).

The project of dedicated sewer lines and treatment plants for industrial effluents never went ahead, but SAPAL's municipal wastewaters treatment plant did come on-line right at the time of the agreement's expiry in November 2000, almost two years behind the fourth agreement's timetable and 10 months after the expiry of the waiver for compliance with standards applicable to discharges into federal waters (see 4.3.2. above). The plant provides primary treatment (settling ponds) and secondary treatment (airing tanks) for all of the city's wastewaters, domestic and industrial. The plant was not designed to treat industrial wastewaters and whether its discharges comply with federal standards is not known: data on the characteristics of treated wastewater will not be made available neither by SAPAL or ECOSYS III, the plant's operator. By the time of the expiry of the agreement, no progress at all had been registered at PIEL, which still lacked an electricity supply (El Heraldo de León, 12 April 1999).

The long-awaited *Manual* for tanneries' solid wastes finally became available nine months after the signing of the agreement (versus the promised 30 days), and only in as a draft preliminary version - the official edition, the *Manual para el Manejo Integral de Residuos Sólidos de Tenería*, was only published two years later in November 1999 (INE, 1999). The *Manual* laid out a series of recommendations for the management of chemical inputs and wastes by step of the tanning process, but in no way resolved the issue of waste classification. In particular, it said nothing about sludge, apart from mentioning that tanneries needed to have sedimentation tanks, clean these periodically and treat the contents according to "specific procedures", which were not specified in the document. In 1999, the director of the state's environmental authority publicly admitted that less than 2% of hazardous wastes generated within the state were disposed of according to federal regulations (El Heraldo de León, February 7 1999). In February 1999, the CICUR membership voted in favor of building a disposal facility for their

sludge (El Heraldo de León, Febrauary 12 1999). The dump eventually opened in 2000 but without any storage or treatment infrastructure to provide protection against soil and groundwater contamination (Correo de Hoy, May 30 2000).

5. León's experience with voluntary agreements: some specific and general conclusions

How can we interpret the experience of the voluntary agreements in León, and what does it teach us about of such policy instruments for developing countries?

The previous section showed that for each agreement, both authorities and tanners repeatedly failed to comply with their respective commitments. In fact, the whole 13-year process produced little more than a business-as-usual scenario for tanneries: sedimentation tanks use became generalized, but the costly problems occasioned by the uncontrolled release of solids into the sewer system needed to be solved by the municipality, irrespective of the agreements' much wider goals; the use of "clean" technologies in the industry expanded, but on the basis of economic consideration exogenous to the agreements. Tanneries made very little or no progress on any of the specific pollution control initiatives contemplated by the agreements: in-house or common effluents treatment, relocation, and solid waste disposal. In terms of industry abatement, the agreements were a near complete failure.

The poor design of each agreement provides an immediate explanation for that failure. In particular, the lack of compliance-inducing mechanisms for industry, either in the form of inducements, or credible threats of punishment, practically guaranteed the non-effectiveness of the agreement. Nevertheless, we suggest that mechanism design failure is more symptom than cause, and that the truly interesting issue has to do with the identification of the factors that lead to the agreements' poor design in the first place.

Since voluntary agreements result from negotiation, power relations between participants ought to bear on the final product's design - and tanners do represent a politically powerful entity. Historically, León's tanning industry has produced mayors, senior municipal and state public servants, and even state governors. Within the agreements process, tanners' successful resistance to relocation illustrates clearly their great weight in municipal politics. As shown in the previous section, both tanners and local authorities initially rejected relocation, and this centerpiece of federal authorities' plans for the industry ever since *before* the start of the agreements process did not even appear in the first agreement. The proposal did resurface in the following three agreements, but the municipality never introduced (or even threatened to) the coercive measures that would have been required to force relocation: zoning laws, which are a municipal prerogative according to the Mexican constitution. The last edition of municipal zoning laws published during the agreements process, the *Reglamento de Zonificación y Usos del Suelo de León, Guanajuato* (POEG, 1998b) enshrined the existing patchwork of land uses and made no explicit references to tanneries. Neither did the municipality (or the state) offer any significant inducements for relocation, beyond the half-hearted and insufficient measures to promote the PIEL project.

Citizens' complacency has aided and abetted tanneries' resistance to relocation, and justified the municipality's soft hand on the issue. The following anecdote amply illustrates this: in the fall of 2002, a nuisance complaint against 22 tanneries operating in a working-class neighborhood of León was presented to the municipal government. In response, the municipality organized a referendum on a proposal to forcibly relocate the tanneries: 8 resident families voted in favor, and 188 voted against. The land use permits held by the tanneries were therefore re-confirmed, and the neighborhood's delegate applauded the decision, arguing that tanneries provide important economic benefits to residents (Correo de Hoy, 2002).

Tanneries are profit-maximizing agents in the business of tanning hides, not producing public goods such as abatement. Therefore, we should fully expect tanners to use all available tools at their disposal, including political leverage, in order to avoid the costs of public good production. That they were so successful at achieving their cost-minimizing goals only points to one fact: the weakness of authorities. This weakness, in the end, is the fundamental factor that explains the poor design of the agreements and the failure of the whole process.

The agreements themselves reflect that weakness. First, the roll call of participants on the authorities' side signals a great deal of instability, with new actors appearing and others disappearing throughout the process. Second, the repeated inability of authorities to produce regulations promised in the agreements within the time frames agreed to, and the inadequacy of the eventual products, reveal severe institutional deficiencies. It is however impossible to understand the underlying causes of those weaknesses by focusing strictly on the agreement process, as they were the product of much larger, external circumstances. At the beginning of the agreements process in 1987, environmental policy in Mexico was barely nascent and the tools to apply it, practically inexistent. Throughout the agreements process, the federal government was slowly building up a tool box of laws, regulations, and institutions necessary for environmental policy. The limited effectiveness of the apparatus therefore comes as no surprise.

Be that as it may, León's experience suggests some important general conclusions about voluntary agreements as environmental policy instruments. First, our case study demonstrates that polluters do not willingly abate – a rather obvious point, but worth re-stating in order to inform the debate on voluntary agreements. Voluntary agreements therefore will only be effective to the extent that they obligate and/or motivate polluters, just as any other policy instrument. Second, the available evidence indicates that in developed countries, voluntary agreements tend to be ineffective and plagued by regulatory capture, despite these countries' sophisticated and long-established environmental authorities – again, reflecting the basic fact that sources will not willingly internalize external costs. Our case study demonstrates that these problems are compounded in a developing country context by the weakness of environmental authorities. Third, for the case at hand, we suggest that the time and resources spent in producing the agreements would have been better invested in fulfilling the necessary preconditions for carrying out an effective environmental policy, i.e. adequate laws, regulations and institutions.

References

Arora, S. 2001. Voluntary Abatement and Market Value: an Event Study Approach. Discussion Paper No. 00-30. Stanford Institute for Economic Policy Research.

Bartone, C. R. and L. Benavides. 1997. Local management of hazardous waste from small-scale and cottage industries. *Waste Management and Research* 15. UN/World Bank Urban Management Programme: Washington, DC.

Blackman A. and A. Kildegaard. 2002. Clean technological change in developing country industrial clusters: Mexican leather tanneries. Discussion Paper 03-12. Resources for the Future: Washington, DC.

Blackman, A. and J. Boyd. 2002. Tailored regulation: Will Site-Specific Environmental Regulation Improve Welfare? *Southern Economic Journal* 69(2): 309-326.

CIATEC (Centro de Investigación y Asesoría Tecnológica en Cuero y Calzado). 2000. Directorio de industria del curtido. January, León, Gto.

CIATEC (Centro de Investigación y Asesoría Tecnológica en Cuero y Calzado). 1996. Apéndice ecológico para la industria del cuero, León, Gto.

CEASG (Comisión Estatal de Agua y Saneamiento de Guanajuato). 1999. Diagnóstico de la Situación Hidráulica del Estado de Guanajuato y Estrategia en Materia de Agua. Gto., Gto.

CEC (Commission for Environmental Cooperation). 1995. CEC Secretariat Report on the Death of Migratory birds at the Silva Reservoir (1994-95). CEC: Oaxaca Mexico.

Correo de Hoy. 2000. Autoridades federales interpondrán demanda penal contra CICUR. Guanajuato. May 21, 19.

Correo de Hoy. 2000. Aún no concluye la primera etapa del parque de lodos. Guanajuato. May 30, 21.

Correo de Hoy. 2002. Permite Cabildo uso de suelo a tenerías instaladas en colonia La Piscina. Guanajuato. December 5, p.19.

Development Research Group, World Bank. 1999. Greening Industry: New Roles for Communities, Markets, and Governments. New York: Oxford University Press.

DOF (Diario Oficial de la Federación). 1988. Acuerdo por el cual se expide la Norma Técnica Ecológica NTE-CCA-021/88. August 4, pp.15-17.

DOF (Diario Oficial de la Federación). 1993a. Norma Oficial Mexicana NOM-CCA-021 ECOL/1993. October 18, Section 2, pp.71-74.

DOF (Diario Oficial de la Federación). 1993b. Norma Oficial Mexicana NOM-CCA-031-ECOL/1993. October 18, Section 2, pp.114-119.

DOF (Diario Oficial de la Federación). 1993c. Norma Oficial Mexicana NOM-052-ECOL-1993. October 22, XXX

DOF (Diario Oficial de la Federación). 1995. Norma Oficial Mexicana NOM-067-ECOL-1994. January 6, pp. 9-13.

DOF (Diario Oficial de la Federación). 1997a. Norma Oficial Mexicana NOM-001-ECOL-1996. January 6, pp.XXX.

DOF (Diario Oficial de la Federación). 1997b. Instructivo para la presentación, vigilancia y seguimiento de programas de acciones para mejorar la calidad de las aguas residuales. February 25, Section 1, pp.9-14.

DOF (Diario Oficial de la Federación). 1998. Norma Oficial Mexicana NOM-002-ECOL-1996. June 3.

Dinámica de la Curtiduría. 1996. Untiltled. *Dínamica de la Curtiduría*. May, No. 65, p.5.

El Economista. 2003. Ofrece QCM solución al caso Cromatos de México. November 4, p.52.

El Heraldo de León. 1999. El 2% de residuos tóxicos van a un confinamiento. February 7, p.5.

El Heraldo de León. 1999. Curtidores aceptan propuesta del parque temporal de lodos para confinar residuos. February 12, p.9.

El Heraldo de León. 1999. La crisis frena la compra de terrenos en el Parque Industrial Ecológico. April 12, p.7.

El Nacional. 1987. No representan Peligro los Residuos de Cromo en el Agua. April 17, p.3.

El Nacional. 1987. Deberán Reubicarse los Curtidores de León. April 21, p.3.

El Nacional. 1987. Reubicarán todas las Curtidurías Leonesas. April 24, p.1.

El Nacional. 1987. Rotunda Negativa de los Curtidores a Reubicarse. April 27, p.3.

El Nacional. 1987a. Podría Salir de León Sólo la Parte Contaminante de la Curtiduría. May 5, p.4.

El Nacional. 1987b. Falso que la Industria Curtidora Provoque Escasez de Agua: Sapal. May 5, p.3.

Hernández, J. 1987. Situación actual del problema de contaminación en la región. *Calzatecnia* 9. CIATEC: León, Guanajuato.

Hernández, M. 2002. Director de Verificación Normativa, Procuraduría de Protección al Ambiente del Estado de Guanajuato. Personal Interview with Allen Blackman and Nicolas Sisto, May 29. Guanajuato, Gto.

INE (Instituto Nacional de Ecología), Dirección General de Gestión e Información Ambiental. 1996. *Manual de estimación de emisiones, prevención de la contaminación y normatividad ambiental para la industria del curtido y acabado de cuero y pieles sin depilar*. INE: México, D.F.

INE (Instituto Nacional de Ecología), Dirección General de Materiales, Residuos y Actividades Riesgosas. 1999. Manual de Procedimientos para el Manejo Adecuado de los Residuos Sólidos de la Curtiduría. INE: México, D.F.

INEGI (Instituto Nacional de Estadística Geografía e Informática). 2001. *Anuario Estadístico del Estado de Guanajuato*. Available electronically on INEGI/INFO at www.inegi.gob.mx

King, A.A. and M. J. Lennox. 2001. Does it Really Pay to be Green? An Empirical Study of Firm Environmental and Financial Performance. *Journal of Industrial Ecology* 5 (1).

Konar, S. and M.A. Cohen. 2001. Does the market value environmental performance? *The Review of Economics and Statistics* 83 (2): 281-289.

Maldonado Vega, M. et al. 2001. Evaluación de dos tipos de composta aplicados en lodos. Working Paper, Universidad Tecnológica de León and Instituto de Ciencias Agrícolas.

Maxwell, J, T. Lyon, and S. Hackett. 2000. Self-regulation and social welfare: The political economy of corporate environmentalism. *Journal of Law and Economics* 43(2): 583-617.

Naya Reynaud, S. 1996. Proyecto de Saneamiento de Aguas Residuales Domésticas e Industriales de la Ciudad de León, Guanajuato. *Dinámica de la Curtiduría* 62: 9-10.

Oliverio Pantoja, C. 2002. Director, Tecnología Ambiental, Universidad Tecnológica de León. Personal Interview with Allen Blackman and Nicolas Sisto, May 30. Guanajuato, Gto.

OECD (Organization for Economic Cooperation and Development). 1998. Environmental performance review for Mexico. Paris.

OECD (Organization for Economic Cooperation and Development). 2003. Voluntary Environmental Approaches for Environmental Policy: Effectiveness, Efficiency and Usage in Policy Mixes. Paris.

Oyarvides, A. 2002. Former Director Guanajuato Delegado PROFEPA. Personal communication with Allen Blackman and Nicolas Sisto. May 31, 2002.

POEG (Periódico Oficial del Estado de Guanajuato). 1998a. Presidencia Municipal – León Gto: Reglamento de Uso de la Red de Alcantarillado de León, Gto. February 3, no.10, Part II, p.1006-1024.

POEG (Periódico Oficial del Estado de Guanajuato). 1998b. Presidencia Municipal – León Gto: Reglamento de Zonificación y Usos del Suelo del Municipio de León, Gto. February 3, no.10, Part III, pp.1034-

PROFEPA (Procuraduría Federal de Protección al Ambiente), Subprocuraduría de Auditoria Ambiental, Delegación Guanajuato, 1997. Caracterización Detallada de un Sitio Abandonado con Residuos Peligrosos, ubicado en el Ejido de Pompas, en el municipio de León, Gto.

Resources for the Future and Universidad de Guanajuato. 2000. Encuesta aplicada a los curtidores de León, Guanajuato.

Segerson, K. and T. Miceli. 1998. Voluntary environmental agreements: Good or bad news for environmental protection?" *Journal of Environmental Economics and Management* 36: 109-130.

Villalobos, J. L. 1999. Subprocurador de Verificación Normativa, Procuraduría de Protección al Ambiente del Estado de Guanajuato (PPAEG). Personal communication with Allen Blackman. Gto., Gto.

Webster, P. M. Burton, and E. Mestre. 2002. Managing water transition in the Lerma-Chapala Basin, Mexico. International Water Management Institute.

Appendix: Tables.

Table 1. Size distribution of a sample of 164 formal tanneries in León

Size	**Survey sample**	
(no. employees)	% all firms	Cum. %
1 - 2	7	12
3 - 5	27	39
6 - 10	27	66
11 - 15	10	77
16 - 20	7	82
21 - 30	7	90
31 - 50	5	95
51 - 100	4	98
101 - 250	1	99
251 - 500	1	100
Total	100	100

(Source: RFF/U. de Guanajuato Survey; CICUR)

Table 2. Tannery effluents characteristics

Pollutant	**Wastewater characteristics for a typical tannery by stage** (mg/l except sediments = ml/l)				
	Rinsing	*De-hairing*	*Tanning*	*Other*	*All*[b]
COD	12,500[a]	26,000	6,000	5,000	18,611
BOD	5,000[a]	14,000[a]	3,000	3,000	5,141
Susp. particles	6,000	10,000	1,310[a]	3,000	--
Sediments	22.5[a]	75	30[a]	60	295
Dissolved solids	60,000[a]	20.5[a]	70,000	8,000[a]	29,382
Chlorides	25,000	--	--	--	--
Grease & oils	180[a]	790[a]	119[a]	77[a]	2,788
Detergents	40	150	40	40	--
Sulfurs	--	22.5[a]	--	5	459
Chromium	--	--	4,000[a]	80[a]	236

[a]Midpoint of range in original table;
[b]Weighted average for all four stages;
Sources: CIATEC 1996: p.12.

Table 3. Tannery sludge characteristics

Substance	Quantity
Water (%)	85.31
Ash (%)	9.33
Chromium – total (g/g)	0.012
Chromium VI (μg/g)	503.61
Organic matter (%)	3.18
Carbon (%)	26.54
Oils and greases (%)	8.54
Sulfurs (g/kg)	4.32
Nitrogen (%)	2.14
Phosphorus (%)	0.031

(Source: Maldonado Vega et al. 2001)