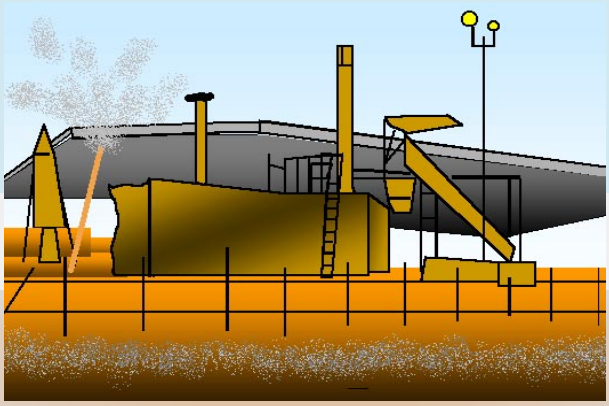
HAZARDOUS WASTE INCINERATION AND COMBUSTION: A TABASCO CASE STUDY

English Summary Document



Asociación Ecológica Santo Tomás A. C.

English Summary: Cyrus Reed, Oliver Bernstein, Texas Center for Policy Studies

Spanish Document: José Manuel Arias Rodríguez and Elías Sánchez Pérez Asociación Ecológica Santo Tomás, A.C.

Editing: Marisa Jacott, Fronteras Comunes

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INTRODUCTION

Between 1994 and 2000, the number of facilities with authorization to store, transport, treat, burn, recycle, reuse or dispose of hazardous wastes in Mexico increased from approximately 140 to nearly 520. Of particular note has been the exponential growth of various types of incineration facilities, including cement plants that burn hazardous wastes, medical waste incinerators, hazardous waste incinerators and the thermal "treatment" of contaminated soils. In fact, in the same time period the number of facilities engaged in these practices increased from less than 10 to more than 50.

This trend raises two questions. First is whether the increased incineration has the potential to result in a net increase in the quantity of pollutants released into the environment through the burning of hazardous materials. What are the consequences of this burning of hazardous wastes in terms of air, water and soil contamination, particularly from persistent, organic pollutants such as dioxins and furans?

The second question relates to the proliferation of these disposal facilities *in Mexico.* What has spurred this impressive growth since 1994? After signing the North American Free Trade Agreement (NAFTA) with the United States and Canada in 1994, Mexico's industrial growth certainly began yielding greater quantities of hazardous wastes that needed to be managed. This industrial growth alone cannot explain all of these new facilities, however. Could it be that certain aspects of Mexico's environmental regulation or enforcement programs help explain the apparently thriving incineration industry throughout the country? It is often difficult to answer these questions in Mexico due to the lack of accurate, public information concerning hazardous waste generation and treatment.

This brief summary highlights a new report published recently in Spanish on the growth of incineration facilities in one Mexican state – Tabasco. The report examines trends in Tabasco, potential links to NAFTA and the Mexican regulatory context, all with a view toward the impacts of hazardous waste incineration on human health and the environment.[1]

[1] This brief English summary of the full report entitled, *Tratadoras Térmicas de Residuos Peligrosos: Caso Tabasco*, was prepared by Cyrus Reed and Oliver Bernstein and was produced by the Asociación Ecológica Santo Tomás A.C., Fronteras Comunes, La Neta:Proyecto Emisiones and the Texas Center for Policy Studies. To request a copy of the original report, which contains full citations and is available only in Spanish, see last page.

HAZARDOUS WASTE INCINERATION AND COMBUSTION

The United States Environmental Protection Agency defines hazardous wastes as "by-products of society that can pose a substantial or potential hazard to human health or the environment when improperly managed."[2] Hazardous wastes usually possess at least one of four characteristics – ignitability, corrosivity, reactivity, or toxicity – and they can originate from a number of sources (domestic, industrial, agricultural or medical). As this report demonstrates, industrial hazardous waste generation in Mexico has increased dramatically since 1994. As Mexico's economy continues to industrialize, the country will have to manage its hazardous waste by using available technologies to miminize the amount of waste generated as well as minimize any negative effects on public health and the environment for those wastes which can not be eliminated.

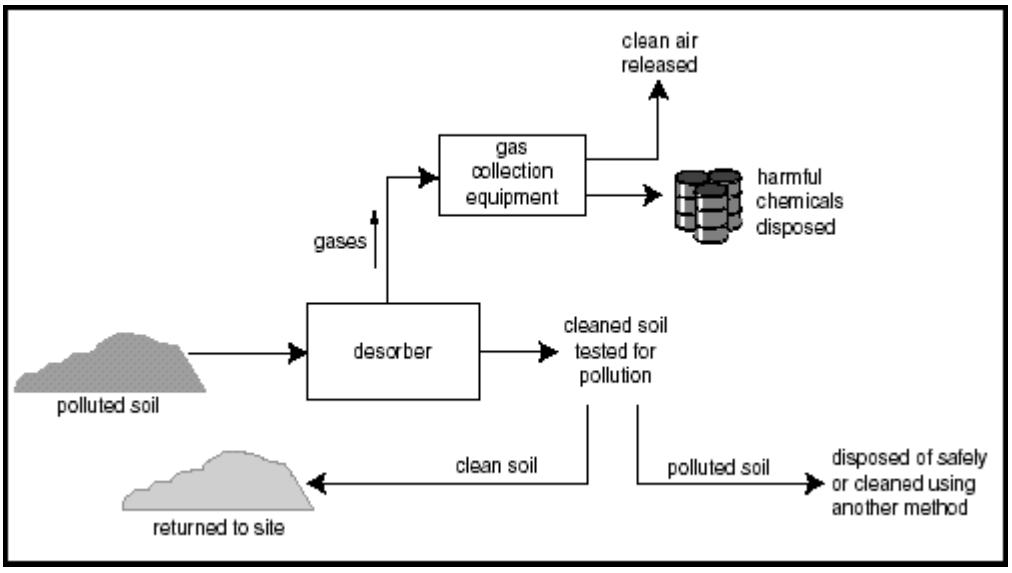
Current incineration technologies used for hazardous waste treatment and management in Mexico include incineration, thermal desorption and combustion in cement kilns. Increased incineration of hazardous wastes, however, especially if inadequately regulated, does have impacts on public health and the environment. While wastes may be dangerous to workers or immediate neighbors when confined in a barrel or dumped on an isolated desert ranch, incineration can spread air pollutants throughout the community on a daily basis.

Many of the pollutants associated with incineration processes, including heavy metals and dioxins and furans, can cause serious health problems. The exposure of a pregnant woman to lead, for instance, can jeopardize the development of the fetus and the neurological development of the child. Human exposure to cadmium can negatively affect the kidneys, the liver and the lungs, and certain forms of cadmium may cause cancer. Exposure to mercury can cause permanent brain damage in humans as well as disorders of the nervous system. Beryllium and chromium, two heavy metals often present in the incineration process, are also suspected carcinogens.

In addition to the standard incineration of hazardous materials, thermal desorption is a technique used to treat contaminated soil by superheating it (see Figure 1) and capturing the released gases.[3] In theory, the toxic chemicals are removed, and the clean soil is returned to the site. Firms in both the United States and Mexico currently practice thermal desorption of contaminated soils.

[2] US EPA Terms of the Environment, http://www.epa.gov/OCEPAterms/hterms.html
[3] Information from US EPA, "A Citizen's Guide to Thermal Desorption," http://www.epa.gov/swertio1/download/citizens/citthermal.pdf

Figure 1. Thermal Desorption



Source: US EPA, " A Citizen's Guide to Thermal Desorption."

Experiences in the United States have shown that thermal desorption can have potentially dangerous consequences for both human and ecological well-being. This is not to say it is not a viable technology. It can be used safely and has been used successfully to treat contaminated soils at a number of Superfund sites. However, unlike incineration, which attempts to destroy pollutants, thermal desorption simply converts soil pollutants into gases for collection and treatment. While promoters claim that there are no toxic air emissions and that the soil and dust generated are rendered harmless, the technique has been found to produce low levels of dioxins and furans.[4] In many cases, soil treated by thermal desorption had to be retreated through traditional incineration. Treated soil is completely transformed and stripped of all organic material and microorganisms, thereby preventing the soil from hosting any vegetation.

The combustion of hazardous materials in cement kilns is another growing practice in both the United States and now in Mexico. By burning hazardous materials in the cement-making process instead of using more expensive fuels like natural gas, coal or fuel oil, the cement producers save large sums of money while also potentially earning money from hazardous waste generators for accepting their wastes. The downside of these savings is the elevated quantity of pollutants released into the environment through the burning of hazardous materials. In Mexico, authorities have been encouraging this type of combustion as a form of energy recycling.

Despite such encouragement, the incineration of hazardous wastes is a process that can seriously contaminate the environment and have permanent harmful effects on public health, especially in the presence of compound organic substances. Studies show that the

[4] US EPA. "Cost and Performance Report: Thermal Desorption at Superfund Sites." http://www.epa.gov/superfund.

incineration of hazardous wastes can generate toxic chemical substances that are even more dangerous than the ones that are incinerated:

> *Burning hazardous waste….releases heavy metals, unburned wastes, and products of incomplete combustion (PICs), i.e., new chemicals formed during the incineration process. [In addition,] metals are not destroyed during incineration and are often released in forms that are more dangerous than the original wastes.*[5]

HAZARDOUS WASTE INCINERATION AND COMBUSTION IN MEXICO

There is no complete and public inventory of the types or volume of hazardous wastes generated in Mexico. Although the National Institute of Ecology requires firms that generate and manage hazardous wastes to submit biannual accounts of their operations, only 30% of companies actually report to the government. The information that is available is often misleading, as evidenced by Table 1.

Table 1. Annual Hazardous Waste Generation in Mexico (tons)

Year	Tons
1991	5.292 million
1994	8 million
2000	3 million

Source: Ministry of the Environment and Natural Resources, Mexico (SEMARNAT). National Institute of Ecology (INE). *Segundo Informe Nacional de Emisiones y Transferencia de Contaminantes 1998-1999. Mexico. 2000*

While this data suggests that hazardous waste generation has decreased in Mexico, it is important to note that 1991 and 1994 numbers are based on estimates, while 2000 numbers are based upon what manufacturing industries were required to report. Based upon increased industrial activity between 1994 and 2000 in terms of the number of facilities and the amount of production, it is a near surety that in fact hazardous waste generation would have increased significantly in that period. Another indication of the likely growth in hazardous waste generation is the significant growth in the number of firms treating and storing hazardous wastes between 1994 and 2000. For example, the number of temporary storage firms rose from 60 to 342 during the six year period. In addition, the number of industrial plants that incinerate hazardous wastes as an “alternative fuel” grew

[5] Costner, Pat and Joe Thornton. *Playing with Fire: Hazardous Waste Incineration.* Second edition. 1993 Greenpeace.

from 4 to 26 in the same period.[6] Regardless of the scarce and inaccurate data that is publicly available, it is clear that the generation of hazardous wastes in Mexico is increasing, not decreasing.

Table 2. Facilities Authorized to Treat Hazardous Wastes in Mexico, 1994-2000

Type of Facility	No. of Facilities 1994	No. of Facilities 2000
Used Solvent Recyclers	17	29
Used Oil and Lubricant Recyclers	9	15
Temporary Storage, Transport	60	342
Metal Recycling	5	18
On-site Mobile Treatment	26	35
Petroleum Treatment Facilities	10	16
On-site Private Incinerators	2	9
Cement Kilns and other Industrial Furnaces Authorized to Burn Hazardous Wastes	4	26
PCB Treatment Facilities	1	6
Medical Waste Treatment Facilities, including incinerators	16	37
Hazardous Waste Landfills	4	2

Source *Informe de la Situación General en materia de Equilibrio Ecológico y Protección Al Ambiente 1993-1994.* SEDESOL, INE. México 1994 (p.252-255); and http://www.semarnat.gob.mx/dgmic/rpaar/rp/infraestructur/infraestructura.html; 2001.

Hazardous waste management in Mexico is governed by a series of laws, regulations and standards – called NOMs or Official Standards – that indicate how to operate hazardous waste facilities and manage hazardous wastes. Unfortunately, there are large gaps in the regulatory structure, and at present there are no NOMs for incineration, thermal desorption or cement kiln burning of hazardous wastes. Instead, federal regulators have instituted a cooperative agreement with the cement industry to allow burning through temporary authorizations and have authorized other incineration facilities on a case-by-case basis through limited trial burns. In the process, the public has been left out of these agreements.

Presently, several NOMs are being considered for adoption, including one which would – for the first time – set emission limits for hazardous waste incinerators, including limits on dioxin and furans. Unfortunately, these proposed limits would be roughly twice the

[6] *Informe de la Situación General en Materia de Equilibrio Ecológico y Protección Al Ambiente 1993-1994.* SEDESOL, INE. Mexico 1994 (p.252-255); 2001. http://www.semarnat.gob.mx/dgmic/rpaar/rp/infraestructura/infraestructura.html

proposed levels in the United States and five times the proposed levels in Europe. In addition, the proposal specifically excludes cement kilns and other industrial furnaces from having these limits apply to them, and would give incinerators presently operating up to three years to comply with even these requirements. Not surprisingly, this proposal has been criticized by major environmental organizations in Mexico for legitimizing incineration without sufficient controls of both air emissions and incinerator ash management. A new proposed law, on the other hand, supported by environmental organizations in Mexico would limit incineration by barring certain kinds of highly toxic wastes from being burned in incinerators or cement kilns. Thus, incineration of hazardous materials such as PVC plastics and other wastes which contain chlorine would be banned since these wastes can generate toxic air pollutants like dioxins and furans, pollutants that are more dangerous than the original hazardous materials themselves.

Table 3. Comparison of Proposed Maximum Emission Limits for Incinerators, Mexico, U.S. and European Union

Chemical	Unit of Measurement	Proposed Emission Limit, Mexico	Proposed Emission Limit, US	Proposed Emission Limit, European Union
Dioxin and Furans	Ng TEQ/cubic meters	0.5	0.2	0.1
Mercury	mg/m³	0.07	0.04	0.05
Cadmium	mg/m³	0.07	0.1 (includes lead)	0.05 (includes thalium)
All other metals	mg/m³	1.4	0.055 (only includes Arsenic, Antiminium, Chromium and Berilium)	0.5
Particulate Matter	mg/m³	50	35	10
Hydrogen Chloride	mg/m³	15	75	10
Sulfur Dioxide	mg/m³	80	NA	50
Carbon Monoxide	mg/m³	63	115	50

- Sources: SEMARNAT, PROY-NOM-098-ECOL-2000, Tabla 1; U.S. EPA, Proposed MACT Limits for Incinerators, U.S. Federal Registry, May 2, 1997; Michelle Allsopp, Pat Costner and Paul Johnston, *Incineration and Human Health – State of Knowledge of the Impacts of the Incinerators on Human Health*, Greenpeace Research Laboratories, University of Exeter, UK. March 2001, Table 5.1

Table 4. Official Mexican Standards (NOM's), Agreements and Laws Related to Hazardous Waste Incineration

Standard Number	Name	Status	Date	To Whom Does it Apply?
NOM-087-ECOL-1995	Requirements for separation, storage, labeling, transport, treatment and disposal of medical hazardous wastes.	Current	1995	Both auto-clave facilities and incinerators that treat medical waste considered hazardous, although does contain specific emission limits.
NOM-040-ECOL-1993	Maximum emission limits for particulate matter, as well control requirements for fugitive emissions, from cement manufacturing facilities.	Current	1993	Cement industry, including those that incinerate hazardous wastes, but only applies to particulate matter, not to other types of air emissions.
	Agreement between SEMARNAT, National Chamber of Cement and Cruz Azul Cooperative to Establish an Alernative Combustion Energy Recycling Program	Current	March 1996; Renewed in September of 2001	Authorizes the burning of hazardous wastes in cement kilns for periods of one year, following test burns, although it does not establish specific emission limits, which are instead set on case-by-case basis.
PROY-NOM-098-ECOL-2000	Environmental Protection, Incineration of Wastes, Operating Specifics and Emission limits for Contaminants.	Proposal in Federal Registry	2001, published for comments	Would apply to facilities incinerating hazardous wastes, but specifically excludes industrial furnaces including cement kilns
PROY-NOM-040-ECOL-2001	Hydraulic Cement Manufacturing – Maximum Emission Limits for Air Contaminants.	Proposal in Federal Registry	February, 2002, published for comment	Would apply new Emission Limits to Cement Industry, including those burning hazardous wastes
	General Law for Integrated Mangement and Prevention of Wastes	Being Considered in the Mexican Congress	Proposed in November 2001	Would among other measures prohibit the incineration of certain wastes, such as lubricants, electric batteries, PCBs, heavy metals and PVC plastics

While Mexican authorities have at least temporarily legitimized incineration and combustion as safer forms of hazardous material "recycling," several studies have shown that incineration is a process that can seriously pollute the environment and cause permanent harm to people's health. While Mexican law permits the importation of hazardous wastes for "recycling" purposes only, this provision causes significant quantities of hazardous waste – some 255,000 tons of it in 1999 according to Mexican officials – to enter Mexico from the United States. Presently, however, none of this waste is "recycled" in incineration facilities; instead, used batteries or electric arc dust containing zinc, lead and other metals are recycled in metal smelter and recycling facilities. There is concern, however, that in the future, Mexican authorities could permit the importation of solvents, thinners and used oils for "energy recycling" in cement kilns and other industrial furnaces.

HAZARDOUS WASTE INCINERATION AND COMBUSTION IN TABASCO

Located in Southeastern Mexico, the State of Tabasco has a population of 1,891,829, or 1.9 percent of the national total (2000). The manufacturing industry is the largest single contributor to Tabasco's economy, accounting for more than 20% of the regional GDP.[7] Much of this manufacturing industry is related to the exploration and production of gas and oil, which produces significant amounts of hazardous waste as a by-product. In the last few years, Tabasco has begun to examine and deal with this important environmental and public health issue.

Map 1. State of Tabasco, Mexico

Source: http://travelamap.com/mexico/tabasco.htm

[7] INEGI, http://tab.inegi.gob.mx/economia/espanol/agregada/agr_03.html

According to the National Institute of Ecology, 314 facilities in Tabasco reported producing a total of 134,096 tons of hazardous wastes in 2000, or 3.61 percent of the national total. In 1994, Mexican officials estimated that facilities in Tabasco produced 44,841 tons of hazardous waste, or 0.63 percent of the national total (see Table 5). It is important to note that the 2000 number is what firms actually reported generating, while the 1994 total is only an estimate. Still, given increased oil exploration and production in Tabasco – much of which was eventually exported to the U.S. -- it is not surprising to assume that hazardous waste generation has increased significantly since 1994.

Table 5. Hazardous Wastes Generated in Tabasco*

1994	44,841 tons
2000	134,096 tons

*1994 value is an estimate from Banco de Información Económica, http://dgchesyp.inegi.gob.mx/pubcoy/estamb/acthum/CIII35.html; 2000 value is the amount reported by companies to the National Institute of Ecology,

http://www.semarnat.gob.mx/dgmic/rpaar/rp/volumen/volumen.shtml

The petroleum industry accounts for the largest share of hazardous waste generation in Tabasco. PEMEX Oil Company, for example, generated 112,412 tons of hazardous wastes in 1999 and treated only 51.6% of this. Health care and other manufacturing industries, in contrast, treat an average of 60.3% and 99.4% of their wastes, respectively. The accumulation of hazardous wastes in the petroleum activity started to decline after 1998 when PEMEX – under a new policy -- began contracting firms to treat hazardous wastes.

Table 6. Hazardous Waste Generation by PEMEX Oil Company and Percentage Treated

Year	Volume in Tons	% Treated
1997	63,555	Not Reported
1998	77,234	44%
1999	112,412	51.6%

Source: Secretary of Environment, Natural Resources and Fishing (SEMARNAP), Federal Delegation, Tabasco. 2000; and *Five-Year Evaluation of Environmental Management*, 1995-1999. p. 27

In response to the increase in hazardous waste generation and the change in PEMEX policy, waste management firms opened new treatment facilities in Tabasco. Among the facilities opening in recent years include both incineration and thermal desorption – as well as the combustion of hazardous wastes in cement kilns. While there is very little public information available concerning hazardous waste *generation or treatment* in Tabasco, the growth in hazardous waste treatment facilities seems to indicate increased waste generation and treatment (Table 7).

Table 7. Number of Facilities Authorized to Treat Hazardous Wastes in Tabasco

Type and Year	Number of Facilities
Hazardous Waste Treatment Facilities, 1995	5
Hazardous Waste Treatment Facilities, 1998	26
Hazardous Waste Treatment Facilities, 1999	27
Collection and Transport of Hazardous Wastes; Bioremediation Treatment; Thermal Treatment (incineration or combustion) Hazardous Waste Landfill	10 7 4 1

Source: Federal Delegate to SEMARNAP in Tabasco, as cited in Reforma Newspaper, November of 2000.

FIELD WORK

The report investigated five facilities in the state of Tabasco that incinerate and combust hazardous materials (see Map 2).[8] Two plants – Residuos Industriales Multiquim (RIMSA) and Promotora Ambiental del Sureste (PASA) – practice thermal desorption. A third thermal desorption plant operated by CYGSA Servicios is awaiting construction. One firm (SIDESOLH) performs incineration of biohazardous hospital waste. The final facility (Cementos Apasco – Planta Macuspana) incinerates hazardous waste in its cement kilns as an "alternative fuel."

RIMSA replied to initial requests to visit the site but failed to respond to subsequent correspondence. PASA did not reply at all. The CYGSA site is in very preliminary stages of construction, and the APASCO plant was only willing to offer a guided tour of their facility. Most of the firms' owners were uncooperative, and very little information was available from government environmental agencies about their practices. SIDESOLH was the only exception, opening its doors and its incinerator to inspection.

Despite claims by regulators that no thermal desorption process could produce dioxin and furans as a byproduct, a single sample of dust from the RIMSA thermal desorption site was sent for this analysis to the University of Niigata, in Japan. Dr. Kaori Takise analyzed the sample and found traces of dioxins that – by their very presence – point to larger questions of environmental quality and public health.[iv] In Tabasco, environmental authorities indicate that some of the ashes from incinerated material have been authorized for use as fill in new construction, depending on the composition of the ashes. Much of the ash is sent to municipal landfills, which lack double liners and other standards required of industrial waste landfills. This ash is potentially contaminated with substances that can cause harm to the environment or to public health.

[8] The full report provides more detail on the operation and compliance of the five facilities mentioned in this section.

[iv] The one kg soil sample was taken in late 2000 from a truck carrying soil treated by thermal desorption at a RIMSA facility to a nearby municipal dump. The dioxin level was 0.0111162 ng toxicity equivalent (ng-TEQ/g).

Map 2. Location of Selected Hazardous Waste Incineration and Combustion Facilities in Tabasco

Name of Firm	Facility Location	Year Started	Type
SIDESOLH	Anacleto Canabal	2001	Hospital Waste
RIMSA	Anacleto Canabal, Municipio de Centro	1999	Thermal Desorption
PASA (1)	Anacleto Canabal	1998	Thermal Desorption
APASCO (2)	Macuspana	1999	Cement Kiln Burning of Hazardous Materials
CYGSA	Comalcalco	Awaiting Construction	Thermal Desorption

(1) PASA began operations as OSCA S.A. de CV. in 1998;

(2) The APASCO facility began operations in 1982 and started burning hazardous materials in 1999

LINKS BETWEEN NAFTA, INCINERATION, THE ENVIRONMENT AND PUBLIC HEALTH

The North American Free Trade Agreement (NAFTA) is neither the first nor the last step in the integration of the Mexican and United States economies, but it does represent the most important step in the process. Mexico began opening its borders in 1985 under the General Agreement on Tariffs and Trade (GATT), and the subsequent administrations have since worked to facilitate foreign investment, liberalize trade and reduce state regulatory intervention.

Environmental issues did not play a major role in early NAFTA negotiations. Presidents George Bush and Carlos Salinas de Gortari shared the vision that a North American trade bloc had little or nothing to do with environmental protection. It was only through pressure from environmental, labor and other civic organizations that the North American Agreement on Environmental Cooperation (NAAEC) and the Labor Side Accords became NAFTA side agreement.

The North American Commission on Environmental Cooperation, a result of the environmental side agreement, has been an important resource for both studying the links of trade and environment, helping governments work to identify issues and to bring to light complaints by citizens about the failure of governments to effectively enforce environmental laws.

While the CEC has been a new and important institution in the struggle to link trade with the environment, NAFTA is not an environmental agreement, but a free trade, or more accurately, a managed trade agreement designed to lower and eliminate tariffs, provide investor protection and eliminate “non-tariff” barriers, which in some cases could include environmental regulations. In fact, protection mechanisms for investors -- through NAFTA’s Chapter 11 – are considerably stronger than our mechanisms to ensure environmental protection and enforcement (see box in text).

During the NAFTA debate, however, supporters argued that the increased trade and investment likely to stem from the agreement, would translate into improvements in environmental regulations, investment and enforcement for three reasons:

- Economic integration would lead to an upward harmonization of environmental laws and regulations in Mexico;
- International competition and investment would help transfer clean technologies to improve quality, productivity and the environment;
- The growth in the economy would lead to more public and private monies invested in infrastructure, including environmental infrastructure;

Each of these claims is considered below.

NAFTA'S Chapter 11 and Hazardous Waste in Mexico

NAFTA sought to attract foreign investors to Mexico by giving them the same rights that Mexican investors have. The prioritization of free trade policies above other interests has made it more difficult to enforce environmental laws, due mostly to NAFTA's controversial Chapter 11. In this chapter, (Article 1102) it states that all investors from member nations must receive equal treatment from the country in which they are investing. Article 1110 of the Treaty declares, "no Party may directly or indirectly nationalize or expropriate an investment of an investor of another Party in its territory or take a measure tantamount to nationalization or expropriation of such an investment," with few exceptions. Under Article 1115, private investors can initiate an arbitration process against a national government if they claim that the government regulatory actions have unduly interfered with their business investment. If a country or state, through its actions, does expropriate an investment, then an arbitration panel may require the country at fault to compensate the investor for the lost investment. The hazardous waste management firm Metalclad has already used this arbitration process to its advantage. In 2000, a tribunal ordered Mexico to pay Metalclad $16.7 million in compensatory damages for the local and state government's role in preventing the firm from operating its hazardous waste landfill in San Luis Potosí. The state government had issued an ecological decree protecting an area that included the landfill site and the local government had refused to grant a land site permit. Without NAFTA, Metalclad would have had to protest the local regulations in a Mexican court. While NAFTA Chapter 11 "law" is still developing, early decisions such as Metalclad indicate the potential for Chapter 11 to be used to block or discourage government regulation, particularly of foreign investors.

Hazardous Waste Regulations and Enforcement since NAFTA in Mexico

The United States and some European countries have had to confront the direct relation between hazardous waste incineration, environmental contamination and public health. In recent years, the combination of strengthening environmental legislation and intense public opposition to incinerators has forced the closure or cancellation of many incinerators in developed countries. New environmental laws in the United States contributed to a reduction in the number of cement kilns burning hazardous waste though the practice continues.[9] There were 27 cement kilns in the United States burning hazardous waste in 1994 and only 18 in 2000, although the volume of waste treated nationwide has remained constant. Overall hazardous waste regulation has increased in the United States since NAFTA, while Mexico has approved only one standard relating to hazardous wastes since 1993, although a number of others have been proposed (see Table 4).[10]

[9] Marisa Jacott, Cyrus Reed and Mark Winfield. April 2001. *The Generation and Management of Hazardous Wastes and Transboundary Hazardous Waste Shipments between Mexico, Canada and the United States, 1990-2000* (Austin, Texas: TCPS), pp. 18 and 70.

[10] See Mexican norm, NOM-087-ECOL-1995, concerning biological-infectious waste.

More lenient environmental regulations in developing countries have encouraged incinerator producers to focus their efforts on developing nations. Companies that manufacture incinerators are currently concentrating their efforts in Asia, Africa and Latin America. Many residents of these regions are either unaware of the harmful health and environmental effects of incineration or have not yet organized against the facilities, while the governments have yet to develop a regulatory and inspection framework for such facilities. As detailed earlier in this report, such is the case in Mexico.

In addition to the regulations themselves being weaker in Mexico, the enforcement of the regulations that do exist appear to be inadequate. Although Mexico's environmental enforcement agency (PROFEPA) increased the number of inspectors and inspections of hazardous waste generation and treatment facilities between 1993 and 1996, these numbers have since declined.

Industrial Inspections and Compliance with Environmental Regulations, 1994-2001

Year	1994	1995	1996	1997	1998	1999	2000*(partial)	2001
Inspections	12,902	12,881	13,224	11,761	9,590	8,671	4,239	7,912
Without Violations (%)	20.6	27.6	25.1	20.6	21.7	20.2	20.9	22.6
Minor Violations (%)	75.7	70.3	72.9	77.4	76.7	78.1	77.0	75.4
Serious Violations (%)	4.1	2.1	1.9	2.0	1.6	1.7	2.1	2.0

Note: For 2000, data was only available for January-June.

Source: PROFEPA. *Índices de Cumplimiento de la Normatividad en* México, January 1999 and http://www.profepa.gob.mx

According to PROFEPA officials, there is less need for inspection now that many of the larger problems at manufacturing facilities have been resolved. In fact, however, environmental compliance at hazardous waste generation and management continues to be problematic. For example, a recent survey found that between 1999 and September of 2001, some 259 companies which manage hazardous wastes received an average compliance score of 43.9 percent, while some 1,165 manufacturing facilities and hospitals that generate hazardous wastes had an average complaince rating of 58.1 percent.[11] Government officials point out, however, that these low levels of compliance do not include companies and facilities that are taking advantage of a *self-auditing* program, whereby firms conduct internal investigations of their behaviors and work with the government to correct them. The self-audits began in 1992, but they have become increasingly popular recently through the participation of large firms, such as CEMEX, General Motors and PEMEX. In Tabasco, 107 firms began or finished environmental self-audits between 1992 and February 2002, including 96 PEMEX-related firms.[12] Although the program apparently shows signs of improving environmental practices in Mexico, critics protest the fact that

[11] PROFEPA, Information from Website (www.profepa.gob.mx). Indices de Cumplimiento de la Normatividad Ambiental en México.

[12] PROFEPA, Registro de Instalaciones al Programa Nacional de Auditoria Ambiental**,** http://www.profepa.gob.mx/saa/audita35.htm

results of the audits are not made public and that companies are not penalized for breaking the law among other issues.

One promising development is the recent passage of amendments to the main environmental law in Mexico, the LGEEPA, or "General Law on Ecological Equilibrium and Environmental Protection." These amendments include for the first time the requirement of an obligatory Pollutant Release and Transfer Registry (PRTR or RETC in Spanish), similar to the Toxic Release Inventory in the U.S.. The change will require manufacturing facilities and hazardous waste management facilities in Mexico to report toxic releases, air emissions, hazardous waste generation and wastewater discharges to a publicly accessible database. In the past, this reporting has been voluntary and few companies have participated. While the rules and regulations governing the new law are still being implemented, having publicly available data on pollution in Mexico is a positive step since NAFTA and a direct result of both pressure by civic organizations and by the Commission on Environmental Cooperation, created as a result of a NAFTA side agreement.

International Competition and Investment in Hazardous Waste Management Technology

The 1986 La Paz Agreement regulates the shipment of hazardous wastes between the United States and Mexico. According to the treaty, the United States will accept wastes generated by the maquiladora export industry in Mexico, as required by Mexican law, as long as the waste results from inputs imported from the U.S.. These hazardous wastes are mostly the result of inputs that the United States sends to Mexico for assembly. Most experts and governmental officials agree that only 10 to 20 percent of the waste generated in the maquiladora industry is actually exported to the U.S. despite these requirements. While Mexican maquiladoras and other manufacturing plants have increased exports of hazardous waste to the U.S over time, the amount is a tiny portion of the total waste managed in the U.S. In 1999, the Mexican government reported that its industry exported some 84,000 tons of hazardous waste, more than 50,000 of which came from maquiladora industries.[13]

Mexico, on the other hand, imports significantly more amounts of hazardous waste from the U.S. Under Mexican law, however, Mexico only allows the import of hazardous wastes from the United States *for "recycling", which thus far has conisted mainly of recycling lead batteries and extracting metals from electric arc furnace dust.* Between 1995 and 1999, hazardous waste imports from U.S. companies grew from 160,000 to 255,000 tons[14].

Where have these imports been going? Apparently to recycling facilities. Since 1994, there has been a tremendous growth in hazardous waste facilities authorized in Mexico, particularly in terms of recycling facilities, which includes metal recycling, solvent recycling and "energy" recycling such as that practiced in cement kilns (see Graph 1). So far, Mexican officials have not authorized imports for fuel blending or energy recovery.

It appears that at least part of this increase in management facilities can be explained by investments and technology transfer from the U.S. to Mexico. Over the last decade, the Mexican Ministry of the Environment and Natural Resources (SEMARNAT) has authorized 19 plants to prepare "alternative fuels," 26 plants in various industries including the cement

[13] US EPA, Binational Solid and Hazardous Waste Working Group, Border XXI, 2001.
[14] Ibid.

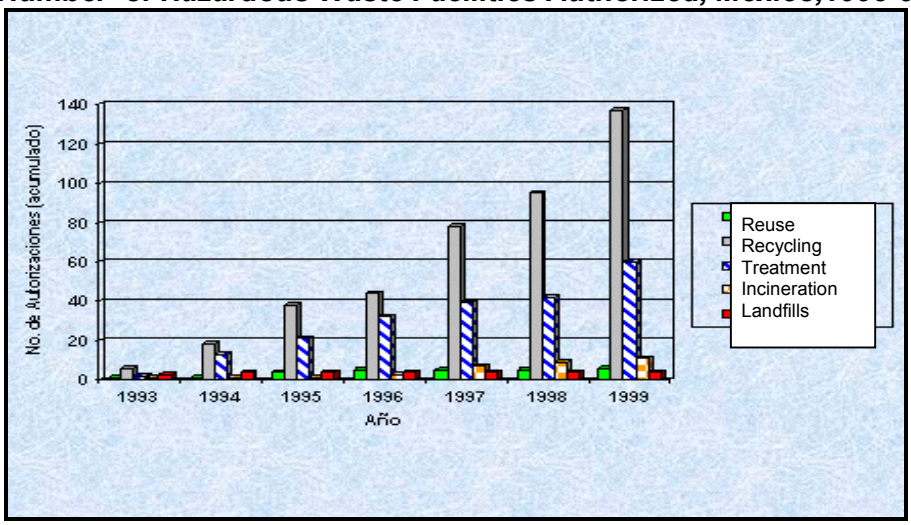
industry to burn the fuel, as well as 14 hazardous waste incinerators. The 26 hazardous waste burning industrial plants are Mexico-based, and they operate under a 1996 Mexican cement industry agreement – without specific standards -- to burn hazardous wastes in their cement kilns which was recently renewed in 2001. Nonetheless, the investment and technology to blend the fuels before they are burned are mostly foreign-based. A number of U.S. hazardous waste managemetn companies, including Mobley Environmental Management, BFI, and Safety Kleen, have been involved in hazardous waste projects in Mexico, to varying degrees, and more specifically in promoting the blending of hazardous wastes for burnign in cement kilns.[15] In Tabasco, RIMSA, which runs both a thermal desorption unit, and also is engaged in fuel blending and landfilling in Northern Mexico, has received substantial technical input from Waste Management, Inc. of the United States. Similarly, PASA/ONYX received its technology for its thermal desorption from a firm in Houston.

Thus, since NAFTA, it appears that foreign investment, increased hazardous waste imports and the transfer of technology have all helped spur an increase in the number of waste management facilities in Mexico. On the one hand, this could be seen as a positive trend, since Mexico certainly needs to manage its hazardous wastes and lacks the capacity to do so. Nonetheless, because of the lack of regulations and enforcements, these types of technologies seem to have been pushed on the Mexican government with little foresight or questioning. Thermal desorption, hazardous and medical waste incineration and hazardous waste combustion in cement kilns have been accepted in Mexico and – in the present study -- Tabasco, even though specific standards have not yet been established.

The hazardous waste treatment plants opening in Tabasco are supported by the government as examples of successful investment projects, but environmental and health consequences of these plants have not been adequately considered.The combination of weaker environmental regulations and enforcement and increased opportunities for firms to treat and “recycle” hazardous waste in Tabasco could be threatening environmental quality and public health across the state.

[15] Reed, Cyrus H., Mary Kelly, Fernando Bejarano González y María Teresa Guerrero *LA INCINERACION DE RESIDUOS PELIGROSOS EN HORNOS CEMENTEROS EN MÉXICO: LA CONTROVERSIA Y LOS HECHOS. 1998*. Comisión de Solidaridad y Defensa de los Derechos Humanos, A.C. y Texas Center for Policy Studies.

Figure 2. Number of Hazardous Waste Facilities Authorized, Mexico,1993-99



Source: National Institute of Ecology, 2000;
www.ine.gob.mx/dgmrar/rip/infraestructura/infraestructura.html.

Financing the Environmental Deficit

A third claim – that NAFTA would generate additional wealth which would be invested in environmental protection both by the government and private industry – also appears suspect. On the one hand, there has been a substantial increase in public and private funds flowing to the construction of water treatment wastewater treatment plants since NAFTA. This is particularly true along the northern border, in large part because of the efforts of the North American Development Bank and Border Environment Cooperation Commission, created in legislation parallel to NAFTA.[16]

Nonetheless, investment in both solid waste and hazardous waste management from the public sector has remained stagnant. While there has been increased monies spent on environmental clean-up by PEMEX in Tabasco and other states, most sites contaminated by environmental contaminants have not been dealt with, and private industry has not volunteered to spend money on clean-up. Unlike the U.S., there is no "superfund" program to clean up such sites and little enforcement to force clean-up.

If there has been private investment in the establishment of a network of hazardous waste management facilities – such as the energy "recycling" cement kilns and thermal desorption units which have proliferated in Tabasco – it has occurred in response to making profits, not to cleaning up the environment. Companies have chosen to shift their wastes – and their problems – off-site and out-of-site to third parties, who themselves treat the wastes with little regulation, inspection or enforcement.

[16] See Texas Center for Policy Studies, *The BECC and NADBANK: Achieving Their Environmental Mandate*, April 2001;

CONCLUSIONS

Since NAFTA, the opportunity for firms like PEMEX to export its products, and for U.S. companies to invest in Mexico have increased, and investment and trade numbers have skyrocketed. At the same, it does appear that this increase in production has led to increases in hazardous waste generation and opportunities for investment in hazardous waste management facilities and technology. Nonetheless, more management does not equal good management, and the promised environmental benefits to Mexico and to Tabasco have not materialized.

Incineration of hazardous wastes has been expanding in Tabasco, even though the Mexican government has yet to adopt strict regulations governing the practice. This trend poses potential adverse risks to the public health and the environment, and there has been a distinct lack of public participation in the authorization process. Tabasco's citizens are faced with difficult questions about the safety and performance of these new medical waste incineration, cement plants burning hazardous wastes and thermal desorption units which are combusting waste at their doorstep. With little information publicly available, the consequences of breathing these fumes or lining landfills and streets with ashes is unknown.

Fortunately, there are alternatives. Pollution prevention, waste reduction and other, more advanced technologies provide safer waste management alternatives. The first step toward protecting human health and the natural environment is to simply reduce the use of toxic substances and the generation of hazardous wastes. By limiting the production of these materials, logically, there will be less of them to eliminate. This is the idea behind "Clean Production and Zero Waste," a concept that seeks to remove hazardous materials from every stage of the production process. To deal with the hazardous waste already in existence, alternatives to incineration include chemical neutralization, supercritical water oxidation and biological treatment. Common alternatives to incinerating medical waste include classification and reduction, autoclave, microwaving, chemical disinfection and deep burial. These technologies do not involve burning hazardous materials and polluting the air, soil and water. In cement manufacturing, natural gas is a sound alternative to burning hazardous waste in cement kilns. Given incentives and a different regulatory structure, NAFTA could even help investment and technology transfer in these other types of hazardous waste management.

For more information:

You can request the complete report, ***Tratadoras Térmicas de Residuos Peligrosos: Caso Tabasco***, which is available only in Spanish and contains full citations, from any of the following organizations:

Asociación Ecológica Santo Tomás A.C.
Avenida 27 de Febrero, No. 1017
Centro, C.P.86000
Villahermosa, Tabasco
Tel/Fax 011 52 - 993 312-6743
Tel: 011 52 - 993 312-9359
Email: stomas2001@hotmail.com

Fronteras Comunes
Yacatas 483 col. Narvarte. c.p. 03020
Delegación Benito Juárez
México, D.F.
Tel: (5)5682-6763; Fax (5) 5682-2856
Email: fcomunes@laneta.apc.org;
fcomunes@avantel.net

Texas Center for Policy Studies
44 East Ave, Suite 306
Austin, Texas 78701
Tel: (512) 474-0811; Fax (512) 474-0811

On the Web: http://www.texascenter.org/bordertrade

http://www.laneta.org