MARKET STUDY ON POLLUTION AND ENVIRONMENTAL CONTROL IN MEXICO

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1. BACKGROUND

Mexico is one of the richest countries in the world in its ecological diversity. In its territory it has almost all existing climates and environments. Even though it is the 13th largest country in the world, it has 449 species of mammals (second highest in the world), 1,150 species of birds (12th place), 282 species of amphibians (4th place), 717 species of reptiles (ist place) and 2,052 species of butterflies, and its 25,000 plant species are above those known either in the U.S., the USSR or China. These resources are in serious danger due to the high concentration of population, the extensive use of land for agriculture and for the very destructive cattle raising. Deforestation is advancing rapidly in order to open areas for cattle, and some 9% of the country's territory is altered by deforestation. This, in addition to increased agricultural land, urban and industrial expansion and fires translates into one million hectares of natural vegetation lost annually. The overexploitation of fishing resources, uncontrolled tourism , the introduction of exotic animals and water pollution have seriously altered the delicate ecological balance of coastal regions and islands. In response to these problems, Mexico has created 100 officially protected areas and 39 more are in the process of being approved as such, for a total of 8.45 million Ha.

The contamination of the environment in Mexico has reached an alarming state. Over 60% of the country's 81 million people, live in urban settlements, including Mexico's four argest cities - Mexico City, Monterrey, Guadalajara and Puebla -, 80 medium sized and 120 small cities. Over 25% of all industry is concentrated in the valley of Mexico, placing tremendous pressure on existing services and infrastructure. In fact, 40% of all air pollutants come from the country's three largest cities cited above. Some 52 thousand tons of garbage must be handled daily, 19,000 tons in Mexico City alone. Industries, internal combustion engines and public transportation services expel thousands of tons of harmful gases into the air, such as sulphur dioxide, carbon monoxide, suspended particles, lead and ozone. Mexico City has suffered extremely high levels of air pollution in recent years, as a result of its industrial development, increased demand for services, low fuel quality, inadequate combustion processes due to its high altitude and an increase in motor vehicles. Mexican citizens have been clamoring for strict corrective measures and the Government has finally responded with concrete actions aimed at fighting the onslaught of pollution, the most important of which being the Federal Law on Ecological Equilibrium and Environmental Contamination enacted on March 1, 1988 and the ensuing body of state laws, federal regulations and specific norms, coupled with more stringent control measures to ensure their application.

When taking up office, president Carlos Salinas de Gortari pledged to publish increasingly strict regulations to reduce air polluting emmissions, waste waters and hazardous wastes. A major National Program of Ecological Conservation and Environmental Protection was published in 1990, including tighter supervision

of industrial pollutant sources, improvement of fuels, natural gas supply to thermoelectrical plants in the Mexico City area and improvement of the city's public transporation system. President Salinas has also relied on international and multilateral cooperation conferences and agreements and will continue to do so in the future.

2. ECONOMIC ENVIRONMENT

With the objective of reducing the inflation rate, the Mexican authorities implemented a stabilization program in 1988, called the Economic Solidarity Pact, which features traditional austerity measures, entailing tight fiscal and monetary policies and unorthodox measures, such as price, wage and exchange rate controls. This program has been the cornerstone of Mexico's economic policy over the past four years, and has been extended to January 1993. It has resulted in a drastic reduction of the inflation rate, from an annual rate of 159% in 1987 to 19.7% in 1989. Inflation rebounded to 29.9% in 1990 but was brought down to 18.8% in 1991 and is expected to be of 11-13% in 1992. At the same time, interest rates have fallen substatially to the present 12%, and the peso-dollar devaluation rate has been set at Mex$0.2 pesos a day or 2.4% per annum.

Along with the objective of consolidating the progress made in price stabilization, Mexico's macroeconomic policy in 1992 aims to reaffirm gradual and sustained economic recuperation, basically by establishing the necessary conditions to encourage national and foreign investment and by stimulating local demand, and to strengthen the improvement in living standards of the poorest segment of society through the Solidaridad program.

Domestic economic activity recovered for the third consecutive year in 1989, after the 1986 recession, with a gross domestic product (GDP) growth rate of 3.1%. In 1990 it grew 3.9% and another 3.6% in 1991 to reach $280.3 billion (1). With an 82.8 million population, per capita GDP was estimated at $3,385 in 1991. Additionally, manufacturing output grew by 5.2% in 1990 and 3% in 1991 in real terms, private investment and consumption expanded 13.6% and 5.2% respectively and public investment was up 12.8%. During the 1992-1994 period, the GDP is expected to maintain an average annual growth rate of 4%-5%. Preliminary figures place GDP growth at 3% for 1992.

In an effort to revitalize and open the Mexican economy, the Mexican Government undertook a series of structural changes, including the accession to the General Agreement on Tariffs and Trade (GATT) on August 24, 1986 leading to an extensive trade liberalization process: import permits were eliminated on all but 325 of the total 11,950 tariff items based on the Harmonized System adopted in 1989. Official import prices are no longer

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1. Note: All values in this report, unless otherwise stated (Mexican pesos, Mex$, Canadian dollars, Cdn$, etc) are quoted in United States dollar equivalents.

applicable, nor the 5% export development tax, and import duties were lowered from a maximum of 100% in 1982 to 20% in January 1988. The weighted average tariff rate is now 10.4%. The automotive and computer industries have also been liberalized, through the elimination of prior import permits, to allow free entry of products in these industries. The approval of the North American Free Trade Agreement will further strengthen trade between Canada, the United States and Mexico.

According to official data from the Mexican Secretariat of Commerce and Industrial Development (SECOFI), Mexico's trade balance dropped once again in 1991 to a $10.4 billion deficit from -$3 billion in 1990. Exports increased by 2.6% in 1991, from $26.8 billion to $27.6 billion, while imports grew 22.2%, from $29.8 billion to $38 billion in 1991, having already increased 27.2% in 1990 from $23.4 billion in 1989. January-May data for 1992, place total exports at $11 billion and imports at $17.9 billion.

3. MARKET ASSESSMENT

Total apparent consumption of pollution control equipment and instruments has grown at a very rapid pace in the last four years, increasing 11.5% in 1988, 11.2% in 1989 and 9.3% in 1990, from $240.6 million in 1989 to $263.1 million in 1990. Prelimany figures for 1991 place the total market at an estimated $282.6 million, reflecting an additional 7.4% increase. This growth pattern has been prompted both, by a growth in domestic production of equipment and by a major increase in imports, in response to the new regulatory environment and the overall awareness of pollution related problems.

Three categories account for approximately 85% of expenditures in pollution control equipment and instruments: industrial wastewater, municipal wastewater and potable water treatment and air pollution control. These areas, together with noise pollution control, are the ones with the greatest market potential for imported products. At the same time, it is expected that these areas will grow at a proportionally faster pace in the coming years.

Demand is expected to grow at an average annual rate of six percent between 1991 and 1994, to reach a total of $336.9 million the latter year (see Table 1). Domestic production, which consists almost exclusively of equipment, is projected to grow from $233.0 million in 1991 to $262.4 million by 1994 at an average annual rate of four percent. Imports represented 22.9% of the total market or $60.3 million in 1990. However, given the need for more sophisticated and specialized instrumentation, the vast majority of which is imported, and Mexico's trade liberalization policies, imports are expected to grow at a faster pace than local production. Imports are estimated to grow at an

average annual rate of 11%, and reach $95.7 million by 1994 or 28.4% of the total market.

International financing programs have been and will continue to be crucial in the growth of the Mexican pollution control market. The Mexico City government has obtained funds from the Japanese Overseas Fund and the World Bank, the latter also granting credits for the disposal of solid waste in several cities in the country, for the proper use and preservation of forestry resources, for drinking water and sewage projects and to improve atmospheric conditions. The Interamerican Development Bank has also provided credits. Additionally, private companies have made many agreements with foreign banks and foreign private companies for the financing of anti-pollution equipment and services, as well as for licensing and representation agreements. In the next three years, some sources estimate global government and private investments of five billion dollars in the "environmental industry".

In order to finance specific projects, SEDESOL has devised a multi-agency financing strategy, whereby the federation, through its own federal budgetary resources covers 26% of the project, the benefitted municipality provides 24% through land and equipment or other inputs, and the municipality receives a loan through BANOBRAS, a government owned bank, funded by World Bank or other credits, to cover the balance 50%. In order to be approved within this mechanism, a project needs to be approved or prepared by SEDESOL based on a technical analysis of the municipality's needs and capabilities, it has to comply with environmental laws and it has to be self-financeable, which means that the project will be financing itself through the collection of tariffs on the service(s) provided by the project itself. At present, several projects have been approved within this strategy, including garbage collection and final disposal, water supply, sewage and unclogging of sewage systems, with an average recovery period on the investment of 7-13 years.

In order to support investments by the small and medium sized businesses, the Mexican President has announced an unprecedented support of Mex$19 trillion ($5.5 billion). The Mexican authorities have also announced that thay expect a Mex$400 billion ($120 million) private investment over the next three years to operate, through the concession mechanism, waste water treatment plants on the Texcoco lake area. Nacional Financiera (NAFIN) is also granting financial support, through a Mex$50,000 million ($15 million) credit instrument to finance the purchase of anti-pollution equipment. Additionally, the National Manufacturing Chamber (CANACINTRA), has launched its Clearinghouse program to provide technical support to its over 90,000 affiliates countrywide for the prevention, control and reduction of pollutants through the United States Environmental Protection Agency (USEPA) and the World Environment Center (WEC). CANACINTRA has also created a soft credit fund to purchase equipment.

The total pollution control market can be divided into two distinct areas: instruments and equipment. Instruments presently account for three percent of the total market and amounted to $8.2 million in 1990 and an estimated $9.1 million in 1991. By 1994 this segment of the market is expected to reach $10.9 million, practically all of which will continue to be imported. The total market size for equipment, on the other hand, was $254.9 million in 1990 and an estimated $273.5 million in 1991. Of this amount, $231.3 million corresponds to equipment manufactured domestically, while $61.2 million, or 22.4%, was imported. By 1992, equipment sales are expected to reach $325.7 million, of which 26.4% or $85.9 million will be imported.

TABLE 1
APPARENT CONSUMPTION OF
POLLUTION CONTROL EQUIPMENT AND INSTRUMENTS
(000 U.S. dollars)

	1987	1988	1989	1990	1991e	1994p
INSTRUMENTS						
Production	1,191	1,515	1,605	1,686	1,770	1,935
+ Imports	3,191	4,388	5,528	6,937	7,769	9,817
- Exports	98	172	404	451	472	516
= TOTAL	**4,184**	**5,731**	**6,729**	**8,172**	**9,067**	**10,936**
EQUIPMENT						
Production	180,475	197,709	207,977	219,856	231,250	260,488
+ Imports	19,259	29,457	43,027	53,344	61,206	85,859
- Exports	9,325	16,452	17,123	18,315	18,964	20,614
= TOTAL	**190,409**	**210,714**	**233,881**	**254,885**	**273,492**	**325,733**
TOTAL POLLUTION CONTROL EQUIPMENT AND INSTRUMENTS						
Production	181,566	199,224	209,582	221,542	233,020	262,423
+ Imports	22,450	33,845	48,555	60,281	68,975	95,676
- Exports	9,423	16,624	17,527	18,766	19,436	21,130
GRAND TOTAL	**194,593**	**216,445**	**240,610**	**263,057**	**282,559**	**336,969**

Source: Import and export data published by Secretariat of Commerce and Industrial Development (SECOFI); production data based on author's estimates

As can be seen in the above Table, imports have grown at a relatively faster pace than local production in the past few years in response to Mexico's trade liberalization policies and the increasing need for more sophisticated and chore-specific equipment and instruments, which are as yet not manufactured domestically. While imports represtented 11.5% of total apparent consumption in 1987, this share has been increasing steadily to the 22.9% of 1990 and the 24.4% estimated for 1991. Total imports have grown at an average annual rate of 33.2% in the past four years, between 1988 and 1991, albeit at a decreasing pace, since

the 1987-1988 growth rate was 50.8%, while the 1989-1990 one was 24.1% and it is estimated at 14.4% for 1990-1991.

U.S. products dominate the market for both instrumentation and equipment, with an import market share of 77%. It is followed by West Germany (9%), Switzerland (2%), Japan (4%), France (2%) and Canada (1%). U.S. products are identified in the Mexican market as incorporating the latest technological advances and being of the highest quality. In addition, due to the geographical proximity of both countries, delivery and service are quick and trustworthy. Several U.S. companies have also established joint ventures with Mexican companies to penetrate the market. These factors have allowed U.S. products to enjoy a high preference among Mexican users. Nevertheless, third country competitors are trying to gain a greater part of the market by offering lower prices, more liberal credit terms, more flexible licensing and joint venture agreements and increased servicing facilities. Some foreign companies operating in Mexico through joint venture agreements include Chemical Waste Management, Degrémont, Cie. Générale del Eaux, Metal Molten Technology and Cheyne Owen. In order to keep or increase their market share, Canadian suppliers need to be more aggressive in the market and promote their products, particularly now that the market is expanding as a result of the increased awareness of pollution hazards and more stringent environmental regulations.

The following Table list Canadian trade with Mexico in all categories related to pollution control. These data, however, are not compareable with those of Table 1, because they include the total figure of imports and exports in each category, while the information in Table 1 is adjusted to reflect only the amounts estimated to correspond to pollution control.

TABLE 2

CANADIAN IMPORTS AND EXPORTS OF POLLUTION CONTROL EQUIPMENT AND INSTRUMENTS WITH MEXICO

(000 Cdn $)

	1988	1989	1990	1991
CANADIAN EXPORTS TO MEXICO				
centrifugal pumps		18	73	1
compressors	48	40	0	0
heat exchange units	385	161	10	223
heat treatment units	2	222	158	3
water filers	9	32	5	2
oil filters for engines	4	4	0	3
liquid purifiers	17	5	4	1
gas purifiers	427	2,349	4,709	1,439
parts purifiers	157	100	53	25
catalytic converters	1,322	1,268	516	303
control valves	75	260	171	76
TOTAL EQUIPMENT	**2,450**	**4,459**	**5,699**	**2,076**
microscopes	0	2	0	0
barometers	9	0	0	0
thermometers		16	51	7
other meters	2	0	0	0
liquid & flow meters	6	156	515	128
liquid & gas meters	4	0	5	26
smoke analyzers	0	4	12	34
chromatographs	23	208	0	0
phys&chem analysis instr.	35	0	112	5
instr. radiation	7	0	0	0
TOTAL INSTRUMENTS	**86**	**386**	**695**	**200**
TOTAL EXPORTS	**2,536**	**4,845**	**6,394**	**2,276**
CANADIAN IMPORTS FROM MEXICO				
boilers over 45tons	0	973	0	0
compressors	6	32	0	0
heat exchange units	37	19	268	265
heat treatment un.	22	195	147	250
oil filters engines	72	105	168	166
gas filters & purifiers	26,285	35,627	33,578	17,714
parts purifiers	2,147	21	8	18
control valves	606	899	877	2,243
TOTAL EQUIPMENT	**29,175**	**37,871**	**35,046**	**20,656**
microscopes	0	34	19	12
thermometers	171	293	173	227
other meters	25	64	27	351
liquid & flow meters	1	0	72	359
liquid & gas meas.	0	1	0	8
TOTAL INSTRUMENTS	**196**	**392**	**291**	**957**
GRAND TOTAL	**29,371**	**38,263**	**35,337**	**21,613**

Source: Statistics Canada - International Trade Division

Based on these data, Canadian exports to Mexico of equipment related to pollution control increased 82% between 1988 and 1989

to Cdn$4.5 million and then another 26.7% in 1990, but fell to Cdn$2.1 million in 1991. In the instrument sector, exports increased threefold to Cdn$370,000 in 1989 and again by 80% in 1990 but again dropped to Cdn$200,000 in 1991. Canada is also a significant importer of Mexican products, in particular of gas purifying equipment. These data also show Mexican exports of certain instruments within general categories, but none of them are for environmental control specifically.

4. ENVIRONMENTAL PROBLEMS

Mexico comprises a total of 1.95 million km2 of continental land and 5,073 km2 of islands. It has 9,953 kms. of coastlines and an exclusive zone of sea of close to three million kilometeRs. In order to effectively develop an activity plan regarding all aspects related to the ecology, an ecological regionalization of Mexico was structured. The more general division is centered around climatic regions, which determine plant and animal life and hydrological characteristics. Four regions were identified: arid, temperate, humid tropic and dry tropics, as shown in the map below. Further, 1,900 distinct eclogical units were identified, which show homogenous characteristics.

4.1 AIR POLLUTION

There is a close relationship between environmental problems and the country's orography, the size and dynamics of human settlements and economic growth. Air pollution is a consequence of Mexico's development in this sense. In terms of orography, over 60% of the population lives in settlements located at over 500m above sea level, where conditions are less favorable. Mexico is a country with a low efficiency in the use of fuels, due to its relatively low industrial development and its climatic characteristics, and thereby requires larger quantities of primary energy to produce the same quantity of goods and services as in other parts of the world. Due to this factor, gasoline consumption for transportation, diesel and fuel oil consumption by industry, electricity generation, utilities and services have generated a high emission of air pollutants.

In three regions of the country, 40% of all air pollutants are generated: Mexico City, the largest city in the world, Guadalajara and Monterrey. The Mexico City metropolitan area concentrates over 15 million inhabitants, which produce 36% of the country's GDP and consume 17% of its energy. At the same time, 20% of industrial establishements are located in Mexico City, 40% of industrial investments are made here and 42% of the country's economically active population is here. In Mexico City the problems are a vast concentration of urban and industrial entities, the increasing use of cars and buses, large erosioned areas and an excessive energy demand, in addition to the lack of ventilation due to the high altitude and the orographical location.

Monterrey has 2.8 million inhabitants, it has over 4,000 industrial establishements, there is an intensive exploitation of non metallic mineral resources and over 300,000 vehicles circulate in the city. Guadalajara has 3.3 million inhabitants, a vehicle circulation of 600,000 and 3,000 industrial establishements. It has ventilation problems, coupled with a rapid population growth and vehicle circulation. The Gulf region has been affected by the petroleum industry and the industrial port activity. Other affected regions are the Bajío industrial corridor located in central Mexico, the Tula-Vito-Apasco industrial area (minerals, petrochemicals, electricity) North of Mexico City and the U.S-Mexico border region.

In order to evaluate the quality of air within the Mexico City metropolitan area, a monitoring station network operates with 25 automatic and 19 manual stations which evaluate several pollutants and metheorological parameters (SO_2, SO_4, CO, NOx, non methane hydrocarbons, O_3, H_2S, NO_2, NO_3, suspended particles, heavy metals, breathable fraction of suspended particles, wind speed, wind direction, temperature and relative humidity). This network is called Red Automática de Monitoreo Atmosférico (Automatic Atmospheric Monitoring Network - RAMA) and the Red Manual de Monitoreo Atmosférico (Manual Atmospheric Monitoring Network). These readings, which are published daily in major newspapers, permit the identification of the level of

contamination and its source, which further permits the elimination of emissions, installation of anti-pollution equipment and/or to temporarily or definitely close down the offending industry and evacuate people in case of emergency.

The World Bank recently approved a loan for the enlargement and reinforcement of the existing network, the latter through the purchase of 39 automatic analyzers for CO, SO2, NOx, HC, O3 and suspended particles. Since 1986, the Mexico City population has been informed of pollution levels through the daily publication of the Metrolpolitan Index of Air Quality (IMECA), which determined as multiples of the value determined by the norm (see Table 4) where norm = 100

The principal air pollutants in Mexico City are carbon monoxide (altitude, inefficient fuel combustion), sulphur dioxide (industrial hydrocarbon consumption), nitrogen oxides (combustion), ozone (other pollutants), suspended particles (erosioned areas) and lead (unleaded fuels). One of elements which contribute most to the accumulation of pollutants in the air is the presence of thermal inversions, which occur basically every day during the winter season, which usually do not break before 9:30-10:00 AM.

The following table shows average levels of pollutants in Mexico City in 1990 and the norm established by the Health Secretariat for each one.

TABLE 3
MEXICO CITY AIR QUALITY 1990

POLLUTANT	NORM	AVERAGE
Carbon monoxide (CO)	13 ppm in 8 hrs	
Sulphur dioxide (SO2)	0.13 ppm in 24 hrs	0.067 ppm
Nitrogen bioxide (NO2)	0.21 ppm in 1 hr	0.111 ppm
Ozone (O3)	0.11 ppm in 1 hr	0.18 ppm
Particles breathable fraction (under 10 micrometers)	150 ug/m3 in 24 hrs	186 ug/m3
Total suspended particles	275 ug/m3 in 24 hrs	691 ug/m3
Lead	1.5 ug/m3 (avg 3 mos)	0.26 ml/l

Source: Comisión Nacional de Ecología - Informe de la Situación General en Materia de Equilibrio Ecológico y Protecciói n al Ambiente 1989-1990.

In 1989, 4.4 million tons of five pollutants (CO, SO2, NOx, HC and suspended particles) were emitted into Mexico City's atmosphere through hydrocarbon combustion and suspended dust particles. The Instituto Nacional de Ecología (INE), previuosly SEDUE (The Secretariat for Urban Development and Ecology), the administrative and control body for environmental matters, attributes 76.6% of air contamination in Mexico City to the use

of internal combustion engines by the public transportation system and private vehicles. Mobile pollution sources, including cars and airplanes, account for 96.7% of carbon monoxide emission, 75.4% of nitrogen oxides and 20.9% of sulphur dioxide (see Table 3). Industry and services account for 8.4% of total pollutants, erosion for 9.6% and fires for 5.3%.

TABLE 4
MEXICO CITY EMISSION INVENTORY 1989
(%)

SECTOR	SOURCE	SO2	NOx	HC	CO	PST	TOTAL
ENERGY	PEMEX	7.2	1.8	5.5	1.8	0.3	2.4
	electricity	28.3	3.7	0	0	0.8	1.6
INDUSTRY & SERVICE	industry	32.0	16.3	7.0	0.5	2.3	3.7
	commerce	10.7	2.2	0	0	0.5	0.7
	SUBTOTAL	78.2	24.0	12.5	2.3	3.9	8.4
TRANSPOR-TATION	**CARS**						
	private	1.7	23.7	24.7	45.0	1.0	34.9
	taxis	0.4	5.4	5.6	10.2	0.2	7.9
	collective	0.4	5.7	7.5	13.7	0.2	10.5
	buses R100	2.5	4.5	0.4	0.2	0.1	0.5
	TRUCKS						
	Mex state	6.3	10.3	0.9	0.4	0.1	1.1
	gasoline	0.5	9.6	11.9	26.4	0.3	19.9
	diesel	9.8	14.7	1.3	0.6	0.2	1.6
	other	0.1	1.5	0.3	0.2	0	0.2
	SUBTOTAL	20.9	75.4	52.6	96.7	2.6	76.6
ECOLOGICAL DAMAGE	erosion	0	0	0	0	93.1	9.6
	fires & other	0.1	0.5	34.9	0.9	0.9	5.3
	SUBTOTAL	0.1	0.5	34.9	0.9	94.0	14.9
GRAND TOTAL		**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
TOTAL (000 tons/year)		**205.7**	**177.3**	**572.1**	**2950.6**	**450.6**	**4356.4**

Source: SEDESOL - Informe Nacional del Ambiente (1989-1991)

The need to travel long distances in Mexico City is caused by the very wide extension of Mexico City's urban area and its intensive economic, cultural and social life. Daily, 29.5 million trips are made using some 2.8 million motor vehicles which circulate in the metropolitan area and emit non-combustible gases and suspended particles into the air, such as carbon monoxide, carbon dioxide, nitrous oxides, sulphates, lead and hydrocarbons. Vehicles are estimated to generate 76% of all pollutants emitted into the Mexico City atmosphere. There are approximately 2.4 million privately owned cars, 57,000 taxis, 69,000 collective

transportation units, 10,500 buses, the subway (metro), the light train and 450 trolleys. Additionally, some 196,000 gasoline trucks circulate in Mexico City and 60,000 passenger diesel trucks. Of these motor vehicles, 33% are over twelve years old and another 27% are between eight and twelve years old. Over 70% of all cars and buses are in poor mechanical condition and operate inefficiently due to the high altitude. In addition, still only a small proportion of the vehicles circulating in Mexico carry anti-pollution devices.

An estimated 13% of air polution is generated by fixed sources, or industry, and the remaining four percent by natural sources. Some 14% of the air pollution generated by fixed sources comes from the production, storage and distribution of fuels. Almost one third of these emissions correspond to hydrocarbons and one sixth to SO2.

There are approximately 33,000 industrial sources of air pollution around Mexico City of which 4,000 have been classified as severe polluters, producing 51,000 tons of sulfur oxides, of which pulp and paper mills are responsible for 40% and cement plants for 20%. Industry is the main producer of sulphur dioxide, which is even more harmful to humans than the carbon monoxide produced by cars. The Mexican authorities are periodically inspecting industries and have closed down several of them (25 are to leave the Mexico City area within three years), forcing them to install anti-pollution equipment in their plants. It is presently estimated that only 30% of all industries in the valley of Mexico have installed any kind of anti-pollution equipment.

The following list shows pollution levels of different industries measured in terms of units of equivalent toxicity (UTE - which averages production levels of SOx, NOx, CO2 and volatile organic components in terms of their tolerance factor based on existing norms).

INDUSTRY	**UET**	**%**
Pulp and paper	79,900	32.4%
Cement	37,500	15.2%
Textiles	26,700	10.8%
Chemicals	24,500	9.9%
Glass	23,900	9.7%
Food and beverages	16,400	6.6%
Ceramics	13,300	5.4%
Ferrous metals	7,600	3.0%
Machinery & equipment	3,100	1.2%
Rubber	2,400	0.9%
Non ferrous metals	1,800	0.7%
Other	9,400	4.2%
TOTAL	246,500	100 %

Source: Expansión, Vol. XXIV, No. 585, March 4, 1992

Some of the more polluting companies include:

COMPANY	BUSINESS	UET
Cementos Anáhuac	cement	37,500
Fábrica de Papel San Rafael	paper	26,601
Cía. de Papeles Industriales	paper	7,658
Fibras Sintéticas	textiles	7,245
Fábrica de Papel de México	paper	6,759
Procter & Gamble	chemicals	6,197
Kimex	textiles	5,839
Vidriera Oriental	glass	5,779
Sílices y Derivados	ceramics	4,059
Papelería Iruña	paper	3,976
Fábrica Nacional de Vidrio	glass	3,791
Papelería Atlas	paper	3,543
Sosa Texcoco	ceramics	3,423
Loreto y Peña Pobre	paper	3,379
Industrias Conasupo	foods	3,339
Madrueño y Cía.	paper	3,041

Source: Expansión, Vol. XXIV, No. 585, March 4, 1992

Of the 50 companies listed as heavy pollutants in the above cited source, only three have installed anti-pollution equipment, including Cementos Anáhuac, Fábrica de Papel San Rafael (electric precipitators, filters), Vidriera México (dust collectors), in addition to Colgate Palmolive (electric precipitators, filters), 3M (bag filter, precipitator, cyclones), Levadura Azteca (organic solvent conversion), Harinas y Grasas Xalostoc (dust collectors), Sosa Texcoco (scruber cyclone), Aceros Corsa (bag filters), Aceros tepeyac (bag filters), Fundidora de Hierro y Acero (bag filters), Kodak, Cemex, IBM, ICI, SC Johnson, Mobil and Hoechst.

In the Mexico City area, there are 12,000 service and utilities establishements operating, which use combustion and incineration processes, mostly using fuel oils, but also diesel, petroleum and gas, such as public baths, bakeries, laundries, food distributors, hotels, sport clubs and hospitals.

An important source of air pollution is the use of heavy fuel oil for industrial purposes. Two thermoelectric power plants located in Mexico City (Jorge Luque and Valle de México) together generate 9% of all pollutants expelled into the air by industrial, commercial and service establishements. They used to generate some 36% of the sulphur dioxide expelled into the air, through the use of heavy crude as fuel, but the Federal Electricity Commission (CFE), the sole producer and distributor of electricity in Mexico, has partly converted them to natural gas plants, thereby reducing SO2 emissions by 80%; however the necessary amount of gas is not yet produced to allow these changes to be made on a large scale.

PEMEX, the national oil monopoly, is installing smokeless burners using natural gas instead of heavy fuel in several of its refineries and it is in the process of substituting natural gas

or other light fuels for heavy fuel in its boilers and heaters in most of its facilities. Its Azcapotzalco refinery, located in Mexico City and which emitted high pollutant levels, was closed down in March 1991.

As a result of the knowledge that has been gathered on the causes and processes that have an influence on air pollution, several actions have been designed to prevent and control the atmospheric contamination. These include:

- preparing a normative framework for the Vehicle Emission Verification Program which is obligatory within the Mexico City metropolitan area for a mandatory semiannual or annual exhaust emission vehicle inspection. This program has also been established in 22 other cities in the country;
- publishing four technical norms in order to apply the verification programs to private and public sector vehicles, both diesel and gasoline powered. During 1991, 1.8 million vehicles were revised;
- adding oxigenated compounds (MTBE - methylterbutyl ether) to gasolines to improve fuel efficiency in high altitudes (through these three actions, CO is expected to be reduced by 405,000 tons/year, in addition to lead and hydrocarbon levels);
- continuing to reduce car circulation through the "one day without a car" ban, first applied in 1989-1990. This program is estimated to reduce pollutant emission in 68,369 tons of CO, 1,440 tons of NOxs and 3,584 tons of hydrocarbons;
- mandatory incorporation of advanced and accessible technologies for vehicle emissions on new cars (including catalytic converters). Between 1985 and 1990, this has brought about an estimated 70% potential reduction in emissions by new cars;
- installing anti-pollution motors on all R-100 urban passenger transportation buses. In 1991, 1,010 new buses were purchased and 2,850 equipped with new motors;
- replacing heavy fuel oil by natural gas in all of the Mexico City area power plants. This has reduced SO2 by 29,500 tons/year;
- closing down the PEMEX 18 de marzo refinery located in Azcapotzalco and relocating 500 brick manufacturers in Chihuahua and one PEMEX petroleum product distribution plant in Tamaulipas;
- establishing the Program for the Control of Evaporative Emissions in PEMEX Storage and Transportation Tanks through the installation of floating membranes on fuel storage tanks, which has reduced evaporative emissions by 7 tons/day and is estimated to reach 20 tons/day when the installation is finished;
- establishing 118 agreements with industries for the installation of control mechanisms in their facilities and evaluating the most important industrial combustion processes to apply measures necesssary to reduce NOxs, which will theorically reduce them by 30%;
- establishing the Environmental Contingency Plan, which, based on the IMECA values, requires 1,100 industrial establishements included in it, to reduce production by differet proportions (30% in phase I and total suspension in phase III);

- evaluating the most important establishements within the Mexico City metropolitan area to optimize combustion processes and avoiding NOx emissions. This has brought about the investments and actions undertaken by the industrial sector to conform with the existing legislation;
- establishing a program of inspection visits to industries with a high polluting potential to verify the fulfillment of control programs, the presence of an operation licence and the annual polluting emission report. During 1991, over 7,000 such visits were made, which brough about 62 total and 747 temporary closures;
- replacement of gasoline by LP gas on in-city cargo transportation truck fleets;
- launching of the reforestation and ecological restauration program for the valley of Mexico. In 1991, over nine million trees were planted and 13 million trees were grown in nurseries for future use.

Best sales prospects for air pollution control are dust collectors and filters, silencers for exhaust gases, catalytic converters, respirators, gas, dust and particle sampling material, analyzers, monitors, metering instruments, controlling equipment, gas pumps, ozone generators, ozone analyzers through chemical luminiscence, UV light photometers, mobile laboratories, electrostatic precipitators, oxidation systems and gas absorbers.

4.2 WATER POLLUTION

Due to its varied characteristics, water is not distributed regularly throughout the Mexican territory. Rainfalls average 780mm overall, but in the North and Center regions it amounts to 500mm and in the Southeast 2,000mm. Approximately 50% of water flows are concentrated in Mexico's plentiful rivers located in the Southeast and which cover only 20% of the national territory in terms of watershed areas. Also, 80% of water resources are located at an altitude below 500m, while 70% of the country's population and 80% of its industry are located above that altitude.

In order to use water rationally and improve control over it, Mexico has a vast network of water storage systems with a total capacity of 125,000 million m3 in addition to 14,000 million m3 in lakes and lagoons, corresponding to 34% of annual water flow.

Water contamination can be classified in three major sources: domestic and public origin discharges corresponding to municipal residual waters; waters generated by cattle raising intallations and polluted waters from agricultural activities; and industrial discharges corresponding to the extraction and transformation of natural resources.

Regarding municipal waste waters, its generation is closely linked to the urban concentration of Mexico's population. Mexico City, Guadalajara and Monterrey, with their vast drinking water and sewage facilities, generate 46.0 m3/second, 8.5 m3/s and 8.2

m3/s of wastewaters respectively. Together, these cities generate a total of 62.7 m3/s coresponding to 34% of the total generated throughout the country. The total volume of waste waters generated is of 5,803 million m3 a year, equivalent to estimated at 184 m3/s, of which 105 m3/s correspond to the population and 79 m3/s to industry. On a national level, the total polluting organic material discharge, measured in terms of biochemical oxygen demand (BOD) amounts to 2.4 million tons/year, of which 36% are of municipal and 64% of industrial origin. By the year 2000, wastewater generation is estimated at 207 m3/s, of which 57% will correspond to the population and 43% to industry.

Water demand in the Mexico City area is 70 cubic meters per second, of which 62 cubic meters per second are actually provided, supplied from several sources. Of these, 30% correspond to domestic use in residential areas. Before entering the city, waters are treated and purified through flocculation, chemical treatment, chlorination, precipitation and clarification. There are some 2,000 purifying plants to make waters drinkable. There is, however, no control over the discharge of industrial and domestic waste into the urban water system. Untreated "black waters" cause serious pollution problems within and outside Mexico City, since these waters find their way, via the Pánuco river, all the way to Tampico on the Gulf of Mexico. The National Water Commission is working on the development of alternative technologies for making residual waters drinkable.

Mexico's agricultural and cattle production covers 22.9 has. and had an estimated water demand of 69,500 m3 in 1990. Waste waters generated by this sector were in the order of 8,345 m3 in 1990 and are estimated to reach over 11,000 m3 by the year 2000. Among the most contaminating sectors in this area is pork raising, in particular in the central states of Guanajuato, Jalisco, Michoacán and Mexico.

Since Mexico's industrial development and population have been concentrated around the cities of Mexico, Monterrey and Guadalajara, this has placed an additional pressure on hydraulic resources, supply and disposal. The Mexican industrial sector is classified in 39 groups, 20 of which have been identified as highly polluting. Together, they account for 82% of all industrial waste waters, although the sugar and chemical manufacturers account for almost 60%. In terms of prevention and control of water pollution, the most significant industries identified by the Mexican authorities are sugar and alcohol, petroleum refining and petrochemicals, pulp and paper, tannery, chemicals, textiles and food processing. The following Table lists industrial sectors responsible for the largest waste water discharges.

TABLE 5
INDUSTRIAL WASTE WATER DISCHARGE
(%)

INDUSTRY	EXTRACTION	CONSUMPTION	DISCHARGE
Sugar	35.2	22.3	38.8
Chemicals	21.7	24.4	21.0
Pulp and paper	8.2	16.1	6.0
Petroleum	7.2	3.7	8.2
Beverages	3.3	6.4	2.4
Textiles	2.6	2.4	2.7
Steel	2.5	5.5	1.7
Electricity	1.5	4.7	0.7
Foods	0.2	0.3	0.2
Other	17.6	14.2	18.3

Source: Comisión Nacional de Ecología - Informe de la Situación General en Materia de Equilibrio Ecológico y Protecciói n al Ambiente 1989-1990.

Mexico lacks the necessary waste treatment plants to process these materials, mostly due to the lack of financial and economic selfsufficiency. There are at present 361 municipal waste water treatment plants with a total installed capacity of 25.1 m3/s, in addition to 282 industrial waste water treatment plants with an approximate capacity of 20 m3/s (although a different source places treatment capacity at 223 municipal plants with a 16.5 m3/s capacity and 177 induistrial plants with a 12 m3/s capacity). Municipal plants are predominantly based on stabilization lagoons and and activated muds, while industrial plants use activated muds with chemiical clotting. Since municipal waste waters generated amount to 105 m3/s, only 24% can be treated and of that amount, half is for reuse and not for pollution control. Also, they have many defficiencies, such as inappropriate design and location, unfinished constructions and lack of equipment and sewage systems, among others. In the case of industrial waste waters, only 25.3% of the total 79 m3/s of waste waters generated can be treated. If all treatment systems were operating (at present only some 50% are operated regularly), a total organic charge of 233,680 tons could be eliminated per year, which only represents 10.5% of the total 2.2 million tons generated annually. In addition to the above, only some 49% of the country's population has sewage systems, and they concentrated in urban areas.

The process of treating residual waters consists of: 1) pretreatment to eliminate heavy solids; 2) primary treatment to separate oils, solids in suspension, colloidals and to control pH; 3) secondary treatment to eliminate harmful biological materials through the use of microorganisms; 4) tertiary treatment to eliminate organic materials, non-biological materials in suspension and salts; and 5) special treatments, for the elimination of muds, for example.

Many rivers in Mexico are being contaminated because of effluent discharge and untreated residual waters. Twenty of Mexico's 270 rivers concentrate 80% of total residual water discharges. Treatment plants are being installed in the neighborhood of the most polluted of these rivers, such as the Lerma, the Bravo and the Coatzacoalcos, and lakes, such as Pátzcuaro and Santiago-Chapala, as well as in Mexico's most important ports, including Zihuatanejo, Acapulco, La Paz, Puerto Vallarta, Progreso and Veracruz. A $2 million project is underway to restore the Lerma river, the Guadalupe lake and the Laguna de Zumpango. The waters of many rivers need to be treated so that they may be subsequently reused for industry, agriculture, irrigation and human consumption.

Of Mexico's total watershed areas, 31 recieve 91% of all discharges. Sanitary actions have been undertaken in the five most important watershed areas, aroung which most development centers are concentrated, which are:

- The Lerma-Chapala watershed, in which 16% of waste waters and 15% of organic charge are generated. Actions undertaken have been centered around identifying critical contamination zones within the area and principal sources of waste waters in order to develop a program to control direct and indirect discharges into the river and high volume or high toxicity discharges. A total of 1,261 industrial companies were identified along the river, which produce waste waters, of which 180 have treatment plants. State-owned companies which have treatment plants in this area include the Federal Electricity Commission, Fertilizantes Mexicanos and PEMEX. Several coordination agreements were signed with different state governments to build water treatment plants, such as Jalisco (16 plants built), Guanajuato (1 plant, 2 in process), Michoacán (1 plant, 4 projects), Mexico (4 plants, 4 in process, 6 projects), Querétaro (1 plant) and Nayarit (1 plant).

- In the río Balsas watershed, the following actions have been taken: sanitary actions were undertaken in its upper area, two waste water treatment plants were put into operation for a total of six plants, three projects were undertaken to rehabilitate and complement waste water treatment plants, and a study was made to determine pollution levels of heavy metals and other toxic materials.

- In the San Juan river watershed, the project for the Monterrey waste water treatment plant was begun with an estimated capacity of 5 m3/s and a toxic substance study was undertaken.

- In the río Blanco watershed, a program was put together and a company created by the Veracruz state government in conjunction with industries located along the río Blanco to build, operate and administer the regional waste water treatment plant, which will be financed by these two groups in a 40%-60% proportion respectively, and which will service six locations, and construction has begun on the project.

- In the río Pánuco watershed, the toxic substance study was undetaken to determine the potential problems of the area and existing contamination levels.

- In the Pátzcuaro lake area, two treatment plants were built and another two are under construction.

- Along the Northern border region, actions have been undertaken in Tijuana for drinking water, sewage and waste water treatment (including a binational plant with a 1,500 l/s capacity and the local plant with a 1,100 l/s capacity; in Mexicali for industrial waste water control, sewage, stabilization lagoons and waste water treatment; in Nogales for a binational treatment plant and in Nuevo Laredo for the construction of a treatment plant.

In order to periodically analyze physical, chemical and bacteriological characteristics of water pollutants in the country's principal water bodies, the Water Quality Monitoring Network was established. Its objectives are to determine water quality, establish a reference to evaluate future changes, evaluate waste water manipulation, identify locations for increased control and establish priorities to study and control in the waste water area. The network consists of 402 stations operated by SEDESOL, which cover 33 rivers, 10 lagoons, five tourism beaches, five lakes, seven ports, three dams, 10 water bearings, three agricultural drainages and 17 coastal interest points, in addition to 774 stations adminmistered by the Secretariat for Agriculture and Hydraulic Resources (SARH). The parameters registered on site are: pH, temperature, disolved oxygen, transparency, conductivity and flow; parameters registered in laboratories (in Mexico City) are: alkalinity, chlorides, chemical and biochemical oxygen demand, fats and oils, amoniacal, organic and nitrate nytrogen, orthophosphates, total, dissolved and suspended solids, sulfates, methylene blue active substances and faecal coliforms.

In accordance with the national ecology plan, the analysis laboratories continue to be equipped and the inventory of polluting sources is constantly being updated; also, a series of techniques and methodologies are being designed to determine the degree of toxicity of national waters, in order to evaluate the presence of toxic substances in superficial and waste waters and to determine the risks for the users of the water and for the environment. The Diagnsostic Studies Program of the Water Contamination Problem by State was established in order to study regional problems. The National Toxic Substances Evaluation and Control Program in Superficial Waters was established in 1989 to determine the degree of contamination of these waters and to establish necessary policies and technologies for their prevention and control. In order to verify the absence of toxic substances in industrial discharges and water bodies, bioessay techniques are being used to detect these compounds.

The highest demand for equipment and instruments is in the areas of primary and secondary treatment. Equipment with best sales potential are aereators, pumps, scrapers and accessories, filter

presses, screw conveyers, chlorinating equipment, absorption towers, band conveyers, screens, water clarifiers, cooling towers, demineralizers, flocculators, ionic interchangers, samplers, leak detectors, analyzers, thermometers, barometers, spectrometers, spectrophotometers, colorimeters, pH meters, polarimeters, refractometers, measuring equipment and laboratory equipment.

4.3 LAND POLLUTION

At present, 27.2% of Mexico's total surface has been transformed by man, 27% for agriculture and cattle raising amd 0.2% for urban and industrial use. The remainder, which includes forests, rainforests, underbrush, savannahs, swamps and deserts, continue to be modified by man's activities, such as extensive cattle raising, forest exploitation and harvesting.

The use of the total 195.8 million has. of land in Mexico can be divided into the following categories:

Agriculture	13.8%
Cattle	58.1%
Forestry	24.5%
Non productive	2.3%
Water bodies	1.1%
Urban	0.2%

Overall, the country's ecological conditions are not appropriate for agricultural and cattle raising activities, due to their mountainous relief, the quality of soils and climatic characteristics. Due to the inappropriate use of soil, erosion and desertification have brought about major damages to the soil.

Solid wastes can be classified into three distinct categories: municipal, industrial and special type waste, which corresponds to special needs of manipulation, treatment and disposal.

In terms of municipal solid wastes, the country has been divided into five zones: Mexico City (D.F.), South, Center, North, Northern border (see Map 2), with very variable waste compositions.

Table 6 shows waste composition by area, excluding Mexico City, which is shown in Table 7.

TABLE 6
MUNICIPAL WASTE BY AREA
(%)

SUBPRODUCT	BORDER	NORTH	CENTER	SOUTH
Bone	0.52	0.59	0.94	0.61
Cans	3.13	2.46	2.10	2.80
Cardboard	3.01	4.28	4.16	4.51
Cloth	2.52	1.94	2.00	1.25
Coloured glass	3.98	3.36	2.86	3.95
Disposable diapers	4.96	2.59	2.79	4.01
Ferrous materials	0.51	0.46	0.86	1.37
Fine wastes	4.68	9.71	6.28	6.37
Food wastes	25.72	37.56	38.20	41.06
Garden wastes	15.35	7.48	6.95	7.88
Non ferrous materials	0.22	0.57	0.45	1.00
Paper	11.36	9.17	8.80	6.90
Plastic film	2.68	3.79	3.32	3.96
Rigid plastic	2.80	2.38	1.96	2.38
Rubber	0.71	0.78	0.90	0.31
Transparent glass	4.22	4.27	4.15	4.28
Other	13.63	8.61	14.36	9.23
TOTAL	100.00	100.00	100.00	100.00

Source: Comisión Nacional de Ecología - Informe de la Situación General en Materia de Equilibrio Ecológico y Protecciöin al Ambiente 1989-1990.

TABLE 7
SOLID WASTE SUBPRODUCTS FROM DOMESTIC USE IN MEXICO CITY
(%)

SUBPRODUCT	%	SUBPRODUCT	%
Bone	0.83	Leather	0.66
Cans	1.62	Non ferrous mats.	0.21
Cardboard	3.34	Paper	12.67
China & ceramics	0.75	Plastic	5.14
Cloth	2.41	Polystyrene	0.33
Coloured glass	2.55	Polyurethane	4.52
Construction materials	0.78	Rubber	0.21
Cotton	0.23	Synthetic fibres	0.47
Disposable diapers	3.06	Transparent glass	4.40
Ferrous materials	0.52	Vegetable fibres	5.00
Fine wastes	0.95	Waxed cardboard	1.44
Food wastes	45.02	Wood	0.59
Garden wastes	4.04	Other	3.20

Source: Comisión Nacional de Ecología - Informe de la Situación General en Materia de Equilibrio Ecológico y Protecciói n al Ambiente 1989-1990.

Mexico's total population of 82,763,740 inhabitants, according to the 1990 census, generates 57,935 tons of solid waste per day, for a total of 21.1 million tons/year, of which 70% is collected (40,554 tons/day or 14.8 million tons/year). Of this total, 28,288 tons/day are thrown into open air garbage areas, and 12,166 tons/day, or 30% of collected waste, is deposited in controlled landfills, while the remainder lies scattered on streets, roads, empty land, etc. Mexico has a total of 44 landfills with a total capacity for 989,000 tons/year which are in acceptable condition, and locations have been selected for another seven. The national authorities are trying to increase landfill capacity and are financing projects to find suitable locations for them and for their construction. At the same time, they are in the process of establishing a self-sufficient tariff system in order to make the collection service more efficient, timely and organized. During 1991 the increase in sanitary landfills was 60% above the capacity built during 1990. Through resources from the National Solidarity Program sanitary landfill construction was promoted, World Bank funds were used to install a garbage treatment plant and a Pilot Program for the Disposal of Solid Waste was developed to build landfills in six cities.

Within the Mexico City area, the Departamento del Distrito Federal (Federal District Department - D.D.F.) disposes of solid waste through two sanitary landfills and one controlled landfill (Santa Catarina with a 1,750 tons/day capacity) which is soon expected to be transformed into a sanitary landfill. These three installations cover 76.7% of the solid waste generated in Mexico City.

Industrial waste has been identified as one of the worst culprits in the contamination crisis, due to improper handling of waste through its non authorized disposal in vacant lots, abandoned areas, river beds or in the ocean. Mexico's industry is widely diversified and the wastes it generates are also within a broad range of characteristics. In order to classify these residues, Mexico uses the internationally accepted CRETI key (corrosive, reactive, explosive, toxic and flammable).

The National Ecology Institute (INE) has been monitoring and regulating industrial hazardous waste and municipal waste disposal. Since March 1989, all industrial waste producers are required to fill the Hazardous Waste Declaration consisting of a 15 point questionaire on what wastes the company generates and how it intends to dispose of them. It is estimated that throughout Mexico a total of 400,000 tons of industrial solid waste is produced daily for a total of 146 million tons per annum. The most polluting industries identified to date are the mining extraction and non ferrous smeltering industries (75%), organic and inorganic basic chemical industry (17.6%), agroindustry (7.4%), in particular in the processing of sugar, coffee, juices and oils. Of the total 400,000 tons/day, 14,000 tons/day or five million tons/year are considered hazardous and are mostly generated by the basic chemicals, petrochemical, heavy metal, foundry, metal concentration and agrochemical industries. Mexico City generates approximately 2.1 tons/year of industrial waste.

The chemical industry has a potentially high impact on the environment and major companies in the sector, such as Dupont, Dow Chemical, Colgate-Palmolive and 3M are facing stricter policies and legislation on health and environmental protection. In response, they are devising special technologies to adequately handle dangerous substances and their waste products, including recycling, cutting the amount of waste materials generated, waste incineration and community work.

There are five ways of handling hazardous waste: using "clean technologies", recycling, treatment, incineration and landfills. In order to fight land pollution, Mexico is encouraging the use of "clean technologies", the reduction in the generation of pollutants through the use of new processes, technologies and raw materials and/or the optimization of existing plants. In its first phase, hazardous waste control establishes the need to reduce generation through recycling, physical, chemical and biological treatment, incineration and controlled confinements.

Some private companies have installed plants for the treatment and final disposal of the residues generated by them. The government is encouraging private enterprises to operate landfills on a profit-making basis under the close scrutiny of the National Ecology Institute. Up to date, 20 recycling plants have been authorized to private investors

Mexico's infrastructure consists of :

- five plants to recycle solvents
- six plants to recycle car and industrial batteries for the recovery of lead;
- one plant for the recovery of dusts with a zinc content;
- one plant for the recovery of lubricating oils;
- four plants for the recovery of aluminum scrap;
- one plant for the recovery of nickel;
- three incinerating plants, two for private service and one for public service;
- three controlled confinements for public service for the final disposal of hazardous waste and one for non hazardous waste;
- four controlled confinements of private use for industrial residues.

New regulations regarding hazardous waste disposal are now in effect. All waste products listed by INE and any that cannot prove that they are not corrosive, reactive, explosive, toxic of inflammable are considered hazardous and their improper disposal is subject to heavy fines, factory closure and imprisonement. Mexican authorities are also proposing the repatriation of substantial amounts of industrial waste produced along the Mexican border by American businesses.

4.4 NOISE POLLUTION

Noise pollution is distinctive of large human concentrations. The most important sources of noise contamination are: industries using internal combustion engines, such as electricity generating plants, steel rolling mills, metal fabrication and paper mills; service related activitiess, such as bus terminals, airports, recreational centers; and transportation vehicles including airplanes, automobiles, trucks and buses, railroads and motorcycles. In the case of industry, the small and medium sized industries have more noise problems, since their machinery tends to be old and their installations are rarely appropriate. In particular, the metalmechanic, textile and construction companies are the principal noise polluters. Service companies have also been identified as polluters due to the use of sound systems and power plants. These include discotheques, bars, hotels and restaurants.

Noise control is mostly an administrative inspection activity undertaken by INE with the objective of determining the source of noise and designing the action to control, reduce or eliminate it and to impose the sanctions applicable. Indirect problems that have to be faced in order to reduce noise contamination are traffic, road systems and land use. In several cities of the country, programs have been undertaken to control noise emission by cars and trucks, through the motor changes and exhaust system controls, in particular on diesel powered vehicles. The mandatory emission control programs for new and old, private and public, passenger and cargo, cars and buses described in section 4.1 also addresses noise pollution. The Industrial Inspection Program also controls noise pollution in the industrial sector. Within the

Mexico City metropolitan area, there is a Noise Diagnosis Program measuring in particular noise related to traffic on Mexico's larger streets. In Mexico City, the overall noise level has approximately diminished by 5 dB "A" to an average 76 dB "A". Also, efforts have been made to reduce airplane related noise, by changing technologies on new aircraft and altering routes and takeoff and landing procedures, but results have not been noticeable. In particular, 25 cities were identified as having noise pollution problems: Celaya, Colima, Chetumal, Durango, Guadalajara, Guanajuato, Hermosillo Irapuato, Cd. Juárez, León, Manzanillo, Mazatlán, Mérida, Mexico City, Monterrey, Pachuca, Puebla, Querétaro, Salamanca, Saltillo, San Luis Potosí, Tepic, Tijuana, Tuxtla Gutiérrez and Zacatecas. At present, the regulations for noise and vibrations are being prepared to legally establish criteria to establish technical norms.

Instruments and equipment with best sales potential for noise control are the following: noise dosimeters, analyzers, vibration monitors, recording equipment, calibrators, insulation materials, earmuffs and plugs.

5. ACTIONS AND PROJECTS

By presidential order, a comprehensive program to combat atmospheric pollution in the Mexico City area was published in 1989. It is based on five strategic areas:

- Rationalization and reorganization of the urban transportation system;
- Improvement of fuel quality;
- Introduction of alternative fuels;
- Installation of emission control systems for vehicles and industry;
- Ecological recovery of deteriorated areas.

The specific measures proposed along these guidelines, of which four have already been taken, are the following:

- Rationalization of vehicle traffic: one day without a car campaign and expansion of non-polluting public transportation services;
- Mandatory vehicle and diesel bus verification and tune-up;
- Ecological restoration of 26,000 Ha. in the Eastern and Southern areas of the city;
- Tune-up, overhauling, new buses and less polluting engines on the publicly owned R-100 bus lines;
- Introduction of catalytic converters on the 15,000 official vehicles and 60,000 public transporation vehicles;
- Emission control in small businesses;
- Research and development of environmentally acceptable strategies, products and technologies;
- Manufacture of unleaded and low volatility gasoline;
- Sufficient supply of unleaded fuel for the 1991 and new model vehicles equipped with catalyitic converters;

- Replacement of fuel-oil by gas in thermo-electric power plants and in highly polluting industries;
- Testing program for alternative fuels, oxigenated compounds and anti-pollution devices;
- Relocation of steel smelters outside city limits;
- Addition of oxigenated compounds to gasolines in the Mexico City area to compensate for the low efficiency in gasoline burning due to the high altitude;
- Establishment of strict fuel control systems in refineries;
- Research projects to be undertaken with foreign institutions with respect to atmospheric photochemical phenomena;
- Replacement of gasoline by LP gas in 45,000 city cargo trucks;
- Manufacture of low sulphur fuel oil;
- Manufacture of low sulphur diesel;
- Expansion of the national storage, transportation and distribution system for new ecological fuels in PEMEX;
- Construction of oxigenated compound plants;
- Modernization of the existing PEMEX sulphur recovery plant and installation of a HC and a sulphur recovery plant;
- Fitting out measures for HC vapor recovery at receiving and distributon terminals and service stations throughout the valley of Mexico.

In the medium to long term the government plans to restructure the public transporation system and restore the ecological balance of the valley of Mexico. The total cost of the program is estimated at $3 billion. Funding for this project is expected to come from loans by the Japanese and European governments and the Word Bank.

SEDESOL has also created a mandatory evaluation of environmental influence, which evaluates how and in which way and proportion a particular project influences the environment. The different aspects taken into consideration to study these are: characteristics of the projected activity or construction, location selected, necessary raw materials, general aspects of the economic and environmental media, relationship to land use norms and regulations, identification of environmental influence, prevention and mitigation measures to be applied and environmental scenario to be projected after the activity or project is completed. All agencies responsible for public or private projects of works capable of altering or damaging the environment within the framework of the General Law for Ecological Balance and Environmental Protection need to file an environmental influence statement with SEDESOL. Between 1989 and 1990, 794 projects were evaluated in comparison to 377 projects between 1983 and 1988. Between 1991 and 1994, 2000 projects are expected to be evaluated. For local or regional projects, the state governments are responsible for their evaluation

In order to respond to environmental emergencies and contingencies, SEDESOL has created a series of programs designed to respond in these cases. These include:

- The Joint Response Plan to the Spilling of Hazardous Substances on the Northern Border Region;

- The National Contingency Plan to Fight and Control Hydrocarbon and Other Hazardous Substance Spillings in the Ocean;
- The Mexico-U.S. Agreement on Marine Contamination Through Hydrocarbon and Other Hazardous Substance Spillings;
- The Tacaná Vulcano Plan;
- The External Radiological Emergency Plan;
- The International Agreement to Prevent Ocean Water Contamination Through Hydrocarbons;
- The London Agreement on Ocean Pollution Prevention Through Waste and Other Material Spillage;
- The Agreement For The Protection and Development of Marine Media in the Great Caribbean Region;
- The Contingency and Emergency Plan for Atmospheric Contamination in the Mexico City Metropolitan Area.

On July 9, 1990 the Mexican authorities, through SEDUE, published the National Program for Environmental Protection 1990-1994 to set objectives, goals and strategies in pollution control for that period.

Its principal objectives are:
- to harmonize economic development with environmental quality;
- to protect the environment based on a territorial classification;
- to subject activity and work projects to environmental criteria;
- to improve air quality;
- to stop and reverse water pollution;
- to prevent and control soil pollution through adequate waste treatment;
- to ensure the recovery and protection of natural resources;
- to strengthen the legal framework;
- to promote education to improve ecological conscience;
- to use scientific and technological advances to improve environmental conditions;
- to ensure the participation and responsibility of society in the protection of the environment;
- to strengthen international cooperation.

The strategies proposed to achieve this are:
- improved communication mechanisms with the population;
- decentralization through increased state and municipal participation and responsibility;
- justice in terms of who pollutes will have to pay the cost to prevent and reverse it;
- simplified regulatory environment;
- financial strategies which involve federal, state and municipal governments, together with private and cummunal investments, as well as the payment of fees on services related to pollution control.

The specific goals and actions to be undertaken are divided into four categories: mandatory (M - federal government), coordination (C - state and municipal participation), negotiation (N - social and private participation) and induction (I - community participation). The most important actions proposed are:

NATURAL RESOURCES

- preparing programs to respect the natural vocation and to recover the soil (M);
- promoting and establish modes and conditions for the rational use of natural resources (C/N);
- restoring altered ecological systems and critical areas (M/C);
- establishing ecological protection and restauration units to reduce pressure on natural resources (M);
- controling forest and jungle exploitaton processes to guarantee the reforestation and recovery of these area (M/N);
- preparing multi-sector programs to fight pollution, fires, deforestation, erosion and/or desertification (M);
- consolidating the National System of Protected Natural Areas by supporting and enlarging existing areas and creating new ones (M);
- involving local communities to define exploitation and global handling projects in protected areas (N);
- reinforcing protection and vigilance of plant and animal species, in particular in protected areas (C/N);
- supporting reproduction of endangered species through nurseries and breeding places within a national network of parks, zoos, breeders and botanical gardens (M/N);
- increasing municipal participation in the above (C);
- revising the inventory of threatened plant and animal species and those in danger of extinction to protect them by closed seasons (M);
- coordinating measures to prevent and control environmental emergencies (C);
- providing environmental education to social, rural, forestry and urban communities to protect the environment and to participate in its manipulation (N).

WATER

- reducing pollution levels in rivers, internal waters and oceans, in particular in high development areas (M/C/N);
- giving prioritary action to the five most endangered watersheds through sanitary actions, proper use of water, residue discharge control, construction and operation of treatment plants, ecological restauration of surrounding areas;
- working on the sanitation of ocean areas (M);
- promoting increased municipal participation (C);
- publishing norms and stricter parameters for wastewaters in order to protect the absorption capacity of the recieving bodies (M);
- increasing inspection and vigilance programs on potential polluting sources (M);
- supporting rehabilitation and construction programs for municipal waste water treatment plants and the installation and increase of drainage and sewage systems, by involving local authorities and the private sector to cover the costs of these works (C);

- establishing agreements for the construction of plants and devices for the prevention and control of water pollution, by industry and in particular by the chemical and sugar manufacturers (N);
- preparing agreements with the private and social sectors for the control and prevention of pollution and for water saving measures (N);
- increasing the number of monitoring stations and continuing to equip analysis laboratories (M);
- bringing the inventory of polluting sources up to date (M);
- providing training for the prevention and control of water pollution (M);
- supervising human settlements to avoid their location along areas with risks to water resources (M).

AIR

- in the Mexico City metropolitan area, further applying measures already in force such as using anti-pollution devices on new cars, increasing the quality and coverage of public transportation systems, ecological restauration of several urban areas, producing higher quality fuels for fixed and mobile sources, the control of polluting agents, the regulation of urban growth and the decentralization of industrial and administrative activities (C);
- in other large cities, applying similar measures to prevent and control pollution in coordination with municipal governments; in smaller cities, establishing monitoring systems and preventive measures (C);
- establishing corrective and preventive measures for mobile and fixed sources (C);
- developing energy saving programs;
- creating specific programs for high polluting cities and areas (C);
- promoting fuel savings through improved traffic conditions, increasing the coverage and efficiency of public transportation systems and the use of light vehicles with a low gasoline consumption (C);
- reducing the production and use of substances which destroy the ozone (N);
- relocating highly polluting industries and prohibiting their installation in critical areas (M);
- intensifying the vigilance and regulation for the installation of anti polluting devices in industrial establishements (M);
- signing agreements with highly polluting industries for the installation of anti-pollution devices and more efficient boilers, in particular in smaller companies (N);
- installing emission reducing devices in thermoelectrical plants located in the valley of Mexico (M);
- signinig agreements with PEMEX and CFE to install vapour recovery programs, to imrove combustion processes and to install continuous pollutant emission analyzers (M)
- continuing agreements made with the automobile industry and repair shops for the installation of emission control devices in all vehicles after 1977, the incorporation of state-of-the-art technologies on new vehicles after 1991, and proper maintenance to anti-pollution devices (N);

- establishing measures to control evaporative emissions in gas stations with their owners (N);
- increasing the atmospheric monitoring network in critical areas throughout the country (M);
- supervising air quality through emission source monitoring and the use of metheorological predictions through dispersion and chemical analysis models in the atmosphere (M);
- establishing technical norms to guarantee air quality by determining maximum levels of emissions by source and pollutant, as well as control and reduction levels, and fuel quality (M);
- finishing and updating the inventory of industrial establishements and vehicles in circulation throughout the country (National Inventory of Pollution and High Risk Sources (M);
- producing "clean" fuels to be distributed in critical areas to reduce smoke, dust and gas emission (C);
- creating the necessary mechanisms to apply emergency and contingecy plans (M);
- promoting fuel savings programs and the use of public transporation systems (N)

SOLID WASTE

- establishing a comprehensive legal framework (M);
- creating comprehensive programs to control solid waste production and disposal with state and municipal participation (C);
- promoting municipal responsibility to cover sanitary obligations, and in the administration and operation of municipal services, including solid waste disposal projects (C);
- controling and reducing the production of disposable products and industrial waste in new processes by authorizing only clean technologies (M);
- establishing less poluting processes within economic viability structures for the installation of agrochemical waste receptors in Mexico's five most important agricultural regions;
- reducing the production and use of low degradation materials and promoting the installation of recycling plants and gathering centers, in particular for plastics (N);
- promoting a more respectful social culture towards the environment (N);
- regulating urban development in industrial areas particularly, and determining safe locations for industrial waste disposal (M);
- establishing the necessary confinement infrastructure for industrial hazardous waste (N);
- establishing agreements with the pesticide industry for the construction of agrochemical receptors in the country's most important agricultural areas (N);
- increasing infrastructure for the control, treatment and disposal of solid wastes, in particular around industrial areas (C);
- increasing the number and capacity of recycling, treatment, incineration and controlled confinement plants in accordance with municipal and industrial needs (C);

- completing the inventory of industrial wastes, pesticides and fertilizers (M);
- on the international level, signing the necessary agreements to control the trans-border movement of solid wastes and their elimination; in particular with the United States, increasing the local border systems of joint response to the escape or spillage of hazardous substances.

Additionally, a series of agreements were made with municipalities (Municipal Development Programs) to determine the functions state, municipal and federal governments have in relation to the environment in order to create a Municipal System of Environmental Administration, through which the municipalities will be given the necessary elements to freely administrate and operate its environmental protection programs.

Mexico has also participated in several international agreements in relation to environmental problems with different organizations within the United Nations, such as the UN Development Program, the UN Industrial Development Organization, the UN Program for the Environment, the UN Conference on the Environment and Development, the World Metheorological Organization, the International Marine Organization, the Panamerican Center for Human Ecology and Health, the Organization of American States, the European Economic Community, the Economic Commission for Latin America and the Caribbean, the Central American Environment and Development Commission, and the UN Food and Agriculture Organization. Several agreements have been signed with other countries, including the United States (in particular in reference to the border region), Japan, the EEC, Spain, Canada, the U.K. and Irland, France, Germany, Brazil, and Chile.

6. END USERS

The principal end users of pollution control equipment and instrumentation are government and industry. The government sector comprises municipal, regional and central governments, port authorities, public utilities, hospitals and research institutes. This sector's expenditures amount to approximately 25% of total apparent consumption. The manufacturing and commercial areas include the following industries: chemicals, pulp and paper, textiles, oil and gas extraction and pipelines, petrochemicals, stone, clay and glass, primary metals, fabricated metal products and transportation. These industries' expenditures account for an estimated 75% of demand. Many of these industries are dominated by state owned companies such as the oil and gas, petrochemicals and electricity generation sectors. Following are small summaries on certain industries and agencies.

- Petroleos Mexicanos (PEMEX) is the national oil monopoly, a decentralized agency owned directly by the State. Its activities include the exploration, production and distribution of crude oil; refining and distribution of gasoline and oil products; production and distribution of certain petrochemicals. PEMEX is ranked the number 36

corporation in the world among "Fortune 500" companies, as measured by its sales of $18.7 billion during 1990. It is the largest enterprise in Latin America and employs over 250,000 people. PEMEX operates 82 exploration and development wells, 129 refining plants, 106 petrochemical plants, 59,000 kilometers of pipelines, in addition to tanks, ships, helicopters and ports.

- Comisión Federal de Electricidad (CFE) is the country's sole generator of electricity and is the second largest government owned company after PEMEX and it employs 126,000 people. It has an installed capacity of 25,300 MW, a gross generation of electric energy of 107,000 GWH and electric energy sales of 85,000 GWH. Steam plants account for 45% of total installed capacity, hydroelectric plants for 30%, and coal electric plants for 5%, while combined cycle, nuclear and turbogas plants account for the balance. CFE has a total of 13 divisions and 100 coordinating offices throughout the country, and it is administratively divided into seven thermoelectric regions and five hydroelectric regions.

- The ceramics and glass industry is dominated by Vitro, a major industrial group from Monterrey with sales of over $3 billion in 1990. It recently made a takeover of Anchor Glass and associated with Corning Inc. through the purchase of 49% of its U.S. and world operation, while Corning acquired 49% of Vitro's Mexico and world operation in the area of kitchen and table articles, through the creation of Corning Vitro Inc. and Vitro Corning SA de CV.

- The Mexican plastics and rubber industry comprises 3,400 companies, which together have 140,000 employees. Of these, 3000 are plastics processors and the remainder includes a variety of related companies. By type of process, there are 1,050 in injection, 900 in extrusion, 450 in blowing, 180 in laminating, 105 in rotational molding, 90 in foaming, 60 in compression, 45 in thermoforming, 45 in coating and 120 in other processes. Together, they have an installed capacity of 1.6 million tons.

- Mexico's pulp and paper industry includes 65 large companies employing 32,500 workers, and covers a wide range of processes. Mexico's production of pulp amounts to an average 800,000 tons, while paper production amounts to close to 3 million tons and is growing steadily. The uses of paper in Mexico, in order of importance, are: packaging, writing and printing, other paper and cardboard, newspapers and free textbooks, sanitary and facial paper and finally, special applications.

- The mining industry consists of over 6,000 mining enterprises, of which 144 are considered large and account for 82% of Mexico's mining exports. The remainig companies are either small or medium sized and basically supply local demand. State majority owned companies still play a major role in this industry, but the massive sale of government owned companies

will lead to state control of only five companies, mining minerals considered strategic: iron, coal, sulphur, phosphorous and potasium. Mexico holds first places in world production of several metals and minerals: first place in production of silver, bismuthç sodium sulphate and celestine; second in barite; third in antimony, fluorite, and graphite; fourth in mercury; and fifth in arsenic, cadmium and molybdenum. Mexico's production of non-ferrous industrial metals was 812,000 tons, that of steel related metals 12 million tons, and that of non-metallic minerals 15.4 million tons in 1990.

- Mexico's steel industry is composed of four large, fully integrated manufacturers, which cover all five basic production processes: concentration of iron ore and production of coke; production of primary iron or fusion; production of pig and sponge iron; production of steel; and production of final products. These companies are the government owned SIDERMEX complex (Altos Hornos de México AHMSA and Siderúrgica Lázaro Cárdenas - las Truchas SICARTSA), which is now in the process of being totally restructured, and the private owned Hojalata y Lámina (HYLSA) and Tubos de Acero de México (TAMSA). These together produced close to eight million tons of steel in 1990 and they account for 86% of total production by the industry and 65% of employment. Additionally, there are 23 semi-integrated firms and 44 mill rollers with a total installed capacity of 11.6 milion metric tons.

- The cement industry presently consists of over 30 plants concentrated in a relatively small number of large producers, ten of which are among the country's 500 largest companies: Cementos Mexicanos, Cementos Tolteca, Cementos Guadalajara, Cementos Apasco, Cementos de Veracruz, Cementos de Chihuahua, Concretos Apasco, Cementos Tolteca, Latinoamericana de Concretos and Tubos DYSA. These companies together reported sales of one billion dollars in 1990. Total installed capacity is estimated at 30 million tons and the cement companies have projects to expand this capacity by 35% in the next four years.

- The automotive industry is concentrated in a small number of large firms, which together operate 15 plants, 10 of which are American, three Japanese and two German. Total production of cars reached 274,500 in 1989 and that of trucks 167,409. The largest car manufacturers are Volkswagen (28%), Nissan (25%), Chrysler (21%), Ford (17%) and General Motors (8%). These companies also manufacture trucks, in addition to Dina, Famsa, and Kenmex.

- The food and beverages industry accounts for 6.5% of the country's total GDP, or an estimated $15 billion. It is one of Mexico's most steadily growing sectors, since it satisfies the most basic needs of the country's growing population. This industry can be divided into the following large categories, listed in order of importance: Meat and dairy products, corn grinding, wheat grinding, soft drinks, coffee, beer and malt,

tobacco, sugar, oils and fats, alcoholic beverages, preserved fruits and vegetables, and animal feed. The government participates in the production, purchase and industrial transformation of food products, as well as in distribution, transportation and storage through the National Company for Popular Subsistence (CONASUPO).

- The construction industry is a major user of materials handling equipment of all types and sizes. This industry consists of approximately 15,000 companies employing 1.4 million workers. Total production by this industry is valued at close to $5 billion, with private and public construction projects accounting for 60% and 40% respectively. Construction projects are concentrated in industrial construction, communications, housing, utilities and municipal services. Since 1991, major investments are being undertaken in the construction of roads. The public sector is expected to invest $1.1 billion and the private sector $2 billion in this project.

- The transportation sector, including air, sea, railroads and roads uses a variety of materials handling equipments. There are a total of 78 national and international airports, which serviced close to one million flights with 9.2 million national passengers and 8.6 million international passengers in 1990. Mexico has 76 sea ports and nine river ports, whith a total dock length of 73,000 meters, where an average 170 million tons of cargo is handled annually. The railroad network consists of 20,000 miles and annual transportation is of 70 million tons of cargo and 25 million passengers. Mexico's highway network consists of 55,000 miles of paved roads, with a total circulation of over 100 million vehicles per annum.

7. REGULATIONS

Between 1972 and 1973 the Government enacted several regulations to specify limits on particulate emission levels from stationary sources and to regulate water pollution. Given the rapidly growing levels of industrialization and urban congestion in the major cities, these requirements were soon obsolete. In January 1984, as a result of increased pressure from the public opinion, the Government published a new set of laws and regulations to supersede, restate or cancel previous laws. Finally, on January 26, 1988 the new Federal Law on Ecological Equilibrium and Environmental Contamination was passed and enacted on March 1, 1988. This law supersedes and abrogates the prior federal law. The fundamental change in the law is organizational as it centralizes power within SEDUE (now SEDESOL-INE) while recognizing the need for inter-agency, state and municipal government participation for successful implementation.

Recently, in order to provide the necessary strength, efficiency, autonomy and objectivity in matters related to ecology, the administrative structure related to environmental control,

legislation and supervision was completely revised. Prior to these changes, the administrative body for ecology was the Subsecretariat of Ecology of the Secretariat for Urban Development and Ecology (SEDUE). As of July 1992 (the organizational structure was only approved in September 1992), all matters related to the study of phenomenon related to the environment and all legislative and normative functions correspond to the Instituto Nacional de Ecología (INE), and all matters related to the vigilance and compliance with the legislative body correspond to the Procuraduría Federal de Protección al Ambiente (Federal Environmental Protection Prosecution Office) (PFPA). Both of these are deconcentrated agencies related to the new Secretaría de Desarrollo Social (SEDESOL) as the previous SEDUE was renamed after the changes. They are autonomous with reference to their decisions, but are financially dependent upon the Federal Government through SEDESOL. Additionally, several other government agencies are responsible for specific areas, such as the Comisión Nacional del Agua (CNA - National Water Commission) responsible for all matters related to water and water contamination, the Comisión Nacional de Ecología (CNE - National Ecology Commission) and the Comisión Metropolitana para la Prevención y Control de la Contaminación del Valle de México (Metropolitan Commission for the Prevention and Control of Pollution in the Valley of Mexico), responsible for environmental matters within the Mexico City area, and which depends from the Departamento del Distrito federal (DDF - Federal Distric Department). The DDF also has the Coordinación General de Reordenación Urbana y Protección Ecológica (General Coordination for Urban Restructuring and Ecological Protection) (Appendix I lists all government agencies related to ecology for further reference). State and municipal governments were also granted more autonomy and have published individual state ecological laws. Each state has a SEDESOL representative for ecological related matters (see Appendix II). The individual responsibilities for each organism were also clearly defined: the federal agencies are responsible for environmental risk matters that affect more than one state, large industrial business lines, rivers and waters (in conjunction with CNA) and in general all matters not limited to one state; DDF is responsible for matters related to its jurisdiction (Mexico City), the individual states for matters limited to within state borders.

The legal basis for ecological action in Mexico is found in its Constitution. Several articles cover the use of natural resources, human health, safety and pollution prevention and control, as well as the decentralization and definition of responsibilities regarding environmental protection and ecological equilibrium between the federal, state and municipal governments.

The new law covers the following points: cooperation of federal, state and municipal governments; major responsibilities of the Ministry of Urban Development and Ecology (SEDUE now SEDESDOL-INE), the Department of the Federal District and the National Ecology Comission; general ecological policy and its instruments;

creation and protection of protected natural areas; rational use of natural elements, including water and its ecosystems, soil and its resources, non-renewable resources and the effects of their exploitation; protection and control of the environment, including atmosphere, water and land; definition of risky activities, dangerous materials and residues; rules regarding nuclear energy, noise, vibrations, thermal and light energy, odors and visual contamination; promotion of social participation; security and controlling measures and sanctions, as well as regulations on testing and inspection, legal actions and fines. This law is patterned after those in effect in the U.S., Spain, Germany and Japan, and incorporate rules designed by the Environmental Protection Agency (EPA).

The new law touches on three basic aspects of environmental law: the use of natural resources, whether renewable or not, the necessary actions to avoid pollution, and ecological equilibrium to allow for further development. Fundamentally, the law states that any public or private activity which causes ecological desequilibrium or excesses must receive prior authorization from SEDESOL. The substantive scope of the law sets forth ecological policy, planning and ordinance, and contains criteria for the promotion and regulation of economic, social and urban development. The law makes detailed provisions for the prevention and control of air, water and soil contamination by regulating vehicular and industrial emissions, depletion and contamination of the existing water supply, importation of hazardous toxic waste, herbicides, pesticides, fertilizers or other toxic substances prohibited in their country of manufacture. The storage, transportation, re-use, incineration or final disposal of waste products also require the prior authorization from SEDUE (SEDESOL-INE). Any company producing hazardous waste is legally responsible for its proper disposal in perpetuity. All contamination due to noise, vibrations, thermal energy, odors or visual effects, when it exceeds the limits established by SEDUE (now INE) and the Secretariat of Health, is prohibited.

The application of these rules, their enforcement and the corresponding administrative and federal sanctions for their violation are contained in the law. Sanctions are potentially harsh: fines of up to 20,000 times the daily minimum wage may be imposed, plants may be shut down and involved individuals may be subject to imprisonement. Federal, state and municipal authorities may inspect and monitor activities to verify compliance. These inspections follow fairly specific procedures. The procedural requisites have also been formalized. All existing and planned operations exceeding the parameters specified in the technical norms require an authorization from INE. An applicant for INE authorization must provide the agency with an environmental impact statement of the project. After evaluating the application, INE may grant or deny the authorization or condition it upon changes in operation or pollution controls.

Seven industrial categories are particularly scrutinized for their environmental impact:
- federal public works;

- water works, oil, gas, carbon and general transportation networks;
- chemical and petrochemical plants, iron and steel mills, paper factories, sugar refineries, manufacturers of beverages, cement, automotive parts, and electricity generating and transmission plants;
- mineral and non-mineral exploration, extraction, treatment and refining;
- federal tourism developments;
- hazardous (including nuclear) waste treatment, storage and disposal plants;
- exploitation of slowly regenerating vegetation in forests and tropical jungles.

To supplement the law and assist in its interpretation and application, various regulations and technical norms have been issued. The regulations outline the procedures required by the law, while the norms provide quantitative parameters for the evaluation of hazardous waste. Additionally, all states are required to publish their own Ecological Law.

The states which have published their Ecological Law to date are:

Aguascalientes	March 89
Chiapas	July 91
Coahuila	January 90
Colima	October 90
Durango	May 90
Guanajuato	August 90
Guerrero	March 91
Hidalgo	June 88
Jalisco	June 89
Morelos	August 89
Querétaro	May 88
Quintana Roo	April 89
San Luis Potosí	July 90
Sinaloa	July 91
Sonora	December 89
Tabasco	December 89
Veracruz	May 90
Yucatán	December 88
Zacatecas	December 89

The regulations published to date are:

- The Regulation for the Prevention and Control of Water Contamination (1973);
- The Regulation for Environmental Protection Against Contamination Originated by Noise Emission;
- The Regulation to the General Law on Ecological Balance and Environmental Protection in the area of Environmental Impact (1988);
- The Regulation to the General Law on Ecological Balance and Environmental Protection for the Prevention and Control of Pollution Generated by Automobiles Circulating in Mexico City and its Surrounding Urban Municipalities (1988);

- The Regulation to the General Law on Ecological Balance and Environmental Protection in the area of Hazardous Waste (1988);
- The Regulation to the General Law on Ecological Balance and Environmental Protection in the area of Prevention and Control of Atmospheric Contamination (1988).

The following is a list of the technical ecological norms (NTE) published to date.

NATURAL RESOURCES

CT -CERN-001/91	ecologic criteria to determine plant and animal life living on land and in water of the Mexican Republic species that are rare, threatened or in danger of extinction or subject to special protection and their endemics

WATER

Technical ecological norms (NTE) for the discharge of industrial waste waters to superficial water bodies, recievieng bodies and sewage by the following industries:

NORM NBR.	INDUSTRY
NTE-CCA-001/88	conventional thermoelectrical centers
NTE-CCA-002/88	sugar cane producing industry
NTE-CCA-003/88	crude oil refining, transformation & petrochemicals
NTE-CCA-004/88	fertilizer production(expect phosphoric acid)
NTE-CCA-005/88	plastics and synthetic polymers industry
NTE-CCA-006/88	flour industry
NTE-CCA-007/88	beer and malt industry
NTE-CCA-008/88	construction asbestos industry
NTE-CCA-009/88	milk and dairy industries
NTE-CCA-010/88	flat glass industry
NTE-CCA-011/88	pressed and blown glass industry
NTE-CCA-012/88	synthetic rubber and tire industries
NTE-CCA-013/88	iron and steel industry
NTE-CCA-014/88	textile industry
NTE-CCA-015/88	pulp and paper industry
NTE-CCA-016/88	soft drinks industry
NTE-CCA-017/88	metal finishing industry
NTE-CCA-018/88	copper lamination, extrusion and drawing
NTE-CCA-019/88	sawmill impregnation products industry
NTE-CCA-020/88	textile asbestos, friction materials and sealing industry
NTE-CCA-021/88	tanning and leather finishing industry
NTE-CCA-022/88	animal slaughtering and meat packaging ind.
NTE-CCA-023/88	preserved food industry
NTE-CCA-024/88	paper production from virgin fibre
NTE-CCA-025/88	paper production from treated cellulosic fibre
NTE-CCA-026/91	hotels and restaurants
NTE-CCA-027/90	coffee exploitation industry
NTE-CCA-028/90	preparation and packaging of preserved fish and crustaceans industry and fish meal and oil production industry

NTE-CCA-029/91	hospitals
NTE-CCA-030/91	soap and detergent industry
NTE-CCA-031/91	automotive repair and maintenance, gasoline stations, laundries, photograpgic development and waste water treatment industries and services
NTE-CCA-032/91	maximum limits on pollutants in waste waters for their disposal through agricultural irrigation
NTE-CCA-033/91	conditions for the use of urban or municial wastewaters, or of their mixture with water bodies for agricultural irrigation
CE -CCA-001/89	Ecological criteria for water quality

HAZARDOUS WASTE

NTE-CRP-001/88	criteria to determine hazardous wastes and their listing
NTE-CRP-002/88	procedures to make the extraction test to determine the components that make a residue dangerous because of its toxicity
NTE-CRP-003/88	procedures to determine the incompatibility between two or more residues considered hazardous by NTE-CRP-001/88
NTE-CRP-008/88	requirements for locations used for controlled confinements of hazardous wastes except radioactive ones
NTE-CRP-009/88	requirements for the design and construction of complementary works to controlled confinements for hazardous waste
NTE-CRP-010/88	requirements for the design, construction and operation of controlled confinement cells for hazardous wastes according to NTE-CRP-001/88
NTE-CRP-011/88	requirements for the operation of a hazardous waste controlled confinement

AIR

Maximum permitted emission levels to the atmosphere of:

NTE-CCAT-001/88	sulfur dioxide and trioxide and sulfuric acid mist in sulfuric acid producing plants
NTE-CCAT-002/91	particles originated in cement industry calcination furnaces
NTE-CCAT-003/88	hydrocarbon and carbon monoxide emission from exhaust pipes of gasoline powered cars
NTE-CCAT-004/88	hydrocarbon, carbon monoxide and nitrogen oxide emissions from exhaust pipes of new gasoline powered cars at the plant
NTE-CCAT-005/88	particles, carbon monoxide, sulfur bioxide, nitrogen oxides from diesel combustion processes in fixed sources
NTE-CCAT-006/88	particles, carbon monoxide, sulfur bioxide and nitrogen oxides from coal combustion processes in coal fueled electricity plants

NTE-CCAT-007/88	particles, carbon monoxide, sulfur bioxide and nitrogen oxides from the combustion of fuel oil by fixed sources
NTE-CCAT-008/88	particles, carbon monoxide, sulfur bioxide and nitrogen oxides from the combustion of natural gas by fixed sources
NTE-CCAT-009/88	solid particles from fixed sources
NTE-CCAT-010/90	smoke opacity from the exhaust pipes of new motors at the plant for diesel powered vehicles
NTE-CCAT-011/90	smoke opacity from the exhaust pipes of diesel powered vehicles in circulation
NTE-CCAT-012/88	sulfur dioxide, sulfur trioxide mists and sulfuric acid
NTE-CCAT-014/91	hydrocarbons and carbon monoxide from the exhaust pipes of gasoline powered vehicles weighing over 3,000 kgs.
NTE-CCAT-015/90	hydrocarbons, carbon monoxide and smoke from the exhaust pipes of gasoline or oil and gasoline powered motorcycles in circulation
NTE-CCAT-017/90	hydrocarbons and carbon monoxide from the exhaust pipes of petroleum liquefied gas powered vehicles in circulation
NTE-CCAT-018/88	establishement of a 2% maximum limit on sulfur weight in liquid fuels used by the industry within the Mexico City metropolitan area
NTE-CCAT-013/89	characteristics of the equipment and measuring procedures for the verification of polluting emissions from gasoline powered vehicles in circulation with maximum permissible limits established by NTEs
NTE-CCAT-016/90	characteristics of the equipment and measuring procedures for the verification of polluting emissions from gasoline or oil and gasoline powered motorcycles in circulation with maximum permissible limits established by NTEs
NTE-CCAM-001/91	procedures to determine the concentration of carbon monoxide in the air and procedures to calibrate the measuring equipments
NTE-CCAM-002/91	procedures to determine the concentration of suspended particles in the air and procedures to calibrate the measuring equipment
NTE-CCAM-003/01	measuring methods to determine the concentration of ozone in the air and procedures to calibrate the measuring equipment
NTE-CCAM-004/91	measuring methods to determine the concentration of nitrogen bioxide in the air and procedures to calibrate the measuring equipment
NTE-CCAM-005/91	measuring methods to determine the concentration of sulfur bioxide in the air

ECOLOGICAL CRITERIA FOR THE ELECTRICAL INDUSTRY

CE -OESE-001/88	to select and prepare locations for the installation of hydroelectric exploitation systems and for the construction and operation of these systems
CE -OESE-002/88	to select and prepare locations for the installation of conventional thermoelectrical centers and for the construction of these
CE -OESE-003/89	to select and prepare locations and paths, construction, operation and maintenance of high tension electric transmission lines and electric power substations
CE -OESE-004/89	to select, explore and prepare locations for the installation of geothermal systems and for the construction of these

Additionally, there are a large series of Official Mexican Norms (NOM) for the specific methods used in the determination of different substances and solids in water, the methods to evaluate and determine air pollutants, to determine solid wastes and to determine noise levels.

8. MARKET ACCESS

Sales in Mexico are usually made through local agents and distributors, normally operating on a commission basis. Decisions should be taken on whether to use an agent, joint venturing or licensing with a Mexican company. Mexico's market is highly competitive and companies which maintain an active presence in the market and establish a good track record by virtue of product performance, competitive price and service will do well.

As a result of Mexico's accession to GATT, the Mexican Government has gradually opened the economy to international suppliers. Import duties have been lowered from a maximum 100% in 1983, to 20% since December, 1988. The official import price system has been totally eliminated and import permits are required on only 325 of the total 11,950 items in the Mexican Tariff Act, none of which correspond to this industry. Mexico adopted the Harmonized System of Tariff Nomenclature on July 1, 1988.

Imports of pollution control equipment and instruments are subject to a 0% to 20% ad valorem duty assessed on the F.O.B. invoice value. In addition, a 0.8% customs processing fee is assessed on the invoice value. A 10% value added tax (recently reduced from 15%) is then assessed on the cumulative value of invoice plus the above taxes. Some manufacturers who use imported inputs for their products under a Mexican Government approved manufacturing plan may have the duty and/or VAT waived or rebated.

Formerly, in order to bid on tenders and sell to a government agency or decentralized company, foreign manufacturers required having a local resident agent and to have the foreign supplier

registered and accepted by the Secretariat of Planning and Budgeting (Secretaría de Programación y Presupuesto - SPP). As of July 1991, the above requirement for prior registration with SPP has been eliminated.

The new procedures now in force require the foreign supplier to have a local agent or representative and it has to be registered through his local representative as an accepted supplier with each government ministry and/or decentralized agency according to the international tender requirements under review.

International tenders financed by the World Bank or the International Development Bank are open to all member countries of these institutions. More recently, the World Bank, where its credits are involved, has required that bid documents should also include an affidavit confirming that the Canadian company is a bona fide Canadian company with an official residence in Canada and that Canada is recognized as a contributing member to the World Bank.

There are no official metric requirements applicable to imports into Mexico, However, since the metric system of units is by law the official standard of weights and measures in Mexico, importers will usually require metric labeling for packaged goods, although the English system is also used. Dual labeling is acceptable. Imported products should be labeled in Spanish containing the following information: name of the product, trade name and address of the manufacturer, net contents, serial number of equipment, date of manufacture, electrical specifications, precautionary information on dangerous products, instructions for use, handling and/or product conservation and mandatory standards. Mexico adheres to the International System of Units (SI). Electrical standards are the same as in the U.S. Electric power is 60 cycles with normal voltage being 110, 220 and 400. Three phase and single phase 230 volt current is also available.

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		M1988	X1988	M1989	X1989
840211	boilers +45t			973	
20	water boilers	517			
841370	centrifug. pumps				18
841480	compressors	6	48	32	40
841950	heat exchange	37	385	19	161
89	material treat	22	2	195	222
842121	water filers		9		32
23	oil filter ice	72	4	105	4
29	liquids purif		17		5
31	airfilter ice		4		
39	gas purifiers	26,285	427	35,627	2,349
99	parts purif	2,147	157	21	100
847989	catalytic con		1,322	176	1,268
848180	control valves	606	75	899	260
TOTAL EQ.		29,692	2,450	37,074	4,459
901180	microscopes			34	
901210	microscopes				2
902511	thermometers	105		90	
20	barometers		9		
80	...meters	25	2	64	
902610	liquid meters	1	6		156
80	liq. gas meas		4	1	

APPENDIX I:
GOVERNMENT MINISTRIES AND AGENCIES RELATED TO ECOLOGY

To call from Canada, dial 011-525 in the case of Mexico City numbers and 011-52 (area code) for all other numbers.

SECRETARIA DE DESARROLLO SOCIAL (SEDESOL)
(SECRETARIAT FOR SOCIAL DEVELOPMENT)
INSTITUTO NACIONAL DE ECOLOGIA (SEDESOL)
(NATIONAL ECOLOGY INSTITUTE)
Río Elba 20 - Piso 16
Col. Cuauhtémoc
06500, México D.F.
Phone: 553-96-47 553-95-38
Fax: 286-66-25
Contact: Fis. Sergio Reyes Luján
Presidente
Private Secreatry: Lic. Pablo A. Cruz Yanez
Phone: 553-95-48 553-95-58

Piso 1
Phone: 533-94-81 553-29-77
Fax: 286-85-59
Contact: Arq. René Altamirano Pérez
Director General de Normatividad Ambiental
Private Scty: Lic Carmen Mora

Contact: Dr. Edmundo de Alba Alcaráz
Director General de Investigación
y Desarrollo Tecnológico
Phone: 286-92-98 553-99-29
Fax: 553-97-53

Contact: Lic. Edgar González Guadiano
Director de Educación Ambiental
Phone: 553-95-73 553-62-79
Fax: 553-08-08

Contact: Dr. Exequiel Ezcurra
Director General de Aprovechamiento
Ecológico de Recursos Naturales
(natural resources)
Phone: 286-92-76 286-92-78
Fax: 553-90-73

Contact: M.I. Cynthia Mossler
Directora de Operaciones
(soil contamination)
Phone: 553-12-35
Fax: 286-79-71

Av. Constituyentes 947
Col. Belem de las Flores
01110 Mexico D.F.
Phone: 271-26-40 271-12-70
Contact: Dr. Sergio Estrada Orihuela
Director General of Ecological Planning

Contact: Ing. Sergio Rodrìguez
Subdirector de Agua
(water contamination)
Phone: 286-87-19

Contact: Ing. Rogelio González
Director de Area de Estudios
de Contaminación Atmosférica
(air contamination)
Phone: 553-94-06
Fax: 553-99-04

Contact: C.P. Jesús Ponce de León
Director de Apoyo Técnico
Phone: 553-97-05

PROCURADURIA FEDERAL DE PROTECCION AL AMBIENTE (SEDESOL)
(FEDERAL ATTORNEY GENERAL FOR ENVIRONMENTAL PROTECTION)
Blvd. Pípila 1
Tecamachalco
53950, Naucalpan de Juárez
Phone: 589-89-83 589-55-39
Fax: 58979-83
Contact: Lic. Santiago Oñate Laborde
Procurador Federal

COMISION NACIONAL DEL AGUA (S.A.R.H.)
(NATIONAL WATER COMMISSION)
Insurgentes Sur 2140 - Piso 2
Col. Ermita - San Angel
01070, México D.F.
Phone: 550-96-21
Fax: 550-22-23
Contact: Dr. Fernando González Villarreal
Director General

Contact: Ing. Enrique Mejia Maravilla
Manager of Water Treatment
Phone: 524-74-89

Contact: Ing. Flores
Deputy Director of Water Treatment
Phone: 524-73-46

DEPARTAMENTO DEL DISTRITO FEDERAL (D.D.F.)
COORDINACION GENERAL DE REORDENACION URBANA
Y PROTECCION ECOLOGICA (CGRUPE)
(FEDERAL DISTRIC DEPARTMENT
GENERAL COORDINATION FOR URBAN RESTRUCTURING
AND ECOLOGICAL PROTECTION)
Pino Suárez 15 - Piso 4
Centro Histórico
06060, México D.F.
Phone: 518-11-00 ext.1400
Fax: 653-33-57
Contact: Lic. Sergio Covarrubias Segura
Subdirector de Instrumentos de
Ordenamiento Urbano

Talavera 20 - Piso 1
Centro Histórico
06060, México D.F.
Phone: 705-12-77 ext.1322 522-82-97
Fax: 522-44-11
Contact: Ing. Gabriel Quadri de la Torre
Asesor en Ecología del Jefe del D.D.F.

Plaza de la Constitución 1 - Piso 1
Centro Histórico
06068, México D.F.
Phone: 542-93-11
Fax: 522-62-84
Contact: Lic. Fernando Menéndez Garza
Srio. Técnico para la Prevención y Control
de la Contaminación en el Valle de México

Contact: Ing. Rodolfo Lacy
Director General of Environmental projects
Phone: 542-93-11 518-11-00 521-81-60
Fax: 522-62-89

PETROLEOS MEXICANOS (PEMEX)
Av. Marina Nacional 329 - Torre Ejecutiva - Piso 3
Col. Huasteca
11311, México D.F.
Phone: 250-43-62
Fax: 250-43-62
Contact: Ing. Guillermo Andrade Gelabert
Gerente de Protección Ambiental

Piso 34
Phone: 254-45-97
Fax: 254-45-97
Contact: Lic. Antonio Brambila Meda
Coordinador Ejecutivo de Protección
Ambiental y Desarrollo Regional

Contact: Ing. Pedro Sanchez
Subdirection of Primary Production
Manager of Security and Industrial Protection
Phone: 531-64-05

Contact: Ing. Manuel Viejo
Subdirection of Industrial Transformation
Executive Coordinator of Ecology
Phone: 354-45-08

Contact: Alfonso Robles
Subdirection of Petrochemicals
Manager of Security and Petrochemical Ecology
Phone: 254-49-63

Contact: Ing. Humberto Aguilar
Manager of Environmental Protection
Phone: 250-66-64

COMISION FEDERAL DE ELECTRICIDAD
Oklahoma 85 - piso 5
Col. Napoles
03810 Mexico D.F.
Phone: 687-91-40
Fax: 687-9004
Contact: Lic. Arturo Garcia Zepeda
Purchasing Manager

SECRETARIA DE SALUD
(HEALTH SECRETARIAT)
San Luis Potosí 192 - Piso 4
Col. Roma
06700, México D.F.
Phone: 584-67-45 584-65-29
Fax: 584-52-60
Contact: Dr. Filiberto Pérez Duarte
Director General de Salud Ambiental

APPENDIX II:
STATE REPRESENTATIVES OF SEDESOL

AGUASCALIENTES
Contact: Ing. Manuel de la Garma Torres
Phone: (49) 15-27-64 17-05-18
Fax: (49) 17-05-18

BAJA CALIFORNIA
Contact: Antonio Sandoval
Phone: (65) 61-74-91 61-78-84
Fax: (65) 61-76-27

BAJA CALIFORNIA SUR
Contact: Jorge Jiménez López
Phone: (682) 210-95
Fax: (682) 209-30

CAMPECHE
Contact: Marco de la Peña
Phone: (981) 664-33
Fax: (981) 666-19

COAHUILA
Contact: Carlos Domínguez Corral
Phone: (84) 15-30-15
Fax: (84) 15-33-15

COLIMA
Contact: C.P. Ma. de Lourdes Chávez Ramírez
Phone: (331) 226-05 227-10
Fax: (331) 404-21

CHIAPAS
Contact: Rafael Camacho Alcántara
Phone: (961) 206-68
Fax: (961)265-05

CHIHUAHUA
Contact: Miguel Angel Orozco
Phone: (14) 20-04-53 20-14-36
Fax: (14) 20-18-44

DURANGO
Contact: Luis David Rodriguera
Phone: (181) 269-97
Fax: (181)131-28

GUANAJUATO
Contact: Lic. Amador Rodríguez Leyaristi
Phone: (473) 216-43
Fax: (473) 227-27

GUERRERO
Contact: C. Alfonso Rescala Cárdenas
Phone: (747) 222-49 244-22
Fax: (747) 222-49

HIDALGO
Contact: Lic. Omar Jiménez
Phone: (771) 324-64
Fax: (771) 365-44

JALISCO
Contact: Rodolfo Flores
Phone: (3) 614-33-04
Fax: (3) 613-75-86

MEXICO
Contact: Hugo González
Phone: (72) 14-47-49 15-17-43
Fax: (72) 14-47-49

MICHOACAN
Contact: José Carmen Soto
Phone: (451) 474-64 508-37
Fax: (451) 435-96

MORELOS
Contact: Liliana Muñíz
Phone: (73) 13-38-60 13-27-77
Fax: (73) 13-02-33

NAYARIT
Contact: Lic. Vicente Aguilar Rizzo
Phone: (321) 209-73 273-87
Fax: (321) 273-87

NUEVO LEON
Contact: Ricardo Ayala
Phone: (83) 54-03-91 54-97-68

OAXACA
Contact: Arq. Pablo González Villalva
Phone: (951) 527-20 505-74

PUEBLA
Contact: Lic. Alejandro Villar Borja
Phone: (22) 49-00-00
Fax: (22) 49-19-69

QUERETARO
Contact: Edmundo González Llaca
Phone: (42) 16-60-90 16-61-50
Fax: (42) 16-60-90

QUINTANA ROO
Contact: Ing. Mario A. Pérez Breña
Phone: (983) 228-65 228-87
Fax: (983) 228-65

SAN LUIS POTOSI
Contact: José Luis Soto
Phone: (48) 13-75-00 13-00-52
Fax: (48) 18-10-35

SONORA
Contact: Edmundo Chávez Méndez
Phone: (62) 13-22-54
Fax: (62) 12-35-70

SINALOA
Contact: Gilberto Casillas
Phone: (67) 17-03-34 14-35-44
Fax: (67) 14-19-67

TABASCO
Contact: C. Manuel Silva Aguirre
Phone: (93) 13-27-25 13-26-36
Fax: (93) 13-24-27

TLAXCALA
Contact: Humberto Ortíz Wetzel
Phone: (246) 224-01
Fax: (246) 231-65

TAMAULIPAS
Contact: Dr. Abundio González González
Phone: (131) 268-22 245-08
Fax: (131) 245-08

VERACRUZ
Contact: Lic. Luis Rafael Ponce Jiménez
Phone: (281) 791-03 829-58

YUCATAN
Contact: Pilar López Marco
Phone: (99) 26-34-14 26-35-03
Fax: (99) 26-35-03

ZACATECAS
Contact: C. Alfonso Delgado Arcega
Phone: (492) 202-33
Fax: (492) 226-68

APPENDIX III:
PRIVATE CHAMBERS, ASSOCIATIONS AND AGENCIES RELATED TO ECOLOGY

ACCION CIUDADANA ECOLOGISTA
(ECOLOGICAL CITIZEN ACTION)
Prol. Ocotepec 312 (antes Av. San Jerónimo)
Col. San Jerónimo Lídice
10200, México D.F.
Phone: 595-26-16
Fax: 255-15-39
Contact: Arq. Guillermo Kramer
Presidente

AGRUPACION SIERRA MADRE
(SIERRA MADRE GROUPING)
Insurgentes Sur 949 - Desp. 701
Col. Nápoles
03810, México D.F.
Phone: 682-86-87 682-86-09
Fax: 543-99-90
Contact: Sr. Patricio Robles Gil
Presidente

ASOCIACION ECOLOGICA DE COYOACAN, A.C.
(ECOLOGICAL ASSOCIATION OF COYOACAN)
Callejón de San Miguel 46
Barrio de San Luças
04030, México D.F.
Phone: 532-27-17 532-56-39
Fax: 532-56-39
Contact: Lic. Regina Barba Pírez
Presidenta

CAMARA NACIONAL DE LA INDUSTRIA DE TRANSFORMACION (CANACINTRA)
(NATIONAL CHAMBER OF THE TRANSFORMATION INDUSTRY)
San Antonio 256
Col. Ampliación Nápoles
03849, México D.F.
Phone: 563-34-00 563-05-01
Fax: 598-94-67
Contact: Lic. Alberto Esparza Mora.
Jefe del Departamento de Asesoría
y Gestiones Industriales

Contact: Ing. Rafael Manjarrez Andion
Director of Environmental Studies

Contact: Ing. Gerardo Olvera Ramirez
Ecology Manager

CENTRO DE INVESTIGACIONES ECOLOGICAS DEL SURESTE (CIES)
(SOUTHEASTERN ECOLOGICAL RESEARCH CENTER)
Carr. Panamericana y Periférico Sur
San Cristóbal de las Casas
29290, Chiapas
Phone: (967) 818-83 y 84
Fax: (967) 823-22
Contact: Lic. Ma. Luisa Ruíz Utrilla
Jefe de la Biblioteca

CONSEJO NACIONAL DE LA FAUNA
(NATIONAL ANIMAL LIFE COUNCIL)
Fray Payo de Rivera 320
Col. Lomas Virreyes
11000, México D.F.
Phone: 520-31-10 540-73-91
Fax: 520-18-81
Contact: Arq. Marco Antonio Pastrana
Director General

CONSULTEA, A.C.
Berlín 16-A
Col. Juárez
06600, México D.F.
Phone: 546-88-27
Contact: Lic. Jesús Arias Chávez
Presidente

COORDINACION DE RED DE FORMACION AMBIENTAL
(COORDINATION OF THE ENVIRONMENTAL FORMATION NETWORK)
Presidente Mazarik 29 - Piso 5
Col. Polanco
11570, México D.F.
Phone: 203-49-78 250-15-55 ext. 222
Fax: 203-45-79
Contact: Enrique Leff Zimmerman
Director General

FUNDACION FRIEDRICH EBERT STIFTUNG
(FRIEDERICH EBERT STIFTUNG FOUNDADTION)
Ejército Nacional 539 - Piso 5
Col. Granada
11520, México D.F.
Phone: 250-05-33
Fax: 250-00-50
Contact: Ing. Enrique Mora
Director

GRUPO DE LOS CIEN
(GROUP OF THE 100)
Blvd. Adolfo López Mateos 369
Col. San Angel
01760, México D.F.
Phone: 683-31-91
Contact: Feliciano Béjar

GRUPO DE ESTUDIOS AMBIENTALES
(GROUP OF ENVIRONMENTAL STUDIES)
Allende 7
Col. Sta. Ursula Coapa
04650, México D.F.
Phone: 684-02-53
Fax: 684-03-77
Contact: Jasmine Aguilar
Directora

GRUPO ECOLOGISTA ARPCI, A.C.
(ARPCI ECOLOGICAL GROUP)
Presa Tesoyo 156
Col. Irrigación
11500, México D.F.
Phone: 557-23-57
Fax: 557-43-68
Contact: Susana Carranza
Directora

INSTITUTO AUTONOMO DE INVESTIGACION ECOLOGICA (INAINE)
(AUTONOMOUS INSTITUTE FOR ECOLOGICAL RESEARCH)
Gladiolas 56
Col. Ciudad Jardín
04370, México D.F.
Phone: 549-26-42 689-68-85
Fax: 689-04-73
Contact: Quim. Luis Manuel Guerra
Director

PROGRAMA DE LAS NACIONES UNIDAS PARA EL MEDIO AMBIENTE (PNUMA)
(PROGRAM OF THE UNITED NATIONS FOR THE ENVIRONMENT)
Virreyes 155
Col. Lomas de Chapultepec
11000, México D.F.
Phone: 202-48-41 202-50-66
Fax: 202-50-66
Contact: Sr. Arsenio Rodríguez
Director


0 50505 25971 7