28 U. Miami Inter-Am. L. Rev. 479

The University of Miami Inter-American Law Review

Winter, 1996-97

28 U. Miami Inter-Am. L. Rev. 479

LENGTH: 4552 words

LEGAL MEMORANDA: MEXICO: MEXICO'S LEAD PHASE OUT PROGRAM FOR PETROLEUM PRODUCTS

SUMMARY: ... The Mexican federal government recognizes that a high lead content in petroleum products over the years has contributed to the severe environmental hazards that Mexico faces today. ... . construction of methyl tertiary butyl ether (MTBE) plants: one-hundred percent of this advance completed, four projects completed; ... It contains twelve tables which regulate the chemical compound of unleaded and leaded gasoline, as well as diesel fuel, industrial gas oil, heavy fuel oil, natural gas, liquid petroleum gas, and turbo fuel. ... As an additional effort above what is required by NOM No. 086, PEMEX is complying with the winter compromise of a thirty percent reduction in the content of lead in Nova Plus gasoline, limiting its content to a maximum of 0.2 milliliters of tetraethyl lead, in place of 0.3 that is the specification that is applicable for the rest of the year. ...

[*479] I. INTRODUCTION

The Mexican federal government recognizes that a high lead content in petroleum products over the years has contributed to the severe environmental hazards that Mexico faces today. In particular, because of Mexico City's great demographic concentration and its geographic location in a valley, the negative effects of fuel with high lead content have been augmented, leading in part to the Metropolitan Zone of Mexico City having one of the worst environmental problems in the world.

[*480] In response to this crisis, on December 2, 1994, the Official Mexican Standard (NOM) No. 086 was published in the Mexican Federal *Diario Official* to combat atmospheric pollution. In particular, specifications were made concerning environmental protection from harm arising from liquid fossil fuels and gasolines used in stationary as well as mobile sources. For this NOM, liquid fossil fuels and gasolines were defined as natural gas and petroleum derivatives such as clear petroleum, diesel fuel, oil, gas oil, liquid propane gas, butane, propane, methane, isobutane, propylene, butylene, or any such combination.

In addition to the enactment of NOM No. 086, the petroleum industry, organized through the governmental organization Petroleos Mexicanos (PEMEX), voluntarily entered into an Ecological Pact in 1991. This Ecological Pact had as its goal the production of better fuels of international quality. Specifically, the production of unleaded "Magna Sin" gasoline was implemented, as well as the progressive decrease of lead contained in leaded "Nova Plus" gasoline.

II. SOME OF THE ACTIONS TAKEN BY THE FEDERAL GOVERNMENT OF MEXICO THROUGH 1995

As part of the Ecological Pact of PEMEX, the following advances were achieved as of late 1995:

. change to continuous regeneration in reforming plants: ninety-three percent of this advance completed, three of six projects completed;

. construction of isomerization units of pentane and hexane: forty-three percent of this advance completed, three of seven projects completed;

. construction of methyl tertiary butyl ether (MTBE) plants: one-hundred percent of this advance completed, four projects completed;

. construction of tertiary amyl methyl ether (TAME) plants: ninety percent of this advance completed, one of two projects completed;

. incorporation of the process of catalytic disintegration F.C.C.: ninety percent of this advance completed, one of two projects completed and operational;

[*481] . construction of units of hydro-desulfurization of diesel: one-hundred percent of this advance completed, two projects completed;

. construction of a complex of residual hydro-treatment: thirty-five percent of this advance completed; and

. leasing of olefins: only one of four projects had been begun as of late 1995.

In addition to the Ecological Pact of 1991, the construction of both refining equipment and a coking plant have been under-taken, which has permitted great availability of unleaded gasoline and gas. The program of investment of PEMEX for the instrumentation of these thirty projects amounts to approximately U.S. $ 3.44 billion.

In conjunction with these actions, the substitution of fifty percent of Nova Plus gasoline (leaded gasoline) for Magna Sin gasoline (unleaded gasoline) has been facilitated, as well as the elimination of diesel with a sulfur weight of 0.05% for automotive vehicles in the Metropolitan Zone of Mexico City and of 0.5% on the national level for industrial plants. Likewise, the content of lead in reformulated gasolines has reached historic minimum levels.*A. Reduction of the Concentration of Reactive and Toxic Hydrocarbons in Nova Plus and Magna Sin Gasolines to Reduce the Maximum Concentrations of Ozone*

One of the government's priority strategies is the improvement of the fuel that is used in the Metropolitan Zone of Mexico City. This action is principally focused on the reduction of the emissions of the precursors of ozone.

Ozone is naturally present in the same quantity in soil as well as in the highest layers of the atmosphere. The formation of ozone is caused by very complex reactive activities of sunlight, in which nitrogen oxides and hydrocarbons participate. Because of this, in 1992 PEMEX adopted strict specifications that limit the content of reactive and toxic hydrocarbons:

. thirty percent maximum of aromatics

. fifteen percent maximum of olefins

[*482] . two percent maximum of benzene

Likewise, a maximum limit for the pressure of reid gas was established at 8.5 per square inch. These levels have been regulated in an official manner since December 2, 1994, with the publication of NOM No. 086.

PEMEX has complied with these strict specifications. In fact, the environmental quality of the gasolines that are consumed in the Valley of Mexico exceeds the average of those that are distributed in the United States and is similar to those of California, which has the most strict environmental standards in the world.

It has been recognized that because of the geographic and atmospheric conditions of Mexico City, atmospheric pollutants become especially trapped within the Valley of Mexico during the winter months. As a result, the Metropolitan Zone of Mexico and PEMEX have established contingency programs that impose more strict regulations during this time of year.

In the winter of 1993-94, for example, PEMEX adopted the following specifications, which, again, are even more strict than the rest of the year:

NOVA PLUS GASOLINE

Parameter	NOM No. 086	Winter 94-95	Percent Reduction
Aromatics	30% vol.	25% vol.	17% vol.
Olefins	15% vol.	12% vol.	20% vol.
Benzene	2% wt.	1.5% wt.	25% wt.

[*483] MAGNA SIN GASOLINE

Parameter	NOM No. 086	Winter 94-95	Percent Reduction
Aromatics	30% vol.	30% vol.	—
Olefins	15% vol.	12% vol.	20% vol.

Benzene	2% wt.	1.5% wt.	25% wt.

To ensure continuation of these compromises, PEMEX and the Government of the Federal District enacted an operation of gasoline quality control in the Metropolitan Zone of Mexico City. An analysis to determine petroleum quality was conducted in service stations as well as four distribution terminals that are accountable to PEMEX in the Valley of Mexico. This independent analysis was carried out by the Laboratory of Bacteriology and Physico-Chemistry at the Universidad Nacional Autonoma de Mexico (UNAM).

The analysis conducted in the distribution terminal showed that the specifications were indeed being met, as the following chart shows:

NOVA PLUS GASOLINE

Parameter	Winter Specification	Average Winter Period
Aromatics	25% vol.	21.9% vol.
Olefins	12% vol.	8.7% vol.
Benzene	1.5% wt.	1.1% wt.

[*484] MAGNA SIN GASOLINE

Parameter	Winter Specification	Average Winter Period
Aromatics	30% vol.	20.9% vol.
Olefins	15% vol.	9.6% vol.
Benzene	2% wt.	1% wt.

Many other factors have contributed toward the stabilization of the level of ozone: a lower concentration of reactive hydrocarbons in the gasoline and consequently a lower concentration of precursors of ozone in the atmosphere; the obligatory vehicular emissions verification; the introduction of catalytic convertors in those vehicles made in 1991 and after; the installation of floating ceilings in PEMEX storage tanks; the installation of systems for the recuperation of vapors in the tanks of fuel transportation trucks of PEMEX; and the conversion of vehicles of intensive use to liquid petroleum gas.

Also, when pollutant levels exceed the established IMECA (Metropolitan Units of Pollution) limit in Mexico City, a contingency program entitled the Program of Atmospheric Hazards goes into effect which imposes even more stringent regulations. Because of advances in fuel quality, the number of days has decreased in which the application of the Program of Atmospheric Hazards has been required. In 1991 it was necessary to apply the program sixty-three days, during 1992 this was reduced to forty-one days. For 1993 and 1994, it was only necessary in eleven and three days respectively and in 1995 only two days.*B. Reduction of the Content of Lead in Nova Plus Gasoline, for Diminishing the Presence of this Pollutant in the Atmosphere*.

In the air, lead is one of the components of suspended particles. The principal source of lead emission is automobiles, owing **[*485]** to the use of gasoline with this metal. As a consequence of the reformulation of gasolines, the concentration of lead has diminished, because lead has been reduced in Nova Plus gasoline to ninety-two percent in relation to the levels in the year 1991.

On the other hand, the consumption of unleaded gasoline, Magna Sin, represents forty-two percent of the total consumption in the Valley of Mexico. At the same time that new fleets of cars were equipped with catalytic converters, the consumption of this gasoline maintained a continuous increase, while that of Nova Plus diminished. As a consequence, the levels of lead have been significantly abated and after two years they have been maintained inside the standard set for the Valley of Mexico.

NOM No. 086 specifically addressed the maximum limits of lead in fuel. It contains twelve tables which regulate the chemical compound of unleaded and leaded gasoline, as well as diesel fuel, industrial gas oil, heavy fuel oil, natural gas, liquid petroleum gas, and turbo fuel. This NOM also recognized that different norms are necessitated for

fuel used inside the metropolitan zones of Mexico City, Guadalajara, and Monterrey, as well as the Northern Border Zone. Because of the concentration of industrial development in these areas, fuel composition is more strictly regulated than in other locations in Mexico.

With regard to unleaded Magna Sin gasoline, Table One of NOM No. 086 sets the maximum level of lead at 0.0026 (0.010) kg/m3 (g/gal). This level is obligatory in the entire country except the Metropolitan Zone of Mexico City and the Northern Border Zone through 1997. Beginning in 1998, these specifications will be applicable to the entire country except the Metropolitan Zones of the cities of Mexico, Guadalajara, and Monterrey and in the Northern Border Zone.

Table Two of NOM No. 086 addresses the content of lead in unleaded Magna Sin Gasoline required in the Northern Border Zone. The maximum level is set at 0.0025 (0.010) kg/m3 (g/gal). Likewise, Table Three establishes the specifications required in designated metropolitan zones at 0.0026 (0.010) kg/m3 (g/gal). These specifications are only obligatory in the Metropolitan Zone of Mexico City through 1997. But beginning in 1998 these specifications will also be applicable to the Metropolitan Zones of Guadalajara and Monterrey.

With regard to leaded Nova Plus gasoline, Table Four of **[*486]** NOM No. 086 sets the maximum permissible content of lead at 0.06 to 0.28 (0.2 to 1.0) kg/m3 (ml/gal). This level is applicable in the entire country through 1997 except in the Metropolitan Zone of Mexico City. Beginning in 1998, these specifications will be required in the entire country except the Metropolitan Zone of Mexico City, Guadalajara, and Monterrey.

The maximum permissible lead content levels in leaded Nova Plus gasoline in designated Metropolitan Zones were set at 0.06 to 0.08 (0.2 to 0.3) kg/m3 (ml/gal). Through 1997, this level is only applicable to Mexico City, but beginning in 1998, the Metropolitan Zones of Guadalajara and Monterrey will also be held to this stricter standard.

As an additional effort above what is required by NOM No. 086, PEMEX is complying with the winter compromise of a thirty percent reduction in the content of lead in Nova Plus gasoline, limiting its content to a maximum of 0.2 milliliters of tetraethyl lead, in place of 0.3 that is the specification that is applicable for the rest of the year. The analysis that was carried out by UNAM showed that the established specifications were being met, as the content of tetraethyl lead during the winter period was on average 0.11 milliliters of tetraethyl lead.*C. Reduction of Sulfur in Industrial Gas Oil to Minimize the Concentration of Sulfur Dioxide in the Air*

As a winter measurement, in the month of December in 1991 the use of fuel oil that contained more than three percent of sulfur by weight was prohibited in the Valley of Mexico. This action has become a permanent restriction. Industrial gas oil (used in diesel engines) was substituted in place of fuel oil, industrial gas oil having an environmental advantage of a lower content of sulfur (two percent maximum by weight).

One of the benefits of fuel with a greater quality is that it diminishes the concentrations of sulfur dioxide in the atmosphere. Additionally, gas oil has a greater combustion owing to a lower content of impurities (gas oil contains 99.5% less insoluble elements of n-pentane and nickel than fuel oil) and less viscosity. As such, its handling and aspersion in the original burners facilitates a cleaner combustion which permits less emission of particles.

[*487] For winter periods, PEMEX established a temporary specification in order that the content of sulfur in industrial gas oil would not exceed 1.5% by weight. The analysis carried out to verify the quality of gas oil indicates that the limits established were being met to the degree that the average content of sulfur in gas oil was 1.4% by weight.

The concentrations of sulfur dioxide registering in the Net-work of Atmospheric Monitoring of the Metropolitan Zone of Mexico City have been maintained since 1993 within the level needed to protect health.

III. CONCLUSION

Recognizing that pollutants such as lead produce deleterious effects on the quality of air, the Mexican federal government has taken an active approach in setting content limits as well as improving the general quality of fuel. These actions took into consideration the National Policy of Fuels, applicable regulations and laws, and the actual production capabilities of PEMEX. Yet despite the advances that have been made throughout the 1990s, regional factors such as Mexico City's geography make the overall improvement of air quality a difficult goal to realize.

The specifications contained in NOM No. 086, as well as other government contingency programs and the independent actions of PEMEX, have led to a significantly diminished level of lead emissions. A report released by the Mexico City government entitled "Program to Improve the Valley of Mexico Air Quality 1995-2000" showed that Mexico's unleaded gasolines now have lower levels of aromatics and benzene than equivalent U.S. or European

petroleum products. However, certain properties, such as sulfur content, are much higher in Mexican unleaded gasoline. In 1996, PEMEX began the sale of premium gasoline. Although no information is available yet on the exact quality of this higher grade, it is another step toward the reduction of lead emissions and, consequently, improved air quality.

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* This legal memorandum was originally presented by Mr. Basurto at the November 1995 Hemispheric Energy Symposium in Washington, DC, at the invitation of the U.S. Department of Energy. Mr. Basurto is a founding partner of Basurto, Santillana y Arguijo and focuses his practice on environmental law. He is a graduate of the Universidad Anahauc with honors. Mr. DeRosa worked at Basurto, Santillana y Arguijo in the Fall of 1995 as a Student Trainee Exchange Program scholar. He is a 1995 graduate of Case Western Reserve University School of Law and is currently a Staff Attorney at Jones, Day, Reavis & Pogue in Cleveland, Ohio.

[*489] APPENDIX I

LEGAL FRAMEWORK OF PETROLEUM ACTIVITIES PRESENT SITUATION OF THE PETROLEUM SECTOR

Legal Decrees	Reference	Description
Political Constitution of Mexico	Art. 27	Establish that the Nation of Mexico shall have the legal ownership of petroleum and all carbides of solid, liquid, or gaseous hydrogen, and that neither concessions nor Contracts will be organized because only the Nation of Mexico will carry out the exportation of these resources.
	Art. 28	Designate that the functions of the State in exercising an exclusive strategic control of petroleum and the other hydrocarbonates, will not constitute a monopoly.

Regulatory Law (LR) of Constitutional Article 27 on the Field of Petroleum	Art. 1	Designate that the Nation of Mexico shall have legal ownership, inalienable and inprescriptible, of all hydrocarbons that are found in the mantel of the earth or in petroleum fields.
	Art. 2	Indicate that the Nation of Mexico can carry out the various activities related to hydrocarbons that constitute the petroleum industry.
	Art. 3	Indicate that the petroleum industry is established for exploration, exploitation, refining, transportation, storage, distribution, and sale of petroleum, gas, artificial gas, the products that are obtained through the refining of the same, and of any derivatives that serve as primary industrial basic materials.
	Art. 4	Designate that the Mexican Nation will carry out the exploration and exploitation of petroleum and the rest of the

		activities that constitute the petroleum industry through public decentralized institution.
	Art. 8	Indicate that the Federal Executive is authorized to establish zones of petroleum reserves in land that is possibly oil-bearing in such quantity as is merited.
	Art. 9	Establish that the petroleum industry is of exclusive federal jurisdiction and only the Federal Government can prescribe the technical or regulatory decrees that govern and establish what taxes are imposed.
	Art. 10	Specify that the petroleum industry is a priority public utility.
Regulation of the LR of Constitutional Article 27 on the Field of Petroleum	Art. 5	Establish that the exploration and exploitation of petroleum as carried out by PEMEX will be realized through the assignment of land by a Secretary appointed for this effect.
	Art. 20, 21, and 22	Indicate that the assignments asked for

		by PEMEX can be totally or partially negated when it is decided that the land requested by PEMEX should be incorporated into or continue to be a part of the reserve zones of the Nation, or when the rights and obligations that it derives are transferred or taxed in any form.
	Art. 23, 24, and 25	Indicate general decrees related to refining.
	Art. 37	Designate that the temporary occupation or expropriation of utility land can be declared for the petroleum industry when an agreement has not been reached with the owners or when the identity of the owner or holder is not known.
	Art. 45	Specify that when the land is of Federal Jurisdiction or the property of the states and municipalities, the acquisition or temporary use of this land must be obtained by the authority in a corresponding form.
Regulation of Petroleum	Art. 1	Specify that petro-

Work		leum work requires both a previous license from the legally authorized Secretary and the definition of what they intend with such operations.
	Art. 7	Establish the obligation of accompanying the license petition with a descriptive report and the plans necessary in order to technically and economically justify the work and constructions, from the point of view of security and better profitability of natural hydrocarbons.
	Art. 23	Indicate that PEMEX has the obligation to maintain all of its installations in a good state of safety and conservation.
	Art. 29	Designate that licensees have the obligation to give timely notice of accidents in the installations to the management or respective agency of PEMEX and to the Secretariat of Environment Natural Resources and Fisheries, when the ecology has been affected or

		the environment has been polluted.
	Art. 37	Designate that corresponding to the licensed organism is the responsibility for damages or injury that arise when in transit across land, river, sea, or atmosphere, and with regard to fish, agriculture, livestock, or third parties.
	Art. 38	Designate the obligation of the licensee to provide to the management or the agencies, all of the plans, reports, or data that is stipulated in this regulation, as well as those that appear in the daily reports of the operation of drilling, completion, and repair of wells.
	Art. 51 to Art. 293	Indicate the regulations concerning the following areas: exploration, drilling, production, tamponage of wells, transportation, storage, terminals and plants of storage and distribution.
Regulation of the LR of Constitutional Article 27 of the Field of Petroleum,	Art. 10	Establish that the legally competent Secretary, taking into

on the Subject of Petro-Chemistry		consideration the opinion of the Mexican Petrochemical Commission, has the power to facilitate the permits for making petrochemical products. These permits will establish, among other things, the location of the plant where the products will be made.
The Organizational Law of the Federal Public Administration	Art. 33	Empower the Secretariat of Energy to carry out petroleum cadastre, as well as regulate the petroleum industry and basic petrochemistry (parts VI and VIII).
General Law of Ecological Equilibrium and Environmental Protection (LGEEPA)	Art. 1	Designate that the object of the law is to establish the basis for the rational development of natural elements in a manner that is compatible with the equilibrium of the ecosystems and to establish the coordination in this matter between the diverse branches and entities of the Federal Public Administration.
	Art. 5	Indicate that the regulation of highly dangerous activities

	and related hazardous materials and residues are of interest to the Federation (parts X and XIX), as well as the rational development and use of the water, the soil, and the resources of the subsoil (parts XVI, XVII, and XVIII).
Art. 15	Designate that nonrenewable natural resources should be utilized in a manner that will avoid its exhaustion and the generation of adverse ecological effects.
Art. 3, 19, 20, 98, and 99	Regulate the activities of ecological ordinance of the territory that have implications for the petroleum industry.
Art. 29	Establish the application of the Environmental Impact Evaluations to public work, exploration, extraction, treatment, and refining of mineral substances and nonmineral reserves of the Federation, oil pipelines, gas pipelines, and the petrochemical industry (parts I, II and IV).

	Art. 108 and 109	Empower the Secretariat of Environment, Natural Resources and Fisheries, to carry out the Official Mexican Standards (NOMs) necessary for the protection of the environment and any of its components that affect the exploration and exploitation of nonrenewable natural resources.
Regulation of the LGEEPA on the Subject of Hazardous Waste (RP)	All of the articles	Regulate the activities of generation, treatment, transportation, recycling, incineration, and final disposal of Hazardous Waste (RP).
Regulation for Land Transportation of Materials and RP	All of the articles	Regulate the activities of packaging and packing, vehicular equipment, safety, responsibilities, and obligations related to the transportation of Hazardous Waste.
The Organizational Law of Petroleos Mexicanos (PEMEX)	Art. 11	Designate that one of the functions of the general directors is to ensure compliance with the decrees related to ecological equilibrium and preservation of the environment that guarantees the adequate use of petro-

leum resources (part XI).

[*499] **[*500]** APPENDIX II

OBJECTIVES

ENERGY POLICY OF MEXICO

1.-- To satisfy the demand for goods and services at a lower cost.

2.-- To increase the technical and economic efficiency of the energy sector.

3.-- To guarantee optimal stability, security and quality in the supply of raw materials and services.

4.-- To implement clear formulas of actual levels of fuel with an international base of reference and the national availability of the same.

5.-- To offer legal security to participants in the energy sector.

6.-- To secure energetic and environmental quality of fuel.

[*501] APPENDIX III

COORDINATED EFFORTS UNDERTAKEN FOR FUEL POLICY

1st. Coordinated planning of investment in the sector of exploitation, refining and sale of hydrocarbons.

. Refining of petroleum.
. Natural gas.
. New technologies.
. Fuel of energetic quality.
. Consumer orientation.
--Substitution of fuel.
--Policy of cost.

[arrow down] [arrow up]

2nd. Coordinated planning of investment in the electricity generation sector.

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[arrow down] [arrow up]

3rd. Analysis of the Environmental Impact of fuels.

. Fuels with sulfur.
. Fuels without sulfur.

[*502] APPENDIX IV

[SEE FIGURE IN ORIGINAL] **[*503]** APPENDIX V

[SEE FIGURE IN ORIGINAL] **[*504]** APPENDIX VI

[SEE FIGURE IN ORIGINAL] **[*505]** APPENDIX VII

[SEE FIGURE IN ORIGINAL]

GRAPHIC: CHARTS 1 through 4, PRESENT CONDITION OF THE GLOBAL POLICY OF FUELS IN MEXICO; EVOLUTION OF THE

PROFILE OF FUEL FOR TRANSPORTATION; DOMESTIC SALE OF AUTOMOBILE GASOLINES 1995, Source: PEMEX, Corporate Manger of Operations; OFFICIAL MEXICAN STANDARD (NOM) NO. 086 FOR THE ECOLOGICAL QUALITY OF FOSSIL FUELS $$