Contents

Mexico City Metropolitan Area Report

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1. Driving Forces and Status
Population and Urban Growth in Mexico City Metropolitan Area (MCMA)

Energy Consumption and Ozone Concentrations in MCMA

Number of Days Above the Air Quality Standards in Mexico City Metropolitan Area
**Trends of Lead in MCMA**

- **1990**: Reduction to [0.5 - 1.0 ml/gal] maximum TEL content in gasolines.
- **1991**: Reduction to [0.3 - 0.5 ml/gal] maximum TEL content in gasolines.
- **1992**: Reduction to [0.2 - 0.3 ml/gal] maximum TEL content in gasolines.
- **1994**: Reduction to [0.1 - 0.2 ml/gal] maximum TEL content in gasolines (during winter in Metropolitan Mexico City).
- **1996**: Introduction of "Premium" Unleaded gasoline.
- **1997**: Finishes distribution of leaded gasoline.
- **1995**: Reduction to 0.01 g/gal maximum TEL content in gasolines.

**PICCA**

**PROAIRE**

**Concentration [µg/m³]**

**Trends of Carbon Monoxide in MCMA**

- **1986**: Partial consumption of natural gas by the industrial and power generation sectors.
- **1991**: Initial substitution of Diesel #2 (2% S) by "National" Diesel (1% S), and Heavy Oil (3.8% S) by Light Oil (3% S).
- **1993**: Substitution of low sulfur diesel (0.5% S) by PEMEX diesel (0.05% S).
- **1995**: Substitution of Light Oil by Industrial Gasoil (2% S).
- **1997**: Substitution of Industrial Diesel by Low sulfur Industrial Diesel (0.05% S).
- **1992**: Power generating plants in MCMA operate 100% with natural gas.

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**PROAIRE**

**Implementation Plans**

- **2001**
  - **1998**: Sulfur content of industrial fuels is lower than 1%.
  - **1994**: Regulation of industrial emissions and fuels quality through the issuance of Standards 085 and 086.
  - **1990 - 1994**: Evaluation of 2-way catalytic converters on the implementation of the Inspection and Maintenance Program in Metropolitan Mexico City.
  - **1994 - 1997**: Modernization of the Inspection and Maintenance Program with the introduction of BAR 97 technology.

**Trends of Sulfur Dioxide in MCMA**

- **1990 - 1994**: Reduction of emissions of sulfur dioxide from the industrial sector.
- **1990 - 1994**: Reduction of emissions of sulfur dioxide from the oil sector.
- **1990 - 1994**: Reduction of emissions of sulfur dioxide from the electric generation sector.
- **1990 - 1994**: Reduction of emissions of sulfur dioxide from the transport sector.

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**PROAIRE**

**Implementation Plans**

- **2001**
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  - **1994**: Regulation of industrial emissions and fuels quality through the issuance of Standards 085 and 086.
  - **1990 - 1994**: Evaluation of 2-way catalytic converters on the implementation of the Inspection and Maintenance Program in Metropolitan Mexico City.
  - **1994 - 1997**: Modernization of the Inspection and Maintenance Program with the introduction of BAR 97 technology.
**Trends of Nitrogen Dioxide in MCMA**

- 1990: Initiate "No Driving Day" and Inspection and Maintenance programs.
- 1991: Initiate the Industrial Emissions Control program for the reduction of NOx and HCs; Natural gas for industrial and power plants.
- 1992: Reduction of reactive HCs in gasolines; Natural gas for industrial and power plants.
- 1994: Regulation of industrial emissions and fuels quality through the issuance of Standards 085 and 086.
- 2001: Introduction of a NOx emissions limit for the I/M program.

**Monitoring Station:** Line B of the metropolitan underground system initiates operation.

**Implementation Plans:**
- 2001

**Trends of Ozone in MCMA**

- 1993: Substitution of low sulfur diesel (0.5% S) by PEMEX diesel (0.05% S).
- 1994: Regulation of industrial emissions and fuels quality through the issuance of Standards 085 and 086.
- 1995: Substitution of Light Oil by Industrial Gasoil (2% S).
- 1999: Program for the mitigation of suspended particles emissions from eroded lands.

**Monitoring Station:**
- 2000

**Implementation Plans:**
- 2001

**Trends of PM10 in MCMA**

- 1990: Initiate the relocation of polluting industries outside Mexico City Metropolitan Area.
- 1991: Initial substitution of Diesel #2 (2% S) by "National" Diesel (1% S), and Heavy Oil (3.8% S) by Light Oil (3% S).
- 1992: Power plants in MCMA operate 100% with natural gas; Environmental Audit Program for major federal jurisdiction industries.
- 1997: Substitution of Industrial Diesel by Low sulfur Industrial Diesel (0.05% S).
- 1998: Sow of 2.2 million plants in the Citizens Participation Program; Sulfur content of industrial fuels is lower than 1%.
- 1999: Program for the mitigation of suspended particles emissions from eroded lands.

**Monitoring Station:**
- 2000

**Implementation Plans:**
- 2001
Relevance of Nitrogen Oxides in the atmosphere of MCMA

$\text{NO}_x + \text{VOCs} + \text{Sunlight} \rightarrow \text{O}_3 + \text{NO}_3 + \text{PAN} + \text{HNO}_3 + \text{particles, etc.}$

"... In contrast to most cities elsewhere, ozone formation in the MCMA is NOx-sensitive."


Health impacts

Ozone

Ozone is a strong oxidant that affects the respiratory system and damages lung tissue.

Among the acute effects are cough and chest pain, eye irritation, headaches, lung function losses and asthma attacks.

Chronic exposure to elevated ozone levels are responsible for losses in immune system functions, accelerated aging, and increased susceptibility to other infections.

PM

Coarser PM$_{10}$ have a higher probability of depositing in the tracheobronchial region, while finer PM$_{2.5}$ particles can reach the periphery of the lung, the respiratory bronchioles and alveoli.

Elevated particulate concentrations in the atmosphere, have been linked to rises in the number of hospital visits for upper respiratory infections, cardiac disorders, bronchitis, asthma, pneumonia, emphysema and the like.

Some particulates are specially dangerous because of their toxicity.

Economic Impacts of Ozone and PM in MCMA

Costs associated with Premature Mortality and Morbidity:

- Hospital Admissions
- Visits to Emergency rooms
- Restricted Activity Days (adults)
- Loss of school days (children and youths)

Costs Associated with Activities During Ozone and PM Episodes:

- Epidemiologic Surveillance
- Vehicles' Usage Limitations
- 30% to 60% emissions reduction of stationary sources (depending on severity of episode)
- Temporarily Closing of Selected Gasoline Service Stations and the Asphalt Plant
Ozone might prevent as many as 300 premature deaths each year and reduce the number of minor restricted activity days experienced by the population by 2 million per year. The benefit of such reduction is on the order of $200 million USD per year.

PM$_{10}$ might prevent as many as 3,000 premature deaths and 10,000 new cases of chronic bronchitis each year. The benefit of such reduction is on the order of $2 billion USD per year.


Scientific Fact

Significant epidemiological evidence exists for the carcinogenicity of diesel exhaust. In particular, diesel particles have been associated with lung cancer. The effect is biologically plausible given their small size of diesel particles and the multiple mutagens and carcinogens adsorbed to the particles surfaces.


Mexico City Metropolitan Area 1998 Emissions Inventory
MCMA Vehicular Fleet Ageing and Emissions

The Gasoline fleet renews faster than the Diesel fleet.
Diesel emissions control technology initiated in 1990 and gasoline control technology in 1993.

2. Main Actions

Main Actions Contained in the ProAire III Implementation Plan for Gasoline Vehicles

- Establishment and application of more strict emission limits for new vehicles.
- Sulfur content reduction to 50 ppm in gasoline.
- Continuous improvement of the mandatory emissions test program.
- Modernization and update of the No-Driving Day Program to promote the renewal of the vehicular fleet.
- Redesign of the Catalytic Converter Replacement Program (PNC). 
- Adaptation of the vehicular emissions control program for vehicles not equipped from factory.
- Redesign of the Ostensible Polluter Vehicles Program and vehicles without pollutant emissions test.
- Renewal of the low-capacity public transportation vehicular fleet.
- Substitution of the medium-capacity public transportation vehicular fleet with high-capacity new vehicles.
Main Actions Contained in the ProAire III Implementation Plan for Diesel Vehicles

- Establishment and application of more strict emissions limits for new vehicles.
- Update the Emissions Test Program of the federal jurisdiction fleet for diesel vehicles and its homologation with Canada and the USA.
- Instrumentation of a Program for the substitution of diesel motors and retrofit of emissions control systems.
- Revision and reinforcement of the Diesel Vehicles Autoregulation Program.
- Removal of the diesel public transport and electric vehicles fleets.
- Renewal of the local cargo carrier fleet.
- Regulation of the driving schedule of the local cargo carrier fleet.
- Reduction of sulfur content in diesel fuel.

Other Actions on the Transport Sector Contained in the ProAire III Implementation Plan

- Establishment of transport corridors.
- Foster the management and coordination for the construction of peripheral highways.
- Elimination of old pollutant vehicles of private use.
- Integral Program of the local cargo carrier fleet
- Foster the use of alternative fuels in the public transportation vehicular fleet.

Implementation Progress
Establishment of Transportation Corridors

The Federal District Government established the Sustainable Transportation Center, with World Bank and Shell Foundation funds. The purpose is to find solutions to air pollution and transportation problems and to coordinate studies for the selection and construction of strategic transportation corridors that will allow:

- A fluid traffic for the high-capacity public transportation vehicles.
- Reduce the fuel consumption and pollutant emissions.
- Test new technologies, such as hybrid, CNG and fuel cells vehicles.

REDISIGN OF THE POLLUTANT EMISSIONS REDUCTION INTEGRAL PLAN (PIREC)

The implementation of the new PIREC scheme did allow the substitution of 22,438 catalytic converters from July to November 2002.

<table>
<thead>
<tr>
<th>Pollutant Emissions (g/km)</th>
<th>WITH CATALYTIC CONVERTER</th>
<th>WITHOUT CATALYTIC CONVERTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>0.19</td>
<td>1.74</td>
</tr>
<tr>
<td>NOx</td>
<td>2.64</td>
<td>3.41</td>
</tr>
<tr>
<td>HC</td>
<td>4.30</td>
<td>5.28</td>
</tr>
</tbody>
</table>

In the Federal District there are 120 PIREC authorized workshops, 7 manufacturing facilities and/or distributors and 3 importers of catalytic converters.

Continuous Improvement of the Mandatory Vehicular Emissions Tests Program

- Revalidation of 74 concessions and authorization of 5 new
- ISO 9000 certification (43 Emissions Test Centers)
- Certification at the local laboratories certification units
- Detection and sanction of pre-test tampering acts
- Better inspection and surveillance of test centers operations
- Technological modernization of data management and control
Revision and reinforcement of the Diesel Vehicles Autoregulation Program

Autoregulation agreements were renewed and improved the supervision and control processes for the participating units.

Foster the Use of of Alternative Fuels

- At present there are 2,006 CNG vehicles and 3 service stations.
- There are 14,253 LPG vehicles.

Public Transportation Bus Fleet Renewal

- Acquisition of 881 low-emission diesel buses.
- At present, 506 old diesel buses have been decommissioned.
Substitution of Medium-Capacity Public Transportation Buses by New High-Capacity Vehicles

The program initiated with a budget of 8 million USD for the acquisition of 800 diesel buses. At present, 500 units have been replaced.

Low-Capacity Public Transportation Fleet Renewal

Financial support to public transport grant holders for the renewal of 10,000 taxis. At present there is a budget for the renewal of 3,000 taxis.

Modernization and update of the No-Driving Day (NDD) Program

Nowadays only 13% of the vehicular fleet is restricted to the No-Driving Day, in contrast with the initially 20% figure. Therefore, there is a revision in course of the criteria for exempting the program in case of episodes and to avoid the saturation of traffic.
**Foster the Construction of Peripheral Highways in MCMA**

**Mexico City Megalopolis Air Quality Research**

Initiated the 2nd phase of the project “Integrated Strategy for Air Quality Management in the Mexico City Metropolitan Area”. Main objectives are the design and application of methodologies for:

- Improve the knowledge of the ozone formation processes and behaviour of ozone and suspended particles
- Evaluate the effects of pollution on human health, and
- Prioritize strategies to reduce pollutant emissions.

**Other Actions Taken**

- Maintenance of the Subway Network
- Rehabilitation of the Subway wagons
- Adequate vehicular intersections of the light train route
- Rehabilitation of trolleys and acquisition of new units
- Integral maintenance of trains, trolleys, railways and installations
- Roads re-pavement
- Construction of vehicular distributors
- Traffic improvement at conflictive intersections
Immediate Actions Pending

- Transfer the presidency of the Metropolitan Environmental Commission to the Federal District Government
- Revision and update of the No-Driving Day and Atmospheric Environmental Contingencies programs
- Revision and reinforcement of programs to reduce diesel vehicles emissions
- Homologation of the Maintenance and Inspection programs
  - Normative revisions and adequateness
  - Further sulfur content reductions in fuels
  - Introduction to new emissions control technologies

Immediate Actions Pending (Cont.)

- Public Transportation Integral Program
  - Public Transportation Mobility Study
  - Regulation of schedules
  - Vehicular Fleet Renewal
- Diesel and gasoline emissions control retrofits
- Energy Reconversion of the Industrial Sector

Thank you for your attention