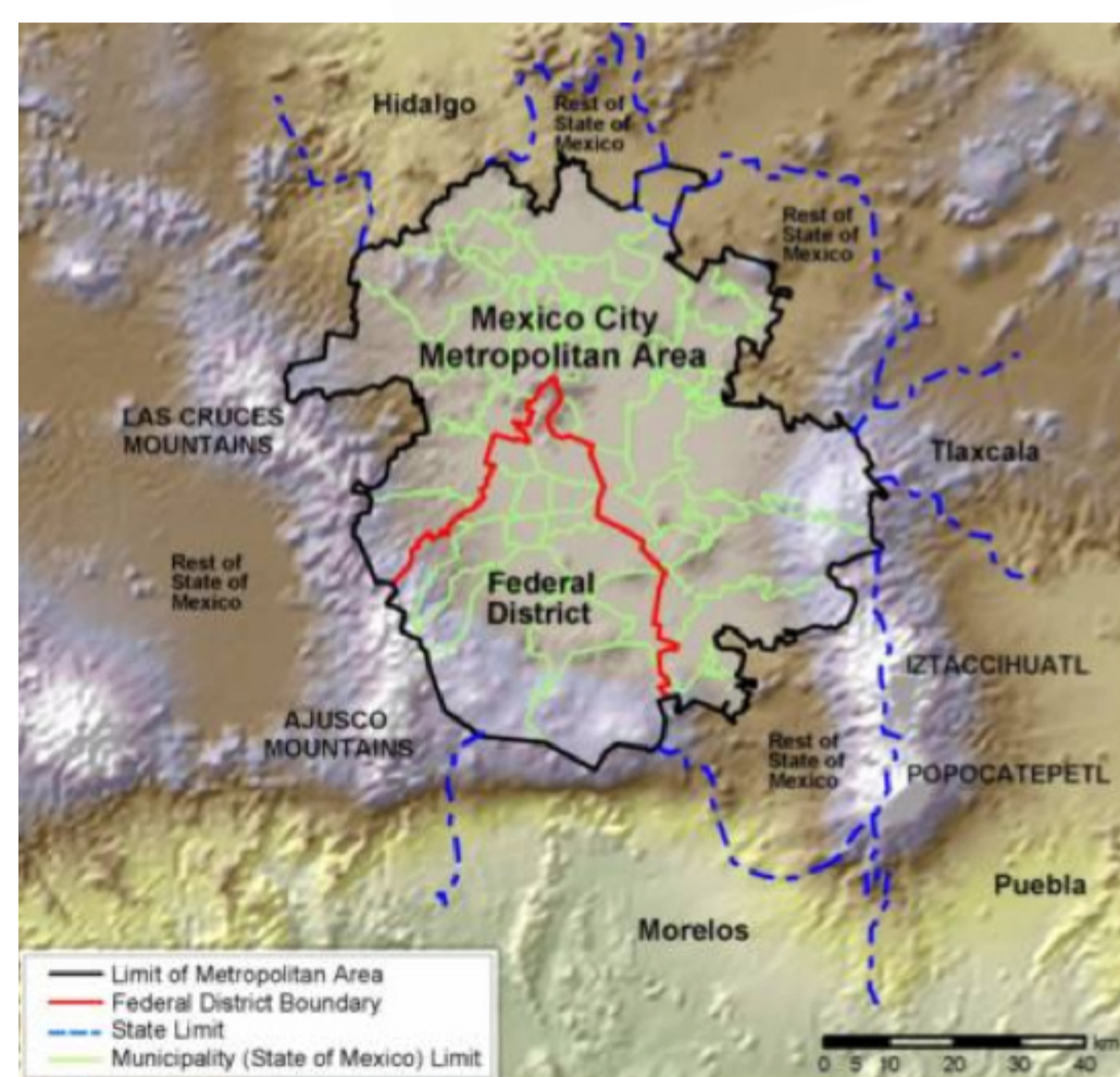




## CASE STUDY: MEXICO CITY METROPOLITAN AREA (MCMA)



The Mexico City Basin sits at a near-tropical latitude with intense solar radiation all year round. This is where the Mexico City Metropolitan Area (MCMA) is located, covering an area of 3,540 km<sup>2</sup>; 1,500 km<sup>2</sup> of which is completely urbanized. Mexico City includes the 16 delegations within the Federal District, 37 municipalities in the state of Mexico and 1 municipality in the state of Hidalgo.

With 19 million inhabitants, the MCMA comprises 18% of the country's population. It is the second largest megacity in the world. The population's daily activities, its 53,000 operating industries and the 3.5 million vehicles that travel throughout the city every day, produce high levels of air pollutants.

Other factors that aggravate this problem are:

- The Mexico City Basin is bounded by mountains on three sides creating a natural barrier that makes air circulation and pollution dispersal difficult.
- The thermal inversions that happen within the Basin are a natural phenomenon causing the air masses to become temporarily stagnant.
- Anticyclone systems are a frequent occurrence at the country's center and can generate stationary air capsules in areas that cover regions larger than the Mexico City Basin.
- The MCMA is at 2,240 meters above sea level. This, together with high solar radiation intensity leads to rapid formation of toxic pollutants like ozone.
- The elevated setting of the MCMA makes oxygen content in the air 23% less than at sea level, reducing the efficiency of combustion processes. Moreover, people have to breathe more air for the same amount of oxygen, which in turn translates into the inhalation of more pollutants.

More information on the characteristics of the MCMA and its air quality is available in the book: Air quality in the Mexico Megacity: An Integrated Assessment, edited by Luisa T. Molina and Mario J. Molina and published by Klumer Academic Press, 2002.

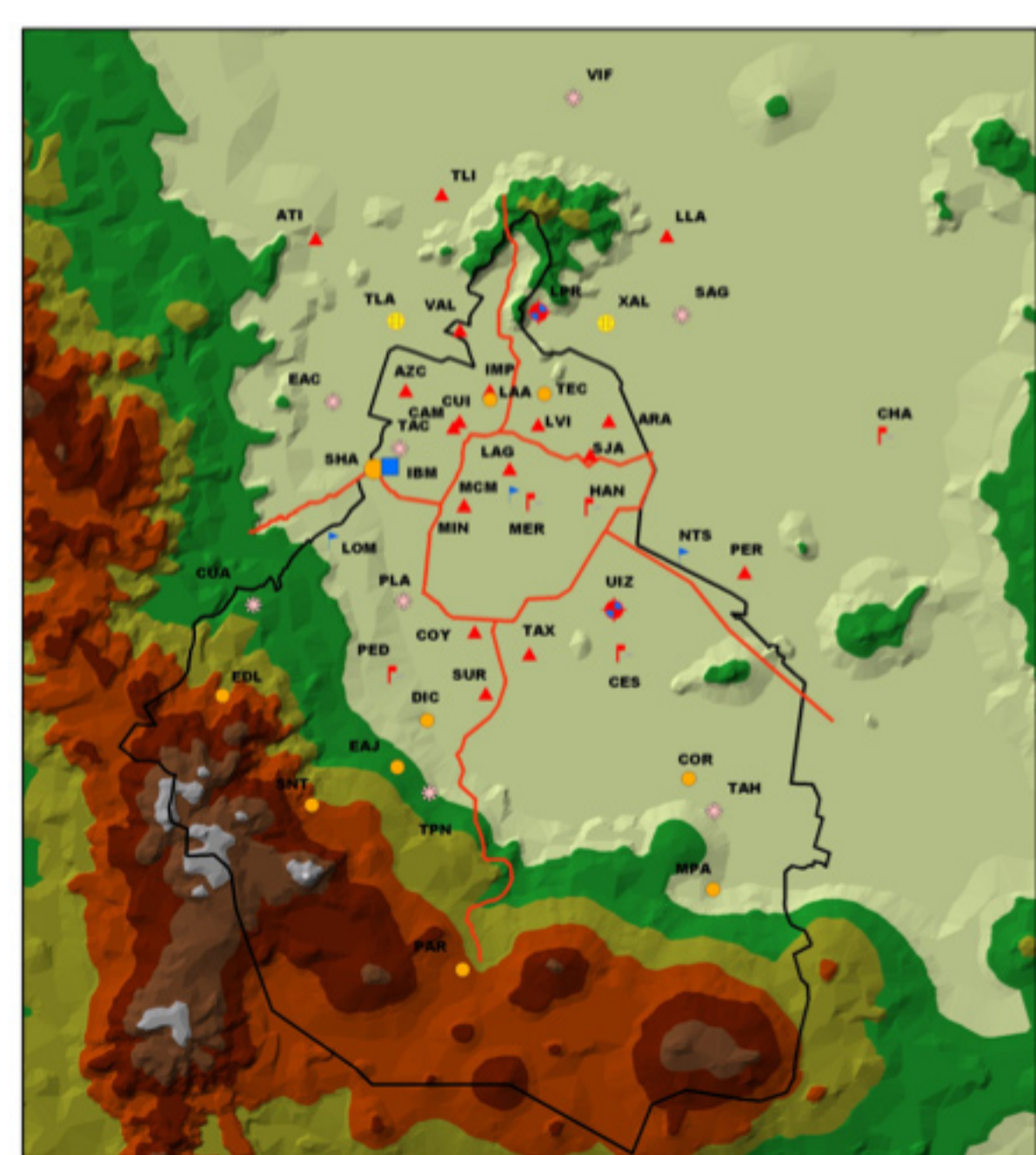
### ATMOSPHERIC MONITORING SYSTEM (SIMAT)

The Atmospheric Monitoring System (SIMAT) is responsible for monitoring the ambient concentrations of pollutants in the MCMA. The Network for Automatic Atmospheric Monitoring (RAMA) is the part of SIMAT in charge of measuring the ozone (O<sub>3</sub>), sulfur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), carbon monoxide (CO), particles smaller than 10 micrometers (PM<sub>10</sub>) and particles smaller than 2.5 micrometers (PM<sub>2.5</sub>).

The information provided by RAMA plays an important role in the evaluation of the air quality in Mexico City and in its dissemination through the Metropolitan Air Quality Index (IMECA). The proficiency and speed with which RAMA transmits the information are essential in order to notify the Atmospheric Environmental Contingency Program when pollution levels have become a health hazard to the population.

RAMA is comprised of 36 monitoring stations located at strategic points of Mexico City. The location of each station is based on technical criteria such as population density, distribution of emission sources and topography.

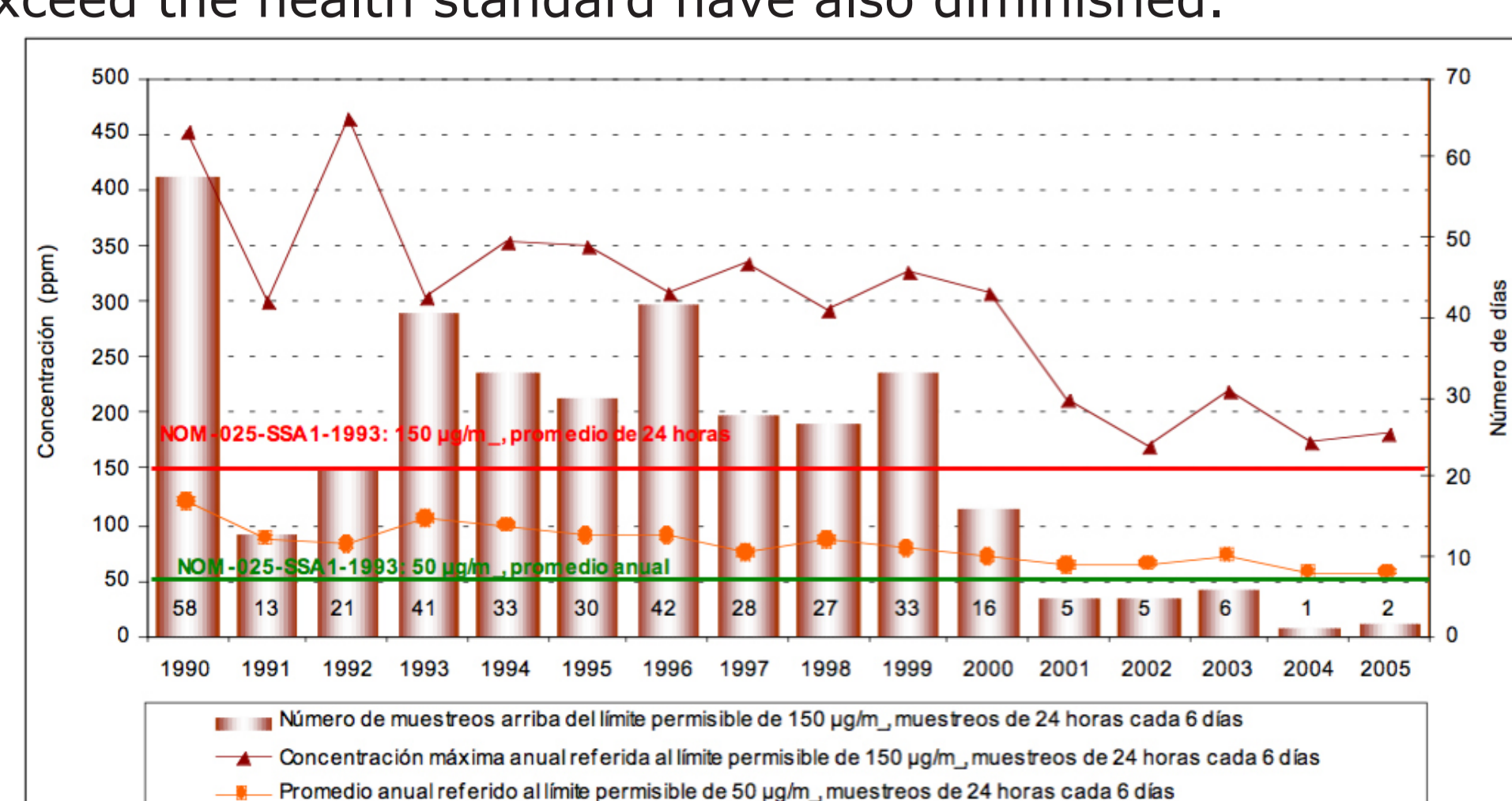
The equipment employed by RAMA to conduct measurements analyzes specific gases. Each instrument operates based on the physical and chemical characteristics of each pollutant. The research teams conduct minute to minute measurements, 24 hours a day, 365 days a year. The data obtained from the monitoring stations is sent to a central system. Once there, it is processed in order to generate hourly averages. This information is then integrated to the public databases.



SECRETARÍA DEL MEDIO AMBIENTE  
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### Trends of Particles Smaller than 10 Micrometers (PM<sub>10</sub>)

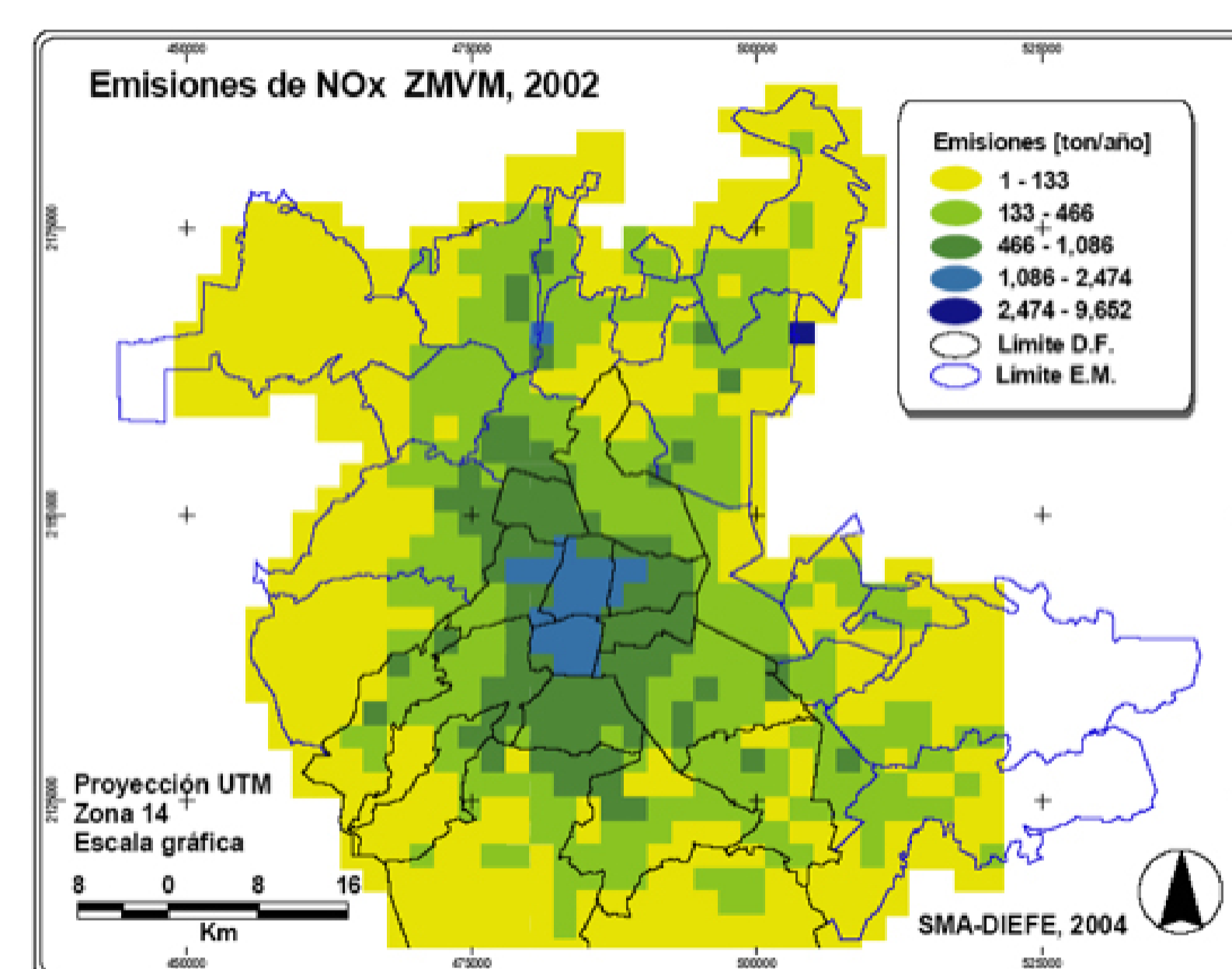
The health standard for particles with a diameter smaller than 10 μm establishes a maximum concentration of 150 μg/m<sup>3</sup> in a 24 hour daily average and an annual average of 50 μg/m<sup>3</sup>. Unfortunately the 24-hour average established by the health standard is still not being met. However, it is important to note that the concentrations of this pollutant have been declining gradually. Concurrently, the number of samples in which the concentrations exceed the health standard have also diminished.



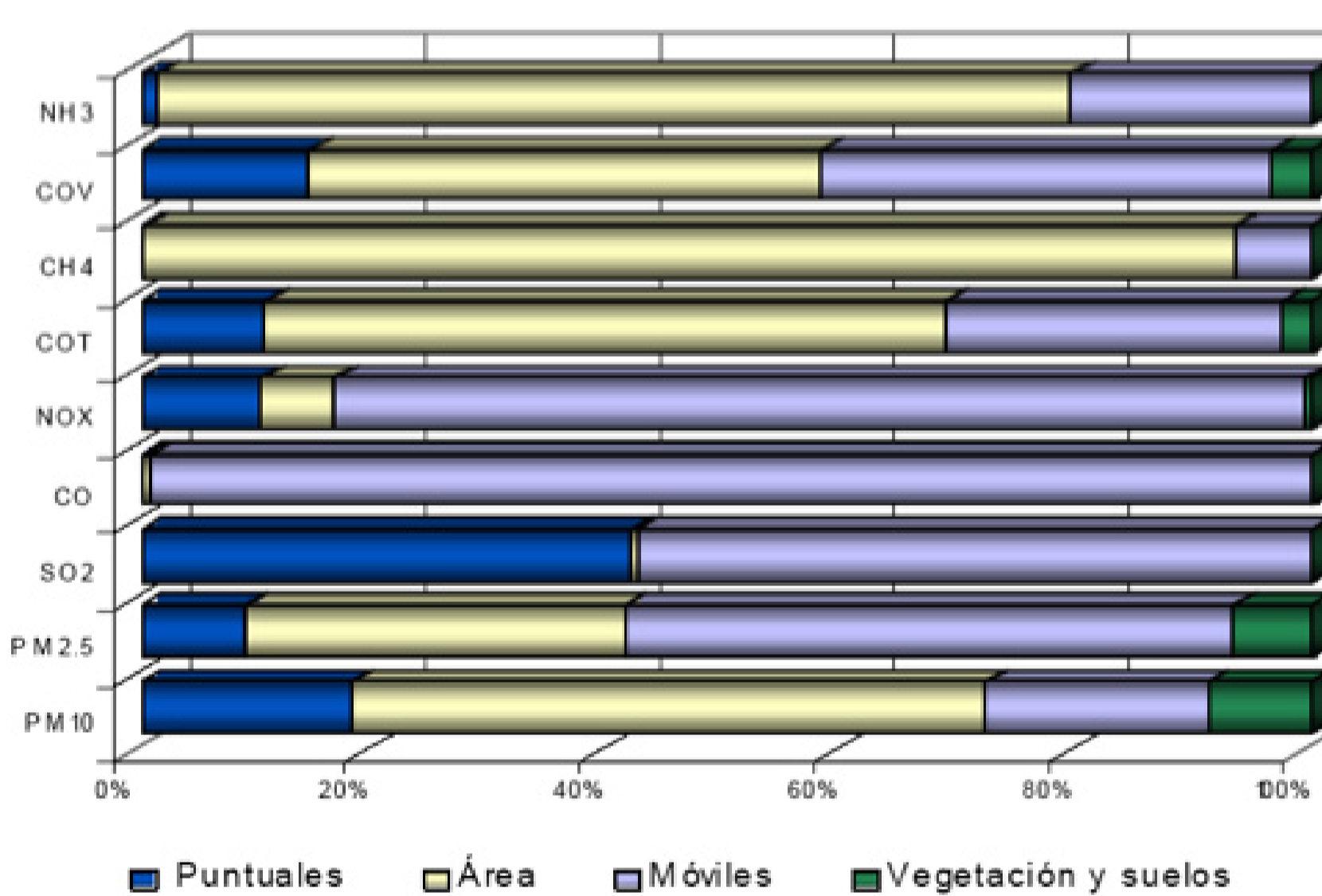
### EMISSIONS INVENTORIES

Emissions inventories help identify the major sources of every pollutant contributing to this environmental problem. They also take part in determining which sources require control measures, and help analyze the cost-effectiveness of such measures. Finally, they play an important role in the evaluation of programs that are currently in place to improve the air quality in the MCMA.

Not all major sources tend to emit a full range of pollutants. However, in general, mobile sources (cars, vans, buses, etc.) are considered as the main pollutants of the MCMA.



Emissions inventories provide information on the spatial and temporal distribution of pollutants. This information helps identify the areas of the city and the time of the day where the emissions are greater. Also, they provide emissions data of different pollutants which are put into the air quality models.



### METROPOLITAN AIR QUALITY INDEX (IMECA)

The Metropolitan Air Quality Index (IMECA) is a reference value developed to keep the population informed of the levels of pollution prevalent in different areas of the city. It is provided in a precise and opportune manner to help the people take the necessary protection measures.

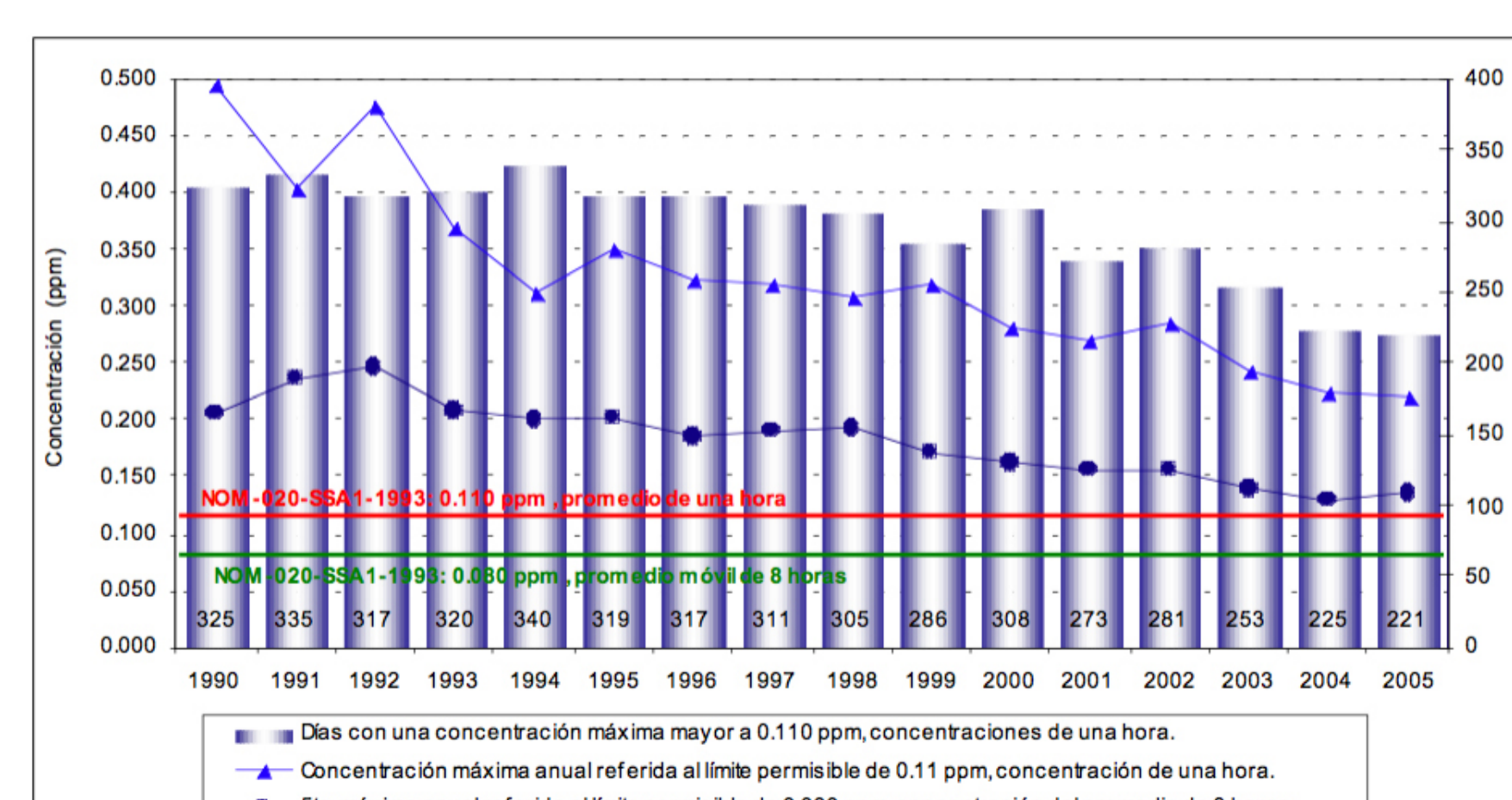
Each pollutant affects human health in a different way. The IMECA indicates when pollutants have exceeded our body's levels of tolerance. When the IMECA reaches or exceeds 100 points, the levels of pollution become hazardous to the health of the population, and as the IMECA points increase the symptoms become more severe.

| Interpretación del IMECA |                              |   |
|--------------------------|------------------------------|---|
| IMECA                    | Condición                    | Efectos a la Salud  |
| 0 - 100                  | Condición dentro de la norma | Ninguno   |
| 101 - 200                | Condición no satisfactoria   | Molestias en ojos, nariz y garganta en personas sensibles   |
| 201 - 300                | Condición mala               | Evitar actividades al aire libre. Posibles problemas respiratorios  |
| 301 - 500                | Condición muy mala           | Se agudizan los síntomas anteriores en personas sensibles y quienes fuman o padecen enfermedades crónicas |

### Ozone Trends (O<sub>3</sub>)

Currently, ozone concentrations in the MCMA go beyond what is established in the health standard on 60% of the days. However, the number of days where the health standard has been exceeded has reduced gradually in the past 15 years.

The standard establishes a maximum concentration of 0.110 parts per million (ppm) in an hour and 0.80 parts per million (ppm) in a moving average of 8 hours.



The SIMAT webpage: [www.sma.df.gob.mx/simat](http://www.sma.df.gob.mx/simat)