



FINAL REPORT

“ADVICE FOR THE DEFINITION OF CRITERIA AND DEVELOPMENT OF AIR MONITORING PROCEDURES”

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1. JUSTIFICATION

Air pollution is one of the main environmental and public health problems in Mexico. It is a phenomenon inherent in the economic, population and technological state of our country that is most seriously witnessed in the large cities and border and industrial zones. Air pollution is, in turn, one of the problems that are most difficult to understand, assess, establish standards for and control, because of the large amount and variety of emitting sources, dilution and/or transformation of pollutants in the air and the effects pollutants have on human health and ecosystems, among other reasons. In order to assess and minimize the impact of air pollution on the population and natural resources, it is essential that the country has adequate air monitoring systems, networks and programs under uniform operation and quality assurance schemes.

The Secretariat of the Environment and Natural Resources, through the National Ecology Institute, has developed and presented the National Air Monitoring Program (PNMA), which sets forth a specific policy framework on the subject and follows the guidelines set forth to date by the National Democratic Planning System.

The objective of this program is:

To establish an air monitoring program that guarantees diagnosis and surveillance of the state of air quality at national level, that generates real, valid information that can be compared among the different sites and networks of the country, as a fundamental instrument in the establishment of environmental policies for the protection of the health of the population and ecosystems (INE-SEMARNAT, 2003).

This program is divided into three sequential, progressive stages. In the first stage, the program sets forth the following objective: to draw up a diagnosis of the current state of air monitoring systems that operate in the country, revising the laws and institutions on which they are based and the financial mechanisms that economically sustain them. This first stage is concentrated on the development of tools and procedures governing the operation of air monitoring systems that makes it possible to guarantee the quality and "comparability" of the data these systems generate.

The second stage of this program attempts to establish a set of strategies for the definition of areas or cities where the priority is to install air monitoring systems. These strategies will be designed to induce an integral Air Quality Management linked to air monitoring with an emphasis on actions like increasing the awareness of the population and the development of a state policy on the matter.



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assessment and surveillance through national level audits. This stage contemplates preparing a proposal for the integration of national networks for the measurement of toxic pollutants in the regions in which their existence is suspected or has been proved.

The following figure shows the principal objectives of the National Air Monitoring Program that is being implemented by SEMARNAT.



*MA: Monitoreo Atmosférico
Fuente: INE-SEMARNAT (2003).

One of the functions of SEMARNAT is the generation of scientific and technical information on environmental problems in order to inform society, support decision making, be a driving force behind environmental protection and promote the sustainable use of natural resources. The National Air Monitoring Program includes the strengthening of the National Air Quality Information System (SINAICA) that has been developed in the National Ecology Institute in compliance with what is set forth in the General Law for Ecological Equilibrium and Environmental Protection (LGEEPA) with the objective of establishing integral administration of air quality data that are generated in the country by both urban monitoring networks and individual monitoring stations belonging either to the government or private initiative.

At present, SINAICA is a virtual space for linking local air monitoring systems in which free information is supplied to the public in general on air pollution, as close to real time as possible, through the Internet. The service offered by SINAICA on the administration, analysis and dissemination of air quality data is aimed at decision makers, researchers, academics and persons interested in the subject, and it therefore possesses technical and standards information, historical data bases and links to other national and international Internet pages on Air Quality.

Within this context, the Japanese International Cooperation Agency, through the Director General's Office of the National Ambient Research and Training Center, CENICA, charged the College of Ambient Engineers of Mexico (CINAM) with the preparation of a study called "Asesoría Para la Definición de Criterios y Desarrollo de Procedimientos de Monitoreo Atmosférico" (Advice for the Definition of Criteria and Development of Air Monitoring Procedures), focused on generating guidelines to cover diverse requirements of the PNMA.

2. METHODOLOGY

The used methodology to make the study related to: *Advice for the Definition of Criteria and Development of Air Monitoring Procedures*, it was divided in the following points:

- **Compilation of Information: International and national**
- **Visits and Interviews with national operators of air monitoring networks**
- **Diagnose of the Air Monitoring Systems**
- **Elaboration of Documents**

3. COMPILATION OF INFORMATION: INTERNATIONAL AND NATIONAL

The excellent and accessible documentation national and international was compiled and reviewed from the the following countries:

- México. Documentation of the operators of monitoring networks, environmental legislation and publications of reference
- USA. Documentation and regulations of the Environmental Protection Agency EPA and the program of "Air". Documentation from South Coast Air Quality Management District
- Europe. Documentation and directives from European Community
- Canadá: Documentation and regulations from the Canadian EPA and the program "Clean Air". Documentation from State of Ontario.
- Alemania. Documentation and regulations of the Environment Federal Office
- Japón. Documentation and specific regulations of Environment Ministry
- World Organization of the Health. Documentation of the Panamerican Center of Sanitary Eng, CEPIS
- Chile. Specific Documentation of Monitoring Network from Santiago de Chile

In general terms, it was detected that in Mexico, the monitoring networks barely are documented and the workers of the same ones adopt for effects of maintenance, operation and securing of quality, the following documents:

- Operation and Maintenance Manual of its suppliers of equipment, mainly when are analyzers of gases and particles
- Mexican official standards , and
- Code of Federal Regulations, Title 40 (CFR-40) from, EPA

Only the government of the City of Mexico, Puebla and Toluca have been drafting documents and procedures, originals and specifics, within the framework of a

program of Quality System, taking as it bases his individual practices and experiences.

The final version of documents of the Government of the Federal District will be accessible in Internet and the documentation of the network of Puebla is handled in an impression in paper. The CINAM has a copy of the documentation of Puebla and could review rough drafts of the documentation of the District Federal and Toluca. In Toluca operative procedures by sampling technique are used very general, made for an internal system of Environmental Management and has already on a certificate by ISO-9000-2002.

In Monterrey the equipment and the general trainings of the North American company are used instructives of that designed and installed the sampling stations. A similar situation prevails in Guadalajara, although in this last city has a serious problem of handling of data exists extremely since there is not a procedure or an established practice of " data validation " and the data collected by the network are published in Internet of direct way.

The networks of Tijuana/Rosarito and Mexicali, are administered under contract with the USA-EPA, by a North American private company and they are become attached strictly to the normative directives of that country. The operative documentation of the North American company was not made available of the CINAM, nevertheless, was explained to us that they such apply criteria that the CFR-40 marks. In this network a problem of accessibility to the information on the part of the local authorities and the citizenship, since the EPA sends the data of quality of the air and the state of conservation of the network, directly to the central offices of SEMARNAT.

International Information

Information of diverse countries of direct way was compiled or through the official pages in Internet of the agencies or referred ministries of environment. The information obtained was reviewed by the experts of the CINAM; and was evaluated to be including in the basic bibliography asked for by the Terms of Reference.

Without doubt, the information system more evolved and documented on the monitoring air quality is the Agency of Environmental Protection of the United States of North America. On the other hand, Canada has a set of rules "mirror", very similar to the employee in the USA.

Germany has a set of manual guides and with detailed procedures and rules in the matter of Quality Management Systems for air monitoring networks, with the difference of which these documents are not so explanatory and extensive as those of the United States of North America.

The directives of the European Community are too generic, like those of the World Health Organization (WHO and CEPIS).

The found documentation from Japan, in English and Internet, is only confined to monitoring networks of dangerous organic compounds and acid deposits. Finally, the obtained of the monitoring network from the city of Santiago de Chile, it is specific and is directed to the five polluting agents criterion that measures the network. This documentation was elaborated under contract and with the financing of JICA, which doubly makes excellent come from a collaboration with a Latin American country with very similar problems of atmospheric pollution to Mexico.

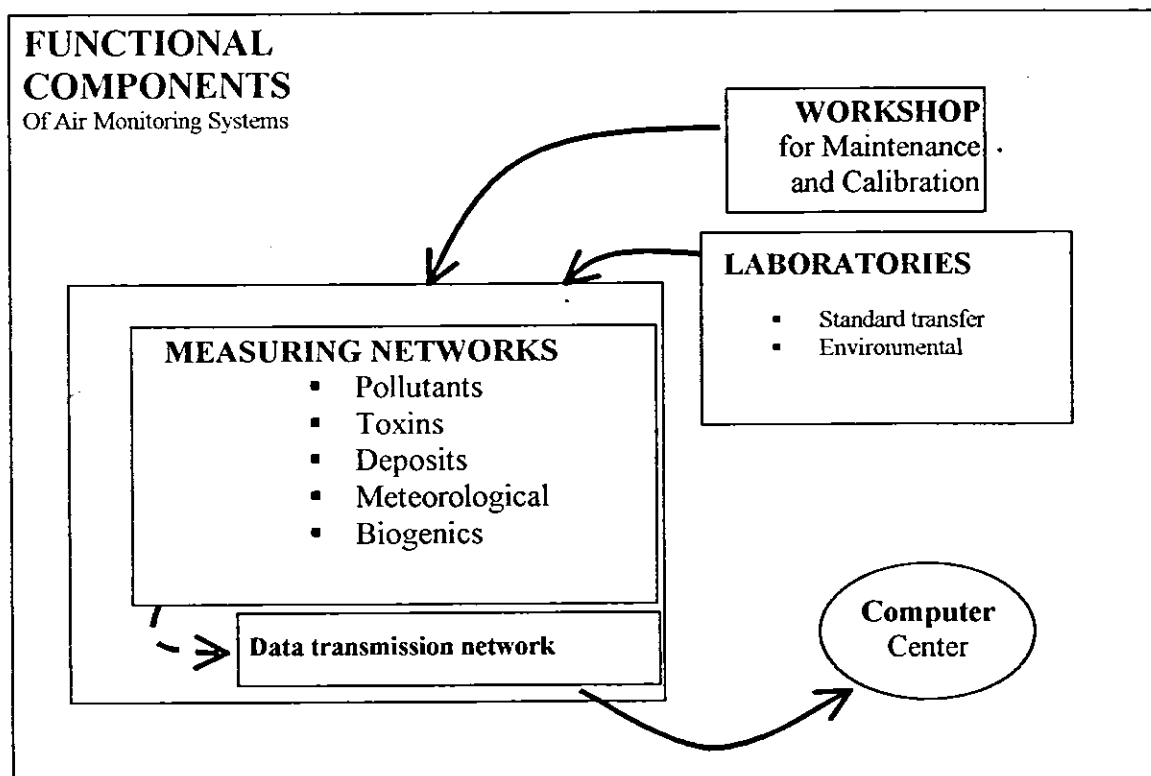
In general terms, the CINAM considers that the North American model of Air Monitoring Quality is most complete at most recommendable at the international level to follow, in the long term, like "Goal image" in our country. To a great extent, it is the model that is following the administrations of the networks of monitoring in Mexico, when having equipment of sampling originating of the United States of North America, designed and certified to fulfill the standards of that country. The main inconvenience of this model is its cost and the great demand of described human resources.

3. VISITS AND INTERVIEWS WITH NATIONAL OPERATORS OF AIR MONITORING NETWORKS

During the visits the CINAM asked for the presence of the personnel and the ones in charge of the operation and maintenance of the monitoring networks. In special, CINAM asked for the presence of the people who have to their position the gas analyzers and those that collect and process the data collected in the stations.

In order to facilitate the development of the interview, the CINAM elaborated questionnaires and graphical guides, as this:

Graphical guide:



Each one of the interviews was divided in two consecutive parts.

First, to the interviewed people one explained in general terms the reaches and times to them of the study that the CINAM was developing to define new criteria and procedures for the Air Monitoring Systems in the country.

In second term, information was asked for to them on the activities that their institutions come developing on monitoring air.

In each city was visited the stations most characteristic and complete of the network, as well as the central offices, computer centers, factories of maintenance

and in its case, laboratories were visited. Each city counts have different equipments and its level of performance varies of significant way.

The principal cities that were visited are::

- México City.
- Monterrey
- Puebla.
- Toluca.
- Guanajuato.
- Tijuana/Rosarito/Mexicali.
- Guadalajara.
- Ciudad Juárez.

With respect to the interviews of the government employees all they agreed in the necessity to reinforce the legislative frame and normative related to the air monitoring because of it is not update, and it is incomplete. In particular, the secretariats of Health and Environment were pronounced in favor of having a " Air Law ", to similarity of which they exist of Water, Solid Waste or Wild Life. A legislative project of that nature and spread can solve the problems diagnosed in the National Program of Atmospheric Monitoring of the National Institute of Ecology (INE).

Although the ideal is to create a "Air Law", the interviewed people wrote down the urgency to update the Regulation of Prevention and Control of the Atmospheric Pollution, that dates from 1988 and it does not agree with the modifications made in 1996 to the General Law of the Ecological Balance and Environment Protection. Also, it is urgent to send the environmental standards corresponding to the measuring instruments and the procedures of calibration for standardized pollutants, as well as to define a legal frame of reference for the measuring instruments of meteorological parameters, which are nonexistent.

Between the subjects nonsolved by the present legislation and administrative procedures, the interviewed people emphasized the following ones:

- The obligatory to write plans of improvement the air quality and programs of contingency in the cities with problems of air pollution, that are supported in air monitoring systems, with a strategic approach. (Ministry of Health, Government Ministry and SEMARNAT)
- The development a national epidemiologist surveillance system who gives to medical sustenance to the design and application of the programs of atmospheric contingency. (Ministry of Health and SEMARNAT)
- Is required of a normative frame to approve "models" of instruments or new technologies of measurement (i.e. Sensorial remote). The CENAM issues

technical rulings on "trazabiirty" qualities that must be based on Evaluations of Conformity to a standard or criterion established by the competent authority. (Ministry of Energy)

- Greater spread and social communication on the quality of the air and the importance of the air monitoring to create conscience between the population and the changing local authorities. (Health, INEGI, SEGOB and SEMARNAT)
- Greater budget to the Air Quality Management to face the problems of health caused by the pollutin. (All)

The Conceptual, legal and administrative transition, proposed by CENICA, of the air monitoring networks was technically well received. The interviewed people recognize the multi-thematic work who make the operators of the networks that currently work in the country and the importance of recognizing that work with budget and a greater hierarchy within the organic structure from government to who they belong.

All the interviewed people have been and are, in different modalities, users of the data bases of air, in special of the one of the Metropolitan Zone of Mexico City. In general, there is a confidence of first intention in the certainty of the data generated in the networks of measurement of the country; confidence arisen from the position of respect to the local authorities and of the explicit and direct knowledge of the institutional and personal commitment of the operators of the networks. However, the budgetary limitations are recognized whereupon they operate the networks from the last economic crisis of 1997.

The institutions that systematically work with the data bases, as are Health, SEMARNAT and the INEGI, have built opinions and suggestions to improve the "quality of the data", since these possibly present/display uncertainties no marked by the operators of the networks. These suggestions agree with the proposal to create a Quality Management System, which is considered indispensable when the data of the quality of the air are tie to a program of Atmospheric Contingencies that can have economic implications and the political premises of the highest relevance.

The interviewed people recognize like a work intrinsic and forced the Quality Management System in Air Monitoring Systems. It is a given institutional value, within the federal government, since the practice of accreditation in ISO-9000 very is spread to national level and in addition, is part of the policy of change of the currently Government Fox. The SEGOB (Ministry of Government) considers that in the subject of Atmospheric Contingencies and Civil Protection, the process must involve to the community or involved population, that of that way ensures the success of the actions.

The Ministry of Health raised the necessity that the Air Monitoring Systems could be audited and that in that process the local authorities of health participate, or of direct form or through institutions or companies that work like "third authorized". This scheme complements and agrees with the proposed one in Document 6 of the study, where the Mexican Organization of Accreditation (EMA) and the Federal Attorney of Environmental Protection to designate Environmental Auditors, who must count on the international and national certifications that guarantee their work and trustworthiness.

The SEGOB left very clear that its participation in the Air Monitoring Systems is only confined to the application of the programs of atmospheric contingency in its last phase and when these cannot be controlled by the local authorities and the environmental authorities and of health of the federal government.

Finally and according to the necessity to incorporate new parameters and technologies of measurement, in particular related to toxic substances and of photochemical origin, the government employees interviewed showed interest, urgency and realism to face to make this kind of projects.

On the other hand, the Mexican Institute of Petroleum (IMP) emphasized that its experience in the monitoring campaigns in the Metropolitan Zone of Mexico City and the peripheries of the petrochemical centers and of refinement of PEMEX, they indicate that it is possible to use methods and novel technologies, cheaper and more good qualified for the computacional handling of the data, inclusively binding in real time precise data with simulation models. To be approved these technologies to measure polluting agents criterion, there would be economies in the measurement practices that could be used to extend the photochemical measurements to toxic and polluting substances.

This alternative is considered feasible and suggests to extend its present Alliance with national laboratories to authorize, to calibrate and to make comparative measurements at national level of new measuring instruments. The experience acquired with the laboratories of the center from the material country when elaborating to them of reference for the verification of the trustworthiness of its measurements, can be used in the programs of Quality Audit to the air monitoring systems.

Of the made interviews the following commentaries can be added, equipment in future decisions with respect to the impulse and evolution of the air monitoring systems.:

- México posee instituciones y recursos humanos capacitados y subutilizados en materia de Gestión de la Calidad del Aire y monitoreo atmosférico, que pueden soportar una política de estado más agresiva y complejo con respecto al monitoreo atmosférico. Mexico has institutions and human

resources enabled and subused in the Air Quality Management, that can support a policy of complex more aggressive state and with respect to the monitoring air.

- The institutions interviewed have diminished their rate of work in the subject (. National Institute of Health, IMP, INEGI, CNA) by lack of budget and projects, not by lack of interest or necessity
- Between the subjects related and not yet considered suitably in the Air Management is: climatic change, forest fires, acid rain, regional and national dispersion of polluting agents of industrial origin, exhibition to polluting agents of the air in intrawalls and environmental evaluation.
- Existe una necesidad e interés por tener mayor información y análisis sobre calidad del aire, en especial en las ciudades donde no se cuenta con un monitoreo continuo y donde hay evidencia de contaminación de origen industrial y vehicular. It exists a necessity and interest to have greater information and analysis on air quality, in special in the cities where it is not counted on a continuous monitoring and where there is evidence of industrial and vehicular pollution.
- There is a preoccupation generalized by the problem of particles and originating organic toxics of the gas, since these are related directly to mortality indices, without to the date a national campaign on the part of the federal government has existed, since there were it perhaps for ozone

The made interviews were briefed in notes of work in the archives of the project in the CINAM and they were taken into account for the elaboration of final documents.

4. DIAGNOSIS OF THE AIR MONITORING SYSTEMS

Currently, the monitoring networks existing in the country assess the concentration of the following pollutants: sulfur dioxide (SO₂), carbon monoxide (CO), particles (TSP, PM₁₀ and PM_{2.5}), nitrogen oxides (NO_x), ozone (O₃), lead (Pb), hydrosulfuric acid (H₂S), heavy metals, sulfates, nitrates, and other parameters such as: solar radiation and air deposits (dry and humid). There are also devices for the determination of meteorological parameters, principally; wind direction (WD) and wind velocity (WV), environmental temperature (TMP) and relative humidity (RH).

The current situation of the main monitoring systems in the country is described in Table that is presented below.

In general, all networks have serious financing problems and are on a much lower organic and budgetary level than the importance of the service they provide. This situation has progressively worsened over the last ten years with the economic crisis that began in 1995 and the new political stage of our country in which the subjects of greatest importance to the population are related with safety, employment and the fight against extreme poverty.

Air Monitoring Networks in Mexico

Monitoring System	Network	Number of Stations	Parameters Measures
Mexico City (Air Monitoring System of Mexico City - (SIMAT))	Air Monitoring Network of Mexico City (RAMA)	36	Equipped with 114 analyzers to measure: O ₃ , SO ₂ , NO _x , CO, PM ₁₀ and PM _{2.5}
	Suspended Particles Manual Network (REDMA)	14	With 19 TSP sampling sites, 5 for sampling PM ₁₀ , 7 remote stations for sampling PM _{2.5}
	Air Deposit Network (REDDA)	16	REDDA has 16 stations equipped with semi-automatic collectors (humid and dry deposit), the parameters measured are pH, anions and cations.
	Meteorological Network (REDMET)	15	Comprising 15 towers with meteorological sensors, determining such parameters: RH, TMP, WD and WV. There are 8 sites from monitoring ultraviolet radiation (UV-A and UV-B).
City of Toluca	Air Quality Monitoring Network of the Metropolitan Zone of Toluca (REDZMT)	7	Parameters measured: O ₃ , CO, SO ₂ , NO ₂ , TSP, PM ₁₀ , RH, TMP, WD, WV.
Monterrey, Nuevo León (Integral Air Monitoring System of Monterrey-SIMA)	Automatic Network of the Metropolitan Zone of Monterrey (REDZMM)	5	Each station is configured to measure the following parameters: O ₃ , CO, SO ₂ , NO ₂ , PM ₁₀ , RH, TMP, WD, WV, pluvial precipitation (PP), solar radiation and atmospheric pressure (AP).
Guadalajara, Jalisco	Air Quality Monitoring Network of the Metropolitan Zone of Guadalajara (RAMAZMG)	8	The following parameters are measured: O ₃ , CO, SO ₂ , NO, PM ₁₀ , NO _x , and such meteorological parameters as: RH, TMP, WD and WV.
Ciudad Juárez, Chihuahua	Air Quality Monitoring Network of Ciudad Juárez (REDCJ)	3	The following parameters are measured SO ₂ , O ₃ , CO, NO ₂ meteorological parameters like: WD, WV, TMP, RH
	Suspended Particles Manual Network (REDMA)	2	TSP and PM ₁₀
Puebla	Automatic State Monitoring Network of Puebla (REMA)	4	Station configuration is homogeneous and consists of the following parameters: O ₃ , CO, SO ₂ , NO ₂ , H ₂ S, HCNM, PM ₁₀ , Meteorological: RH, TMP, WD, WV, UVA, UVB, PP.
Guanajuato (Air Quality Monitoring Systems of the Bajío Industrial Corridor)	Salamanca Network	3	The following parameters are measured: CO, SO ₂ , NO _x , O ₃ , PM ₁₀ And meteorological parameters like: WD, WV, TMP, RH
	Irapuato Network	3	The following parameters are measured: CO, SO ₂ , NO _x , O ₃ , PM ₁₀ And meteorological parameters like: WD, WV, TMP, RH
	Celaya Network	3	The following parameters are measured: CO, SO ₂ , NO _x , O ₃ , PM ₁₀ And meteorological parameters like: WD, WV, TMP, RH
Tijuana-Mexicali, Baja California		6	Parameters measured: O ₃ , NO ₂ , SO ₂ , CO, NO y NO _x ; PM ₁₀ and meteorological parameters: TMP, WD, WV

Adapted from: PNMA (2003), www.sma.df.gob.mx/simat/, <http://semades.jalisco.gob.mx/site/indexaire>,
www.nl.gob.mx/sduop/sima/sima_des.htm, www.edomex.gob.mx/portalgem/se/, www.arb.ca.gov/aqdp.htm,
www.sedurbecop.pue.gob.mx/Monitoreo/Remareporte.html

The level of commitment of the professionals involved in the operation of the networks is very high and professional pride can be observed in the work they do. This work mystique is particularly relevant for the future standards on the subject, since the operators have set goals far beyond those imposed by the official Mexican standards and all of them, with no exception, make extraordinary, non-remunerated efforts each day in order to comply with them. From the start of their activity, all the operators have been exposed to the communication media and the population at large, a situation that can be compared to ongoing assessment of their performance as a professional work team and of their personal work. Given these circumstances, their level of commitment is greater since their work comes under the daily scrutiny of the population, including their friends and family.

The most advanced administration in our country with respect to the management and monitoring of air quality is undoubtedly to be found in Mexico City. The Air Monitoring System of the Metropolitan Zone of the Valley of Mexico (SIMAT) could be the national model, which we can realistically aspire to either totally or partially in the other metropolitan, border or industrial regions of Mexico. However, it must be taken into account that the automatic air monitoring network operated in SIMAT is the oldest in the country and that the complexity and gravity of pollution in the Valley of Mexico is a strategic priority at national level and receives local resources and international support that are not replicable in other urban areas of the country.

The air monitoring environmental infrastructure in Mexico is characterized by the following characteristics:

- The air monitoring networks are located in metropolitan regions, capital cities, border towns and industrial zones with severe or evident problems of air pollution.
- The air quality monitoring networks in the country are essentially urban. Some of the measurement networks are subject to quality assurance and control programs and have expansion plans, either because the urban areas where they are located have grown or because the original design of the networks thus determined. With the exception of the border networks, all the monitoring networks in the country have particular operative manuals and technical and administrative procedures that are different one from the other.
- Most of the measurement stations are located in "booths", which facilitates their identification, maintenance and in the case of the mobile booths, their reinstallation if necessary due to loss of representativity. The level of equipment in each station is highly varied and there are few stations that are "completely" equipped with instruments to measure all standardized parameters and those of meteorological interest.

- Most of the networks are equipped with instruments and equipment from North America. The measuring equipment has operative characteristics and functions that reply to the standards imposed in the United States of America (USA), by the Environment Protection Agency (EPA), although some do not have all the internal and peripheral additions requested by this agency, since they are not used in Mexico.
- In general, the responsible executives and technicians in the monitoring networks have been formally trained by the manufacturers of the equipment, by personnel from the Secretariat of the Environment and Natural Resources (SEMARNAT), by personnel from the Mexico City government, by different academic institutions and by technical personnel from the EPA. The use of didactic and technical materials issued by this American agency is usual since it can be accessed for free on the Internet. Practical training in the work area is the common denominator in the training of operational technicians

5. ELABORATION OF DOCUMENTS

It is the intention that the preparation of these documents provides a series of guidelines for the preparation of both the future regulations of the General Law on Ecological Equilibrium and Protection to the Environment with respect to air quality monitoring, and the Official Mexican Standard that will set forth the minimum requirements those responsible for the operation of SMAs in Mexico must comply with.

For the purpose of these documents, an Air Monitoring System (SMA) is defined as the organization responsible for generating and reporting data on air quality in an air basin under the criteria and conditions established in the PNMA.

An SMA includes the human, administrative resources and infrastructure (air quality monitoring networks and meteorology networks, support laboratories and computer systems for information processing) operated under one accredited, approved quality management system

As part of the specific scopes of the project, six documents on Air Monitoring in Mexico have been drawn up, whose subject matter is described below:

Document 1. "Air Monitoring in Air Quality Management"

This document is aimed at giving a response to the requirements of the first stage of the PNMA and therefore basically includes a diagnosis of the air monitoring systems in Mexico by describing, on the one hand, the administrative and operative system that prevails in the Air Quality monitoring networks operating in the Country and, on the other, the Legal, Political and Institutional framework on which this activity is based.

Another chapter describes the importance of air monitoring in Ambient Management, principally as instruments to alert the population, for management, with health protection purposes, and for the analysis of air quality trends, among others.

Finally, the last chapter presents the importance of establishing an SMA assessment and accreditation system that will have an influence on the quality of the data generated by said agencies.

Document 2. "Objectives and components of Air Monitoring Systems"

This document includes proposals for the establishment of SMAs using criteria related to the number of inhabitants and inventories of sources and emissions, together with the particular characteristics of the air basins.

A second section puts at the consideration of the National Ecology Institute a network and station classification system in terms of representativity and territorial importance, as well as a classification of air quality monitoring stations in terms of ground use types, in both the urban and rural spheres.

Chapter 2 sets forth the overall objectives of the SMAs that are recommended at national level and states the criteria used at international level for the assessment of quality of data in terms of representativity, measurement uncertainty (precision, bias and accuracy), as well as those corresponding to the limits of reliability and integrity.

Chapter 3 defines the basic components of an SMA and a description and examples of the principal subsystems are given for each case.

Document 3. "Design and Installation of Monitoring Networks"

This document approaches the main aspects for the design and installation of SMAs based on a precise definition of objectives and characterization of the air basin where the project is to be carried out. Subsequently, criteria are given for the selection of the pollutants and meteorological parameters to be assessed and their respective measurement technologies and sampling times. The following section gives the basic criteria for determining the number of stations and requirements that must cover the selected sampling sites.

A further section refers to the specific characteristics monitoring stations must comply with and the technical specifications and localization criteria for sample taking.

Finally, the main considerations for the location of the computer center are presented in terms of its important role with respect to the acquisition and storage of information generated by the different monitoring stations.

Document 4. "Operation, Maintenance and Calibration of Monitoring Systems"

Chapter 1 describes the detection principles and main characteristics of the sampling and/or monitoring equipment used in the SMAs for the assessment of air pollutant criterion.

Chapter 2 refers to the requirements for training the personnel that participate in the operation, maintenance and calibration activities of the SMAs and gives the basic criteria for team selection. Criteria are also included for the preparation of Operative Procedures (OPs) that represent an essential tool in Quality Assurance schemes.

Chapter 3 sets forth the general guidelines and minimum requirements that the SMA preventive maintenance programs (PMP) must have. Basic aspects are also

included related to the availability of parts, spares and equipment; the availability of appropriate Installations and the general characteristics of supervision and recording (Log) activities that must be documented in the PMPs.

Chapter 4 refers to general aspects of the Calibration Programs whose convergence in this type of system with the maintenance activities in the test methods carried out is important, while the final part refers to aspects related to safety and attending emergencies.

Document 5 “Management, Quality Assurance and Control in Air Monitoring Systems”

The objective of this document is to introduce to those responsible for the SMAs the basic aspects for the introduction of a Quality Management System in their organizations and to give some general instructions on air monitoring practices. Chapter 3 of this document provides the bases with respect to the term ‘quality’ and a quality management system, starting with the eight principles of quality management. Subsequently, it explains how to design and implement a quality management system.

Chapter 4 begins by stressing the importance of Quality Policy as a governing instrument of all activities related to quality. Subsequently, responsibilities and functions are defined based on organization structure. Similarly, the basic concepts of planning and quality objectives are described.

Section 4.2 refers to the main requirements set forth in the quality standards for Quality Assurance with respect to the document system, document control, purchases, selection of infrastructure and calibration; while section 4.3 gives Quality Control criteria that are applicable to SMAs, placing special emphasis on aspects related to revision, verification and validation of data.

Document 6 “Auditing Procedure for Air Monitoring Systems”

This document proposes a federal auditing scheme under the precepts and guidelines set forth in the Federal Law on Metrology and Standardization concerning accreditation and the adoption of the guidelines and general criteria of the Auditing Program developed by USEPA, based on the execution of Technical System Audits, Functioning Audits and Data Quality Assessment.

Finally, it is important to point out that the documents described above are not intended to be a technical manual, but a guide to the standards for designing, operating and maintaining air monitoring systems. It is the responsibility of the local authorities to prepare their own technical manuals on the details and quality assurance and control in accordance with the physical and technological configuration of their systems..

