3．事前調査時の M/M（第一次事前調査 M/M、第二次事前調査 M/M）

# MINUTES OF MEETING
# BETWEEN THE JAPANESE PREPARATORY STUDY TEAM AND THE AUTHORITIES CONCERNED OF THE GOVERNMENT OF THE UNITED MEXICAN STATES ON JAPANESE TECHNICAL COOPERATION FOR STRENGTHENING OF AIR MONITORING PROGRAM IN THE UNITED MEXICAN STATES

The Japanese Preparatory Study Team (hereinafter referred to as "the Team"), organized by Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Mr. Eiji Iwasaki, visited the United Mexican States from November 18 to November 30, 2004, for the purpose of discussing with the Mexican authorities concerned (hereinafter referred to as "the Mexican side") on the formation of the Japanese Technical Cooperation Program regarding Strengthening of Air Monitoring Program in the United Mexican States (hereinafter referred to as "the Project").

During its stay in the United Mexican States, the Team exchanged views and had a series of discussions about the Project formation with the Mexican authorities concerned. As a result of the discussions, and in accordance with the provisions of the Agreement on Technical Cooperation between the Government of Japan and the Government of the United Mexican States signed in Tokyo on December 2, 1986 (hereinafter referred to as "the Agreement") and the Embassy of Japan's Note No. 145-128/04 dated June 25, 2004 and the Ministry of Foreign Affairs of the United Mexican State's Note No. CTC-09186 dated September 23, 2004, both the Team and the Mexican authorities concerned agreed to recommend to their respective Governments the matters referred to in the document attached hereto. The technical member of the Team will continue to stay in Mexico to work out tentative activities of the Project until December 11, 2004.

Done in duplicate in Spanish and English languages, each text shall be equally authentic. In case of any divergence of interpretation, the English text shall prevail.

Mexico, D.F., November 29, 2004

岩崎英二

Eiji Iwasaki
Leader,
Japanese Preparatory Study Team,
Japan International Cooperation Agency,
Japan

Exequiel Ezcurra
President,
National Institute of Ecology,
Ministry of Environment and
National Resources,
The United Mexican States

## ATTACHED DOCUMENT

### I. COOPERATION BETWEEN JICA and THE MEXICAN GOVERNMENT

The Government of the United Mexican States will implement the Project for Strengthening of Air Monitoring Program in the United Mexican States (hereinafter referred to as "the Project") in cooperation with JICA.

### II. PROBLEMS ANALYSIS AND TENTATIVE PROJECT FRAMEWORK

CENICA and the Japanese Preparatory Study Team (hereinafter referred to as "the Team") jointly held a PCM workshop to analyze problems regarding air quality monitoring in Mexico on November 24, 2004; a list of the participants is attached in Annex I. The participants identified lack of information about criteria and non-criteria air pollutants as the core problem and figured out its cause and effect relationship. CENICA and the Team further analyzed the core problem and revised its cause and effect relationships as shown in Annex II. Based on the problem analysis, CENICA and the Team prepared a tentative framework of the project as below.

Super Goal

- Impact of air pollution on public health is reduced.

Overall Goals

- Air pollution contingency plans are applied when needed.
- Effective air pollution control measures are being taken by local and federal authorities.
- Civil society and authorities are aware of status of air pollution.
- Health risk, impact on ecosystems, and economic losses due to air pollution is identified.

Project Purpose

- Air quality information is improved and increased.

Outputs

- Air quality monitoring is conducted in the areas with enough coverage to determine impacts of air pollution.
- Air quality monitoring equipment is properly operated.
- Quality Assurance and Quality Control (hereinafter referred to as "QA/QC") of air quality monitoring data is performed.
- Air quality monitoring results are disseminated to the civil society and authorities through

the National Air Quality Information System on Air Quality (SINAICA) and analyzed for policy making.

- Studies that complement existing air quality monitoring are sufficiently carried out.
- CENICA's capacity to implement the National air quality monitoring program is strengthened.

It is important to mention that during the problem analysis activity an issue regarding the need to strengthen the legal framework related to air quality was identified. Although the scope of this project does not include this issue, outputs of this project will support the consolidation of the air quality regulatory system in the United Mexican States. Based on the tentative Framework, CENICA and JICA will have further discussions on the Project, finalize the framework and develop a Project Design Matrix (hereinafter referred to as "PDM").

## III. EVALUATION OF THE FRAMEWORK

CENICA and the JICA study team have evaluated the project framework by criteria of relevance, impact and effectiveness as follows.

### 1. Relevance

- Article 112 of the General Law of Ecological Balance and Environmental Protection requires local governments to establish and operate, with the technical support of the SEMARNAT, air quality monitoring systems. The National Program on the Environment and Natural Resources, which is a sector-program of the National Development Plan, stresses the need for local governments to monitor air quality and air pollutant emissions periodically, and the Mexican National Air Quality Monitoring Program has been developed and implemented since 2003. These facts show that the Mexican Government has committed to promote establishment of the air quality monitoring systems.
- The results of the air quality monitoring are required to be integrated into SINAICA developed and updated by the SEMARNAT according to the Regulation on Air Pollution Prevention and Control. SINAICA operates on Internet to disseminate results of the air quality monitoring and has become fully operational in 2004, it is recognized as one of the priority projects by the President to promote transparency of the Federal Government. Assisting the enhancement of SINAICA is considered as relevant to the national priority.
- Air quality management mainly consists of establishment of air quality and emission standards, development of emission inventories, enforcement of the emission standards, and monitoring of air quality. Because the air quality and emission standards have been established, and

because emission inventories have been developed, assisting the establishment of the air quality monitoring system is legitimate in terms of the level of air quality management in Mexico.

- Although air quality is being automatically monitored in 18 cities and metropolitan areas as well as manually monitored in 24 localities in Mexico, these monitoring networks and stations do not cover enough area to evaluate whether the air quality standards are met in the Mexican territory. Health risks due to air pollution in towns with a high degree of industrialization are of great concern. Providing reliable information about the air quality would meet the needs of large population.
- In addition to the above-mentioned facts, lack of quality information about air pollutants has been identified as the core problem at the PCM workshop with the participants from relevant organizations. The project purpose properly meets the needs of the relevant organizations and the society in general.
- The internal regulation of the SEMARNAT defines responsibilities of CENICA in the field of air quality monitoring as to 1) develop technical standards for designing air quality monitoring systems, 2) promote and supervise establishment of the air quality monitoring systems by the local governments, 3) develop QA/QC methods for measurement and determination of air pollutants, 4) conduct studies on air pollution and evaluation of exposure of individuals, 5) develop a national air quality information system, and 6) disseminate scientific information about air pollutants. It is reasonable to assist CENICA for increasing their capacity in the field of their responsibility through the project.

**2. Impact**

- If the project is implemented, overall goals, such as 1) Application of air pollution contingency plans when needed, 2) Implementation of effective air pollution control measures by local and federal authorities, 3) Increased awareness of civil society and authorities toward status of air pollution, and 4) Identification of health risk, impact on ecosystems, and economic losses due to air pollution would be pursued, given that increased quality information about the status of air pollution is reached to civil society and authorities, and that the studies supplementing air quality monitoring could provide information about relationship between concentration levels of air pollutants and their influences on human health, ecosystems, and economic activities.
- Major beneficiaries of the project would be CENICA, local governments whose monitoring networks are integrated to National Air Quality Monitoring Program, civil society and decision makers at local, state and federal levels.
- Proper analysis of the air quality monitoring data would provide policy makers with useful information in order to design and implement effective measures to prevent and control air pollution.
- Studies complementing air quality monitoring could provide basis to establish air

quality/emission standards for non-criteria air pollutants and better understanding of air pollution phenomena.

- If CENICA becomes a reference laboratory in the field of air quality monitoring, local governments could be supported by CENICA for the standardization of their equipment and procedures.

**3. Effectiveness**

- Appropriate air quality monitoring coverage would increase the quantity and quality of information about the status of air pollution. Adequate operation of the monitoring equipment and QA/QC of air quality monitoring data would increase their quality. In addition, this information will be relevant to the political decision making process. Studies complementing air quality monitoring would also provide additional information about the air pollution formation mechanism. Thus, the project purpose is considered to be achievable through implementing activities that will produce the five outputs.
- An increase in information about the status of air pollutants would provide a solid basis to judge whether air pollution contingency plans should be applied, to identify the levels and types of health risk, impact on ecosystems, and economic losses, and increase awareness of civil society and authorities.

## IV. MEASURES TO BE TAKEN BY JICA

In accordance with the laws and regulations in force in Japan and the provision of Article III of the Agreement, JICA, as the executing agency for technical cooperation by the Government of JAPAN, will take, at its own expense, the following measures according to the normal procedures of its technical cooperation scheme. Details will be discussed by the second preparatory study team.

1. DISPATCH OF JAPANESE EXPERTS
   JICA will provide services of the Japanese experts for the Project.

2. PROVISION OF MACHINERY AND EQUIPMENT
   JICA will provide some machinery, equipment and other materials (hereinafter referred to as "the Equipment") necessary for the implementation of the Project.

3. TRAINING OF MEXICAN PERSONNEL IN JAPAN
   JICA will receive Mexican counterpart personnel of the Project for their technical training in Japan.

## V. MEASURES TO BE TAKEN BY THE GOVERNMENT OF THE UNITED MEXICAN STATES

1. The Government of the United Mexican States will take necessary measures to ensure that the self-reliant operation of the Project will be sustained during and after the period of Japanese technical cooperation, through full and active involvement in the Project by all related authorities, beneficiary groups and institutions.

2. In accordance with the provision of Article IV of the Agreement, the Government of the United Mexican States will ensure that the technologies and knowledge acquired by the Mexican nationals as a result of Japanese technical cooperation will contribute to the economic and social development of the United Mexican States.

3. In accordance with the provisions of Article V and VI of the Agreement, the Government of the United Mexican States will grant in the United Mexican States privileges, exemptions and benefits to the Japanese experts referred to in II-1 above and their families.

4. In accordance with the provisions of Article VIII of the Agreement, the Government of the United Mexican States will take the measures necessary to receive and use the Equipment provided by JICA under IV-2 above and equipment, machinery and materials carried in by the Japanese experts referred to in IV-1 above.

5. The Government of the United Mexican States will take necessary measures to ensure that the knowledge and experience acquired by the Mexican counterpart personnel of the Project through technical training in Japan will be utilized effectively in the implementation of the Project.

6. In accordance with the provision of Article V-(b) of the Agreement, the Government of the United Mexican States will provide the services of the Mexican counterpart personnel of the Project and administrative personnel.

7. In accordance with the provision of Article V-(a) of the Agreement, the Government of the United Mexican States will provide the buildings and facilities necessary for the Project.

8. In accordance with the laws and regulations in force in the United Mexican States, the Government of the United Mexican States will take necessary measures to supply or replace at its own expense machinery, equipment, instruments, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than the Equipment provided by JICA under IV-2 above.

9. In accordance with the laws and regulations in force in the United Mexican States, the Government of the United Mexican States will take necessary measures to meet the running expenses necessary for the implementation of the Project.

## VI. ADMINISTRATION OF THE PROJECT

1. President of National Institute of Ecology, as the Project Director, will bear overall responsibility for the administration and implementation of the Project.

2. General Director of CENICA, as the Project Manager, will be responsible for the managerial and technical matters of the Project.

3. The Japanese Chief Advisor will provide necessary recommendations and advices to the Project Director and the Project Manager on any matters pertaining to the implementation of the Project.

4. The Japanese experts will provide necessary technical guidance and advice to the Mexican counterpart personnel on technical matters pertaining to the implementation of the Project.

5. For the effective and successful implementation of technical cooperation for the Project, the Joint Coordinating Committee (hereinafter referred to as "JCC") will be established for the effective and successful implementation of technical cooperation for the Project. JCC will meet at least once a year or whenever necessity arises, in order to fulfill the following functions;
   - To formulate the annual work plan of the Project;
   - To review the progress of the annual work plan;
   - To review and exchange opinions on major issues that may arise during the implementation of the Project;
   - To discuss any other issue(s) pertinent to smooth implementation of the Project.

## VII. JOINT EVALUATION

Evaluation of the Project will be conducted jointly by JICA and the Mexican authorities concerned, at the middle and during the last six months of the cooperation term in order to examine the level of achievement.

## VIII. CLAIMS AGAINST JAPANESE EXPERTS

In accordance with the provisions of Article VII of the Agreement, the Government of the United Mexican States undertakes to bear claims, if any arises, against the Japanese experts engaged in technical cooperation for the Project resulting from, occurring in the course of, or otherwise connected with the discharge of their official functions in the United Mexican States except for those arising from the willful misconduct or gross negligence of the Japanese experts.

## IX. MUTUAL CONSULTATION

There will be mutual consultation between JICA and the United Mexican States Government on any major issues arising from, or in connection with, this Attached Document.

## X. MEASURES TO PROMOTE UNDERSTANDING AND SUPPORT FOR THE PROJECT

For the purpose of promoting support for the Project among the people of the United Mexican States, the Government of the United Mexican States will take appropriate measures to make the Project widely known to the people of the United Mexican States.

## XI. TERM OF COOPERATION

The duration of the technical cooperation for the Project will be discussed by the second Japanese preparatory study team.

## XII. SCHEDULE BEFORE THE COMMENCEMENT OF THE PROJECT

1. From November 30,2004 to December 11, 2004
   The technical member of the Team will continue to stay in Mexico until December 11, 2004.
   The purpose of the stay is to work out tentative activities through;
   - Collecting more information,
   - Conducting site visits, and
   - Discussing with authorities concerned.

2. The second Japanese preparatory study team
   JICA will dispatch the second Japanese preparatory study team in the first quarter of 2005 to discuss details of the project such as activities, inputs, duration and so on.

3. Exchanging signs on Record of Discussions (hereinafter referred to as "R/D").
   After taking necessary measures or procedures for the approval of the Project based on the Minutes of Meeting of the second mission, both side will exchange signs on R/D as an implementation agreement.

ANNEX I LIST OF PARTICIPANTS OF THE PCM WORKSHOP
ANNEX II PROBLEMS TREE

## ANNEX I LIST OF PARTICIPANTS OF THE PCM WORKSHOP

### MEXICAN SIDE

| NAME | POSITION | ORGANIZATION |
|---|---|---|
| Mr. Roberto Martínez | Head of Department. | SEMARNAT |
| Mr. Jorge M. Barrera M. | Head of Department | SEMARNAT Tlaxcala |
| Mr. Esteban Amigón Ramírez | Head of Department | PROFEPA |
| Mr. Rodrigo Zamora M. | Deputy Director | PROFEPA |
| Mr. Miguel Orozco Malo | Coordinator of Informatics' Systems | INE |
| Mr. Rodrigo Duran | Coordinator | Instituto de Ecología de Guanajuato |
| Mr. Carlos Aarón Ávila | Technician | Instituto de Ecología de Guanajuato |
| Mr. Victor Javier Gutierrez Avedoy | General Director | DGCENICA |
| Mr. Rafael Ramos | Director | Air Monitoring System- GDF |
| Mrs. Beatriz Cardenas | Director of Research in Air Pollution | DGCENICA |
| Mrs. Ana Patricia Martínez | Director of Research in Air Quality Monitoring | DGCENICA |
| Mr. José Zaragoza | Deputy Director of Air Quality Monitoring | DGCENICA |
| Mr. Salvador Blanco | Deputy Director of Air Pollutants Characterization | DGCENICA |
| Mr. Oscar Fentanes | Head of Department of Air Quality Monitoring | DGCENICA |
| Mr. Felipe Angeles | Head of Department of Personal Exposition Studies | DGCENICA |
| Mrs. Susana Hernández | Technician | DGCENICA |
| Mrs. Carmen Alejandra Sánchez Soto | Head of Department of SINAICA | DGCENICA |
| Mr. Francisco Rivera | Services Director | DESIMA, SA de CV |
| Mr. Moris A. Arezland V. | Head of Department | Consejo Estatal de Ecología del Estado de Hidalgo (COEDE) |
| Mr. Miguel Ángel Soto Loza | Chief Office | Consejo Estatal de Ecología del Estado de Hidalgo (COEDE) |
| Mr. Iván Luis Steinle | Director | REPMEX, SA de CV |
| Mrs. Patricia Carvajal R. | Researcher | REPMEX, SA de CV |
| Mr. Alejandro López | Head of Department | Secretaría de Ecología del Gobierno del Estado de México |
| Mr. Armando Gutiérrez | Head of Department | Coordinación de Agua y Medio Ambiente del Gobierno del Estado |

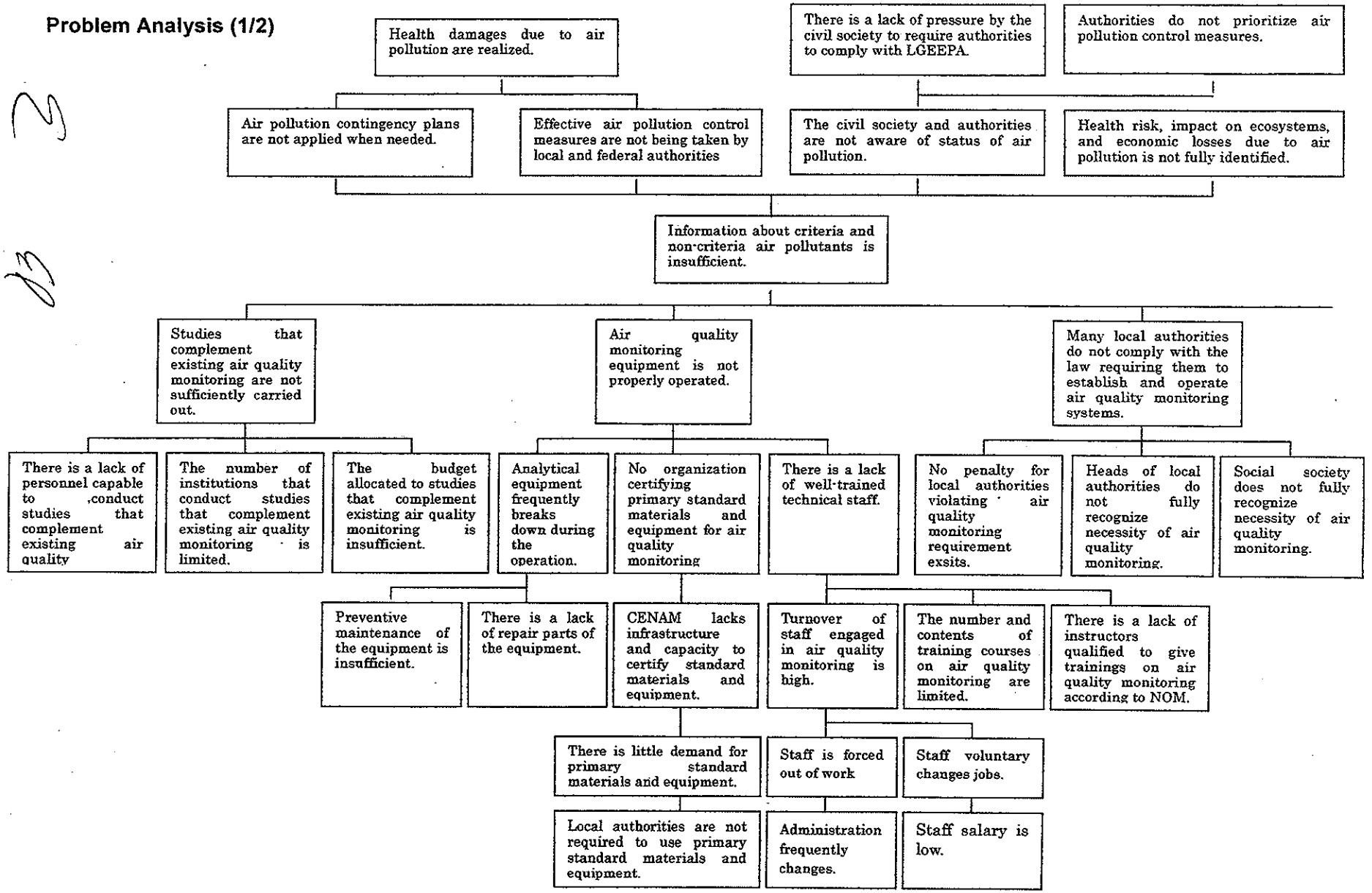
| | | |
|---|---|---|
| | | de Morelos (CEAMA) |
| Mr. Alberto Cruzado | Project Engineer | Colegio de Ingenieros Ambientales (CINAM) |
| Mr. Jesús Castillo | Project Engineer | Colegio de Ingenieros Ambientales (CINAM) |
| Mrs. Eva Rosas | Technician | Entidad Mexicana de Acreditación (EMA) |
| Mr. Gamaliel Parra Cevallos | Morelos Air Monitoring State Network Responsible | Coordinación de Agua y Medio Ambiente del Gobierno del Estado de Morelos (CEAMA) |
| Mr. Jaime E. Fernández | Technician | Coordinación de Agua y Medio Ambiente del Gobierno del Estado de Morelos (CEAMA) |
| Mr. Carlos Aguirre | Technician | Secretaría de Ecología del Gobierno del Estado de México (SEGAM) |
| Mrs. Guadalupe de la Luz | Coordinator | Comisión Federal para la Protección contra Riesgos Sanitarios (COFEPRIS), Secretaría de Salud |
| Mr. Alejandro Rivera | Director | Ingeniería Ambiental, SA de CV |
| Mrs. Claudia Mendoza | Office Head | Ecología de Tlaxcala |

**JAPANESE SIDE**

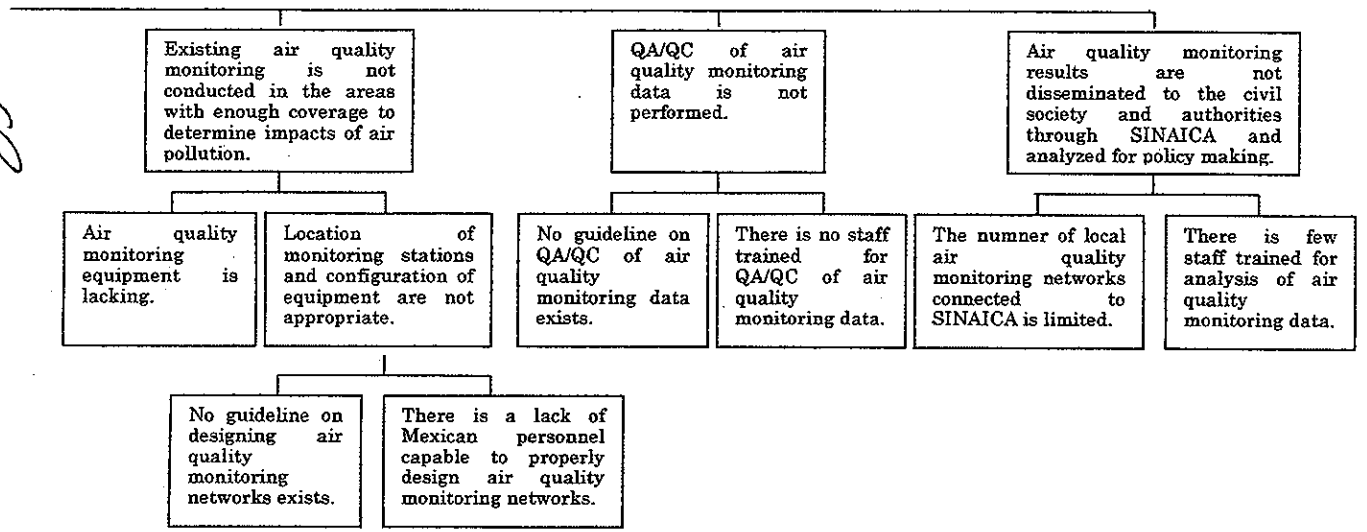
| NAME | POSITION | ORGANIZATION |
|---|---|---|
| Mr. Eiji Iwasaki | Team Leader, Environmental Management Team I, Group II, Global Environment Department | JICA |
| Dr. Shinji Wakamatsu | Project Leader, PM2.5 · DEP Research Project | National Institute For Environmental Studies |
| Mr. Toyosaku Kato | Senior engineer, Technical Group, | Japan Techno Co. Ltd. |
| Ms. Kaoru Oka | Manager, Global Environmental Issues Division | EX Corporation |
| Mr. Minoru Kobayashi | Staff, Environmental Management Team I, Group II, Global Environment Department | JICA |
| Mr. Ichiro Sato | Staff | JICA Mexico Office |
| Ms. Emi Charles | Staff | JICA Mexico office |
| Ms. Keiko Suzuki | Interpreter | |
| Ms. Reiko Furukawa | Interpreter | |

ANNEX II PROBLEMS TREE

## Problem Analysis (1/2)



## Problem Analysis (2/2)



# MINUTES OF MEETING
# BETWEEN THE SECOND JAPANESE PREPARATORY STUDY TEAM AND THE AUTHORITIES CONCERNED OF THE GOVERNMENT OF THE UNITED MEXICAN STATES ON JAPANESE TECHNICAL COOPERATION FOR STRENGTHENING OF AIR MONITORING PROGRAM IN THE UNITED MEXICAN STATES

The Second Japanese Preparatory Study Team (hereinafter referred to as "the Team"), organized by Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Mr. Eiji Iwasaki, visited the United Mexican States from January 31 to February 11, 2005, for the purpose of discussing with the Mexican authorities concerned (hereinafter referred to as "the Mexican side") on the formation of the Japanese Technical Cooperation Program regarding Strengthening of Air Monitoring Program in the United Mexican States (hereinafter referred to as "the Project").

During its stay in the United Mexican States, the Team exchanged views and had a series of discussions about the Project formation with the Mexican authorities concerned. As a result of the discussions, and in accordance with the provisions of the Agreement on Technical Cooperation between the Government of Japan and the Government of the United Mexican States signed in Tokyo on December 2, 1986 (hereinafter referred to as "the Agreement") and the Embassy of Japan's Note No. 145-128/04 dated June 25, 2004 and the Ministry of Foreign Affairs of the United Mexican State's Note No. CTC-09186 dated September 23, 2004, both the Team and the Mexican authorities concerned agreed to recommend to their respective Governments the matters referred to in the document attached hereto. The technical members of the Team will continue to stay in Mexico to work out tentative activities of the Project until February 12, 2005.

Done in duplicate in Spanish and English languages, each text shall be equally authentic. In case of any divergence of interpretation, the English text shall prevail.

Mexico, D.F., February 10, 2005

岩崎英二

Eiji Iwasaki
Leader,
Japanese Preparatory Study Team,
Japan International Cooperation Agency,
Japan

Exequiel Ezcurra
President,
National Institute of Ecology,
Ministry of Environment and
National Resources,
The United Mexican States

## ATTACHED DOCUMENT

## I. COOPERATION BETWEEN JICA AND THE MEXICAN GOVERNMENT

1. The Government of the United Mexican States will implement the Project for Strengthening of Air Monitoring Program in the United Mexican States (hereinafter referred to as "the Project") in cooperation with JICA.

2. The Project will be implemented in accordance with the Master Plan which is given in ANNEX 1 and also be managed by the use of the Project Design Matrix and Tentative Plan of Operation those are attached in ANNEX 2 and ANNEX 3.

## II. MEASURES TO BE TAKEN BY JICA

In accordance with the laws and regulations in force in Japan and the provisions of Article III of the Agreement, JICA, as the executing agency for technical cooperation by the Government of JAPAN, will take, at its own expense, the following measures according to the normal procedures of its technical cooperation scheme.

1. DISPATCH OF JAPANESE EXPERTS
   JICA will provide the services of the Japanese experts as listed in ANNEX 4, whose counterparts are listed in ANNEX 5. The provision of Article IX of the Agreement will be applied to the above-mentioned experts.

2. PROVISION OF MACHINERY AND EQUIPMENT
   JICA will provide such machinery, equipment and other materials (hereinafter referred to as "the Equipment") necessary for the implementation of the Project as listed in ANNEX 4. The provision of Article VIII-1 of the Agreement will be applied to the Equipment.

3. TRAINING OF MEXICAN PERSONNEL IN JAPAN
   JICA will receive the Mexican personnel connected with the Project for technical training in Japan.

## III. MEASURES TO BE TAKEN BY THE GOVERNMENT OF THE UNITED MEXICAN STATES

1. The Government of the United Mexican States will take necessary measures to ensure that the self-reliant operation of the Project will be sustained during and after the period of Japanese technical cooperation, through full and active involvement in the Project by all related authorities, beneficiary groups and institutions.

2. In accordance with the provision of Article IV of the Agreement, the Government of the United Mexican States will ensure that the technologies and knowledge acquired by the Mexican nationals as a result of Japanese technical cooperation will contribute to the economic and social development of the United Mexican States.

3. In accordance with the provisions of Article V and VI of the Agreement, the Government of the United Mexican States will grant in the United Mexican States privileges, exemptions and benefits to the Japanese experts referred to in II-1 above and their families.

4. In accordance with the provisions of Article VIII of the Agreement, the Government of the United Mexican States will take the measures necessary to receive and use the Equipment provided by JICA under II-2 above and equipment, machinery and materials carried in by the Japanese experts referred to in II-1 above.

5. In accordance with the laws and regulations in force in the United Mexican States, the Government of the United Mexican States will take necessary measures to cover the cost of value-added tax (IVA) and delivery in the United Mexican States for the Equipment provided through JICA, and to supply or replace at its own expense machinery, equipment, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than the Equipment provided through JICA under II-2 above.

6. The Government of the United Mexican States will take necessary measures to ensure that the knowledge and experience acquired by the Mexican counterpart personnel of the Project through technical training in Japan will be utilized effectively in the implementation of the Project.

7. In accordance with the provision of Article V-(b) of the Agreement, the Government of the United Mexican States will provide the services of the Mexican counterpart personnel of the Project and administrative personnel.

8. In accordance with the provision of Article V-(a) of the Agreement, the Government of the United Mexican States will provide the buildings and facilities necessary for the Project as listed in ANNEX 6.

9. In accordance with the laws and regulations in force in the United Mexican States, the Government of the United Mexican States will take necessary measures to meet the running expenses necessary for the implementation of the Project.

## IV. ADMINISTRATION OF THE PROJECT

1. President of National Institute of Ecology, as the Project Director, will bear overall responsibility for the administration and implementation of the Project.

2. General Director of CENICA, as the Project Manager, will be responsible for the managerial and technical matters of the Project.

3. The Japanese Chief Advisor will provide necessary recommendations and advices to the Project Director and the Project Manager on any matters pertaining to the implementation of the Project.

4. The Japanese experts will provide necessary technical guidance and advice to the Mexican counterpart personnel on technical matters pertaining to the implementation of the Project.

## V. JOINT COORDINATING COMMITTEE

For the effective and successful implementation of technical cooperation for the Project, a Joint Coordinating Committee (hereinafter referred to as "JCC") will be established whose function and composition are described in ANNEX 7.

## VI. JOINT EVALUATION

Evaluation of the Project will be conducted jointly by the Mexican side and JICA, at the middle and during the last six months of the cooperation term in order to examine the level of achievement.

## VII. Evaluation of the Master Plan

CENICA and the JICA study team have evaluated the Master Plan following the criteria of relevance, efficiency, effectiveness, impact and sustainability. The result of the evaluation is shown in ANNEX 8.

## VIII. CLAIMS AGAINST JAPANESE EXPERTS

In accordance with the provisions of Article VII of the Agreement, the Government of the United Mexican States undertakes to bear claims, if any arises, against the Japanese experts engaged in technical cooperation for the Project resulting from, occurring in the course of, or otherwise connected with the discharge of their official functions in the United Mexican States except for those arising from the willful misconduct or gross negligence of the Japanese experts.

## IX. MUTUAL CONSULTATION

There will be mutual consultation between the United Mexican States Government and JICA on any major issues arising from, or in connection with, this Attached Document.

## X. MEASURES TO PROMOTE UNDERSTANDING AND SUPPORT FOR THE PROJECT

For the purpose of promoting support for the Project among the people of the United Mexican States, the Government of the United Mexican States will take appropriate measures to make the Project widely known to the people of the United Mexican States.

## XI. TERM OF COOPERATION

The duration of the technical cooperation for the Project under this attached Document will be three (3) years starting from the date when the expert team arrives in 2005.

## XII. SCHEDULE BEFORE THE COMMENCEMENT OF THE PROJECT

As preparation of the Project, CENICA shall give sufficient explanation to and discussion with the authorities concerned, such as SEMARNAT, INE, CENAM, Universities, Local governments and so on. And also the Mexican side shall provide the JICA Mexico office with the plan of budget allocation for the Project before middle of March, 2005.

When the Project is found viable and officially accepted by JICA, based on the outcome of the Team, the implementation and detailed contents of the Japanese Technical Cooperation for the Project shall be determined in the "Record of Discussions" (R/D) which would be signed between the Mexican Government and the JICA Mexico Office. The official request forms to assign Japanese experts for the term of technical cooperation will be submitted by CENICA through the official channel.

## ANNEX 1 MASTER PLAN

The Project will be implemented in accordance with the Master Plan as follows.

### 1. Title of the Project

Strengthening of Air Monitoring Program in the United Mexican States.

### 2. Overall goal

Capacity of the Mexican society to manage air quality is strengthened.

### 3. Project purpose

The Mexican society recognizes importance of air quality monitoring, and capacity of the local governments to provide and utilize reliable air quality information for policy planning and evaluation is strengthened.

### 4. Outputs

1) Capacity to collect reliable air quality monitoring data in Mexico is strengthened.
2) The existing air quality monitoring equipment calibration system in Mexico is improved.
3) Studies that complement existing air quality monitoring are carried out.
4) Capacity to conduct management and analysis of air quality monitoring data in Mexico is strengthened.
5) Accessibility of the general public and policy makers to information about air quality is increased.
6) The National Air Quality Monitoring Program (PNMA) 2007-2010 is prepared.

### 5. Activities

1)-1 CENICA, with the help of a Japanese expert, modifies the existing draft standard manuals on air quality monitoring (1. air quality monitoring, 2. monitoring network design, 3. installation of monitoring equipment, 4. operation, maintenance and calibration of monitoring equipment, 5.QA/QC, 6. audit by the federal government).

1)-2 CENICA and three model cities, with the help of a Japanese expert, carry out pilot projects (1. evaluation of the locations of the existing monitoring stations, 2. establishing a QA/QC system) in the model cities.

1)-3 The draft standard manuals on air quality monitoring are finalized.

1)-4 CENICA, with the help of a Japanese expert, designs and conducts capacity building programs in air quality monitoring according to the standard manuals for the local

governments (to be carried out in conjunction with 2)-3 if possible).

1)-5 CENICA, SEMARNAT, and a Japanese expert promote equipping and staffing for air quality monitoring in local governments.

2)-1 A master plan to improve the existing air quality monitoring equipment calibration system is prepared (including the establishment of the secondary standard laboratory under CENICA).

2)-2 Capacity of CENICA to calibrate air quality monitoring equipment is strengthened.

2)-3 CENICA, with the help of a Japanese expert, designs and conducts capacity building programs in calibration of air quality monitoring equipment according to the standard manual prepared in 1)-3 for the local governments (to be carried out in conjunction with 1)-4 if possible).

2)-4 CENICA acquires ISO17025 for air monitoring and calibration of the monitoring equipment.

3)-1 CENICA conducts studies on designing an air quality monitoring network (to be carried out as a part of the pilot project to evaluate locations of the existing monitoring stations in 1)-2).

3)-2 CENICA conducts studies on effective utilization of monitoring data through the use of the models (to be carried out as a part of the pilot project to analyze air quality monitoring data in 4-2).

3)-3 CENICA conducts studies on the measurement of hydrocarbons related to photo-chemical smog (VOCs) and their impacts.

3)-4 CENICA conducts studies on measurement methods of non-standard air pollutants (PM2.5).

4)-1 A Japanese expert, in cooperation with CENICA and other Mexican counterparts, prepares a draft standard manual on air quality monitoring data management (including methods of analysis/evaluation of weather and climate, model analysis, and evaluation of relevance between emission sources and concentration of pollutants).

4)-2 Management and analysis of air quality monitoring data and application of the results of the analysis to policy planning are carried out in the model cities selected in 1)-2.

4)-3 The draft standard manual on air quality monitoring data management is finalized (including methods and case studies of analysis/evaluation of weather and climate, model analysis, and evaluation of relevance between emission sources and concentration of pollutants).

4)-4 CENICA conducts capacity building of the local governments for management and

analysis of air quality monitoring data according to the standard manual.

5)-1 Capacity to provide information about air quality through SINAICA is improved.

5)-2 CENICA and SEMARNAT promote that the model cities introduce effective media, such as a computer display showing SINAICA pages to disseminate air quality monitoring data to the general public in the model cities.

5)-3 SEMARNAT holds seminars to present the results of the whole projects for each of the general public (including NGOs, academe, private companies) and policy makers (including government staff).

6)-1 CENICA, in collaboration with a Japanese expert, prepares a draft PNMA 2007-2010 based on identification of current status and results of the PNMA 2003-2008.

6)-2 CENICA consults with stakeholders on the draft PNMA.

6)-3 The PNMA 2007-2010 is approved by INE and SEMARNAT.

## ANNEX 2 PROJECT DESINGN MATRIX (PDM)

PDM of Project on Strengthening of Air Monitoring Program in the United Mexican States

| Narrative Summary | Objective Verifiable Indicators | Means of Verification | Important Assumptions |
|---|---|---|---|
| Overall Goal<br>• Capacity of the Mexican society to manage air quality is strengthened.<br><br>1. Effective air pollution control measures are being planned, taken, and evaluated by local and federal governments.<br>2. Health risk, impacts on ecosystems, and economic losses due to air pollution are identified.<br>3. Air pollution contingency plans are applied when needed.<br>4. Civil society and policy makers increased their support to air quality management measures. | <u>Federal government</u><br><br>1. The number of the local networks whose air quality monitoring data are utilized in policy planning or evaluation by the federal government is increased.<br><br><u>Federal and local governments</u><br><br>2. The number of research papers on health risk, impacts on ecosystems, and economic losses due to air pollution that can be utilized for policy planning or evaluation is increased.<br><br><u>Local governments</u><br><br>3. The number of local governments that have established an air pollution contingency plan is increased.<br>4. The number of local governments that utilize air quality monitoring data for policy planning or evaluations is increased. | 1. Policy documents prepared by the federal government<br>2. Scientific journals and technical reports<br>3. Publications of the air pollution contingency plans<br>4. Local air quality management programs<br>5. Budget documents of federal and local governments | • Energy consumption, especially unclean fuels, in Mexico does not drastically increase.<br>• Mexico does not face severe economic downturn. |

| | | | |
|---|---|---|---|
| | Civil society and policy makers<br>5. Budgets for air quality management measures at the federal and local levels are increased. | | |
| Project Purpose<br>• The Mexican society recognizes importance of air quality monitoring, and capacity of the local governments to provide and utilize reliable air quality information for policy planning and evaluation is strengthened. | Local governments<br>1. At least 18 local networks are confirmed by CENICA as providing reliable air quality monitoring data through SINAICA.<br>2. At least 18 local networks are confirmed by CENICA as utilizing air quality monitoring data for policy planning or evaluation.<br>3. Awareness of those who are responsible for environmental programs of the State governments towards importance of air quality monitoring is increased.<br>Civil society<br>4. Access counts per month to SINAICA is increased. | 1. CENICA's audit report<br>2. CENICA's evaluation report<br>3. Results of the discussions with those who are responsible for environmental programs of the State governments<br>4. SINAICA homepage counter | • Local governments allocate enough resources for air quality monitoring.<br>• The seven manuals are adopted as NOM.<br>• CENICA staff who can be trainers of capacity building for the local governments do not leave the institution.<br>• Mexico does not face severe economic downturn. |
| Outputs<br>1. Capacity to collect reliable air quality monitoring data in Mexico is strengthened.<br>2. The existing air quality monitoring equipment calibration system in Mexico is improved.<br>3. Studies that complement existing air quality monitoring are carried out.<br>4. Capacity to conduct management and analysis of air quality monitoring data in Mexico is strengthened.<br>5. Accessibility of the general public and policy makers towards information about air quality is increased.<br>6. The National Air Quality Monitoring 2007-2010 is prepared. | 1-1. The six standard manuals on air quality monitoring in Mexico are prepared by the middle of the second year.<br>1-2. At least two CENICA staffs can lecture on 1) overview of air quality monitoring, 2) monitoring network design, 3) installation of monitoring equipment, 4) operation, maintenance and calibration of monitoring equipment, and 5) QA/QC at seminars by the middle of the second year. | 1-1. Approved manuals.<br>1-2. Evaluation report of the lecture at the seminars by a Japanese expert<br>1-3. Evaluation report of the audit procedures by a Japanese expert | • SINAICA system does not break down for a long time. |

| | | | |
|---|---|---|---|
| | 1-3. At least two CENICA staffs acquire steps to conduct audit on air quality monitoring stations by the middle of the second year.<br>1-4. Locations of the existing air quality monitoring stations are evaluated in the model cities by the end of the first year.<br>1-5. A QA/QC system is established in the model cities by the end of the first year.<br>1-6. At least one staff from each of the existing local networks participated in the training workshop on proper air quality monitoring held by CENICA by the middle of the second year.<br>1-7. Necessary actions to implement the standard air quality monitoring are identified in the 18 local networks by the middle of the second year. | 1-4. Reports on evaluation of the locations of the existing monitoring stations submitted to CENICA<br>1-5. Reports on the QA/QC system submitted to CENICA<br>1-6. Attendance list of the training workshops<br>1-7. Reports on the identification of necessary actions to implement air quality monitoring according to the standard manuals submitted to CENICA | |
| | 2-1. A master plan on the improvement of the existing air quality monitoring equipment calibration system is finalized after the consultation with the local networks and SEMARNAT by the middle of the first year.<br>2-2. At least two CENICA staffs can lecture on calibration of monitoring equipment the | 2-1. A master plan on the improvement of the existing air quality monitoring equipment calibration system<br>2-2. Evaluation report of the lecture at the | |

| | | | |
|---|---|---|---|
| | middle of the second year.<br>2-3. Staff of the 18 local networks can acquire proper calibration methods of air quality monitoring equipment by the middle of the second year.<br>2-4. CENICA acquires ISO17025 accreditation for air quality monitoring and equipment calibration by the middle of the second year.<br><br>3-1. Locations of the existing air quality monitoring stations are evaluated in the model cities by the end of the first year.(same as 1-4)<br>3-2. A group of experts on the use of meteorological, photochemical, transport and diffusion models is formed by the end of the project.<br>3-3. Results of the studies using models are presented to policy makers in the target cities by the end of the project.<br>3-4. Scientific information based on the measurement of VOCs in the target cities useful to identify O3 precursors is submitted to the policy makers by the end of the project. | seminars by a Japanese expert<br>2-3. Results of the achievement test at the training workshop held by CENICA<br>2-4. ISO17025 certificate<br><br>3-1. Reports on evaluation of the locations of the existing monitoring stations submitted to CENICA (same as 1-4)<br>3-2. List of the participants completed the training program.<br>3-3. Reports submitted to the policy makers in the target cities<br>3-4. Study report | |

| | | | |
|---|---|---|---|
| | 3-5. Scientific information based on the measurement of PM2.5 useful to characterize levels of PM2.5 in the target cities is submitted to the policy makers by the end of the project. | 3-5. Study report | |
| | 4-1. The standard manual on air quality monitoring data management is prepared by the middle of the second year.<br>4-2. At least two CENICA staffs can lecture on air quality monitoring data management by the end of the second year.<br>4-3. Air quality management measures are reviewed based on the results of the air quality monitoring data analysis in the model cities by the middle of the second year. | 4-1. The standard manual on management and analysis of air quality management<br>4-2. Evaluation report of the lecture at the seminars by a Japanese expert<br>4-3. Reports on the review of existing air quality management measures submitted to CENICA | |
| | 5-1. The ratio of real-time data transmission of SINAICA increases by the end of the second year.<br>5-2. Additional six local networks become connected to SINAICA by the end of the | 5-1. SINAICA database<br>5-2. SINAICA database | |

| | | | |
|---|---|---|---|
| | project.<br>5-3. Air quality information communication media such as a computer display showing SINAICA pages is installed in the model cities by the end of the first year.<br>5-4. At least a half of those who are responsible for environmental programs of the State governments attended the seminars on the results of the whole project.<br>6. The National Air Quality Monitoring Program (PNMA) 2007-2010 is prepared by the end of the project. | 5-3. Record of official announcement of the introduction of the information communication media<br>5-4. Attendance lists of the seminars<br>6. Document of PNMA 2007-2010 | |
| Activities | Inputs<br>"CENICA"<br>1. Project staff (Project Director, Project Manager, counterpart personnel, administrative personnel)<br>2. Buildings and facilities<br>3. Project operation costs<br><br>Inputs<br>"JICA"<br>1. Dispatch of Japanese experts<br>2. Equipment, machinery, materials<br>3. Trainings in Japan | | • Model cities selected by the committee agree to participate in the project.<br>• Those who have acquired skills through the trainings under the project remain engaged in air quality monitoring.<br><br>Pre-conditions<br>1. Financial and human resources are allocated to CENICA to implement the project during the project period. |

## ANNEX 3 TENTATIVE PLAN OF OPERATION (PO)

**PROJECT TITLE: Project on Strengthening of Air Monitoring Program in the United Mexican States**

| Outputs and Activities | | 1st Year I | 1st Year II | 1st Year III | 1st Year IV | 2nd Year I | 2nd Year II | 2nd Year III | 2nd Year IV | 3rd Year I | 3rd Year II | 3rd Year III | 3rd Year IV | Mexican Counterpart |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Output 1:** | **Capacity to collect reliable air quality monitoring data in Mexico is strengthened.** | | | | | | | | | | | | | CENICA Tecamachalco (standard transfer laboratory) |
| 1-1 | CENICA, with the help of a Japanese expert, modifies the existing draft standard manuals on air quality monitoring (1. air quality monitoring, 2. monitoring network design, 3. installation of monitoring equipment, 4. operation, maintenance and calibration of monitoring equipment, 5.QA/QC, 6. audit by the federal government) | ■ | ■ | | | | | | | | | | | |
| 1-2 | CENICA and three model cities, wit the help of a Japanese expert, carry out pilot projects (1. evaluation of the locations of the existing monitoring stations, 2. establishing a QA/QC system) in the model cities. | | ■ | ■ | | | | | | | | | | CENICA-UAMI |
| 1-3 | The draft standard manuals on air quality monitoring are finalized. | | | ■ | ■ | | | | | | | | | |
| 1-4 | CENICA, with the help of a Japanese expert, designs and conducts capacity building programs in air quality monitoring according to the standard manuals for the local governments (to be carried out in conjunction with 2-3 if possible). | | | | | □ | | □ | | | □ | | | |
| 1-5 | CENICA, SEMARNAT, and a Japanese expert promote equipping and staffing for air quality monitoring in local governments. | | | | | | □ | | □ | | | □ | | |
| **Output 2:** | **The existing air quality monitoring equipment calibration system in Mexico is improved.** | | | | | | | | | | | | | CENICA Tecamachalco (standard transfer laboratory), CENAM |
| 2-1 | A master plan to improve the existing air quality monitoring equipment calibration system is prepared (including the establishment of the secondary standard laboratory under CENICA). | ■ | | | | | | | | | | | | |
| 2-2 | Capacity of CENICA to calibrate air quality monitoring equipment is strengthened. | | ■ | | | | | | | | | | | |

| Outputs and Activities | | 1st Year | | | | 2nd Year | | | | 3rd Year | | | | Mexican Counterpart |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | I | II | III | IV | I | II | III | IV | |
| 2-3 | CENICA, with the help of a Japanese expert, designs and conducts capacity building programs in calibration of air quality monitoring equipment according to the standard manual prepared in 1-3 for the local governments (to be carried out in conjunction with 1-4 if | | | | | | | | | | | | | |
| 2-4 | CENICA acquires ISO17025 for air monitoring and calibration of the monitoring equipment. | | | | | | | | | | | | | |
| **Output 3:** | **Studies that complement existing air quality monitoring are carried out.** | | | | | | | | | | | | | |
| 3-1 | CENICA conducts studies on designing an air quality monitoring network (to be carried out as a part of the pilot project to evaluate locations of the existing monitoring stations in 1-2)). | | | | | | | | | | | | | CENICA |
| 3-2 | CENICA conducts studies on effective utilization of monitoring data through the use of the models (to be carried out as a part of the pilot project to analyze air quality monitoring data in 4-2). | | | | | | | | | | | | | CENICA, DGCURG-INE, DGGCA and RETC-SEMARNAT, local governments |
| 3-3 | CENICA conducts studies on the measurement of hydrocarbons related to photo-chemical smog (VOCs) and their impacts. | | | | | | | | | | | | | CENICA |
| 3-4 | CENICA conducts studies on measurement methods of non-standard air pollutants (PM2.5). | | | | | | | | | | | | | CENICA |
| **Output 4:** | Capacity to conduct management and analysis of air quality monitoring data in Mexico is strengthened. | | | | | | | | | | | | | CENICA, DGCURG-INE, DGGCA and RETC-SEMARNAT, local governments |
| 4-1 | A Japanese expert, in cooperation with CENICA and other Mexican counterparts, prepares a draft standard manual on air quality monitoring data management (including methods of analysis/evaluation of weather and climate, model analysis, and evaluation of relevance between emission sources and concentration | | | | | | | | | | | | | |
| 4-2 | Management and analysis of air quality monitoring data and application of the results of the analysis to policy planning are carried out in the model cities selected in 1-2 | | | | | | | | | | | | | |
| 4-3 | The draft standard manual on air quality monitoring data management is finalized (including methods and case studies of analysis/evaluation of weather and climate, model analysis, and evaluation of relevance between emission sources and concentration of pollutants) | | | | | | | | | | | | | |

| Outputs and Activities | | 1st Year | | | | 2nd Year | | | | 3rd Year | | | | Mexican Counterpart |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | I | II | III | IV | I | II | III | IV | |
| 4-4 | CENICA conducts capacity building of the local governments for management and analysis of air quality monitoring data according to the standard manual. | | | | | | | | | | | | | |
| **Output 5** | **Accessibility of the general public and policy makers to information about air quality is increased.** | | | | | | | | | | | | | |
| 5-1 | Capacity to provide information about air quality through SINAICA is improved. | | | | | | | | | | | | | CENICA |
| 5-2 | CENICA and SEMARNAT promote that the model cities introduce effective media, such as a computer display showing SINAICA pages to disseminate air quality monitoring data to the general public in the model cities. | | | | | | | | | | | | | CENICA, local governments |
| 5-3 | SEMARNAT holds seminars to present the results of the whole projects for each of the general public (including NGOs, academe, private companies) and policy makers (including government staff). | | | | | | | | | | | | | SEMARNAT, CENICA |
| **Output 6** | **The National Air Quality Monitoring Program (PNMA) 2007-2010 is prepared.** | | | | | | | | | | | | | CENICA, INE, SEMARNAT |
| 6-1 | CENICA, in collaboration with a Japanese expert, prepares a draft PNMA 2007-2010 based on identification of current status and results of the PNMA 2003-2008. | | | | | | | | | | | | | |
| 6-2 | CENICA consults with stakeholders on the draft PNMA. | | | | | | | | | | | | | |
| 6-3 | The PNMA 2007-2010 is approved by INE and SEMARNAT. | | | | | | | | | | | | | |

## ANNEX 4 LIST OF INPUTS FROM JAPANESE SIDE

### 1. Dispatch of the JICA Experts Team for the Project

Fields to be covered by the Japanese experts are as follows:

1) Chief adviser
2) Coordinator
3) Air quality monitoring
4) Environmental measurement
5) Air quality monitoring network design
6) Air quality monitoring data management/analysis
7) Air pollution modeling
8) Gaseous air pollutants analysis
9) Aerosol air pollutants analysis
10) Network system engineering

### 2. List of the Equipment

The tentative list of the major equipment, which is subject to budget approval, necessary for the implementation of the Project is shown as follows. The details of the equipment will be discussed between JICA expert team and the Mexican side. The official request forms for provision of the equipment will be submitted by CENICA.

The tentative list of the major equipment

| | Field of Equipment | Equipment | Place of installation |
|---|---|---|---|
| 1 | Equipment for the calibration | | |
| | (1) Analyzer for calibration | Nitrogen Oxides Analyzer | Tecamachalco |
| | | Sulfur Dioxides Analyzer | Tecamachalco |
| | | Carbon Monoxide Analyzer | Tecamachalco |
| | | Ozone Analyzer | Tecamachalco |
| | | PM10 Analyzer | Tecamachalco |
| | | PM2.5 Analyzer | Tecamachalco |
| | (2) Calibration system | Gas Dilution Calibrator | Tecamachalco |
| | | Zero Air Source | Tecamachalco |
| | | Standard Flow Meter | Tecamachalco |
| | | Mass Flow Meter | Tecamachalco |
| | | Standard Thermometer | Tecamachalco |
| | | Standard Hygrometer | Tecamachalco |

| | Field of Equipment | Equipment | Place of installation |
|---|---|---|---|
| | | Standard Anemometer | Tecamachalco |
| | | Solar Meter | Tecamachalco |
| | | Standard Assman Psychrometer | Tecamachalco |
| | | Constant Temperature Chamber | Tecamachalco |
| | (3)Equipment for standard | National Standard Ozone Analyzer | Tecamachalco |
| | | National Standard Flow Meter | Tecamachalco |
| 2 | Equipment for air quality monitoring | | |
| | (1)Air quality monitoring | Nitrogen Oxides Analyzer | UAM-I |
| | | Sulfur Dioxides Analyzer | UAM-I |
| | | Carbon Monoxide Analyzer | UAM-I |
| | | Ozone Analyzer | UAM-I |
| | | Hydrocarbon Analyzer | UAM-I |
| | | PM10 Analyzer | UAM-I |
| | | PM2.5 Analyzer | UAM-I |
| | | Gas Dilution Calibrator | UAM-I |
| | | Data logger | UAM-I |
| | (2)Meteorological observation | Solar Meter | UAM-I |
| | | Net Radiometer | UAM-I |
| | | Anemometer | UAM-I |
| | | Thermo Differential Meter | Determined during the |
| | | Thermo Humidity Meter | Determined during the |
| 3 | Equipment for study in model cities | | |
| | | Solar Meter | Model cities |
| | | Radiation-Radius Differential Meter | Model cities |
| | | Passive Sampler | Model cities |
| | | Shelter for passive sampler | Model cities |
| | | GPS | Model cities |
| | | Equipment or materials for Public | Model cities |
| | | Hi-volume air sampler for PM 10 | UAM-I |
| | | Hi-volume air sampler for PM 2.5 | UAM-I |
| | | Mini-volume air sampler for PM 2.5 | UAM-I |

Note:

The machinery and equipment which CENICA requested the team to take note are shown, in prioritized order, as follows:

- SINAICA server
- Data loggers
- A set of Computer(s) and software for modeling
- GC-MS or MS detector for VOC analysis

## ANNEX 5 LIST OF MEXICAN COUNTERPART AND ADMINISTRATIVE PERSONNEL

### 1. Project administrative management counterpart

1) Project Director

Exequiel Ezcurra — President, INE, SEMARNAT

2) Project Manager

Victor Javier Gutiérrez Avedoy — General Director, CENICA, INE

### 2. Technical Counterpart

1) Division of Investigation in Atmospheric Monitoring and Analytical Characterization of Pollutants

1)-1 Ana Patricia Martinez Bolivar

1)-2 José Zaragoza Ávila, Deputy Director of Air Quality Evaluation

1)-3 Oscar Fentanes Arriaga, Head of Air Quality Monitoring Department

1)-4 Carmen Alejandra Sánchez Soto, Head of National Air Quality Information System Department

1)-5 Susana Hernández Millán, Professional in Special Services

1)-6 Alejandro García Fragoso, Professional in Special Services

1)-7 Ma. Teresa Ortuño Arzate, Deputy Director of Research and Analytical Characterization of Pollutants

1)-8 Mercedes Reyes Sánchez, Head of Basic and Biotoxicity Characterization of Pollutants Department

1)-9 Paola Salgado Figueroa, Head of Characterization of pollutants by Atomic absorption and Emission Department

1)-10 Ana María Maldonado Contreras, Head of Instrumental Research of Organics Compound

1)-11 Ma. Del Carmen Gutiérrez Cigales, Head of High Performance Liquid Chromatography Laboratory

2) Division of Research in Atmospheric Pollution

2)-1 Beatriz Cardenas, Director

2)-2 Salvador Blanco Deputy Director on air pollutants characterization

2)-3 Henry Wohrnschimmel, Deputy Director of integral analysis of air pollution

2)-4 Emma Bueno, Department head of VOC studies

2)-5 Felipe Angeles, Department head of personal exposure and microenvironmental

studies

2)-6 Rosa Maria Bernabe, Department head of air pollutants characterization

2)-7 Francisco Mandujano, Department head of physicochemical particle characterization

2)-8 Claudia Marquez, Department head of transport and impact of air pollutants studies

## ANNEX 6 LIST OF BUILDINGS AND FACILITIES

1. Buildings and facilities necessary for the implementation of the Project
2. Office space and necessary facilities in the buildings of the Project for Japanese experts and meetings
3. Facilities and services such as electricity, gas, water supply, telephone, internet access and furniture necessary for the Project activities
4. Other facilities mutually agreed upon as necessary

## ANNEX 7 JOINT COORDINATING COMMITTEE

The Joint Coordinating Committee, which consists of both the Mexican and the Japanese sides, will be established for the smooth and effective implementation of the Project.

1. Functions

The Joint Coordinating Committee will meet at least once a year or whenever the necessity arises, in order to fulfill the following functions:

1) To formulate the annual operational work plan of the Project based on the Tentative Schedule of Implementation within the framework of the "Record of Discussions" (R/D).
2) To review the result of the annual operational work plan and the overall progress of the Project.
3) To exchange views on major issues arising from or in connection with implementation of the Project.

2. Composition

1) Chairperson

- President of INE, SEMARNAT (Project Director)

2) Members

a) Mexican side

- General Director of Air Quality Management, Emission Register and Pollutants Transfer, SEMARNAT
- General Director of Research on Urban, Regional, and Global Pollution, INE
- General Director of CENICA, INE (Project Manager)
- President of Environmental Engineers Association
- Dean of UAM-I
- General Director of Ambient Air Management, G.D.F (Mexico City)

b) Japanese side

- Japanese experts
- Representatives of JICA Mexico Office
- Members of JICA study team, to be dispatched when necessary

Note: Official(s) of Mexican Foreign affairs ministry and the Embassy of Japan in Mexico may attend the Joint Coordinating Committee as observer(s).

Environmental Commission (CAM) will be also recruited as lecturers for the training program on using air pollution and climate simulation models.

## 5. Sustainability

- The General Law of Ecological Balance and Environmental Protection and the Regulation on Prevention and Control of Air Pollution set a legal framework of air quality management and require federal and local governments to play specific roles in air quality monitoring. Since the Law requires local governments to establish and operate, with the technical support of the SEMARNAT, air quality monitoring systems; the Law supports strengthening of air quality monitoring capacity.
- This project originates from the National Air Quality Monitoring Program, which was prepared by CENICA and approved by INE and SEMARNAT. Therefore, the ownership of the project belongs to CENICA. Since CENICA has been implementing the program since 2003, it has allocated some financial and human resources to the program. This means that the strengthening of air quality monitoring is likely to continue after the end of the Project.
- The counterpart of the project is CENICA, which was established in 1995 through the JICA technical cooperation project. CENICA has increased its capacity to be an institution to be reference laboratory and conduct training and research in the areas of air quality and hazardous waste management. CENICA's capacity will be further strengthened through the project, which assures continuity of the activities to support local monitoring networks.
- Since deteriorated air quality directly affects people's health, air pollution is a concern of the general public. As governors and mayors are chosen by elections, they are also concerned about interest of the general public. As reliable information about air quality is provided to the general public, their awareness towards air pollution is increased as well as support to air quality management measures including air quality monitoring.

## ANNEX 8 EVALUATION OF THE MASTER PLAN

### 1. Relevance

- Article 112 of the General Law of Ecological Balance and Environmental Protection requires local governments to establish and operate, with the technical support of the SEMARNAT, air quality monitoring systems. The National Program on the Environment and Natural Resources, which is a sector-program of the National Development Plan, stresses the need for local governments to monitor air quality and air pollutant emissions periodically, and the Mexican National Air Quality Monitoring Program has been developed and implemented since 2003. These facts show that the Mexican Government has committed to promote establishment of the air quality monitoring systems.
- The results of the air quality monitoring are required to be integrated into the national information system on air quality developed and updated by the SEMARNAT according to the Regulation on Air Pollution Prevention and Control. The National Air Quality Information System on Air Quality (SINAICA) operated on Internet to disseminate results of the air quality monitoring has become fully operational in 2004 and is recognized as one of the priority projects by the President to promote transparency of the Federal Government. Assisting the enhancement of SINAICA is considered as relevant to the national priority.
- Air quality management mainly consists of establishment of air quality and emission standards, development of emission inventories, enforcement of the emission standards, and monitoring of air quality. Because the air quality and emission standards have been established, and because emission inventories have been developed, assisting the strengthening of the air quality monitoring system is legitimate in terms of the level of air quality management in Mexico.
- Although air quality is being automatically monitored in 18 cities and metropolitan areas as well as manually monitored in 24 localities in Mexico, these monitoring networks and stations do not cover enough areas to evaluate whether the air quality standards are met in the Mexican territory. In addition, because the existing monitoring networks do not conduct quality management of monitoring data, the information about air quality provided to the general public is not fully reliable. It is known that the higher the concentrations of air pollutants above the environmental standards, the more incidence of respiratory diseases and mortality due to these diseases. Increases in reliable information about air quality provide the general public with judging criteria for safety of their living environment, and with rationale for them to require authorities to take necessary measures to control air pollution if air quality exceeds the environmental standards. Reliable information about air quality also makes it possible for authorities to take effective measures to control air pollution, which contributes securing safe living environment. Since SINAICA has been in operation, reliable information about air quality equally benefits all the citizens in Mexico. Therefore, providing reliable information about air quality would meet the needs of all the citizens in Mexico for securing safe living environment..

- In Mexico, 1) an air quality monitoring system, 2) emission inventories, 3) an epidemiological monitoring system, 4) research on air pollution mechanisms are identified as basic administrative tools to combat air pollution. Reliable air quality monitoring data can provide the general public with information easy to understand the performance of authorities in air pollution control. The reliable information also makes it possible to detect fraudulent reporting on emissions from point sources. Moreover, it supports the epidemiological monitoring system and research on air pollution mechanisms. Furthermore, effective measures to control air pollution are formulated based on the information from 1) through 4). Therefore, strengthening capacity to increase reliable information about air quality is indispensable to administer air quality management in Mexico.
- In addition to the above-mentioned facts, lack of quality information about air pollutants has been identified as the core problem at the PCM workshop with the participants from relevant organizations. The project purpose properly meets the needs of the relevant organizations and the society in general.
- The internal regulation of the SEMARNAT defines responsibilities of CENICA in the field of air quality monitoring as to 1) develop technical standards for designing air quality monitoring systems, 2) promote and supervise establishment of the air quality monitoring systems by the local governments, 3) develop QA/QC methods for measurement and determination of air pollutants, 4) conduct studies on air pollution and evaluation of exposure of individuals, 5) develop a national air quality information system, and 6) disseminate scientific information about air pollutants. It is reasonable to assist CENICA for increasing their capacity in the field of their responsibility through the project.
- Japan has rich know-how and experiences in establishing the national standard for air quality monitoring, which enables providing its citizens with reliable information about air quality. This project could make the most use of such know-how and experiences.

**2. Impact**

- The overall goal (capacity of the Mexican society to manage air quality is strengthened) is divided into the four areas such as 1) Application of air pollution contingency plans when needed, 2) Implementation of effective air pollution control measures by local and federal authorities, 3) Increased support of civil society and policy makers toward air quality management measures, and 4) Identification of health risk, impact on ecosystems, and economic losses due to air pollution.
- Major beneficiaries of the project would be CENICA, local governments whose monitoring networks are integrated to SINAICA, the federal government, and civil society.
- CENICA's capacity to promote the National Air Quality Monitoring Program is strengthened in terms of providing trainings on air quality monitoring and analysis of monitoring data, conducting research on non-standard pollutants, and providing technical services such as calibration of air quality monitoring equipment. Moreover, if the standard manuals on air quality monitoring that are to be

prepared in the project become NOMs, it makes easier for CENICA to promote standardized air quality monitoring.

- Local monitoring networks could receive trainings on proper air quality monitoring such as designing monitoring networks, operation, maintenance, and calibration of equipment, QA/QC as well as management and utilization of monitoring data such as analysis of data for policy planning. These trainings and CENICA's technical services of calibrating air quality monitoring equipment increase capacity of the local governments in 1) providing reliable information about air quality, 2) planning and evaluating measures to control air pollution, and 3) implementing the air pollution contingency plans when necessary.
- The federal government would also benefit from the project in terms of increases in reliable information about local air quality necessary to plan and evaluate national level policies for air quality management. The reliable monitoring data, with epidemiological, ecological, and economic researches, enables it to identify health risk, impacts on ecosystems, and economic losses due to air pollution. For example, the reliable monitoring data enables the government to estimate benefits of improving air quality (reduced medical costs and lost wages due to respiratory diseases due to air pollution) and persuade decision makers and polluters to adopt new policies to control air pollution. In addition, the studies complementing air quality monitoring could provide basis to establish air quality/emission standards for non-criteria air pollutants and better understanding of air pollution phenomena.
- Through the project, more local networks with more reliable information about air quality will be connected to SINAICA, and SINAICA's data transmission ability will be improved. As a result, civil society could have more reliable information to judge safety of their living environment, and they strongly support authorities to take necessary actions to combat air pollution.
- Improved information about air quality also increases awareness and seriousness of private companies towards air pollution. Researchers are also benefited from improved information about air quality for their research activities, especially, those including epidemiological, ecological, and economic studies.

**3. Effectiveness**

- Project purpose (The Mexican society recognizes importance of air quality monitoring, and capacity of the local governments to provide and utilize reliable air quality information for policy planning and evaluation is strengthened) is further clarified by the objective verifiable indicators by major target groups. Capacity of CENICA in training the local governments on collecting reliable air quality data and analyzing data for policy planning and evaluation are strengthened through the trainings by Japanese and Mexican experts. Capacity of the model cities in proper air quality monitoring is strengthened mainly through pilot projects carried out with the help of CENICA and Japanese experts,

and so as that of the local networks through training workshops held by CENICA.

- Appropriate air quality monitoring coverage would increase the quantity and quality of information about the status of air pollution. Adequate operation of the monitoring equipment and QA/QC of air quality monitoring data would increase their quality. In addition, this information will be relevant to the political decision making process. Studies complementing air quality monitoring would also provide additional information about the air pollution formation mechanism. Thus, the project purpose is considered to be achievable through implementing activities that will produce the six outputs.
- An increase in information about the status of air pollutants would provide a solid basis to judge whether air pollution contingency plans should be applied, to identify the levels and types of health risk, impact on ecosystems, and economic losses, and increase awareness of civil society and authorities.

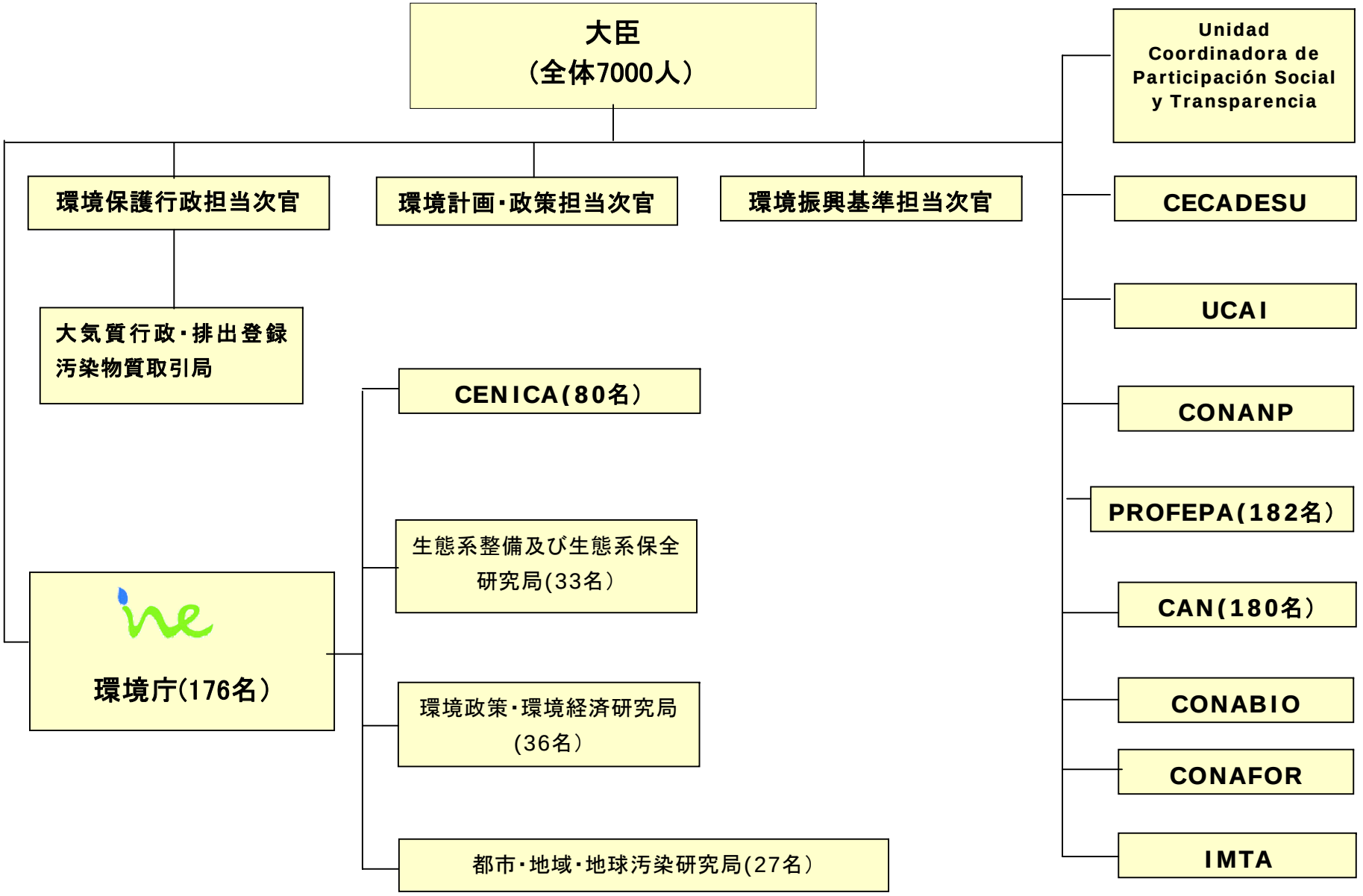
**4. Efficiency**

- The most important two assumptions for the project are that CENICA staff who can be trainers of capacity building for the local governments do not leave the institution and that staff of local monitoring networks who have acquired skills through the trainings under the project remain engaged in air quality monitoring. Based on an interview with General Director of CENICA, turnover of CENICA staff is very low compared to other federal institutions because it provides employees with stable status and good professional opportunities. In addition, according to the report on the current status of the air quality monitoring in Mexico, the local monitoring network staff feel strong responsibility to conduct air monitoring under the hardship of resource shortage. These facts show that the important assumptions are likely to be realized.
- The project aims to strengthen capacity of air quality monitoring in Mexico by the phased implementation in order to maximize limited resources efficiently. Japanese experts train CENICA staff with their know-how and experiences, who will continuously train staff of local monitoring networks. Since the 18 local networks have automatic monitoring equipment and are or will be connected to SINAICA, the first batch of the training workshops will target the 18 local networks. The training is expected to realize improvement in quality (reliability) of information that is or will be disseminated through SINAICA to the general public. The second batch of the training workshop will target the other existing local networks, and the third batch the State governments and municipalities with population of 500,000 or more without air quality monitoring network.
- The project makes the good use of resources in Mexico. Staff of CENICA and Mexico City will be lecturers for the training workshops on air quality monitoring for the local monitoring networks, which is made possible by the past accomplishment of the JICA technical cooperation projects with CENICA and Mexico City. Mexican experts at universities, research institutions, and the Mexico

Environmental Commission (CAM) will be also recruited as lecturers for the training program on using air pollution and climate simulation models.

5. Sustainability

- The General Law of Ecological Balance and Environmental Protection and the Regulation on Prevention and Control of Air Pollution set a legal framework of air quality management and require federal and local governments to play specific roles in air quality monitoring. Since the Law requires local governments to establish and operate, with the technical support of the SEMARNAT, air quality monitoring systems; the Law supports strengthening of air quality monitoring capacity.
- This project originates from the National Air Quality Monitoring Program, which was prepared by CENICA and approved by INE and SEMARNAT. Therefore, the ownership of the project belongs to CENICA. Since CENICA has been implementing the program since 2003, it has allocated some financial and human resources to the program. This means that the strengthening of air quality monitoring is likely to continue after the end of the Project.
- The counterpart of the project is CENICA, which was established in 1995 through the JICA technical cooperation project. CENICA has increased its capacity to be an institution to be reference laboratory and conduct training and research in the areas of air quality and hazardous waste management. CENICA's capacity will be further strengthened through the project, which assures continuity of the activities to support local monitoring networks.
- Since deteriorated air quality directly affects people's health, air pollution is a concern of the general public. As governors and mayors are chosen by elections, they are also concerned about interest of the general public. As reliable information about air quality is provided to the general public, their awareness towards air pollution is increased as well as support to air quality management measures including air quality monitoring.


大臣
（全体7000人）
環境保護行政担当次官
環境計画・政策担当次官
環境振興基準担当次官
大気質行政・排出登録
汚染物質取引局
環境庁(176名)
CENICA(80名)
生態系整備及び生態系保全
研究局(33名)
環境政策・環境経済研究局
(36名)
都市・地域・地球汚染研究局(27名)
Unidad
Coordinadora de
Participación Social
y Transparencia
CECADESU
UCAI
CONANP
PROFEPA(182名)
CAN(180名)
CONABIO
CONAFOR
IMTA

## 第 10 章 環境庁（INE）

第113条　　都市・地域・地球汚染研究局は下記の権能を持つ。

I. 生態系及び環境サービスの経済的意義、または個別の汚染を起こす製品・活動に関し分析・審査を行い、これを省・庁の検討に付す。

II. 省の管理ユニットや外局、その他連邦行政府のしかるべき部署と協議の上、環境コストの内面化のための税制・金融・市場面での経済ツールを設計・提案し、生産セクターの経済・環境的決定に結びつける。

III. 生態系、天然資源、環境サービスの環境経済評価方法の分析・設計・適用を促進し、これを調整する。

IV. 省の管理ユニット及びしかるべき外局と協力して、環境基準の遵守の決定に関与する経済要素、及びその効果に関する調査を実施する。

V. 適用可能な法規則に基づき、国内に於ける環境問題の解決や天然資源の適切な管理を目的とした国外からの融資や国際機関・組織よりの供与の獲得とその効率的な利用に関する判断基準を、省のしかるべき管理ユニットに対し提示する。

VI. 環境政策が貧困世帯に与える影響に関する調査を実施し、社会開発省を協力して環境上メリットを持つような貧困低減プログラムを立案する。

VII. 環境統計情報局及び国家統計地理院(INEGI)と協力して国家持続可能性指標システムの開発に貢献する。

VIII. 大学、研究センター、その他の国内・国外の機関と共同で、生物・物理システムと経済・社会プロセスの相互関係を分析的に再現するモデルの構築、作成、運営を促進し、これに参加する。

IX. エネルギー・セクター当局と共同し、将来の様々なエネルギー/環境シナリオ、燃料品質シナリオを評価するためのコンピューターモデル、一般均衡モデルを評価し、使用する。

X. 省のその他の局と協力して、環境行政に関する政策、プログラム、基準、ガイドライン、対策、判断基準、手順などの作成と実施に資する都市・地域・セクター経済に関する応用研究ラインを提案し、これを開発する。

XI. 大気質、有害廃棄物・有害物質の取り扱いと処理、及び気象変化に関する研究の実施を通じて国際協力プロジェクト・国際協力活動に参加する。　その際、国際事業調整ユニットの然るべき参加を得る。

XII. 温室効果ガスの減少、これによって起こる気象変化の我が国への影響、及びこれに対する対応策の評価に関する調査を促進し、調整する。

XIII. 国立環境研究研修センター局と協力して、環境毒性及び個人暴露に関する研究プロジェクトを提案し、これを評価する。

XIV. 環境優先性を確立する省の他部署を支援するため、比較リスク分析に関する研究を実施する。

XV. 国立環境研究研修センター局と協力して、全国の大気質情報の体系である全国大気質情報システムや、環境汚染・環境劣化に関するその他のシステムやデータベースを設立する。

XVI. 国立環境研究研修センター局とともに、大気汚染及び有害物質・有害廃棄物の取り扱いに関する研究プログラムの立案、実施に参加する。

XVII. エミッション・ファクター及び活動パターンの更新のための調査を促進し、これを調整する。

XVIII. 品質保証のデータベースやサブシステムの維持・改善を奨励し、これを調整する。

第 115 条　　国家環境研究研修センター局（CENICA）は下記の権能を持つ。

I. 大気排出の減少、有害廃棄物の安全な取り扱い及び廃棄物の減量化に関する技術革新の評価プログラムを設定し、これを調整する。

II. 大気汚染物質、化学物質、廃棄物のサンプリング及び分析を実施する試験ラボが、連邦度量衡・規格化法に基づき、メキシコ公式規格に合致しているか否かを評価することが必要とされる場合には、これらのラボの認証・承認のための評価委員会に参加する。　この際、（環境天然資源省）環境振興・基準次官がこの点に関し発行する判断基準やガイドラインを尊重する。

III. 省の当該管理ユニットに対し、大気モニタリングシステムの技術仕様、設計ベース、操作プロトコル、データの取り扱い方を提案し、大気モニタリングシステムの運営の評価と品質保証を行うとともに、全国各州の大気汚染モニタリングシステムの設置を奨励し、調整し、監督する。

IV. 省の当該管理ユニットに対し、大気汚染と有害物質の取り扱い分野に於ける応用研究ラインを提案する。　又、交通・都市開発の環境的管理に関する政策、プログラム、基準、ガイドライン、対策、手順などの立案及びその実施に貢献する。

V. 有害物質・有害活動総合行政局、及び大気質・排出登録・汚染物質移転行政局と協力してメキシコ盆地首都圏環境委員会の環境モニタリングプロジェクトを実施する。

VI. 連邦行政府のその他の機関・部署や州政府・市町村当局と調整の上、大気質の決定のための調査を指導し、その結果を普及させる。

VII. 外国の同様な研究所と協力関係を樹立し、法務・機関間協力ユニットと共同して汚染予防・防止や有害廃棄物の取り扱いに関連したテーマの技術協力を促進する。

VIII. 都市・地域・地球汚染研究局と協力して、大気質行政に貢献するコンピューターモデルの応用・操作に参加する。

IX. 有害物質・有害活動総合行政局、大気質・排出登録・汚染物質移転行政局、法務・機関間協力ユニット、国際関係調整部と協力して、大気域や河川域の持続可能な管理や工業資材・工業廃棄物の保管・取り扱いに関する国際フォーラムに省の代表として参加する。

X.　省の当該管理ユニットに対し、大気汚染物質の測定と同定のプロセスに関する分析法の開発や管理手順、品質保証などを提案する。

XI.　大気汚染と個人暴露の評価に関する研究を実施する。

XII.　有害廃棄物の減量化や汚染土壌の回復に関する研究を実施する。

XIII.　都市・地域・地球汚染研究局と協力して、環境統計・情報局のガイドラインに従い、全国大気質情報システム及び汚染・環境劣化に関するその他のデータシステム、データベースを開発し、使用する。

XIV.　全国レベルで大気中の汚染物質や土壌中の有害廃棄物の存在や量に関するデータを作成し、科学的情報を提供・普及させる。

XV.　省の当該管理ユニットと協力して、メキシコの公共・民間・学術セクターの専門員に対し、大気汚染と固形廃棄物・有害廃棄物の取り扱い、分析技術に関する技術科学的研修プログラムを組織する。

XVI.　大気汚染物質の分析及び測定機器の校正に関し、標準ラボとして機能する。

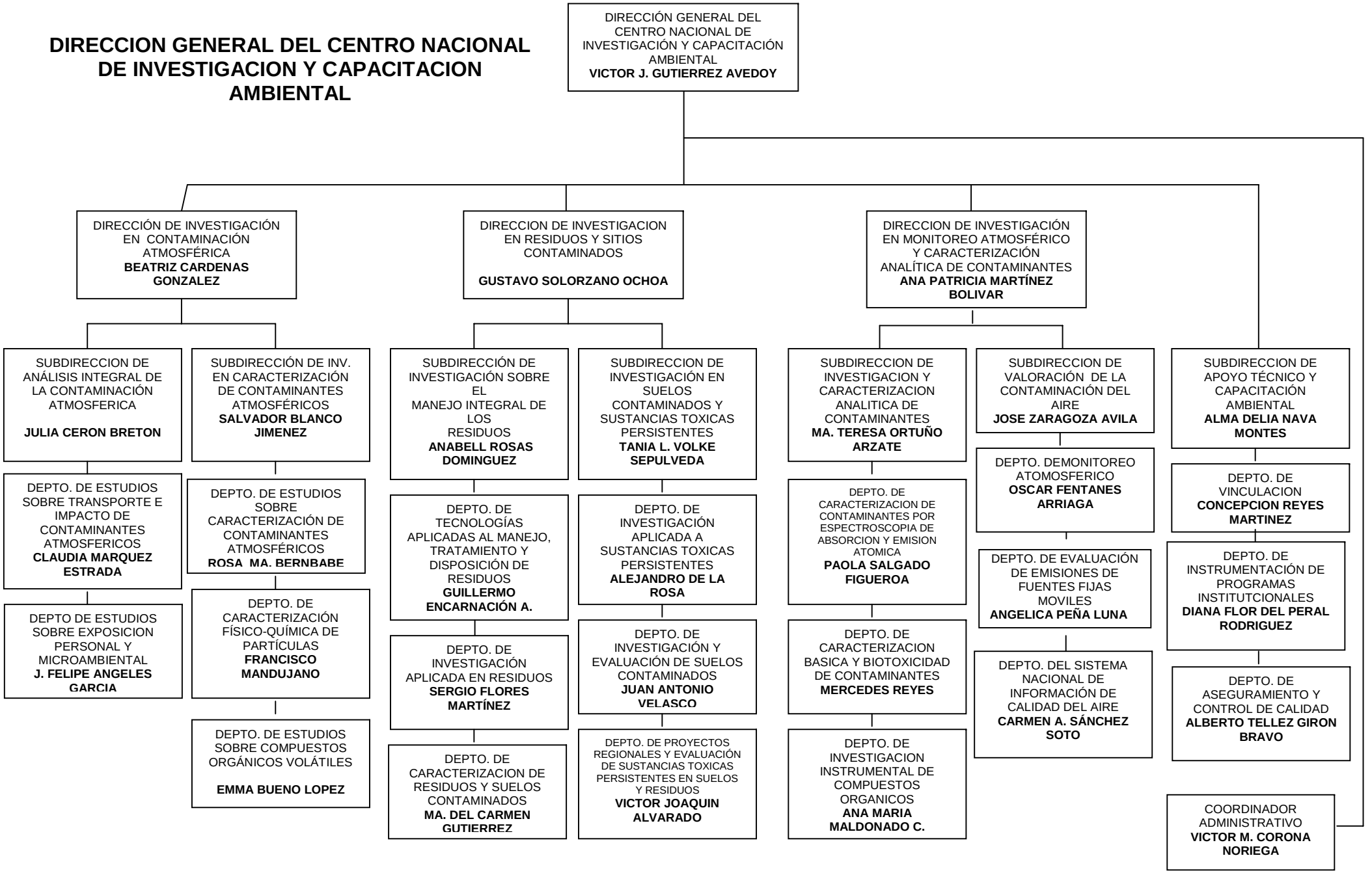
XVII.　省の管理ユニットや外郭組織などが必要とする場合には、調査や研究、技術評価プログラムへの参加、大気モニタリングシステムの監督や評価を行って意見を発表し、技術報告書を作成する。

## 第 11 章　連邦環境保護検察庁

第118条　連邦環境保護検察庁は長官を責任者とし、下記の権限を持つ。

XXXVI　環境庁（INE）国家環境研究研修センター局（CENICA）の意見を事前に聴取した上で、度量衡・基準化連邦法の規定に従って認証を受けた検査ユニットや認定機関が行う業務を承認・監督する。

# DIRECCION GENERAL DEL CENTRO NACIONAL DE INVESTIGACION Y CAPACITACION AMBIENTAL



６－２　CENICA 職員一覧

1. 国立環境研究研修センター　局長　ビクトル　グティエレス　アベドイ

2. 大気汚染研究部　部長　ベアトリス　カルデナス　ゴンサレス

3. 廃棄物・汚染地研究部　部長　グスターボ　ソロルサノ　オチョア

4. 大気測定・汚染物質分析同定部　部長　パトリシア　マルティネス　ボリバル
5. 大気汚染総合分析副部長　フリア　セロン　ブレトン
6. 大気汚染物質移動･影響調査課長　クラウディア　マルケス　エストラダ
7. 個人暴露・微小環境調査課長　フェリーペ　アンヘレス　ガルシア
8. 大気汚染物質同定副部長　サルバドル　ブランコ　ヒメネス
9. 大気汚染物質同定調査課長　ロサ　マリア　ベルナベ
10. 粒子状物質物理化学同定課長　フランシスコ　マンデュハノ
11. 揮発性有機化合物調査課長　エマ　ブエノ　ロペス
12. 廃棄物総合管理研究副部長　アナベル　ロサス　ドミンゲス
13. 廃棄物管理・処理・処分応用技術課長　ギジェルモ　エンカルナシオン A.
14. 廃棄物応用研究課長　セルヒオ　フローレス　マルティネス
15. 廃棄物汚染土壌同定課長　マリア　デル　カルメン　グティエレス
16. 汚染土壌･高残留性有害物質研究副部長　タニア L　ボルケ　セプルベダ
17. 高残留性有害物質応用研究課長　アレハンドロ　デラロサ
18. 汚染土壌研究評価課長　フアン　アントニオ　ベラスコ
19. 土壌･廃棄物中の高残留性有害物質地域プロジェクト･評価課長　ビクトル　ホアキン　アルバラード
20. 汚染物質研究･分析同定副部長　マリア　テレサ　オルテュニョ　アルサテ
21. 原子吸光・原子放射分光計による汚染物質同定課長　パオラ　サルガドフィゲロア
22. 汚染物質基礎同定・生物学的毒性課長　メルセデス　レイエス

23. 有機化合物計器研究　アナ　マリア　マルドナド　C
24. 大気汚染監視副部長　ホセ　サラゴサ　アビラ
25. 大気観測課長　オスカル　フォンタネス　アリアガ
26. 固定・移動発生源排出評価課長　アンヘリカ　ペニャ　ルナ
27. 全国大気質情報システム課長　カルメン　サンチェス　ソト
28. 技術支援・環境研修副部長　アルマ　デリア　ナバ　モンテス
29. 連携課長　コンセプシオン　レイエス　マルティネス
30. 機関プログラム実施課長　ディアナ　フロレス　レアル　ロドリゲス
31. 品質保証・品質管理課長　アルベルト　テイジェス　ヒロン　ブラボ
32. 管理コーディネーター　ビクトル　M　コロナ　ノリエガ

６－３　CENICA 取得認証一覧

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メキシコ認証機構（EMA）総裁
マヌエル　フェルナンデス　スアレス　殿

NMX-EC-025-INMC-2000 に基づき、国立環境研究研修センターに対し与えられた認証 NO. FRA-190-028702 の更新を当状をもって要請致します。　又、この更新には、添付書類に明記する通り、基準 NMX-EC-17025-IMNC-2000 に基づく認証を含めること、及び方法（メソッド）の範囲拡大をも要請致します。

以上
敬具

マリア　テレサ　オルトゥニョ　アルサテ
汚染物質研究・分析同定副部長

添付文書

| 試験方法あるいは試験の技術手順の正式名称 | 基準名　又は/及び<br>使用する方法名 | 提案認証者<br>人数 |
|---|---|---|
| 1. 大気中の浮遊粒子状物質総量の濃度 | NOM-PA-CCAM-002/93 | 8 |
| 2. 腐食性　電位計による廃棄物の PH 測定 | EPA 9040 C 2002 | 6 |
| 3. 廃棄物中に存在する酸に溶解・非溶解の硫化物による反応性 | EPA 9034 dic 1996 抽出 7 章、7.3.4.1 項 | 6 |
| 4. 廃棄物中のシアン化物による反応性 | EPA 9014B dic 1996 抽出 7 章、SW846 | 6 |
| 5. 廃棄物の着火性 | EPA 1010A-2002 閉ざされたカップ内での着火性 | 6 |
| 6. 水素化物発生器付き原子吸光によるヒ素 | EPA 7061A ヒ素 jul 1992 | 3,4 |
| 7. 比色計による六価クロム | EPA 7196A 六価クロム<br>jul 1992 | 6 |
| 8. 原子吸光分光計による廃棄物・土壌中の金属 | EPA 7000 B – 1998（消化 EPA 3015, 3051） | 3,4 |
| 9. 水素化物発生によるセレニウム | EPA 7741A セレニウム sep 1994 | 3,4 |
| 10. 亜揮発性有機化合物<br>クロルダーノ、o-クレゾール、m-クレゾール、p-クレゾール、2,4 ジニトロトルエン、エンドリン、ヘプタクロロ及びそのエポキシ化物質、ヘクサクロロエタン、リンデン、メトキシクロロ、ニトロベンゼン、ペンタクロロフェノル、2,3,4,6 テトラクロロフェノール、トクサフェノ、2,4,5 トリクロロフェノール、エーテル bis (2 エチルクロロ) 1,2 ジクロロベンゼン、1,4 ジクロロベンゼン、フェノール、ヘクサクロロベンゼン、ヘクサクロロ、1,3 プタジエン、アルファ BHC、ベータ BHC、 ガンマ BHC、アルドリン、アルファエンドサルファン、DDE、ジエルドリン、エンドリン、ベータエンドサルファン、DDD、エンドリンアルデヒド、DDT | EPA 8270D-98 ガスクロマトグラフ/マススペクトルスコープによる亜揮発性有機化合物 dic 1996 | 1,2 |
| 11. 廃棄物中の除草剤（2,4 D　及び Silvex） | EPA 8321A 高性能液体クロマトグラフによる溶剤抽出可能非揮発性化合物 dic 1996 | 5, 10 |
| 12. 廃棄物、土壌、沈殿物中の金属 (Sb, As, Ba, Be, Ca, Cd, Cr, Co, Cu, Fe, Li, Sr, Ni, Hg, Mg, Mn, Mo, Ag, Pb, Se, Ti, Ta) | EPA 6010C-2000<br>原子放射分光器、ICP dic 1996 | 4 |
| 13. 廃棄物中の揮発性有機化合物 | EPA 8260 ガスクロマトグラ | 1,2 |

| 試験方法あるいは試験の技術手順の正式名称 | 基準名　又は/及び<br>使用する方法名 | 提案認証者<br>人数 |
|---|---|---|
| | フ/マススペクトロスコープによる揮発性有機化合物　dic 1996 | |
| 14. 少量大気測定に関する重量分析 | CENICA/PT-APF-01 少量大気測定の際のフィルター調整と重量測定 | 8 |
| 15. 土壌及び廃棄物の PH | EPA 9045C-2002 土壌と廃棄物の Ph ene 95 | 6 |
| 16. 土壌及び沈殿物中の殺虫剤 | EPA 8081A dec. 1996<br>ガスクロマトグラフによる有機塩素殺虫剤 | 1,2 |
| 17. 土壌、沈殿物、大気中の亜揮発性有機化合物（PAH 類、有機塩素殺虫剤、有機リン殺虫剤) | EPA 8270D 1998 ガスクロマトグラフ/マススペクトロスコープによる亜揮発性有機化合物 | 1,2 |
| 18. 石油中の総炭化水素量（土壌及び沈殿物中の TPH） | EPA 8015 D 2003 GC/FID による非ハロゲン化有機物 | 1,2 |
| 19. 廃棄物中のアニオン物質　（硝酸塩、亜硝酸塩、硫酸塩、リン酸塩、塩化物） | EPA 9056 A nov 2000<br>イオンクロマトグラフによるアニオン非有機物質同定 | 2 |
| 20. 廃棄物の有害性 | NOM-AA-87-1995-SCFI Daphnia magna stratus （甲殻類）を使用した急性毒性試験法 | 3,7 |
| 21. 大気中のアニオン物質　（硝酸塩、亜硝酸塩、塩化物、硫酸塩） | EPA 9056 nov 2000<br>クロマトグラフによるアニオン非有機物質の同定 | 2 |
| **試験方法拡大** | | |
| 22. 侵出 | NOM-053-SEMARNAT | 6 |
| 23. 有害廃棄物の反応性 | NOM-052-SEMARNAT　EPA 7 章　7.3.2.1 項 | 6 |
| 24. フィルターで捕獲される多芳香属炭化水素 | EPA 8310 1996 | 5 |
| 25. 遺伝子組み替えトウモロコシの同定 | CENICA 法（ポリメラーゼ連鎖反応　PCR） | 11 |
| 26. 大気中の揮発性有機物質の同定 | EPA TO-14 1999 修正版 | 9 |

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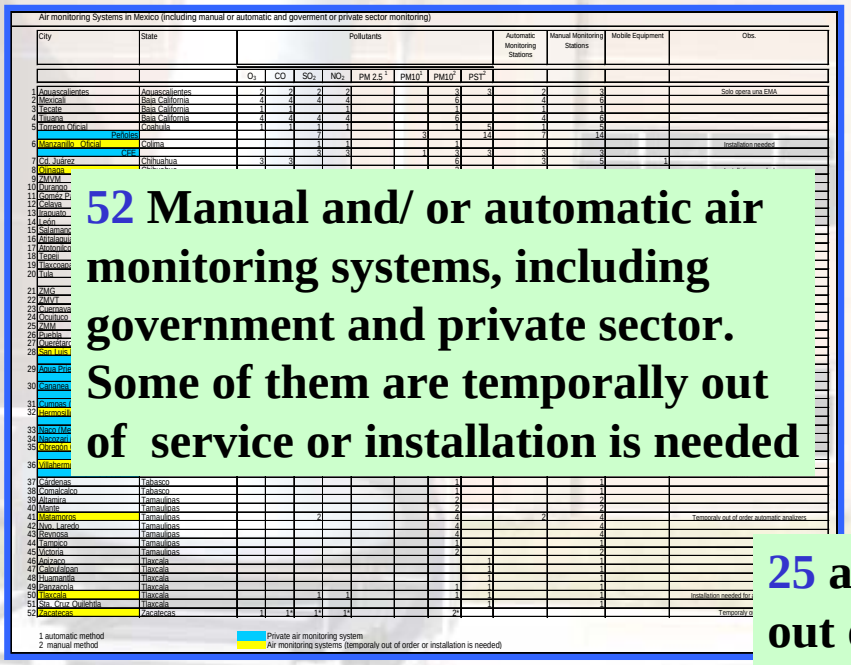
7-1　SENICA大気汚染総合分析同定部部長による「メキシコの大気質モニタリングの現状と展望」に関するプレゼンテーション


メキシコの大気質モニタリング
現状と将来

このプレゼンテーションはメキシコに於ける大気質の測定のための活動とインフラの現状を知って頂くためのものです。

又、全国大気モニタリング・プログラムの実施と全国大気質情報システムの設立に至るまでの計画やその目標も説明されています。　全国大気モニタリング・プログラムと全国大気質情報システムは、環境行政の政策設計の基本的ツールとなるべきものです。

# Information available of air monitoring systems

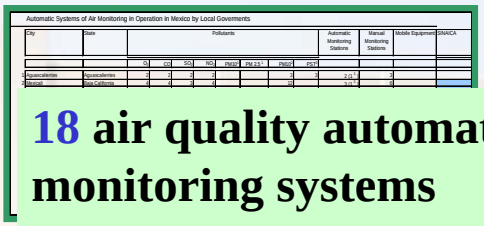

Air monitoring Systems in Mexico (including manual or automatic and goverment or private sector monitoring)

| | City | State | Pollutants | | | | | | | | Automatic Monitoring Stations | Manual Monitoring Stations | Mobile Equipment | Obs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $O_3$ | CO | $SO_2$ | $NO_2$ | PM 2.5 [1] | PM10 [1] | PM10 [2] | PST [2] | | | | |
| 1 | Aguascalientes | Aguascalientes | 2 | 2 | 2 | 2 | | | 3 | 3 | 2 | 3 | | Solo opera una EMA |
| 2 | Mexicali | Baja California | 4 | 4 | 4 | 4 | | | 6 | | 4 | 6 | | |
| 3 | Tecate | Baja California | 1 | 1 | | 1 | | | 1 | | 1 | 1 | | |
| 4 | Tijuana | Baja California | 4 | 4 | 4 | 4 | | | 6 | | 4 | 6 | | |
| 5 | Torreon Oficial | Coahuila | 1 | 1 | 1 | 1 | | | 1 | 1 | 1 | 1 | | |
| | Peñoles | | | | 7 | | | 3 | | 14 | 7 | 14 | | |
| 6 | Manzanillo Oficial | Colima | | | 1 | 1 | | | 1 | | | 1 | | Installation needed |
| | CFE | | | | 3 | 3 | | 1 | 3 | 3 | 3 | 3 | | |
| 7 | Cd. Juárez | Chihuahua | 3 | 3 | | | | | 6 | | 3 | 5 | 1 | |
| 8 | Durango | | | | | | | | | | | | | |
| 9 | ZMVM | | | | | | | | | | | | | |
| 10 | Durangito | | | | | | | | | | | | | |
| 11 | Gomez Pl | | | | | | | | | | | | | |
| 12 | Celaya | | | | | | | | | | | | | |
| 13 | Irapuato | | | | | | | | | | | | | |
| 14 | León | | | | | | | | | | | | | |
| 15 | Salamanc | | | | | | | | | | | | | |
| 16 | Atitlaquiu | | | | | | | | | | | | | |
| 17 | Apotonilco | | | | | | | | | | | | | |
| 18 | Tepeji | | | | | | | | | | | | | |
| 19 | Tlaxcoaqu | | | | | | | | | | | | | |
| 20 | Tula | | | | | | | | | | | | | |
| 21 | ZMG | | | | | | | | | | | | | |
| 22 | ZMVT | | | | | | | | | | | | | |
| 23 | Cuernava | | | | | | | | | | | | | |
| 24 | Ocuituco | | | | | | | | | | | | | |
| 25 | ZMM | | | | | | | | | | | | | |
| 26 | Puebla | | | | | | | | | | | | | |
| 27 | Queretaro | | | | | | | | | | | | | |
| 28 | San Luis | | | | | | | | | | | | | |
| 29 | Sonit Chic | | | | | | | | | | | | | |
| 30 | Sanginés | | | | | | | | | | | | | |
| 31 | Cumecs | | | | | | | | | | | | | |
| 32 | Hermosill | | | | | | | | | | | | | |
| 33 | Nuevo Mo | | | | | | | | | | | | | |
| 34 | Monclova | | | | | | | | | | | | | |
| 35 | Obregón | | | | | | | | | | | | | |
| 36 | Villahermo | | | | | | | | | | | | | |
| 37 | Cárdenas | Tabasco | | | | | | | 1 | | | 1 | | |
| 38 | Comalcalco | Tabasco | | | | | | | 1 | | | 1 | | |
| 39 | Altamira | Tamaulipas | | | | | | | 2 | | | 2 | | |
| 40 | Mante | Tamaulipas | | | | | | | 2 | | | 2 | | |
| 41 | Matamoros | Tamaulipas | | | 2 | | | | 4 | | 2 | 4 | | Temporaly out of order automatic analizers |
| 42 | Nvo. Laredo | Tamaulipas | | | | | | | 4 | | | 4 | | |
| 43 | Reynosa | Tamaulipas | | | | | | | 4 | | | 4 | | |
| 44 | Tampico | Tamaulipas | | | | | | | 1 | | | 1 | | |
| 45 | Victoria | Tamaulipas | | | | | | | 2 | | | 2 | | |
| 46 | Apizaco | Tlaxcala | | | | | | | | 1 | | 1 | | |
| 47 | Calpulalpan | Tlaxcala | | | | | | | | 1 | | 1 | | |
| 48 | Huamantla | Tlaxcala | | | | | | | | 1 | | 1 | | |
| 49 | Panzacola | Tlaxcala | | | | | | | 1 | 1 | | 1 | | |
| 50 | Tlaxcala | Tlaxcala | | | 1 | 1 | | | 1 | 1 | | 1 | | Installation needed for |
| 51 | Sta. Cruz Quilehtla | Tlaxcala | | | | | | | | 1 | | 1 | | |
| 52 | Zacatecas | Zacatecas | 1 | 1* | 1* | 1* | | | 2* | | | | | Temporaly o |

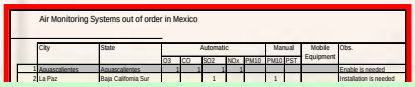
1 automatic method
2 manual method

Private air monitoring system
Air monitoring systems (temporaly out of order or installation is needed)

**52 Manual and/ or automatic air monitoring systems, including government and private sector. Some of them are temporally out of service or installation is needed**


Automatic Systems of Air Monitoring in Operation in Mexico by Local Goverments

**18 air quality automatic monitoring systems operated by local governments**


Air Monitoring Systems out of order in Mexico

| | City | State | Automatic | | | | | | Manual | | Mobile Equipment | Obs. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | O3 | CO | SO2 | NOx | PM10 | PST | | | | |
| 1 | Aguascalientes | Aguascalientes | | | | | | | | | | Enable is needed |
| 2 | La Paz | Baja California Sur | | | 1 | | | | 1 | | | Installation is needed |

**25 air monitoring systems out of order or whose instruments are not installed yet**

前のスライドは、全国に設置されているネットワーク、測定所、測定装置を、その稼働状況、物理的状況、管理状況から3つのカテゴリーに分けて示したものです。

- 第1の表には、公共セクター以外のセクターが持っているものを含め、自動、手動、その両方を問わず、何らかのタイプの大気質測定装置が設置されている52の都市が示されています。

- 第2の表は政府セクターが運営している自動モニタリングシステムのある都市を示したもの。

- 第3は故障とか資金不足により設置ができないなど、何らかの理由で稼働していない測定装置のある都市の表です。

# Automatic air quality monitoring systems in operation

Automatic Systems of Air Monitoring in Operation in Mexico by Local Goverments

| | City | State | Pollutants | | | | | | | | Automatic Monitoring Stations |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $O_3$ | CO | $SO_2$ | $NO_2$ | $PM10^1$ | PM 2.5 [1] | $PM10^2$ | $PST^2$ | |
| 1 | Aguascalientes | Aguascalientes | 2 | 2 | 2 | 2 | | | 3 | 3 | 2 (1 [3]) |
| 2 | Mexicali | Baja California | 4 | 4 | 3 | 4 | | | 12 | | 3 (1 [3]) |
| 3 | Tecate | Baja California | 1 | 1 | | 1 | | | 1 | | |
| 4 | Tijuana | Baja California | 4 | 4 | 2 | 4 | 4 | 1 | 6 | 6 | 3 (1 [3]) |
| 5 | Torreon | Coahuila | 1 | 1 | 1 | 1 | | | 1 | 5 | |
| 6 | Cd. Juárez | Chihuahua | 3 | 3 | | | | | 6 | | |
| 7 | ZMVM | Distrito Federal | 20 | 25 | 26 | 19 | 15 | 8 | 7 | 13 | 3 |
| 8 | Goméz Palacio | Durango | 1 | 1 | 1 | 1 | | | 1 | | |
| 9 | Celaya | Guanajuato | 3 | 2 | 2 | 3 | | | | | |
| 10 | Irapuato | Guanajuato | 3 | 3 | 3 | 3 | | | | | |
| 11 | León | Guanajuato | 1 | 1 | 1 | 1 | 1 | | | | |
| 12 | Salamanca | Guanajuato | 3 | 3 | 3 | 3 | 1 | | 2 | 1 | |
| 13 | ZMG | Jalisco | 8 | 8 | 8 | 8 | 8 | | | | |
| 14 | ZMVT | México | 7 | 4 | 7 | 7 | 7 | | 2 | 5 | |
| 15 | Cuernavaca | Morelos | 1 | 1 | 1 | 1 | | | | 3 (2 [3]) | |
| 16 | Ocuituco | Morelos | 1 | 1 | 1 | 1 | | | | 1 | |
| 17 | ZMM | Nuevo León | 5 | 5 | 5 | 5 | 5 | 5 | | | |
| 18 | Puebla | Puebla | 4 | 4 | 4 | 4 | 4 | | | | |

1 automatic method
2 manual method
3 Temporaly Out of Order

Aguascalientes, Ags.
Mexicali, BC.
Tecate, BC.
Tijuana, BC.
Torreón, Coah.
Cd. Juaréz, Chih.
ZMVM
Gómez Palacio, Dur.
Celaya, Gto.
Irapuato, Gto.
León, Gto.
Salamanca, Gto.
ZMG
ZMVT
Cuernavaca, Mor.
Ocuituco, Mor.
ZMM
Puebla, Pue.

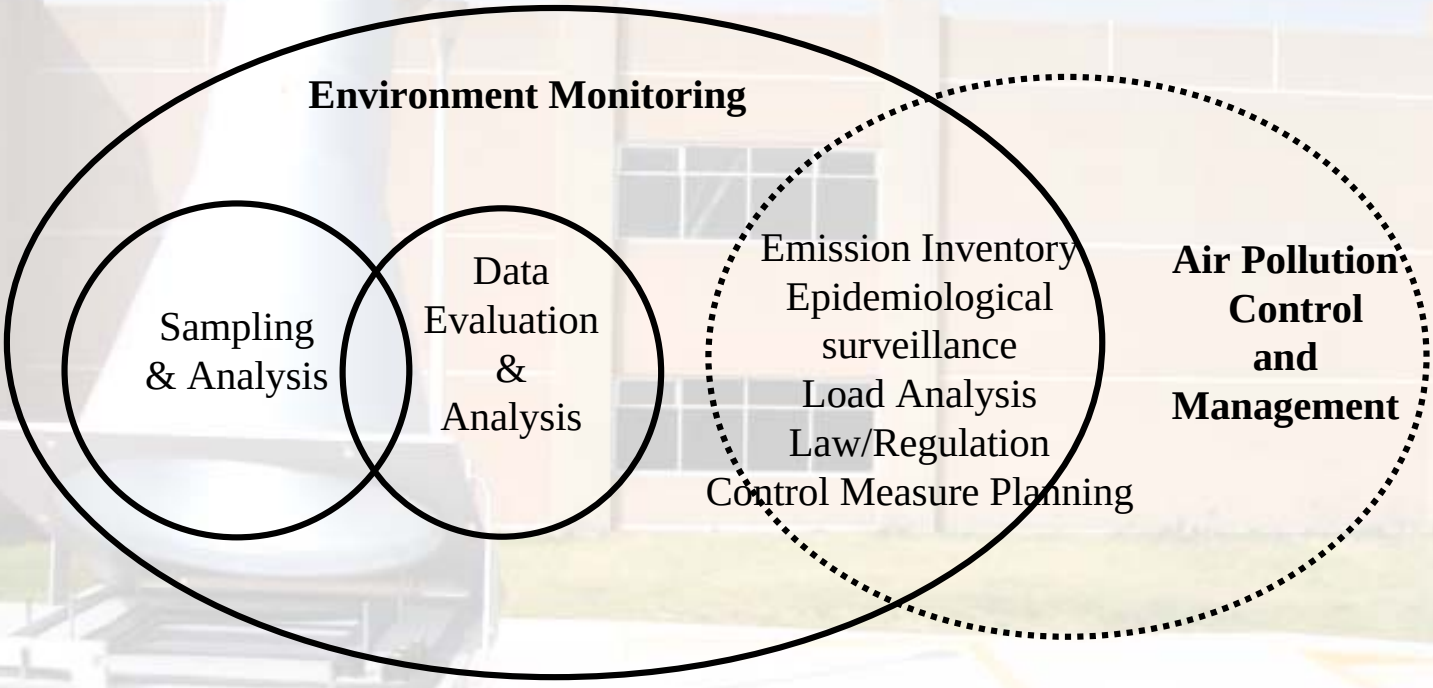
スライドNO.5は、現在稼働している18都市の自動測定装置の詳細が示されています。 ここに含まれる情報は下記の通りです。

- 都市名と州名
- 各測定所で測定されているパラメーター
- 使用されている測定装置のタイプ
- 測定所のタイプと数
- SINAICAに接続しているか否か
- 移動測定装置を持っている都市

スライドNO.7の地図は、18のネットワークの地理的位置を示す補完的情報です。

# Current automatic air quality monitoring systems


# Monitoring System in the Environment Management Control Structure



スライドNO.8はプログラムの中で考えられている様々な要素がどのように構成され、どのように相互に関連することによって、大気質の適切な管理が可能となるようなシステムが実現するか、を示したものです。（スキームは湯川博士から提供されたもの。）

- 大気汚染物質の測定と分析により、汚染物質の濃度に関するデータが作成され、それを確認・評価した上で、補完的な情報を提供する他の環境評価・測定ツールと組み合わせる。 これらの他のツールとは、エミッションインベントリー、疫学調査、基準や規則などで、これらを組み合わせて、大気政策の具体的な形である様々な汚染防止措置のオプションを考え、評価し、場合によってはこれを改変する。

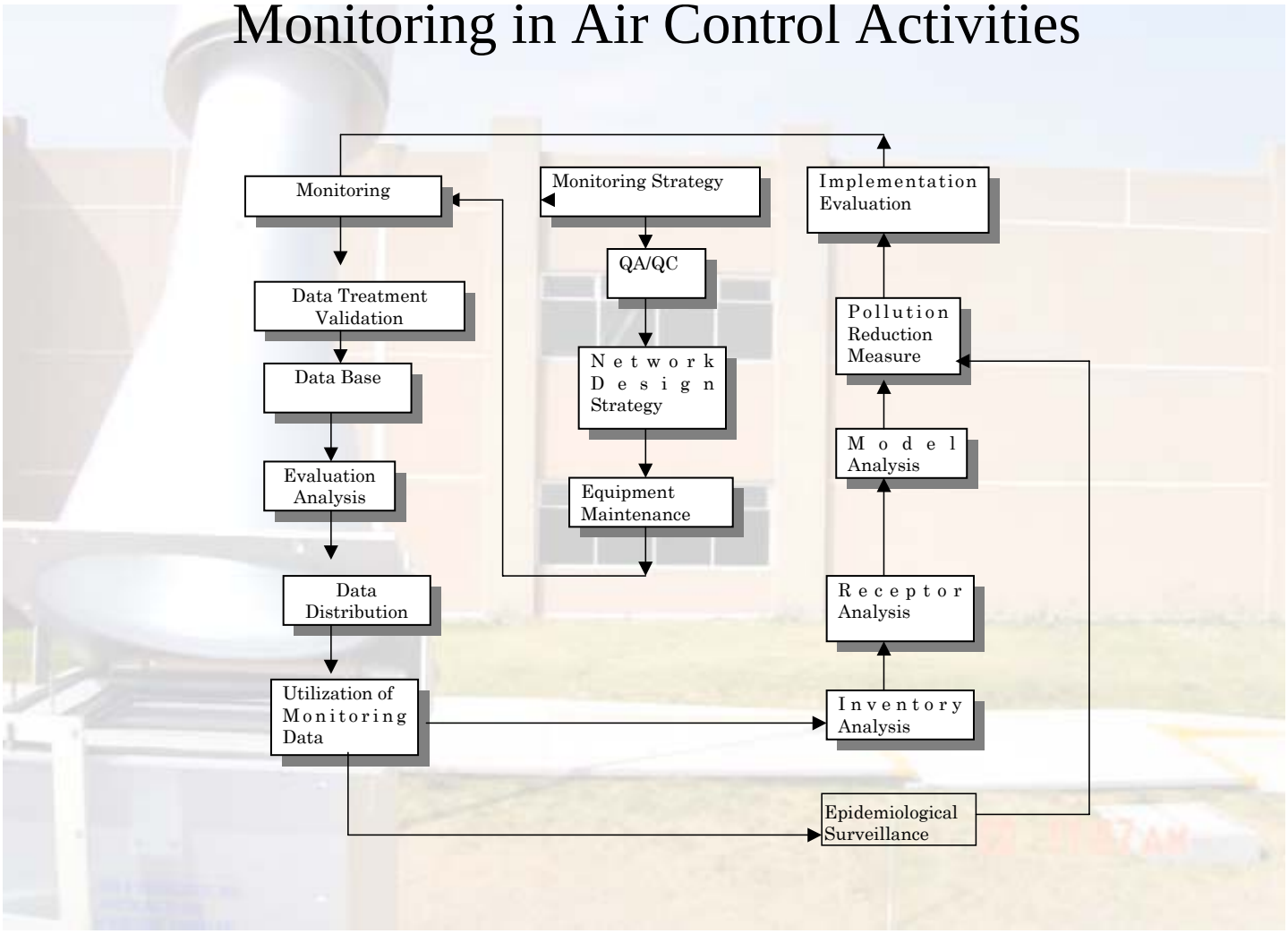


図10は（湯川博士から提供されたもの）、スライドNO.8を補完する形で大気汚染防止活動の中で大気質測定が果たす役割を示したものです。 この図には、測定活動自体を始める前に考慮すべきいろいろな活動も示されています。 例えば、品質保証／品質管理計画、ネットワーク設計戦略、装置のメンテナンス・プログラムなどがこれに相当します。

又、データの取り扱いや検証(validation)、データ分析、疫学調査の裏付けとかエミッションインベントリーの調整のための使用など、その配布先や使用用途も設定されています。 加えて、これらの間の相互関係が示され、こうした活動サイクルを完成させ、かつ、汚染軽減のための政策や措置を決定するために必要となる情報需要に常に答えられるような大気測定システムであるためのフィードバックがされるようなシステムの評価が設定されています。

# Monitoring Strategy, Where?

- In the 32 capital cities or metropolitan areas
- Manual and Automatic monitoring in cities with a population of more than 1 million
- Manual and Automatic monitoring in cities with real or potential air quality problems. Hot spots:
  - Petrochemical complexes
  - Industrial corridors
  - National interest places: tourist areas
- TSP and PM10 sampling in cities with a population of at least 0.5 million

全国レベルで大気モニタリング戦略を設定しようとする時、まず答えなければならない質問は、どこに大気測定ネットワークを設置すべきか、と言う質問です。 この質問に答えるためには、幾つかの判断基準を多くの人と同意した上で決定しなければなりません。 このスライドは、これらの判断基準のいくつかを示しています。

- 各州の州政府所在地である32の都市、あるいはその都市圏に設置する、と言う政治的判断基準

- 人口100万人以上の都市、と言う判断基準。 100万規模の大都市となると、大量のエネルギーを様々なサービスの形で消費するため、環境の質に大きな影響を与える。

- 周辺に石油化学工業関連の施設・プラントや発電所がある都市。 及び大きな工業地帯の一部を構成している都市。 こうした都市では、汚染により住民の健康に影響の出る可能性があり、リスクを負っている。

- 観光地など、国家的関心のある場所。 これらの場所は、その状況を監視し、保護する必要がある。

- 50万人以上の住民がある都市。 これらについても、サービスによるエネルギー消費を考え、大気質の指標としてPSTとPM10の基礎的測定を実施する。

# Monitoring Strategy, Which parameters?

- 5 criteria pollutants and meteorological parameters in metropolitan areas, national interest places and cities with more than 1 million inhabitants

- 5 criteria pollutants, VOCs, POPs and meteorological parameters in Hot spots:
  - Petrochemical complexes
  - Industrial corridors

- TSP and PM10 sampling in cities with at least 0.5 million inhabitants

大気質評価プログラムの実施のための戦略の一部として、測定対象となる汚染物質を選定しなければなりません。 その際には、一定の都市・集落が抱えている問題、あるいは都市・集落で今後起こりそうな問題を考え、これを代表するような汚染物質を選定することが必要になります。

全ての大都市圏、観光名所のある都市、人口100万以上の都市全てについて、5つの基準汚染物質と汚染物質の挙動に関係する気象パラメーターの測定を地方ネットワーク・プログラムの中に含めることを提案しました。

工業地帯、石油化学コンビナートや発電所、あるいはその両方に近い所にある都市は、これらの施設が通常大気質に影響を及ぼす所から、特に重要な地区と考えられています。

人口50万人以上の都市は、少なくとも浮遊粒子状物質、PST又はPM10の測定を行って、影響の程度を設定する大気質指標を持つことが必要です。

# Air monitoring stations, What Kind of ?

- URBAN

- ROADSIDE

- INDUSTRIAL

- SUBURBAN
  (at least 2 in major cities)

- TRANSBOUNDARY (at least 5 in the country)

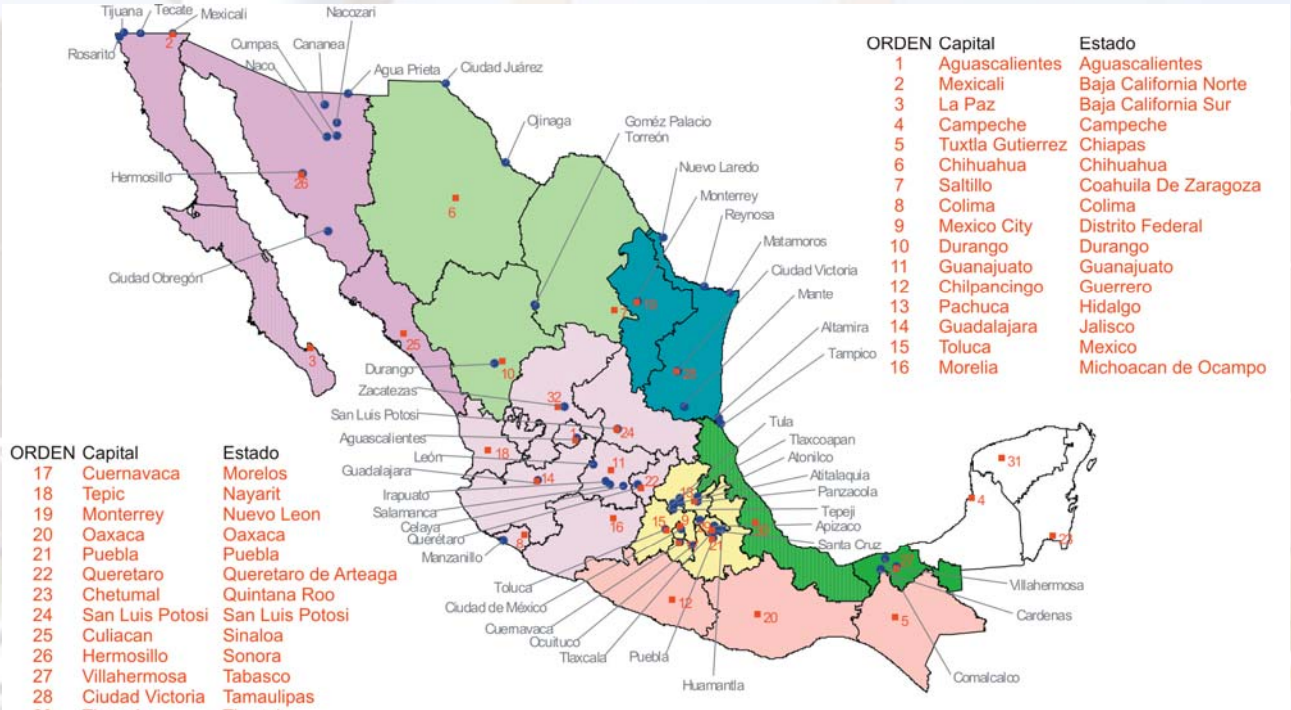
具体的な目的に従った測定所のタイプについては、その測定所が設置される予定の場所の環境に従って、カテゴリーに分けて考えるべきであることは明らかです。

完全に市街地にある測定所の情報は、周辺部・バックグラウンドの測定所のデータと比較し、これによって補完されるべきものです。 又、都市部で発生する汚染物質が農村部あるいは天然の地域に運搬されるような場合、そうした汚染物質の挙動に関する情報も必要になります。

他方、線的発生源、面的発生源の直接的な貢献度を推定するための測定所も必要と考えられます。

更に考慮すべき要素は、使用する測定器のタイプです。 現在メキシコで使用されている測定器の大部分は、自動のものも手動のものもアクティブ・タイプですが、特殊なモニタリングについてはパッシブ・タイプの測定器の使用も普及されるべきでしょう。

# Potential air monitoring systems




| ORDEN | Capital | Estado |
|---|---|---|
| 1 | Aguascalientes | Aguascalientes |
| 2 | Mexicali | Baja California Norte |
| 3 | La Paz | Baja California Sur |
| 4 | Campeche | Campeche |
| 5 | Tuxtla Gutierrez | Chiapas |
| 6 | Chihuahua | Chihuahua |
| 7 | Saltillo | Coahuila De Zaragoza |
| 8 | Colima | Colima |
| 9 | Mexico City | Distrito Federal |
| 10 | Durango | Durango |
| 11 | Guanajuato | Guanajuato |
| 12 | Chilpancingo | Guerrero |
| 13 | Pachuca | Hidalgo |
| 14 | Guadalajara | Jalisco |
| 15 | Toluca | Mexico |
| 16 | Morelia | Michoacan de Ocampo |

| ORDEN | Capital | Estado |
|---|---|---|
| 17 | Cuernavaca | Morelos |
| 18 | Tepic | Nayarit |
| 19 | Monterrey | Nuevo Leon |
| 20 | Oaxaca | Oaxaca |
| 21 | Puebla | Puebla |
| 22 | Queretaro | Queretaro de Arteaga |
| 23 | Chetumal | Quintana Roo |
| 24 | San Luis Potosi | San Luis Potosi |
| 25 | Culiacan | Sinaloa |
| 26 | Hermosillo | Sonora |
| 27 | Villahermosa | Tabasco |
| 28 | Ciudad Victoria | Tamaulipas |
| 29 | Tlaxcala | Tlaxcala |
| 30 | Jalapa | Veracruz-Llave |
| 31 | Merida | Yucatan |
| 32 | Zacatecas | Zacatecas |

前のスライドの地図は、全国各州の州政府所在地にモニタリング・プログラムが設定され、機材も提供された場合、全国大気測定ネットワークと全国大気質情報システムのベースはこうなる、と言うことを示したものです。

# Strengthening of air quality monitoring

- Monitoring Renovation Planning
  1) Objectives of Measurement
     - Regional Monitoring Station
     - Federal Surveillance Center
  2) Review of Present Monitoring Stations
     - Workmanship and Performance
     - Site and Monitoring Objectives. Classification of stations
  3) Maintenance and Budget Planning. Enough availability of consumables and Spare Parts for each network

- Definition of Measured Value
  1) One Hour Average
  2) Daily Average. Effective Measuring Hours (20 hours)
  3) Monthly Average. To be based on Hourly, not Daily
  4) Yearly Average. To be based on Hourly, not Monthly, nor daily

- Data Management/Validation
  1) Definition of “Missing Value”
  2) Definition of System Error
  3) Review of Historical Statistical Value
  4) Validation of Daily, Monthly and yearly Value
  5) Storage of Hourly Value for Five to Ten years

# Strengthening of air quality monitoring

- **QA/QC development**
  - Assessment of local monitoring systems activities. Validation, Evaluation, Analysis
  - Contents of Measuring Technology and Other Method
  - Maintenance and Budget Planning
  - Detailed Manual
- Training Programs
  - Operation, calibration and maintenance
  - Data management, storage and analysis
  - Network design and evaluation of the representativeness of the sites
- Transfer standard laboratory
  - Equip, operate and support a primary standard lab for air quality monitoring

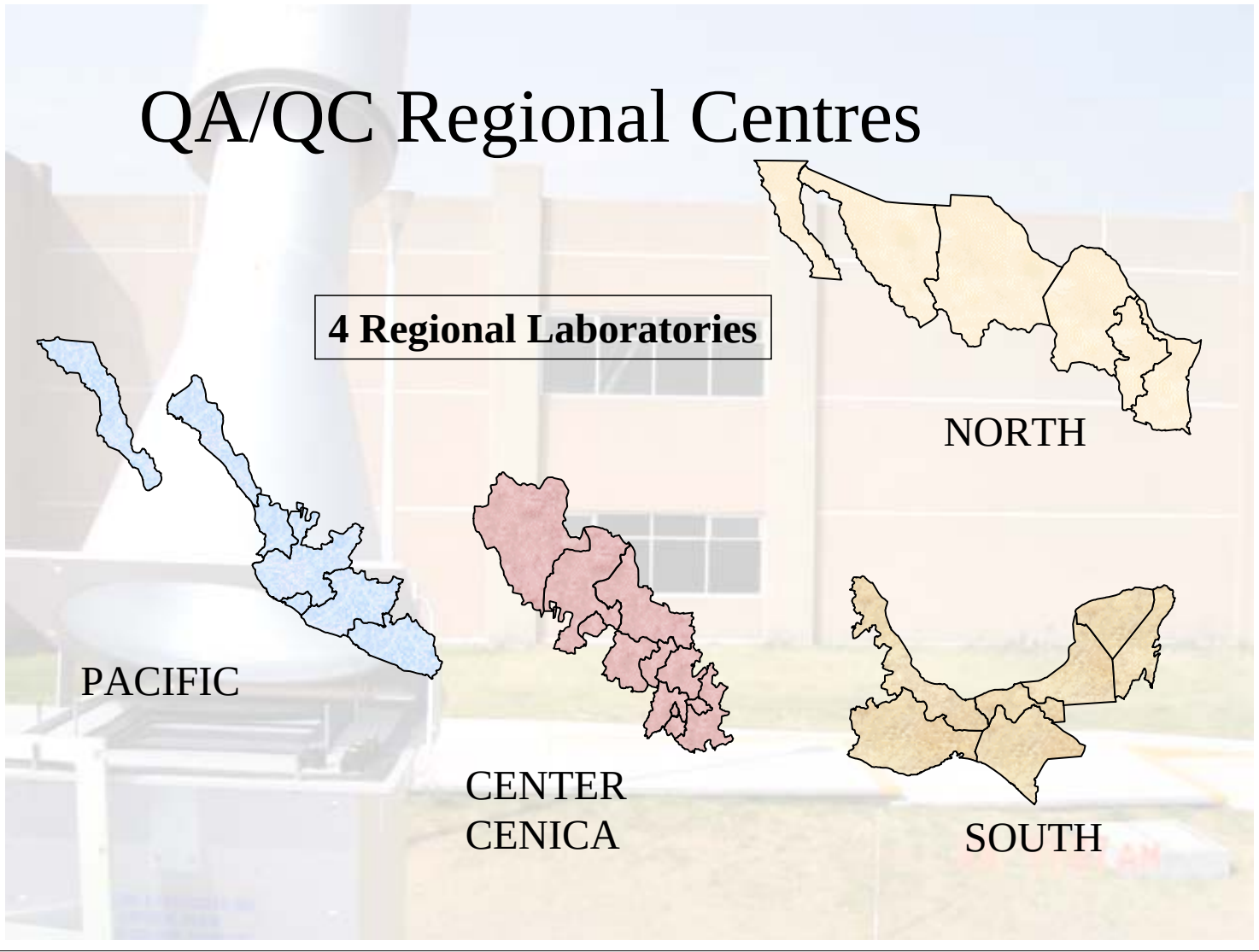
前の２枚のスライドはメキシコに於ける大気測定を実際に強化するため、考慮すべき側面や施策を示したものです。 モニタリングの立案の見直し、測定所に於ける測定の明白で具体的な目的や、カバレッジ、代表制の設定に始まって、現在全国に存在する測定所の監査や診断、適切な予算措置やスペアパーツ・消耗材の購入計画、汚染物質の発生源、その挙動や分布を知ることができる連邦レベルの大気質監視センターの設置まで、様々な必要性があると考えられます。

指標やその適用を決定するための判断基準も考えなければなりません。 例えば一定の単位時間内に有効と考えられるデータの数、異常値や矛盾する値を示す一連の「フラッグ」など、データ取り扱い上の判断基準も必要です。

又、質・量の点で適切なデータを生み出すための品質管理／品質保証プログラムへの支援活動に含めるべき要素も示されています。

この点については、データの取り扱いや検証、他のテクノロジーに関する知識、オペレーションマニュアルに関する知識などの面について、地方ネットワークのオペレーターの指導が重要であることが指摘されています。

最後に、全国的に大気測定機器に関するガイドラインを設定し、これを均質化するような校正・基準移転ラボの重要性が強調されています。



地域センター

現在CENICAが中央レベルで実施している活動を地域レベルで実施できる地域センターのアイディアは、技術支援需要が高まって来ている現状を反映したものです。

今後数年間にできる限り多くの都市を含めようと言う、大気モニタリング全国プログラムの目的から考えられる展望や、全国大気質情報システムの設定している目標から見て、CENICAの機能を分散させ、地域センターにこれらの機能を移転して、サービスをより効率的に実施する努力が必要です。

# DATA analysis

- **Analysis of Site Measurement**
  - Graphical Analysis for Hourly , Daily, Weekly, Seasonal Trend is a "Must"
  - Yearly Trend Analysis
  - Review of Pollution Pattern Change between the Sites
- **Correlation Analysis between Pollutants**
  - SPM,CO and NO2
  - VOC,NO2 and O3
  - With Meteorological Parameter
- **Correlation of Sites and Representativeness in the Region**
- **Simulation Analysis**
  - Application for Major Polluted Cities in conjunction with Integrated Investigation on Regional Air Quality（Fortran Basis）
  - Detailed Site and Zoning Analysis for the Target Regions（Excel Basis）
  - Further step; Complex with Cluster Analysis

# DATA analysis

- **Analysis on Hourly value in Relation to Regional, Social and Economic Activities**
  1) Hourly Analysis on CO, NO2, SPM and O3
  – Weekly Analysis on Activity Characteristics

- **Analysis on Monthly Pollution Characteristics**
  - In Relation to Meteorological Conditions
  - In Relation to Social and Customs

- **Analysis on Receptor Relationship**
  - 80% Catchments for Point Sources
  - Mobile Source for Highway, Federal way and State way
  - Surface emission from Commercial, Public Service and Living

前の２枚のスライドは、データ分析に関するもので、大気モニタリングのデータをより効果的に使用するため、明白なガイドラインや方針の設定を提案しています。

これらのガイドラインや方針によって、モニタリング・データを最も効率的に使用するための様々な情報分析のレベルが設定され、測定努力が実際に住民の健康や生態系の保護に役立つ対策に活かされるべきです。

次ぎのスライドでは大気モニタリングと関係付けて考えられるべき用途や活動が示されています。

# Utilization of Monitoring DATA

- **Development of State wise Inventory Collection**
  - Classification of Point Sources
  - Vehicular Inventory
  - Surface Emission
  - Inventory and Production
- **Historical Trend of Economic and Social Activities GD Trend**
  - Inventory and Production
  - Market price Index
  - Employment Rate, etc
- **Establishment of Inventory Collection System in the State**
  - Annual Air Pollution Prevention Plan
  - Committee and Working Group
  - Sector wise Coordination by the State Air Pollution Dept

# Measures and Evaluation of Monitoring Project

- Periodical Integrated Air Monitoring & Investigation: with Passive Sampler, Upper Layer Measurement, among others.
- Integrated Analysis of Air Pollution Mechanism: Relationship between Concentration and Source-Receptor, Simulation Modeling,
- Preparation of Air Pollution Prevention Measures: Short and Long Term Strategy, Action Plan, Basis for Annual Monitoring Plan
- Annual Evaluation of Air Pollution Prevention Measure: Evaluation of project, Monitoring Evaluation and Next Year Planning.
- Midterm Basis Renovation Plan for the System: Air Pollution Prevention Measure, Monitoring Evaluation, Law and Regulation, Enforcement System

前のスライドでは、我々の大気測定プログラムを定期的に評価することが必要であるとされているとともに、大気測定プログラムと他の調査・研究とを関連付ける必要性が提示されています。

最初から何枚目かのスライドの図にもあったように、大気測定は大気質管理が成功を収めるのに必要な様々の対策に達するのに必要な一連の活動の一環を成しています。

# National Air Quality Monitoring Program
# "The Web Page"

**AIR MONITORING NATIONAL INVENTORY (CURRENT OPERATIVE PERFORMANCE)**

*Overview*

*Network design documents*

*Operation Standard Procedures (for automatic and manual methods)*

- Technical support (discussion groups)
- Annual audits program

**TRANSFER STANDARDS AND CALIBRATION LABORATORY**

*Overview*

*Instrumentation and capabilities*

*Annual Work Program*

**SINAICA**

*Overview*

*Data validation procedures*

*Manual & Automatic networks data*

– Raw data
– Validated data

*Data display, tools, indicators, graphics, maps, index ...*

加えて、測定活動の普及・支援策の一つとして、現在開発中のいくつかのマニュアルのプロトコルのガイドラインや校正・基準移転ラボに関する情報、SINAICAへのコネクションを設定したウェッブページを作成する可能性が検討されています。

このウェッブページには、各所のモニタリングネットワークの専門家が互いに支援や指導を求めて連絡し合い、モニタリングに関する疑問や問題点を討議できるようなサイト、フォーラムを設けることもできるかもしれません。

QUALITY

COMPETITIVE SYSTEM

NEW MARKETS

EMISSIONS TRADING PROGRAMS

# NEW POSSIBLE FINANCE SOURCES

**FOR THE DESIGN AND IMPLEMENTATION OF THE NATIONAL AIR QUALITY MONITORING PROGRAM, PNMA 2007 - 2010**

こうして、我々が情報の品質を保証することが¥できれば、排出交換などの新しい市場メカニズムを実施することも可能となるでしょう。

我が国のモニタリングシステムを国際的に認知されたシステムとすることができれば、新しい市場や新しい金融的なオプション／チャンスも開かれることでしょう。

Instituto Nacional de Ecología

**DIRECCIÓN DE INVESTIGACIÓN EN MONITOREO Y CARACTERIZACIÓN DE CONTAMINANTES ATMOSFÉRICOS**

# CENICA project for Air Quality Modeling

**(working title)**

March 18, 2005

Claudia Márquez, Henry Wöhrnschimmel

# 1 Introduction

On February 10, 2005, the Second Japanese Preparatory Study Team and the Mexican authorities signed the minutes of their meeting on the program of Strengthening Air Quality Monitoring in the United States of Mexico. The overall goal of this program is to make the Mexican society recognize the importance of air quality monitoring, and to strengthen the capacity of the local governments to provide and utilize reliable air quality information for policy planning.

This project proposal is a contribution of the Mexican National Center for Environmental Research and Training (CENICA) to the Japanese Technical Cooperation, and aims at defining in more detail the activities agreed on under Output 3-2: "CENICA conducts studies on effective utilization of monitoring data through the use of models", as part of output 3: "studies that complement existing air quality monitoring are carried out". These studies are expected to provide additional information about air pollution formation mechanisms.

It has to be emphasized that this document is a first draft and that a revision and comments by the Japanese counterpart is kindly requested

## 1.1 Modeling in the framework of decision making

Air pollution models are used by scientists to interpret measurements of air pollutant concentrations, and by governments to support the decision making process in air quality management. Thus, models play a crucial role in the framework of science and air quality management. A representation of information flows between air pollution monitoring, modeling, and decision making is represented in Figure 1.1. Typical questions that are addressed by air quality models are:

- What is the contribution of source A to the concentrations of pollutants at site B?
- What is the most cost-effective strategy for reducing pollutant concentrations bellow an air quality standard?
- What will be the effect on air quality of the addition or the reduction of a specific air pollutant emission flux?
- Where should one place a future source (industrial complex, freeway, etc.) to minimize its environmental impacts?
- What will be the air quality tomorrow or the day after?

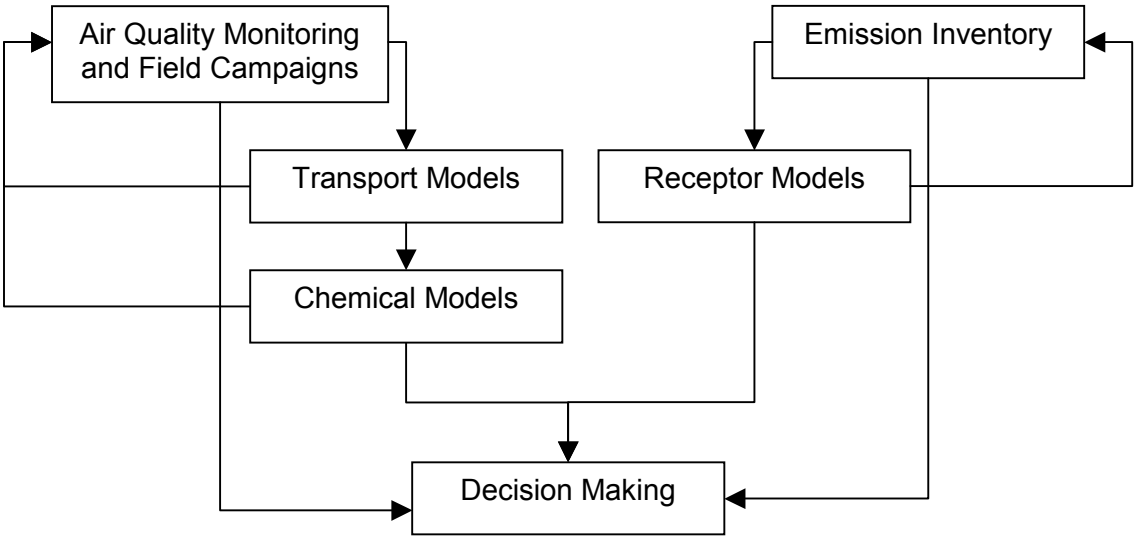



**Figure 1.1** *Air pollution models in the context of decision making. Arrows indicate the flow of information.*

## 1.2 Experience in Monitoring, Emission Inventory and Modeling in Mexico

As illustrated in Figure 1.1, air quality monitoring, emission inventories and modeling go hand in hand in providing decision makers with a base for environmentally sound decisions. This section describes the experience that exists in Mexico in these fields.

*Monitoring*

At present, the National System of Air Quality Information (SINAICA) is reporting data in real time on its webpage (http//:sinaica.ine.gob.mx). Monitoring networks of different Mexican cities are included, as those of Mexico City, Guadalajara, Monterrey, Tijuana, Mexicali, Rosarito, Tecate, Salamanca, Puebla, Toluca, Ciudad Juárez and the air quality monitoring station of CENICA located in the southeast of Mexico City. This rich information is used primarily in a descriptive manner, so that there is a need for a profound analysis of the air quality network data from different states in the country. Such analysis may include correlations between long-term trends in pollutant concentrations to changes in emissions, or the mid-term response of air quality to actions to prevent or control air pollution such as those included in the air quality programs (PROAIRE's). Understanding the causes of inter-annual variation in pollutant concentrations requires to distinguish different causes like changes in emissions and meteorological variability. With increasing complexity of the problem, the application of models becomes more necessary.

Measurements of the more specific non-criteria pollutants have been carried out by CENICA, for example PM2.5, volatile organic compounds, and the speciation of particulate matter. Thanks to the first and second phase of the JICA project, CENICA is now becoming a leading research institution in the measurement of air pollution. Through the years, equipment and expertise provided by JICA experts has allowed the performance of projects that have not only generated scientific knowledge but also have been used in the decision making process to improve air quality in Mexico. However, this information has remained mostly on a descriptive level, so that the use of models is a good option to obtain more benefit of the measurement data and expertise in ambient measurements. Therefore, the third phase of the JICA project intends to consolidate the research at CENICA also in applying air pollution simulation models on

monitoring data. Furthermore, capacitating CENICA staff is of high importance for consulting services that this institution is requested to offer to local and state governments throughout the country.

*Emission Inventories*

The development of an emission inventory for the Mexico City Metropolitan Area made it possible to quantify the emissions of sources within the Federal District, as well as the State of Mexico. Since 1989, efforts were done to know the volume and type of air pollutant that is produced by every source or sector. Thus, the major contributors were identified, to which priority should be given in emission control. The emission inventory for Mexico City is analyzed every two years.

The first national emission inventory, based on the year 1999, is currently being established, with the final version being expected for 2005 (see more detailed information on http://www.ine.gob.mx/dgicurg/calaire/lineas/download/info_inem.pdf). It will include emissions of nitrogen oxides, sulfur oxides, volatile organic compounds, carbon monoxide, suspended particles and ammonium from point sources, mobile, area and biogenic sources. Depending on data availability, the resolution will be on the scale of state and municipal.

*Modeling*

In Mexico there are some groups that model air pollution and meteorological conditions. The most important one is at the National University of Mexico (UNAM), composed of scientists from the Center of Atmospheric Science. They are currently working on dispersion, meteorological and chemical models. In Annex 4.1, a short resume is included of the different members of this center. In addition, there is a group of people from various institutions and the Mexico City government, known as CAM (Comisión Ambiental Metropolitana), also working with meteorological models like the MM5 and MEMO. Some efforts have been done at the National Institute of Ecology (INE) with the photochemical model MCCM. Data from the different monitoring networks in Mexico have been used to feed various models. The networks are located in Mexico City (*Molina & Molina, 2002*), in Salamanca, Monterrey and other major urban centers in Mexico.

However, there is not a real institutionalized scheme to make decisions on model-based information, in contrast to other countries where models constitute a fundamental element in air quality management. The US-EPA is nowadays using models of several types in order to support decision making in air quality management. Examples are given on the EPA-website http://www.epa.gov/oar/oaqps/modeling.html. In Canada the same models are used. Also the European Environmental Agency recommends the use of specific models in its Guidance Report on preliminary assessment under EC air quality directives (http://reports.eea.eu.int/TEC11a/en/page011.html).

## 1.3 Objectives and goals

The proposed project is meant to close the gap between monitoring and decision making by the use of air pollution models. The principal objective of the project is the *formation of human resources in air quality model application*, in order use data from air quality monitoring networks more efficiently, thus contributing to scientific understanding of air pollution and to environmentally sound decision making. Particular objectives are:

(1) Exchange knowledge between government staff and expert modelers on the information needs of air quality management, and solutions that may offer the application of air quality models.

(2) Commonly work out responses to specific problems in air quality management by means of applying air quality models on an expert level as well as screening level, thus building capacity within government staff to include air quality models as an element for decision making;
(3) Create a group with experts on modeling activities and government staff trained in model applications, to advise policy makers on how to consider model information in their decisions, on an institutional and regular.

# 2 Methods

## 2.1 Overview

The steps to meet the objectives described above are given in the following:

1a) Realize interviews with experts in air quality modeling and mesoscale circulations in order to prepare the training, to be imparted to government staff.
1b) Synthesize expert views in the framework of a workshop in order to work out the final definition of the training.
1c) Define dates and contents of the training.
1d) Select government staff (technical areas) for participating in the training on air quality models.
2) Impart practical training on the use of models for government staff (DG-CENICA, DG-ICURG, DG-GCA, RETC-SEMARNAT and staff from the three model cities). Workshops which are held after each training module.
3a) Prepare already available input data from Mexico City and the three model cities to be used in the air quality models during the training.
3b) Define necessary measurements to be carried out in order to complete the input data for the air quality models.
3c) Carry out additional measurement in Mexico City and the three model cities.
4) Formalize further collaboration between experts and government staff, which leads to an advisory board supporting federal and local governments in the interpretation of model results and the formulation of policies on air quality problems.

A preliminary schedule of the activities to be conducted during the project is given in Table 2.1. A description of each activity is provided in the following sections.

**Table 2.1** *Schedule of activities*

| | 05/II | 05/III | 05/IV | 06/I | 06/II | 06/III | 06/IV | 07/I | 07/II | 07/III | 07/IV | 08/I |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1a) Individual Expert Interviews | ■ | | | | | | | | | | | |
| 1b) Expert Workshop | | ■ | | | | | | | | | | |
| 1c) Course definition | | ■ | | | | | | | | | | |
| 1d) Select participants | | | ■ | | | | | | | | | |
| 2) Training and Workshops | | | | | ■ | ■ | | ■ | ■ | ■ | | |
| 3a) Prepare Input data | | ■ | ■ | | | | | | | | | |
| 3b) Define Measurements | | | ■ | | | | | | | | | |
| 3c) Do additional measurements | | | | ■ | | ■ | | ■ | | ■ | | |
| 4) Formalize Expert-Government Interaction | | | | | | | | | | | ■ | ■ |

## 2.2 Training and Workshops

*Responsibilities*

CENICA will be in charge of coordinating all activities with regard to the training in air quality modeling, and in collaboration with JICA experts and UNAM researchers. The preparation includes selection of instructors and participants, as well as the course design, which will be discussed in more detail in this section. Thus, CENICA will be the interface between policy makers and academia during this project.

Researchers from UNAM will be responsible for the realization of the training, due to their expertise in model research and education, and due to the computational facilities and infrastructure already existing at UNAM, which means the most efficient utilization of financial resources. UNAM experts will, however, not participate in any decision making process during this project. Furthermore, there is the option of education projects in collaboration with UNAM after this project, which may even include other Latin-American countries.

JICA experts are kindly requested to supervise the project, from its design until its realization and follow-up. Guidance, as well as the possible participation of JICA experts as instructors in the modeling course, are desirable and would be highly appreciated.

*Selection of instructors and participants*

The instructors of the training will be selected by CENICA in agreement with UNAM and JICA. The number of participants is thought to be between 10 and 15, mainly middle level staff from local, state and federal governments, including DGCENICA, DGICURG-INE, DGGCA y RETC-SEMARNAT, and staff from two to three model cities. The purpose of including representatives from several governments and geographical regions is to assure an efficient transfer of knowledge during and after the project, and to promote the use of models also in decentralized entities. Further criteria for participants include: theoretical base in sciences and computing, and the principal agreement of the participant's employer (federal and local governments). Regarding the latter, INE will provide administrative support.

*Course design*

The training in the use of air quality models, to be imparted to government staff, shall include the necessary theoretical background on meteorology and the strengths and limitations of air quality models, as well as practical exercises with models, using real data from Mexico City and the model cities. The range of models presented shall be from simple screening models up to complex models, in order to provide the participants with the ability to run models themselves and to understand in which way complex models can solve a problem.

The course is proposed to be imparted in five modules, which cover the topics: Basic meteorology, Gaussian models, transport models, emission models and receptor models, photochemical models. The design in modules enables the participants to select the contents according to their necessities. In the case of participants from the federal institutions, the attendance of all modules is desirable.

During the course, the models shall be used with real data from the model cities as case studies, in order to answer first questions of air quality management in those cities during the course. Measurements in the model cities (see Section 2.3) will increase the quality of the model outputs. In particular, the field campaign in Mexico City, which will be carried out in February/March 2006 by the US-Department of Energy, the US

National Center for Atmospheric Research, and the Molina Center, will be a good opportunity to obtain new input data for modeling and open up a collaboration between modelers from the US and Mexico (see http://mirage-mex.acd.ucar.edu/).

At the end of every course module a workshop is proposed with the purpose of summarizing the aspects learnt as well as the results obtained with real data during the exercises. Decision makers (the participants' superiors and others) should be invited to these workshops in order to get them involved and start to institutionalize the collaboration between experts and government. Workshop minutes should give answers to the following questions:

- What kind of information is needed for atmospheric modeling?
- What kind of measurements can be done in the future to provide model input data?
- What are the predictive capacities of the different models?
- Which policy questions can be resolved by modeling in the model cities?
- Which applications can be carried out in an everyday manner?
- Which model shall be used as common tool for the governments?

The proposed contents, methods, schedule and products of the training are given in Table 2.2. It is emphasized, that the exact contents of the course modules will be agreed on at a final revision stage with the course instructors, and that any suggestions by JICA experts are welcome to improve the course design. In particular it will be necessary to revise the title, content, products, dates, duration, etc. of the course

**Table 2.2** *Modules of the training in air quality modeling*

| | | **Topics** | **Products or results by the end of each module** |
|---|---|---|---|
| **Module 1a: Introduction II/2006** | Theory | ◦ What is numerical modeling of the atmosphere?<br>◦ Time and spatial scales<br>◦ Gaussian Models<br>◦ Prognostic Models<br>◦ Needs for information on atmospheric conditions for decision making.<br>◦ Application of models to urban and industrial sites.<br>◦ Potential use of air quality models in Mexico City and other urban centers of Mexico | ◦ Executive summary for decision makers: General information on the applicability of models in Mexico; special needs for input data for the model cities; needs during the capacity building process.<br>◦ Lecture material for further use in decentralized training by participants<br>◦ Web page which will be updated with examples on the use of model information<br>◦ Minutes of Workshop |
| | Workshop | | |
| **Module 1b: Meteorology II/2006** | Theory | • Basic Meteorology (see Annex 4.3.1)<br>• Meteorology of Mexico City<br>• Numerical weather prediction in Mexico: the initial value problem; data assimilation, use of numerical models in an operational manner<br>• Limitations, uncertainties, needs, and predictive capacities of meteorological models, measurement of input data.<br>• Impact of meteorology on Mexico City air pollution | • Executive summary for decision makers: Information on the applicability of meteorological models in Mexico, data needs, meteorological patterns of the model cities, and specific policy questions in the model cities that could be resolved by means of model information.<br>• Lecture material for further use in decentralized training by participants<br>• Web page which will be updated with exemplary model results on real data<br>• Minutes of Workshop |
| | Practical Exercise | • Fields work with surface and upper air meteorological observations: tethered balloon measurements, radiation, etc.<br>• Lab of numerical prediction analysis using outputs of different atmospheric models (global, regional and mesoscale)<br>• Use of simple diagnostic models to determine characteristics of the atmospheric in urban regions (vertical and horizontal structures) | |
| | Workshop | | |

| | | | |
|---|---|---|---|
| **Module 2: Gaussian Models III/2006** | Theory | ‣ Principles of operation of Gaussian models<br>‣ Available Gaussian models<br>‣ Implementation of a Gaussian model<br>‣ Use of a Gaussian model<br>‣ Limitations of Gaussian models | ‣ Executive summary for decision makers: Information on the applicability of Gaussian models in Mexico<br>‣ Lecture material for further use in decentralized training by participants<br>‣ Web page which will be updated with exemplary model results on real data<br>‣ Minutes of Workshop |
| | Practical Exercise | ‣ Running a Gaussian model | |
| | Workshop | | |
| **Module 3: Transport Models I/2007** | Theory | • Meteorology and air pollution using computational models<br>• Simple and complex models for pollutant transport and diffusion<br>• Limitations and needs of transport and diffusion models<br>• Interpretation of model output to diagnose and predict transport and diffusion of pollutants<br>• Experience in the Valley of Mexico and other main Mexican Cities.<br>• MM5, MCCM | • Executive summary for decision makers: Information on the applicability of prognostic models in Mexico<br>• Analysis on specific policy questions in the model cities that could be resolved through model analysis<br>• Lecture material for further use in decentralized training by participants<br>• Web page which will be updated with exemplary model results on real data<br>• Minutes of Workshop |
| | Practical Exercise | • Air quality diagnostic and prognostic real time exercise<br>• Using MM5<br>• Using MCCM | |
| | Workshop | • What are the predictive capacities of the different models? What is meant by uncertainty in model forecasts?<br>• Operational diagnoses and forecasts based on numerical models.<br>• Interpretation of model output for government decisions on air quality | |
| **Module 4a: Emission Models II/2007** | Theory | ‣ Mobil<br>‣ International Emission Model (IVE)<br>‣ Car simulators<br>‣ Limitations<br>‣ Experience in Mexico using emissions models | ‣ Executive summary for decision makers: Information on the applicability of emission models in Mexico and emission patterns in the model cities.<br>‣ Lecture material for further use in decentralized training by participants<br>‣ Web page which will be updated with exemplary model results on real data<br>‣ Minutes of Workshop |
| | Practical Exercise | ‣ Experimentation in a Dynamometer<br>‣ Obtaining emissions in the field<br>‣ Running IVE | |
| | Workshop | | |
| **Module 4b: Receptor Models II/2007** | Theory | • Impact of emission sources on Mexico City air pollution<br>• Source profiles measured in Mexico and in other countries<br>• Experience with source apportionment in Mexico<br>• CMB<br>• PCA | • Executive summary for decision makers: Applicability, data needs and limitations of receptor models in Mexico.<br>• Lecture material for further use in decentralized training by participants<br>• Web page which will be updated with exemplary model results on real data<br>• Minutes of Workshop<br>• |
| | Practical Exercise | • Using CMB<br>• Using PCA | |
| | Workshop | | |

| | | | |
|---|---|---|---|
| **Module 5: Photochemical Models III/2007** | Theory | ‣ Theory: Impact of photochemistry on air pollution modeling, NOX, HC and ozone<br>‣ Photochemical models and importance of photochemistry<br>‣ Aerosols<br>‣ Impact of photochemistry on Mexico City air pollution<br>‣ Range of photochemical models used in Mexico and elsewhere<br>‣ What applications can be conducted with an operational photochemical model?<br>‣ What are the predictive capacities of various photochemical models?<br>‣ Is there a common photochemical model for operational purposes within the local governments?<br>‣ Limitations and needs of photochemical models | ‣ Executive summary for decision makers: Applicability, needs and limitations of photochemical models in Mexico and ozone concentration pattern in the model cities<br>‣ Knowledge on specific policy questions in the model cities that could be resolved by model application<br>‣ Lecture material for further use in decentralized training by participants<br>‣ Web page which will be updated with exemplary model results on real data<br>‣ Minutes of Workshop |
| | Practical Exercise | ‣ Air quality diagnostic and prognostic real time exercise | |
| | Workshop | | |
| **Symposium I/2008** | Symposium (1-2 days) | • Summary on training with big audience<br>• Which are the models that will be applied, adapted and improved in the future?<br>• What are the governments´ self-commitments with respect to the use of models and the application of model-derived policy measures?<br>• Which model shall be used as common tool for the governments? | • Minutes on Symposium, including knowledge what kinds of information and measurements are needed in the next future to provide model input data<br>• Knowledge on specific policy questions in the model cities that could be resolved by model application<br>• Conference papers in international journals |

There is a wide range of possible model applications, and it won't be possible to test all of them during the training. However, some of the applications that may be included in the training are:

- Diffusion field analysis including meteorological and climate data from the participating model cities
- Air pollutant concentrations are determined by means of photochemical and dispersion models and are compared with the monitoring data
- The dynamics of the atmosphere and air pollutants are studied on data generated at CENICA.
- Trace the air pollutants that result from various sources in Mexico, as well as trans-boundary contributions.
- Predict the response of particulate matter and gaseous air pollutants levels after changes in emissions and upwind concentrations.
- Apportion receptor concentration to the potential sources and precursor concentrations, dividing local emissions and long-range transport.

Further specific objectives that might be covered in the future are:

- Population exposure to air pollutants is assessed in the model cities.
- Correlate pollutant concentrations at specific geographic areas with human health problems, agricultural yields and natural ecosystems in Mexico.
- Analyze the transport of anthropogenic pollution and pollution produced by natural processes such as dust storms or forest fires.
- Identify "hotspots" within Mexico with respect to air pollutants, impact on human health, impact on natural ecosystems and economic development.
- Propose air pollution mitigation strategies for policy makers.

### 2.3 Additional Measurements

An important aspect of imparting a training to government staff is to understand the needs of models for further specific measurements. Such measurements can be efficiently carried out with the help of expertise of CENICA staff and experts from JICA.

At this moment, only general needs are known. For example, vertical wind profiles are essential to feed dispersion models. Modelers have expressed their need for additional instrumentation, for example RADAR profilers. There exist also very cost-effective tethered balloon sounding systems, developed by researchers from UNAM, the use of which would provide an additional benefit to the training in air quality modeling. In general, the development of instrumentation in Mexico, which is of lower cost than imported technology, is strongly needed, and could be part of a subproject of the training in air quality modeling. A detailed justification for the acquisition of this type of equipment is given in annex 4.1.2.

### 2.4 Formalize Expert-Government Interaction

Finalizing the training of government staff in the application of air quality models, a group will have formed, consisting of modeling experts and specially trained government staff. This group will be able to support the decision making process: Simple modeling problems can be solved by government staff, and specific problems can be treated by the experts under the supervision of government staff. Thus, a direct link will have been established between the modeling experts and governments, and real world problems can be solved efficiently with expertise from universities and research institutions.

### 2.5 Evaluation of Project Success

The success of the project can be determined from the following indicators:

- Number of experts involved in the modeling advisory board
- Number of model types applied by the participants at the end of the training
- Common products of the modeling advisory board (articles, recommendations), executive summaries and reports prepared by the participants of the training.)
- Number of CENICA staff trained in the use of air quality models
- Improved model capacity for prediction

The means of verifying these indicators are:

- Reports of the modeling advisory group to local and federal government
- Trainings given by CENICA staff on air pollution modeling
- Test for prediction capacity of the models

## 3 Expected Results

During the project, expert knowledge on air quality modeling will be gathered, which will be transferred to decision makers, and an institutional modeling advisory board will be created lead by CENICA. In this chapter, the project results are described in terms of expected products, the overall impact of the project, and the possible obstacles which could lead to a partial or total failure of the project.

### 3.1 Expected Products for March 2008

By 2008, the following products are expected, resulting from the activities realized during the project and described in the previous sections:

- There is staff with experience in air quality models present in the federal and at least in two local governments, and at least two staffs from CENICA can lecture on the use of meteorological, transport, diffusion and photochemical models.
- At least one scientist from INE and two more from local governments can lecture on air simulation models as a support tool in air quality management, and use screening models for the evaluation of policies.
- A group of experts on air quality models is conformed that interacts in an institutionalized manner with government staff. A program for its future work is established.

### 3.2 Project Impact

The application of models in air quality management helps to understand cause-effect relationships between certain political measures and the resulting changes in air quality. Therefore, decisions taken on the base of modeling results can lead to a considerable impact on air quality, and on the health of human beings and ecosystems. From a set of possible interventions, the most efficient and effective option can be chosen with the help of models.

In the case of air pollution in Mexico City, for example, there is much uncertainty on the right strategy to mitigate the ozone problem. Different sources of volatile organic compounds and nitrogen oxides contribute to strong ozone formation. However, it is not known at the moment, the reduction of which would be most efficient way to bring down ozone levels, speaking in terms of cost-benefit. As well, it is not well understood how transport of particles may affect different regions of the metropolitan area. Knowing about these processes by means of air quality models, decisions could be taken that protect a major part of the population from the health effects of air pollution.

Further examples of cities, where air quality modeling could show possible actions to mitigate the impact of industries on the population, are Salamanca, Monterrey, and Guadalajara. Finally, models can help to determine the impact of hotspots on the region surrounding them. This refers both to existing and planned point sources, such as the power plant at Tuxpan, which is one of Mexico's largest power plants.

### 3.3 Expected Obstacles

The project success depends on several internal and external factors. Internal factors, like good communication, adequate course preparation, etc. can be controlled by the project leaders, whereas external factors can't. In the best case, efforts can be done to prevent external factors from disturbing the process. Possible external factors that could lead to the failure of the project are:

During the project:
- There is no interest from local governments to build capacity in modeling
- Students are withdrawn from the program and do not finish the training course.
- The knowledge and capacity acquired is not used for policy making.
- Mexican modeling experts have no sufficient time to impart the training

During the project's follow-up:

- Governments are not sufficiently committed to make use of models after the training.
- Mexican modeling experts are not willing to collaborate in an inter-institutional advisory board, due to lack of time or interest.
- There are no resources to provide sufficient input data for the model.

These success-inhibiting obstacles can be avoided by good communication and written declarations of commitment signed by all participating members.

# 4 Annex

## 4.1 Proposed Budget

The following budget has been sent previously to JICA (April 12, 2005) and contains the estimated costs of the project per item and per year. Not considered in the basic budget (Section 4.1.1) the acquisition of monitoring equipment of more the 20,000 Mexican Pesos, according to a solicitude of Dr. Sato. However, recommendations are given in Section 4.1.2 to incorporate a radar profiler and a second tethered balloon into the budget. All prices are in Mexican Pesos.

### 4.1.1 Basic budget

**2005: subtotal = $38,000**

*Japanese Expert and INE design training in models*

| | |
|---|---|
| Rent of room: Workshop with Japanese and Mexican experts in SEMARNAT building, 1 day | 5000<br>JICA |

Comments:
- One week with Japanese experts and UNAM researchers in CENICA building without additional costs.
- Japanese transportation and accommodation costs in Mexico shall not be considered in this budget.

*Formation of a modeling group*

| | |
|---|---|
| Transport: Three model cities will be visited by two staffs from CENICA during one day each in order to guarantee commitment of the model cities in modeling course and provide continuity by personal interaction. | 3*2*4000 = 24,000<br>CENICA |
| Expenses: see above | 3*2*1500 = 9000<br>CENICA |

**2006: subtotal = $1,021,800**

*Japanese Expert and INE design training in models*

Comment
- Participation of Japanese experts in Workshops meet objective of control and guidance and does not require additional money if experts are present in Mexico.

*Training in modeling*

| | |
|---|---|
| Transport: Additionally to the local participants of Mexico City, from each model city there will be invited 2 staffs to come to Mexico City. Their stay is planned during 10 days that lasts each of the two course modules in 2006 (including the workshop) | 6*2*4,000 = 48,000<br>JICA |
| Expenses: see above | 6*2*12*1,500 = 216,000<br>JICA |
| Consulting: Course for 15 participants, two modules, 20,000 and 65 hours per module. | 15*2*20,000 = 600,000 |

| | |
|---|---|
| | JICA |
| Rent of room: Computer room for practice, 22,000 Pesos per month (2*2 weeks) | 22,000<br>JICA |

*Diffusion field analysis with complementary studies*

This section describes the measurements in field, theoretical analysis is done within modeling course.

| | |
|---|---|
| Transport: One 30 day campaign in Mexico City, one 10-day campaign in one model city, one CENICA staff and two technicians each for meteorology. Considered here is only public transportation for three persons, since equipment can be transported together with VOC, PM2.5 project. | 1*1,600 = 1,600<br>CENICA<br>2*1,600 = 3,200<br>JICA |
| Expenses: see above, only for model city, 10 days | 1500*10 = 15,000<br>CENICA<br>1500*2*10 = 30,000<br>JICA |
| Consulting: two technicians for 8 weeks in total (5 weeks Mexico City, 3 weeks model city), 6000 per month and person | 2*2*6000=24,000<br>JICA |
| Materials:<br>• Kytoon 10,000 per campaign for gases, 1000 reactives, 1000 replacement parts.<br>• Pilot balloon: 25,000 for 150 balloons (only model city), 5000 for gases | 2*10,000 + 1000 + 1000 + 25,000 + 5000 = 52,000<br>JICA |

*Present Results to policy makers*

| | |
|---|---|
| Rent of room: Two workshops on results of case studies treated during modeling course. | 2*5000 = 10,000<br>JICA |

**2007: subtotal = $1,543,600**

*Japanese Expert and INE design training in models*

Participation of Japanese experts in Workshops meet objective of control and guidance and does not require additional money if experts are present in Mexico.

*Training in modeling*

| | |
|---|---|
| Transport: Additionally to the local participants of Mexico City, from each model city there will be invited 2 staffs to come to Mexico City. Their stay is planned during 10 days that lasts each of the three course modules in 2007 (including the workshop) | 6*3*4000 = 72,000<br>JICA |
| Expenses: see above | 6*3*12*1500 = 324,000<br>JICA |
| Consulting: Course for 15 participants, three modules, 20,000 and 65 hours per module. | 15*3*20,000 = 900,000<br>JICA |
| Rent of room: Computer room for practice, 22,000 Pesos per month (2*2 weeks) | 22,000*1.5 = 33,000<br>JICA |

*Diffusion field analysis with complementary studies*

This section describes the measurements in field, theoretical analysis is done within modeling course.

| | |
|---|---|
| Transport: One 10-day campaign in each of the two remaining model cities. One CENICA staff and two technicians for meteorology. Considered here is only public transportation for three persons, since equipment can be transported together with VOC, PM2.5 project. | 2*1*1600 = 3200<br>CENICA<br>2*2*1600 = 6400<br>JICA |
| Expenses: see above, for each of the two model cities, 10 days | 2*1500*10 = 30,000<br>CENICA<br>2*1500*2*10 = 60,000<br>JICA |
| Consulting: two technicians for 6 weeks in total, 6000 per month and person | 1.5*2*6000=18,000<br>JICA |

| | |
|---|---|
| Materials:<br>• Kytoon 10,000 per campaign for gases, 1000 reactives, 1000 replacement parts.<br>• Pilot balloon: 25,000 for 150 balloons (for both remaining model cities), 5000 for gases | 2*10,000 + 1000 + 1000 + 2*25,000 + 2*5000 = 82,000<br>JICA |

*Present Results to policy makers*

| | |
|---|---|
| Rent of room: Three workshops on results of case studies treated during modeling course. | 3*5000 = 15,000<br>JICA |

**2008: subtotal = $10,000**

*Present Results to policy makers*

| | |
|---|---|
| Rent of room: Two-day symposium with final results of the complete course and case studies. | 2*5000 = 10,000<br>JICA |

**2005-2008: total = $2,613,400**

### 4.1.2 Recommendations for the acquisition of equipment

| | |
|---|---|
| Equipment: Doppler Radar Profiler, 915mHz, up to 4 km above ground | USD 180,000 - 200,000*<br>JICA |

*Justification*

The Doppler Radar Profiler** is an essential tool for data assimilation and the control of model performance. It is the only instrument that combines the following advantages:

- Determines vertical profiles (horizontal and vertical wind speed, wind direction) up to 4 km above ground and with a range resolution of 60m;
- Permits determination of the mixing height as an important factor for the dilution of air pollutants;
- Provides data on a 24 hour basis, since the system operates unattended;
- Allows mobility between different measurement sites.

Furthermore, the acquisition of the equipment allows CENICA to use it for scientific purposes also after concluding the project on air quality modeling.

* The approximate price for equipment offered by Vaisala, Inc. is about 200,000 USD (exact price offer expected for first week of May). However, information has been released by Scintec, Inc. that shortly a cheaper version of their standard product will be available, which will be between 180,000 and 200,000 USD. The cheaper profiler alternative is the SODAR. This technique, however, is highly limited by the noise present in urban areas, and would not allow to take profiles of more than 1 km above ground level, and therefore not recommended for deploying in this study.
** It has to be emphasized that this equipment is different from the ones deployed by the national meteorological service (SNM). The radars from SNM are used to determine precipitation patters by horizontal screening. This equipment can be used complementarily during specific field campaigns.

| | |
|---|---|
| Balloon for measurements | USD 6,000***<br>JICA |

*Justification*

The tethered balloon is a complementary tool to ground measurements and the radar profiler. The tethered balloon

- Determines vertical profiles of meteorological parameters and air pollutants;
- Permits investigation of transport and chemical processes in the lower layers of the troposphere, as well as the determination of the mixing height;
- Helps to adjust air quality models;
- Mobility between different measurement sites.

Furthermore, the acquisition of the equipment allows CENICA to use it for scientific purposes also after concluding the project on air quality modeling.

* Approximate price for a balloon developed by UNAM researchers in competence to commercial products.

## 4.2 List of Experts from the Center for Atmospheric Science of the UNAM

**Dr. Arón Jazcilevich Diamant**
Departamento de Ciencias Ambientales, Centro de Ciencias de la Atmósfera,
Universidad Nacional Autónoma de México (UNAM)
Circuito Exterior s/n, Ciudad Universitaria
Del. Coyoacán, 04510 México D.F
E-mail: jazcilev@servidor.unam.mx
Tel: 56-22-40-64, 56-22-40-58

| | |
|---|---|
| Investigation: | Numeric methods for fluids, Model MCCM |
| Teaching: | Air quality models, mathematical methods of physics |
| Recent Publications: | (1) A modeling study of air pollution modulation through land-use change in the Valley of Mexico, Atmospheric Environment, 32, 2002<br>(2) A study of air flow patterns affecting pollutant concentrations in the Central Region of Mexico, Atmospheric Environment<br>(3) Simulación Numérica del impacto provocado por la alteración del uso del suelo en el clima termal del Valle de México, Ingeniería Investigación y Tecnología, Vol. III, 2002.<br>(4) Simulated Urban Climate response to historical land use modification in the Basin of Mexico, Climatic Change, 44, 2000. |
| Education: | PhD and Masters in applied mathematics, State University of New York, Stony Brook<br>Masters in Communications and Control, State University of New York, Stony Brook<br>Bachelor in Computer Engineering, UNAM |

**Dr. Agustin Garcia Reynoso**
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**Dr. Dr. Víctor O. Magaña Rueda**
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Modelo: MM5

**Dra. Luz Mireya Moya Núñez**
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Universidad Nacional Autónoma de México
Tels: 56-22-40-53, Fax: 56-22-42-48
E-mail: lmoya@atmosfera.unam.mx

| | |
|---|---|
| Investigation: | Modeling of atmospheric aerosols with SELQUID, Atmospheric Pollution, Thermodynamics of aerosols, physical and chemical properties of urban aerosols |
| Teaching: | Tutor in post-graduate program of Chemical Sciences, UNAM |
| Recent Publications: | (1) Moya, M., Ansari, A. and Pandis, S.N. (2001) Partitioning of nitrate and ammonium between the gas and particulate phases during the 1997 IMADA AVER study in México City. Atmospheric Environment, 35, 1791-1804.<br>(2) Moya, M., Pandis, S.N. and Jacobson, M.Z. (2002) Is the size distribution of urban aerosols determined by thermodynamic equilibrium? An application to Southern California. Atmospheric Environment,36, 2349-2365. |
| Education: | PhD in Chemical Sciences, UNAM<br>Masters in Environmental Sciences, Universitat Politecnica de Catalunya<br>Bachelor in Chemical Engineering, UNAM |

## 4.3 Some fundaments on modeling

### 4.3.1 Topics of Basic Meteorology

- Vertical structure of the atmosphere; Analysis of various scales of motion. Synoptic and Mesoscale meteorology basis.
- Meteorological observations (surfacestations, soundings, wind profiles, radar, satellite and others instruments. Practice session.
- Meteorological analysis (variables, coordinate systems, graphical and numerical analysis, isotacs, streamlines, trajectories.
- Atmospheric kinematics; geostrophic wind, curvature and wind shear, vorticity and divergence, vertical velocity evaluation.
- Atmospheric vertical analysis; atmospheric stability, moist air thermodynamics, *Skew T-Log p* diagram; stability indexes; mixing layer height, thermal wind.
- Air Masses and weather; air masses classification; large scale weather patterns (surface and upper air); mesoscale analysis; boundary layer flow.
- Cyclones, anticyclones and atmospheric fronts. Convective systems; mesoscale convective systems.
- Winds and horizontal transport; Ventilation and dispersion.
- Air pollution and urban heat island; latent and sensible heat fluxes; solar radiation effects
- Climate and climate change: regional an local impacts: greenhouse gases, emissions and radiative effects; anthropogenic and natural climate change. Impacts on various scales.

### 4.3.2 Model Types

Model can be divided in: (1) Gaussian models, which estimate1 the impact of non-reactive pollutants from specified points and line sources in simple terrain, (2) Numerical models, which consider complex terrain and flow, multiple sources emitting reactive pollutants, (3) statistical models, which are applied when there is a incomplete understanding of physical and chemical processes or a lack of required data, (4) physical models, which consist of wind tunnels, convection tanks, or other physical device that equals reality. In this document only the first three model types are treated. Further, every model can be categorized into classes of applicability for regulation. According to US-EPA, the classes are: (1) screening model, (2) preferred refined model (3) alternative refined model. In the following, model types are described in terms of the effects and processes that they describe.

*Transport and Diffusion Models*

1. Gradient Transport Theories
    a. Eulerian
    b. Mass Conservation and Diffusion Equations
    c. Molecular and Turbulent Diffusion
    d. Fickian Diffusion Theory
2. Statistical Theories of Diffusion
    a. Lagrangian
    b. Statistical Theory of Absolute Diffusion
    c. Plume Diffusion from Continuous Sources
    d. Statistical Theory of Relative Diffusion
    e. Puff Diffusion
3. Gaussian Diffusion Models
4. Numerical Dispersion Models
5. Urban and Regional Air Quality Models

*Chemical-Transport Models*

1. Introduction: Eulerian Model, Lagrangian Model
2. Current Status of PM/VOC's/other pollutants Chemical –Transport Models:
    a. Emissions
    b. Meteorology and Topography
    c. Transport and Diffusion Processes
    d. Chemical Transformations
    e. Representation of Pollutants
    f. Depositions Processes
    g. Computational Aspects
3. Applications of Chemical-Transport Models:
    a. Episodic Simulations
    b. Long-Term Simulations

4. Evaluation Process for Chemical-Transport Models:
    a. Model Simulations versus Ambient Measurements
    b. Data Needs for models performance Evaluation
    c. Corroboration of Models Results with Indicator-Species Methods

*Receptor Model*

1. Receptor Model Types:
    a. Chemical Mass Balance: The CMB model expresses ambient chemical concentrations as the sum of products of species abundances and source attributions.
    b. Enrichment Factors:
    c. Multiple Linear Regression on Marker Species
    d. Temporal and Spatial Correlation Eigenvectors
    e. Time Series
    f. Neural Networks
    g. Pollutants Evolution and Equilibrium
2. Receptor Model input measurements:
    a. Particle Size, Pollutants Concentrations
    b. Chemical Composition
    c. Temporal and Spatial Variability
    d. Combining Size, Composition, Space and Time
3. Receptor Models and Decision–Making
4. Developing Pollutants Management Strategies

### 4.3.3 Transport and Diffusion Models

*Gaussian Plume Models*

Application:
Plume Models: Asessing Impacts of existing and proposed sources of air pollution on local an durban air quality, particularely for regulatory applications.
Ground level concentration: Pal Arya (1999), p. 198, eq. 9.3
Ground level concentration at centerline: Pal Arya (1999), p. 198, eq. 9.7)

Limitations:
- Idealized uniform flows (steady state) with homogeneous turbulence; no wind sheers, constant meteorological conditions.
- Wind speed larger than standard deviations of turbulent velocity fluctuations (upstream diffusion can be negelected).
- Continuous emission at constant rate for a time equal to or greater than the time of travel from source to receptor.
- Mass conservation in the plume

Input Data and required measurements:
Simple models work with a limited set of meteorological data, as they are obtained by standard meteorological surface monitoring stations. More complex models with more detailed information on turbulence and stability parameters (vertical profiles of temperature and wind velocity (see p. 209) via balloon soundings, data of a meteorological tower, turbulence and mixing height measurements) will improve the prediction.

Effective emission height and emission factor:
- Emission factor Q
- Effective stack height H
    - Formulae including stack gas velocity, internal stack diameter, stack gas temperature, ambient temperature, physical stack height, mean wind speed (Godish 1997, p. 232)

Surface stress and heat flux:
- Mean wind speed at one level $z_r$ in surface layer
- Mean temperature difference between two levels $z_1$ and $z_2$ in surface layer
- Surface roughness parameter $z_0$

  → $u^*$ and $\theta^*$ from equation 4.45

OR
- Mean wind speed between two levels $z_1$ and $z_2$ in surface layer
- Mean temperature difference between two levels $z_1$ and $z_2$ in surface layer

  → $u^*$ and $\theta^*$ from equation 4.48

Latent heat flux (if significant):
- Estimation of latent heat flux, OR
- Estimation of evaporation rate, OR
- Estimation of Bowen ratio (equation 4.51), OR
- Temperature in convective mixed layer above surface layer

Mixing height as a function of time:
- Remote sensing (SODAR, LIDAR). OR
- Estimate mixing height using diagnostic relations (only for steady state near-neutral conditions) OR
- Estimate mixing height using prognostic relations (with vertical wind speed and entrainment velocity)

Wind speed as a function of time:
- Mean wind speed and direction at release height, OR
- Wind speed profile, using $u_r$ (10 meter) and Obukhov-length L, OR
- Wind speed profile, using vertical soundings
- Wind speed profile, using SODAR or LIDAR

Stability:
- Stability-Turbulence index (see box below), OR
- Vertical profiles / characteristic length scales / eddie diffusivities as a function of time

Turbulence:
- Stability-Turbulence index (same as in Stability), OR
- Calculated in function of stability, OR
- Turbulence measurements

Overview on the parametrization of dispersion parameters $\sigma_x$ and $\sigma_y$ (lateral and vertical plume spreads):

- Estimated indirectly from ground measurements and p. 198, eq. 7
- Estimated from plume spread $\theta_p$ and $z_p$, using equations 9.14 and 9.15
- Estimated from Pasquill-Gifford scheme (p. 102, table 4.2; p. 203, fig. 9.1) for short range dispersion over flat terrain with $z_0$ = 0.03 to 0.3 m.
    - Wind speed at 10m, cloud cover, strength of solar insolation
    - Estimated from BNL scheme (p. 204, table 9.1) for elevated non-buouyant release above the surface layer.
        - Horizontal plume spread $\theta_p$
    - Estimated from TVA scheme (p. 204, fig. 9.2) for highly elevated and very buouyant release above the surface layer.
        - Potential temperature gradient $\delta\theta/\delta z$ at plume height
    - Estimated from urban dispersion schemes, including effects of wakes, heat islands (p. 205, fig. 9.4).
        - Wind speed at 10m, cloud cover, strength of solar insolation
    - Estimated with Briggs interpolation formulas for open country (p. 206, table 9.3) and urban areas (p. 207, table 9.4), for distances up to 10km (20-30 km)
        - Wind speed at 10m, cloud cover, strength of solar insolation
    - Estimated with statistical theory p. 208 eq. 9.18 and p. 209 eq. 9.22
        - $\sigma_\theta$ (lateral wind direction fluctuation) or W/u for unstable conditions; PBL-height, Obukhov length, $\sigma_\Phi$ (vertical wind direction fluctuation)....