Chapter 7

Chapter 7 Recommendations for Framework of Nationwide Monitoring System

7.1 Framework of Nationwide Monitoring System

Based on the results obtained through the Study on the selection of the model city (Chapter 3), it is easily judged that the considerable air pollution is existing in the major cities of the Country, and furthermore, air emission in winter caused by heating facilities, stationary sources using low quality fuel and mobile sources are the major causes of air pollution.
With regard to the existing monitoring system, it is noticed that the equipment installed at those cities are not responsive in emergency case.
To solve this problem, it is recommended that the nationwide monitoring system shall be established using latest system.
The basic aims of setting framework of monitoring system on environmental administration are defined as follows:

- To understand the level of air pollution and judge whether environmental standards are cleared or not.
- To take countermeasures in emergency case
- To satisfy the requirement of EU Directives

The framework of system is summarized as follows.

- Setting up of additional ten Air Quality Monitoring (AQM) stations
- Installation of five Continuous Emission Monitoring (CEM) stations
- Introduction of one mobile monitoring system
- Establishment of Air Pollution Monitoring Center (APMC) including data bank system
- Introduction of auto-exhaust gas inspection system
- Improvement in analytical instruments of the Institute of Environment "Zelezara" (IEZ) (first phase and second phase)

The introduced equipment and instruments in the model city on the course of the Study are listed again as follows.
- Four sets of AQM stations and its central station and one set of street display
- One mobile monitoring system for emission and ambient air monitoring
- One set of AAS, XRF and NMHC sampler and analyzer

7.2 Selection of Municipality for Nationwide Air Pollution Monitoring

(1) AQM System

In order to select the municipalities for the establishment of nationwide AQM system, it is reasonable to investigate the level of damage to human health by the municipality based on the existing materials first and then to give priority to the serious air-polluted industrial or major municipalities for its selection.

According to the National Environmental Action Plan (NEAP) report, air pollution is a problem in 18 municipalities of the whole country and these municipalities are classified into three pollution levels.

The municipalities are listed by the pollution level, as follows:

- Critical pollution level
  - Three municipalities: Skopje, Veles and Bitola
- Significant pollution level
  - Five municipalities: Tetovo, Kichevo, Kumanovo, Ohrid and Prilep
- Unsatisfactory pollution level
  - Ten municipalities: Berovo, Gevgelija, Gostivar, Kavadarci, Kochani, Kriva Palanka, Negotino, Resen, Strumica and Shtip

Based on the pollution level mentioned above, it is planned by the MOE to set up 30 AQM stations in total over 18 municipalities besides the present four stations in Skopje set up in the course of the Study.

Although the plan is financially supported, it is nevertheless expected to be difficult to maintain and operate all 34 stations in total including the present four stations in Skopje because it costs a large amount. Taking into consideration the financial situation, 34 stations seem to be too many and it is necessary to reconsider the plan.

It is therefore reasonable to give priority to industrial and major cities classified as "significant or critical pollution level" in NEAP and establish the nationwide monitoring system.

However, two monitoring stations have already been set up in Veles and those two stations are thought to be sufficient. On the other hand, there is the largest coal-fired thermal power plant in Bitola having a considerable impact on the surroundings. Only one monitoring station is insufficient and another monitoring station should be set up accordingly.

In addition, there is a conventional type of monitoring station in Lazaropole. This station is located in the background concentration place and one of the stations of international monitoring network. It has been desired for long time that automatic continuous monitoring system be introduced because of its importance as an international network.

It is therefore recommended to set up one AQM station for each in six municipalities of

Tetovo, Kichevo, Kumanovo, Ohrid, Prilep and Lazaropole, and two stations for each in Skopje and Bitola. Then the total number of additional AQM stations nationwide will be ten.

The reason why Kavadarci is excluded from the nationwide AQM system mentioned above is that it is located in non-residential area although the Ferro-nickel smelter in Kavadarci is the major emission source of air pollution in the area. It is recommended that Kavadarci be covered with the mobile monitoring car for AQM.

(2) CEM System

It is recommended that the smelter in Veles and the coal-fired thermal power station in Bitola be monitored continuously because the air pollution caused by emission from those stations has already been observed and has considerable impact on the surroundings.

In addition to two stations mentioned above, it is also recommended that three stations in the model city be monitored as described in Section 6.2.3 (p.6-10). Then the total number of CEM stations will be five.

(3) Mobile Monitoring System

It is recommended that in addition to the introduced mobile monitoring system by the Study, another mobile system equipped with the dilution method which is able to monitor both ambient air quality and emission be introduced for the monitoring of other ten municipalities classified as "unsatisfactory pollution level" in NEAP besides the eight municipalities including Skopje. And for the monitoring of large-scale stationary emission sources nationwide taking into consideration the cost effectiveness. The mobile monitoring car will be based on the IEZ of the MOE in Skopje and municipalities and emission sources if required.

7.3 Implementation Schedule

Implementation schedule for the nationwide air pollution monitoring system at each stage is the followings.

(1) First Stage (within five years)

1) AQM System

Total number of nationwide AQM stations will be ten. The detailed plan for the list of equipment and materials was described in Section 6.2.2 (p.6-7).

- Additional station in the model city:	2 stations
- Additional station for nationwide monitoring:	8 stations
Total	10 stations

2) CEM System

Total number of CEM system will be five. The detailed plan for the list of equipment and materials was described in Section 6.2.3 (p.6-10).

- Model city	2 heating plants:	2 stations
	1 cement plant:	1 station
- Veles	1 smelter plant:	1 station
- Bitola	1 coal-fired power plant:	1 station
	Total	5 stations

3) Mobile Monitoring System

One set of mobile monitoring car will be introduced. The detailed plan for the list of equipment and materials for mobile monitoring system was described in Section 6.2.4 (p.6-11).

4) Auto-exhaust Gas Inspection System

One set of auto-exhaust gas inspection system will be introduced. The detailed plan for the list of equipment and materials for auto-exhaust gas inspection system was described in Section 6.2.5 (p.6-12).

5) Software for Data Acquisition and Processing for Air Pollution Monitoring Center (APMC)

One set of software for data acquisition and processing for APMC to be established will be introduced. The detailed plan for the list of equipment and materials for data acquisition and processing for APMC was described in Section 6.2.6 (p.6-14).

6) Improvement in Analytical Instruments for Institute of Environment "Zelezara"(IEZ) (First Phase)

One set of analytical instruments for the IEZ (first phase) will be introduced. The detailed plan for the list of equipment and materials for improvement in analytical instruments for the IEZ was described in Section 6.2.8 (p.6-22).

(2) Second Stage (within ten years)

1) Improvement in Analytical Instruments for the IEZ (Second Phase)

One set of analytical instruments for the IEZ (second phase) to be improved will be introduced. The detailed plan for the list of equipment and materials for improvement in analytical instrument for the IEZ was described in Section 6.2.8 (p.6-22).

2) AQM System

It is expected that air pollution will be mitigated gradually through the fuel conversion into natural gas under planning. It is therefore reasonable to expand the monitoring capability step-by-step at the second stage, based on the results of pollution level to be obtained through AQM for eight municipalities and through the mobile monitoring for ten municipalities, and the monitoring capability at that moment.

7.4 Organization and Institution, Management Planning

The APMC will be the central organization for the management of nationwide monitoring activities as well as in the model city. Section 6.3.2 (p.6-27) described the maintenance and management planning on the monitoring stations, and the outline of the APMC including the works, organization, personnel and its development. The same organization of the APMC in model city is possible to manage the nationwide system.

7.5 Estimation for Project Expenses

7.5.1 Cost Estimation for Equipment and Materials

(1) Cost Estimation for AQM System

In addition to the present six AQM stations in Skopje and Veles, it is recommended that ten more stations be newly set up for the nationwide AQM system. The estimated cost is as follows and the details are shown in Table 7.1.

- Equipment and materials:	US$	2,041,800
- Consumables:	US$	41,900
- Spare parts:	US$	25,400
Total	US$	2,109,100

Table 7.1 Price List of Each Equipment and Materials for AQM System

Unit: US$

No.	Name of Equipment	Q'ty	Unit Price	Total Price
1	Fluorescent SO_2 Analyzer	10	10,400	104,000
2	Chemiluminescence NOx Analyzer	10	10,800	108,000
3	NDIR CO Analyzer	10	10,000	100,000
4	UV O_3 Analyzer	10	7,600	76,000
5	Suspended Particulate Matter Analyzer	10	18,400	184,000
6	Calibrator	10	18,900	189,000
7	Zero Air Generator	10	4,600	46,000
8	Standard Gas (NO, CO) 10 ℓ	20	3,100	62,000
9	Regulator (NO, CO)	20	2,600	52,000
10	Recorder (12 dot)	10	2,600	26,000
11	Sample Manifold with Heated	10	2,800	28,000
12	Wind Direction & Speed Meter	10	2,300	23,000
13	Thermometer / Hygrometer	10	2,000	20,000
14	Solar Radiation Meter	10	2,700	27,000
15	Net Radiation Meter	10	8,800	88,000
16	Meteorological Data Translator	10	2,400	24,000
17	Data Logger with Telemeter System	10	20,000	200,000
18	Automatic Voltage Stabilizer 8 kVA, single phase	10	5,000	50,000
19	Automatic Delayed Restoration Device from Power Failure	10	3,200	32,000
20	Rack for Analyzer	10	1,900	19,000
21	High Volume Sampler (outdoor)	10	8,800	88,000
22	Shelter with Air Conditioner	10	24,000	240,000
23	UPS (30 minutes Back Up) 5 kVA	10	7,200	72,000
24	Public Information System	1	10,400	10,400
25	Maintenance Car	1	14,400	14,400
26	Installation and Start Up	10	4,800	48,000
27	Training	10	3,500	35,000
28	Transportation and Insurance	10	4,000	40,000
29	Foundation Work for Shelter	10	1,600	16,000
30	Fence Works for Monitoring Stations	10	2,000	20,000
			Total	2,041,800

No.	Consumables for One Year Operation	Q'ty	Unit Price	Total Price
1	Fluorescent SO_2 Analyzer	10	280	2,800
2	Chemiluminescence NOx Analyzer	10	360	3,600
3	NDIR CO Analyzer	10	280	2,800
4	UV O_3 Analyzer	10	270	2,700
5	Suspended Particulate Matter Analyzer	10	240	2,400
6	Calibrator SO_2 PMT	10	460	4,600
7	Zero Air Generator	10	300	3,000
8	Standard Gas (NO, CO) 10 ℓ	20	800	16,000
9	Recorder	10	240	2,400
10	Filter for High Volume Sampler	10	160	1,600
			Total	41,900

No.	Spare Parts for Ten Monitoring Stations	Q'ty	Unit Price	Total Price
1	Fluorescent SO_2 Analyzer	2	1,900	3,800
2	Chemiluminescence NOx Analyzer	2	2,000	4,000
3	NDIR CO Analyzer	2	500	1,000
4	UV O_3 Analyzer	2	300	600
5	Suspended Particulate Matter Analyzer	2	1,600	3,200
6	Calibrator SO_2 PMT	2	1,700	3,400
7	Zero Air Generator	2	600	1,200
8	High Volume Sampler	2	4,100	8,200
			Total	25,400

(2) Cost Estimation for CEM System

It is recommended that five sets of CEM equipment and materials be installed to five stacks of factories in Skopje, Veles and Bitola. The monitoring system comprises of emission monitoring instruments, data logger and telemetric transmission system. The estimated cost for CEM system is as follows and the details are shown in Table 7.2.

- Equipment and materials:	US$	520,500
- Consumables:	US$	28,000
- Spare parts:	US$	12,800
Total	US$	561,300

Table 7.2 Price List of Each Equipment and Materials for CEM System

Unit: US$

No.	Name of Equipment	Q'ty	Unit	Total
1	Multi-Gas Analyzing System (SO_2, NOx, CO, O_2) Outdoor	5	48,000	240,000
2	Opacity Meter	5	16,000	80,000
3	Data Logger with Telemeter System	5	20,000	100,000
4	Standard Gas (SO_2, NO, CO, N_2, O_2) 10 ℓ	25	800	20,000
5	Regulator (SO_2, NO, CO, N_2, O_2)	25	1,300	32,500
6	Installation and Start Up	5	3,600	18,000
7	Training	5	2,400	12,000
8	Transportation and Insurance	5	3,600	18,000
			Total	520,500

No.	Consumables for One Year Operation	Q'ty	Unit	Total
1	Analyzer (SO_2, NO, CO, O_2)	5	1,600	8,000
2	Standard Gas (SO_2, NO, CO, O_2, N_2) 10 ℓ	25	800	20,000
			Total	28,000

No.	Spare Parts for 5 Monitoring Stations	Q'ty	Unit	Total
1	Analyzer	2	6,400	12,800
			Total	12,800

(3) Cost Estimation for Mobile Monitoring System

The estimated cost is as follows and the details were shown in Table 6.12 (p.6-44).

- Equipment and materials:	US$	255,100
- Consumables:	US$	22,430
- Spare parts:	US$	1,200
Total	US$	278,730

(4) Cost Estimation for Auto-exhaust Gas Inspection System

The estimated cost is as follows and the details were shown in Table 6.13 (p.6-45).

- Equipment and materials	US$	78,500
- Consumables:	US$	5,240
- Spare parts:	US$	3,900
Total	US$	87,640

(5) Cost Estimation for APMC

The estimated cost is as follows.

- Equipment and materials:	US$	148,000
- Consumables:	US$	2,500
Total:	US$	150,500

(6) Cost Estimation for Improvement in Analytical Instruments of IEZ

The estimated cost is as follows and the details were shown in Table 6.14 (p.6-46).

- First phase:	US$	536,940
- Second phase:	US$	253,660
Total	US $	790,600

(7) Total Cost Estimation

Total estimated cost for the establishment of nationwide air pollution monitoring system during both first and second stage will be US$ 3,977,870 including the cost for equipment and materials, annual consumables and spare parts. Table 7.3 shows the summery of cost estimation for nationwide air pollution monitoring system.

Table 7.3 Summary of Cost Estimation for Nationwide Air Pollution Monitoring System

Unit: US$

Stage	Item	Cost Estimation			
		Equipment & Materials	Consumables	Spare Parts	Sub-total
1st	AQM	2,041,800	41,900	25,400	2,109,100
1st	CEM	520,500	28,000	12,800	561,300
1st	Mobile monitoring	255,100	22,430	1,200	278,730
1st	Auto-exhaust gas inspection	78,500	5,240	3,900	87,640
1st	Software for data acquisition and processing for APMC	148,000	2,500	-	150,500
1st	Improvement in analytical instruments for IEZ (1st phase)	536,940	-	-	536,940
2nd	Improvement in analytical instruments for IEZ (2nd phase)	253,660	-	-	253,660
1st Stage Total		3,580,840	100,070	43,300	3,724,210
2nd Stage Total		253,660	-	-	253,660
Total		3,834,500	100,070	43,300	3,977,870

(8) Cost Estimation for Renewal

Lifetime of monitoring instruments is 7 to 10 years approximately and the renewal of present monitoring instruments will be at the time of completion of second stage. It is therefore necessary to secure the budget for renewal about US$ 150,300 per AQM station, US$ 227,000 per mobile monitoring car, US$ 65,000 for auto-exhaust gas inspection and US$ 150,000 for APMC.

7.5.2 Annual Cost Estimation for Maintenance and Management

Details of maintenance services, such as trouble shooting, periodical checks and overhaul etc., were described in Section 6.3 (p.6-24). The annual estimated cost for maintenance of nationwide monitoring system through the outsourcing to the local agent is as follows.

- Consumables:	US$	100,070
- Spare Parts:	US$	43,300
- Fee of Service Engineer:	US$	48,000
- Transportation:	US$	48,000
Total	US$	239,370

7.6 Source for Operation and Maintenance (O & M) Cost

(1) Source of O & M Cost

One of the essential conditions for operating the system for many years is sources of O & M cost. The MOE, in this regard, asserts that the Ministry will appropriate major O & M cost for establishment of nation wide monitoring system as well as personnel cost for the budget. And at same time, it is possible to apply the Fund for the Environment and Nature Protection and Promotion (NEPP) to the cost. With regard to the usage of Fund, the MOE obtained approval of environmental related Ministries at the working session (Ref. 2-6). The Fund has begun its activity in 1998. And the US-AID team supports its development, further backing is expected from the EU and its related sources. The bulk of the means, about 90% are coming from automobile insurance deductions so far. It is expected that the Fund in 1998 is amounted to US$ 1,750,000.

It is recommended that the Fund should be allocated of the O & M cost for the nationwide monitoring system.

(2) Further Sources of the Fund

The Law on Environment and Nature Protection and Promotion (1996) will amend to establish a viable founding system for environmental policy by 1999, as one of air emission protection measures.

The founding system consists of the following environmental load sources.

a) Premium for Automobile

Under the present law, 2 to 4 % of automobile insurance at the time of the registration of cars is paid to the Fund. After the amendment of law, however, it is planned that the percentage would be raised by 2 to 20 %. Consider the age of cars in the country, US$ 2,800,000 would be paid to the Fund.

b) Toll Road Fees

Toll fee will be also one of the major sources of the Fund. Based on the traffic data and toll fees, the amount of Fund source is calculated. Assuming that the average fee for toll road is 50 Den per vehicle and the 20 % of toll fee would be allocated to the Fund. Since almost all vehicles are passenger cars and the average traffic of toll roads is about 42,200 per day, US$ 2,770,000 approximately would be paid for the revenue of Fund a year.

c) Environmental Tax

The Law, it is expected to amended articles 30 to 32 by 1999, will be introduced an environmental tax based on polluter pays principle by 2002. According to the principle, the amount of tax will vary depend on the extent to which the polluter, who is responsible for the emission in the factory, has exceeded the permissible limit value. Taking the example of Heating Plant EAST, it would be US$ 18,000 during the heating season for 6 months. Assuming that the tax is proportional to the amount of emission, based on the data of 153 emission sources which were registered at the time of investigation in 1996 at Skopje, the total amount would be US$ 299,100.

(3) Amount of the Fund

The amount of NEPP Fund in 2002 is summarized as follows.

Insurance Fees for Automobile:	US$	2,800,000
Toll Road Fees:	US$	2,770,000
Environmental Tax (Skopje):	US$	299,100
Total	US$	5,869,100

The Fund will be utilized widely for pollution control measures. The O & M cost for nationwide monitoring system account for approximately 4 % of the Fund in the whole Macedonia. According to this percentage, the Fund will be sufficient as a source for O & M cost. What is important is to clarify the rate of allocation of the Fund.

7.7 Cost Estimation on Each Implementation Schedule

Table 7.4 shows cost estimation on each implementation schedule for establishment of monitoring system.

Table 7.4 Cost Estimation on Each Implementation Schedule

Unit : US$

Item \ Stage & Year	First Stage				
	1	2	3	4	5
Initial investment cost					
AQM system	2,109,100	-	-	-	-
CEM system	561,300	-	-	-	-
Mobile monitoring	278,730	-	-	-	-
Auto-exhaust gas inspection	87,640	-	-	-	-
Data acquisition and processing for APMC	150,500	-	-	-	-
Subtotal	3,187,270				
Annual O & M Cost					
Spare parts & consumables	143,370	143,370	143,370	143,370	143,370
Fee of service engineer & transportation (outsourcing case)	96,000	96,000	96,000	96,000	96,000
Subtotal	239,370	239,370	239,370	239,370	239,370
Other investment cost					
Improvement in analytical instrument for IEZ	536,940	-	-	-	-
Total	3,963,580	239,370	239,370	239,370	239,370

Item \ Stage & Year	Second Stage				
	6	7	8	9	10
Initial investment cost					
AQM system	-	450,900	450,900	601,200	601,200
CEM system	-	-	-	-	-
Mobile monitoring	-	-	-	227,000	227,000
Auto-exhaust gas inspection	-	-	-	65,000	-
Data acquisition and processing for APMC	-	-	150,000	-	-
Subtotal		450,900	600,900	893,200	828,200
Annual O & M Cost					
Spare parts & consumables	143,370	143,370	143,370	143,370	143,370
Fee of service engineer & transportation (outsourcing case)	96,000	96,000	96,000	96,000	96,000
Subtotal	239,370	239,370	239,370	239,370	239,370
Other investment cost					
Improvement in analytical instrument for IEZ	253,660	-	-	-	-
Total	493,030	690,270	840,270	1,132,570	1,067,570

7.8 Evaluation for Monitoring System

With the establishment of the monitoring system, prompt comprehension of air pollution concentration will become possible. From the administrative point of view, it will be possible to conduct environmental management efficiently and support the decision of environmental policy aimed at environmental improvement.

Further, the official and prompt announcement of pollution concentration in accordance with public awareness program will be a cause for concern about environmental problem. The environmental improvement will be effective as a result.

Therefore it is desirable that this plan will be carried out step by step with the confirmation of the effect.

Chapter 8

Chapter 8 Technology Transfer

8.1 Technology Transfer on the Study

Technology transfer has been carried out through joint survey with the Counterpart. It has been carried out along with each step of the Study.

(1) Method of Evaluation for Data Accuracy and Examination of the Cause of Error

The Study Team carried out the cross-check of existing samplers by standard SO_2 gas with the Counterpart. Problems of existing samples were extracted and accuracy was evaluated. The Study Team improved existing samplers to obtain data of a high accuracy. Technology transfer of the dynamic calibration method was carried out at the same time.
Besides, accuracy evaluation was carried out through the cross-check as follows. The means of accuracy evaluation was also included in technology transfer.

a) Existing sampler – Simplified sampler
b) Automatic continuous monitoring equipment – Existing sampler

(2) Procedures of Installation and Calibration of Continuous Monitoring Instruments

The Study Team planned and conducted the long-term training for automatic continuous monitoring instruments, since the installation in Skopje was the first time, paying attention to the Operation and Maintenance (O & M) of instruments, procedures of calibration and handling of data.

(3) Selection Method of Locations for Monitoring

The Study Team carried out the technology transfer related to the survey method for the selection of monitoring locations, covering the entire area of Skopje for survey of concentration distribution pattern of SO_2 and NO_2 by the simplified samplers. This method is inexpensive in survey and is possible to make simultaneous survey at many locations.

(4) Method for the Maintenance and Management of Continuous Monitoring Instruments

The Study Team explained the responsibility of monitoring of air pollution, importance of self-consciousness, maintenance and management of monitoring system, its necessary personnel and budget through the joint works with the Macedonian side.

(5) Measuring Method for Flue Gas using Continuous Monitoring Instruments with Dilution Method

The Study Team carried out the technology transfer related to the selection of sampling port, sampling method and other miscellaneous attentions to the sampling and measurement of flue gas, since the continuous measurement with the latest equipment was the first time to the Macedonian side and the careful attention to the measurement of flue gas was required.

(6) Data Confirmation and Format

It has suggested on the judgement of accidental value and its removal and the data format in the future.

8.2 Technology Transfer Seminar

The objective of technology transfer is to support the Macedonian side to enforce proper environmental management in future based on the given know-how and using the equipment fully which was provided during the Study.

(1) Working Period

The working period of the seminar was March 22 and 23, 1999. The training related to air pollution estimation model followed till March 25.

(2) Contents of the Seminar

1) Administration of Air Pollution Control

Administration of air pollution control shows examples collected in Japan.

- Historical background of air pollution
- Framework of air pollution control
- State of air quality
- Regulatory measures for stationary sources

2) Air Pollution Control Management and Sustainable Development

Current global trends show that environmental management and sustainable development are indispensable. A definite explanation about several air pollution control management and

the present arrangement condition of related laws and ordinances in Japan are given in this place.

- Statutory context and trade issues
- Industry's proactive pollution combating efforts
- Delegation of enforcement power and responsibility
  - Instrument for self compliance
  - Settlement of pollution disputes
- Fugitive emission control technology

3) Design, Construction and Maintenance for Air Quality Monitoring System

In the seminar, a method of planning, design and advice of air quality monitoring system were explained. Establishment, adjustment and maintenance of equipment, and a way of data reporting were described. Besides, air quality measuring methods of EU, Japan and USA were explained. The major items are as follows.

- Design, construction and maintenance for air quality monitoring stations
- Selected measuring method for monitoring system of EU, Japan and other countries

4) Definition of Measured Values

In some cases citizens might be confused if the data announced officially without definition of measurement. Taking those into consideration, definition work of measured value and its importance were explained at the seminar.
The main topics of the seminar were collection of measured values, contents of definition work and judging/ processing of abnormal values.

5) Public Awareness Program (Environmental Education Program)

This topic shows what an environmental education should be in school, for citizens, factory managers, workers and leaders in future.

- Environmental education in school
- Retraining for teachers, leaders and scholars
- Enlightenment of citizens
- Environmental education in companies
- Environmental education within Japan and policy measures related to environment study

6) General Description of Environmental Impact Assessment in Japan

It is important for the country, which is going to arrange environmental impact assessment system in future, to know about problems that were pointed out in the past in Japan, the outline of Environmental Impact Assessment Law and future tasks.
The country should cope with environmental assessment from almost similar point of view with Japan and EU participants in principle. However, arranging realistic legal system is most required. Aforementioned were mainly explained in the seminar. Main contents are described as follows.

- Role of environmental impact assessment
- Future directions and environmental impact assessment problems pointed out in the past
- Outline of the newly-established environmental impact assessment law

7) Other Items Related to Air Quality Monitoring

Technology transfer related to air quality monitoring has done on items as follows.

- Methods to measure flue exhaust gas and equipment for them
- Simple measuring method
    - NO-NO_2 simultaneous sampling protocol
    - Introduction of simplified measuring method
- SO_2 measurement by pararosaniline instead of mercury
- Monitoring plan of air pollutants

8) Dispersion and Receptor Modeling in Air Quality Management

What is important in modeling is how to improve the accuracy of many parameters such as various emission sources, meteorological and geographical conditions.
During two days seminar, basic items and advice about modeling were generally explained. For example, the outline and selection of various models of dispersion and receptor, and securing parameters and accuracy needed for models.
Following the seminar, the training mainly aimed at a definite method of modeling took place. Sorts of models used in training are as follows.

- Dispersion modeling
    Long-term modeling: ISC3
    Short-term modeling: CALMET/CALPUFF

- Receptor modeling
  Principal Component Analysis (PCA)
  Chemical Mass Balance (CMB)

Each simulation model of ISC, CALMET/CALPUFF and PCA were prepared for Skopje as the object in this Study.

(3) Conclusion

Though the time was limited, technology transfer seminar and training were solid enough as the last stage of the field survey. Participants were mainly the member of the MOE and the Counterpart institution.

Various knowledge and skills which were gained through this Study along with technology transfer seminar are expected to make the best use of, and improved and widely transmitted to the person concerned in the Macedonian side from now on. It is important to make the most of the facilities that were bestowed for a long time. In order to do so, proper maintenance and management and budget for them are required.

MOE expects of active announcement and free apply of data. MOE also hopes to introduce advanced technology related to air pollution monitoring, and develop it through the country.

MOE declared that they cope with maintenance and management of facilities appropriately. Taking MOE's positive attitude into consideration, maintenance and management of facilities will not be a big problem.

The results of technology transfer seminar and training would be an aid for environmental management that MOE positively promotes. Besides, it is certain that they would furnish with much information about planning AQM for related institutions.

Chapter 9

Chapter 9 Recommendations

(1) European Union Legislation and Program Related to Air Quality

As for the establishment of monitoring system, attention must be paid to the attitude of EU Directives and the establishment of regular reporting system. Attention must be also paid to have an eye on the environmental aspects concerning the official procurement and to open the environmental information of EU to the public.

<Recommendations for Monitoring according to the EU Directive>

a) The EU Directive requires periodic reporting of the monitored results. Therefore, it would be desirable to establish a reporting system using the data processing software introduced in the Study.
b) In terms of improving the monitoring system, attention must be paid to developments in the EU Directive and they must be reflected in Macedonia's environmental policies.
c) Attention must also be paid to place emphasis on environmental aspects in public procurement, which is another part of EU's environmental policy, and to the disclosure of EU environmental information.

(2) Environmental Organization in Macedonia

1) Administration

The monitoring system and its function should be completed for the proper monitoring management in the near future. The more mutual cooperation between relevant organization, companies, are also desired.

2) Law and Regulation

<Emission Standards>

a) Harmful substances were categorized into three or four groups depending on their toxicity. MPC and MPQ levels have been applied uniformly, but MPQ should be re-examined by its source type and scale. Groups should be defined in further detail in consideration of their effects on MPC of the various substances provided in the environmental regulation.
b) Attention must be paid not only to dioxin, but to other nonregulated harmful substances as well.
c) In the emission regulation, the height of emission sources, with a further classification of

whether the facilities are existing or new should be added. For existing facilities, it may be reasonable to regulate these in stages over a specified grace period.

<Standards and Methods Related to Air Quality Monitoring>

The currently-enforced Law on Protection from Air Pollution provides an environmental standard for 13 items. Some figures in these standards differ from EU, WHO or Japanese regulations. The various standards are decided by government in the context of conditions of the particular country. However, when new views are obtained, these must be re-examined and revised.
The following are suggestions of important points for future reference:

a) In terms of evaluation time for the environmental standard, include a one-hour value in addition to the daily average and one-minute values. In terms of Ox, it is suggested to include an eight-hour value as an evaluation time in addition to the one-hour value because problems primarily arise during the day.
b) The CO standard is strict at 1 mg/m^3. It is suggested that this be relaxed to the WHO level which is 10 mg/m^3 (8-hour value) and 30 mg/m^3 (1-hour value).
c) BS is already stipulated as particle matter. Since automatic continuous monitoring instruments for particles smaller than 10 μm (SPM) have been introduced and are expected to become more widely used. SPM should be added in addition to BS.
d) With the addition of new monitoring methods, it is desirable that the standard monitoring methods for environmental standards should be added on existing system.

<Alarm System on Air Pollution>

The alarm system is defined as 3 steps by meteorological conditions, as well as pollutants concentration and their duration period.
The application of the alarm system is summarized as follows:

a) Only 24-hour values have been available until recently and it took several days to obtain results. Currently, however, automatic continuous monitoring is available. It is suggested to improve operations, including a review of the evaluation time.
b) As 1-hour values are accumulated, statistical forecasts of concentrations according to current meteorological conditions will become possible. It will also be meaningful to add new evaluation methods such as using 1-hour value of SPM etc. and improve the operation of the current alarm system.

(3) Socio-economic Analysis

The current economic downturn has had the effect of significantly reducing the economy's impact on the environment. However, air pollution still remains a serious problem. In addition, the economy is expected to grow in future. With no countermeasures in place, it is obvious that environmental pollution will increase. From another perspective, however, some aspects of this can be beneficial for environmental management policies, as economic growth and privatization will have the effect of increasing the government's environmental budget and of promoting tighter regulations.

Environmental monitoring and conservation measures involve considerable costs and have been seen as a "retroactive" investment. However, those measures are indispensable nowadays.

(4) Forecast Future Air Quality

In the Study, material and information related to the emission of air pollutants and environmental conditions for creating a simulation model have been collected and compiled, but these are hardly adequate. In order to improve the accuracy of created simulation model, data and material must be collected and accumulated on an ongoing basis. Needless to say, forecasts will have to be revised as new views are obtained, but these forecasts will be useful in examining the overall direction of air pollution prevention measures.

(5) Effective Use of Obtained Data

Data accumulation and processing of ambient air quality and meteorological data are performed as routine work without any problem. However, data are not adequately utilized or accumulated in accordance with the intended purpose. The installation of the data bank system and the processing system is required from now onward.

Alarm announcement has become possible due to a system at the central station to continuously supervise data from each AQM station. Attention must be paid to the following points to sue the analyzed data effectively.

a) It is necessary to continuously accumulate the analyzed data and to look into the possibility of sending out alarm at the time of high concentration levels.
b) Summarizing processed and analyzed data as annual reports is desirable so that everyone can access to them.
c) Before the public announcement of data, it is necessary to examine the data abnormality.
d) As a result, there is a need to examine the alarm announcement system for emergency cases,

including public holidays.

e) In recommendation to carry out the above measures effectively, it is necessary to make suitable preparations for budget and personnel.

f) In order to raise the public awareness on environmental problems, it is necessary to look into the effective use of mass media for such purposes.

(6) Recommendation for Establishment of Monitoring System in Model City and Nationwide

1) Consideration for Selection of Equipment and Materials

a) Consideration of Temperature for Container
In order to minimize the effect of the temperature variation, it is necessary to strengthen the container insulation.

b) Selection of Wind Vane Anemometer
To enable air pollution analysis, it is appropriate to select an ultra sonic wind vane anemometer which has no driven part and can monitor the breeze accurately.

c) Considerations Concerning Monitoring Range
It is essential that the monitoring equipment has a range sufficiently compatible with large concentration changes.

d) Selection of SPM Meter
It is essential to prepare the specification after a thorough Study of the effect of humidity.

e) Self-diagnosis and Remote Control Function of the Monitoring Equipment
In order to prevent failures before they occur, the monitoring equipment with self-diagnosis and remote control function is desirable.

2) Considerations for Procurement of Equipment and Materials

To ensure effective utilization over a long period, it is necessary before procurement that measures to prevent the manufacturer from simply selling of spare parts and materials and failing to provide after-sales service be incorporated in the specification. In this context, it is desirable to select a reliable bidder who has a technically acceptable method and provide the appropriate after-sales service, without placing too much emphasis on the price only.
Preparation of a clearly understandable specification is the sole means to prevent trouble with the manufacturer during various procurement processes. The specification must be prepared by specifically describing the item, quantity and specification details.

3) Best Location for AQM Station and Equipment

a) In locating AQM station in future, the actual place should be decided after adequate analysis of the location of existing measuring points, data and information.

b) Equipment should be located taking notice of characteristic of measured data. On one hand, equipment which monitor SO_2, NOx, CO and SPM should be located closely with one another because of their strong local limitation. On the other hand, equipment for O_3, temperature and humidity, solar radiation and wind direction and speed can be located distantly.

c) In the area that has unique emission source, sampling equipment is required to comprehend it.

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* Dr. Sergej Miloshevski, grad. eng., Administration for International Scientific and Technical Cooperation-Skopje, Republic of Macedonia

** Liljana Talevska, grad. eng. Republic Institute of Hidrometeorology-Skopje, Republic of Macedonia

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