

(3) Briefing of Draft Basic Design Report

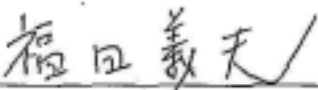
MINUTES OF DISCUSSIONS  
ON THE BASIC DESIGN STUDY  
ON THE PROJECT FOR ESTABLISHMENT OF  
ENVIRONMENTAL MONITORING SYSTEM  
(EXPLANATION ON DRAFT REPORT)

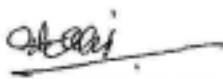
In February 2005, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Basic Design Study Team on the Project for Establishment of Environmental Monitoring System (hereinafter referred to as "the Project") to Islamic Republic of Pakistan (hereinafter referred to as "Pakistan"), and through discussions, field survey, and technical examination of the results in Japan, JICA prepared a draft report of the study.

In order to explain and to consult with the Government of Pakistan on the components of the draft report, JICA sent to Pakistan the Draft Report Explanation Team (hereinafter referred to as "the Team"), which is headed by Mr. Yoshio Fukuda, Team Director, Water Resources Development and Environment Management Team, Project Management Group III, Grant Aid Management Dept., JICA, from June 1 to 7, 2005.

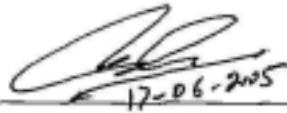
As a result of discussions, both parties confirmed the main items described on the attached sheets.

Islamabad,  
June 17, 2005

  
Yoshio Fukuda, Leader of Draft Report  
Explanation Team, Grant Aid  
Management Dept, Japan International  
Cooperation Agency Japan (JICA)

  
Khalid Masood Ahmed, Joint Secretary  
Ministry of Environment,  
Islamic Republic of Pakistan

  
Yasmin Masood, Deputy Secretary,  
Ministry of Economic Affairs & Statistics  
(EAD), Islamic Republic of Pakistan

  
Asif S. Khan, Director General  
Pakistan Environment Protection Agency  
(Pak-EPA), Islamic Republic of Pakistan

## ATTACHMENT

### 1. Components of Draft Report

The Draft Report had been handed to Pak-EPA, on May 28, 2005 by JICA Pakistan office. Pakistani side made the following comments:

- i) It was suggested to reconsider roof top location of fixed monitoring stations and to follow the USEPA siting guidelines for heavy pollutants concentration, because high SPM (which is a serious issue in Pakistan) is prone to height built up. It was also mentioned that height of sampling point (suction point) of mobile station would be different from one fixed at rooftop and the results in that case would not be comparable. Japanese side responded that the siting of the fixed stations would be reconsidered to finalizing the detailed design of the Project.
- ii) The two-story building has been proposed by the team for the laboratory. Pakistani side explained to the Team about its expansion plan and mentioned that fragmentation of EPA laboratory and other offices is not desirable since it would not be an efficient use of the costly land and will not achieve objectives of the Project. Japanese side responded that the Project would take care of the foundation to bear the 3-story building, 2 stories of which will be constructed by the Project and the third floor will be constructed by Pakistani side with its own funds. Pakistani side agreed to the proposal and promised to submit the authorized construction plan to Japanese side before agreement on Exchange of Notes; however, it showed its concern over the design of the building and strongly suggested that its proposal of a foundation for a 4-story building may be reconsidered. The Team agreed to convey the concerns of the Pakistani side to the relevant agencies.
- iii) Pakistani side found it difficult to conduct high-density monitoring pattern design (page 2-7 of the report) by leasing mobile stations from other EPAs because of long distances between the provinces and unfavorable inter-provincial road conditions. Responding to this the Team explained that Pakistani side should plan concrete monitoring schedules by utilizing 3 mobile stations on monthly or annual basis, in which high-dense utilization would be possible.

In spite of these comments above made by Pakistani side, the Government of Pakistan agreed and accepted in principle the components of the draft report explained by the Team.

### 2. Japan's Grant Aid scheme

The Pakistani side understands the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Pakistan as mentioned in Annex-1 and Annex-2 of the



Minutes of Discussions signed by both parties on January 29, 2004.

### 3. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and send it to the Government of Pakistan by September 2005.

### 4. Other relevant issues

#### 4-1) Acquisition of the necessary land for the Central Laboratory for Environment Analysis (CLEAN)

The Pakistani side explained that the necessary land for the building has been acquired for the Project, mentioning that they had submitted the letter of evidence to JICA Pakistan Office as attached in Annex-1.

#### 4-2) Fixed Automatic Air Quality Monitoring Station

The Japanese side explained the candidate sites for Fixed Automatic Air Quality Monitoring Station as follows.

- (1) Pak-EPA: Rooftop of the central environmental monitoring center
- (2) Sindh-EPA: Rooftop of the EPA's Building, Rooftop of the Revenue Office
- (3) Punjab-EPA: Rooftop of the new EPA building, Rooftop of the Lahore City District Office.
- (4) NWFP-EPA: Rooftop of the EPA's building.
- (5) Balochistan-EPA: Rooftop of the Town Nazim Office.

Japanese side mentioned that the siting of the fixed stations would be reviewed in accordance with US EPA in the detailed design. Pakistani side promised that they should consult and get necessary consent of each EPA as well as the Provincial Governments by June, 2005 and they should make necessary utility lines (electricity, telephone etc.) and enough security systems before the installation of the equipment or by September 2006.

#### 4-3) Pakistani side showed concern on reduced number of fixed and particularly mobile monitoring stations. Both sides agreed to explore ways and means to provide mobile Laboratories to NWFP EPA and Balochistan EPA in future though this does not mean to promise provision of it by Japanese side.

#### 4-4) Construction schedule of a new building for Punjab-EPD

The Pakistani side explained that the new building for Punjab-EPD should be completed by June 2006, before the installation of equipment. In order to confirm this schedule, Japanese side requested Pakistani side to convey the construction



schedule of the new building for Punjab EPD by 17 June 2005.

4-5) Staffing and training plan for the Project

The Pakistani side explained that a total staff of about 120 was planned for scope as given in the PC-1, since the Project is now being implemented partially, the number of staff and budget will be proportionately reviewed and provided for Pak-EPA and the provincial EPAs for 2 years as indicated in PC-1, and submitted training plan of new staff members to the Team as attached in Annex-2. The Pakistani side promised to provide the new staff to be required for the Project.

4-6) Budget for running of the monitoring system

Japanese side explained the necessary budget for running of the monitoring system. Pakistani side informed about the high estimates of the operating and maintenance cost and requested to review it. Japanese side explained that such cost has been made on some assumptions, and would be necessary and inevitable. The O/M estimate is within amount of PC-1. Pakistani side agreed it and promised that they would secure necessary budget for running of the monitoring system, as attached in Annex 3.

4-7) Conduct of Soft Component

The Team explained to Pakistani side that three courses of Soft Component will be conducted in January/February 2007 for one month each in Islamabad: 1) air monitoring, 2) stack gas monitoring and 3) water monitoring. This is for operators of the EPAs. Pakistani side promised to select suitable operators and to allocate the budget for the Soft Component.



4-8) Naming of Central Environment Research Center

Both sides agreed with the naming of a new laboratory and air-monitoring center to be constructed under the Project as Central Laboratory for Environment Analysis (CLEAN).

4-9) Rehabilitation of laboratories of Sindh, NWFP and Balochistan EPAs

The Pakistani side agreed that three EPAs of Sindh, NWFP and Balochistan should rehabilitate their laboratories before the installation of the equipment of the Project on schedule.

4-10) Establishment of PMU

   
3

The Pakistani side agreed that PMU (Project Management Unit) should be established after confirmation of the project by Japanese side, and the staff of PMU should be informed to the Japanese side through JICA Pakistan Office at the same time. The Pakistani side explained that the office of PMU has established at Sitra Market of G7, Islamabad.

4-11) Draft detailed specification of the equipment

The Team handed one copy of the draft detailed specification of the equipment to the Pakistani side. Both sides agreed that this draft specification was confidential and should not be duplicated or released to any outside parties. Pakistani side explained that comments on the draft specifications would be provided after consultation with provincial EPAs and other concerned departments by end of June 2005. Responding to this Japanese side explained that their comments would be reviewed within the frame of agreement of the last field survey.

ATTACHMENTS

Annex -1: Land Acquisition

Annex-2: Staffing and Training Plan for the Project

Annex-3: Budget for O/M of the Monitoring System



Annex -1: Land Acquisition

CAPITAL DEVELOPMENT AUTHORITY  
(Estate Management Directorate-II)

3/3  
PT/GM-005J

No. CD/AM/27(2235)/05/2784-86 Islamabad; May: 17 2005

To: Secretary (Admin)  
Ministry of Environment  
Government of Pakistan  
CD Block No. 17, Civic Centre,  
Parkway C.C., Islamabad.

Subject: OFFER OF ALLOTMENT OF LAND FOR ESTABLISHMENT OF  
ENVIRONMENTAL RESEARCH TRAINING CENTRE IN M.B/2,  
ISLAMABAD.

Dear sir,

It is to inform you that request of Ministry of Environment regarding allotment of land for establishment of Environmental Research Training Centre in Islamabad has been considered by the Authority and it has been decided to offer you a piece of land measuring 92,660/02657.77 Square yards in sector M.B/2, Islamabad on 53 years lease basis extendable for two subsequent terms of 33 years each subject to provision of approval of the Prime Minister of Pakistan.

2. The Premium of the land @ Rs. 500/- per square yard works out to Rs. 46,330,000/- Beside payment of Premium Annual Ground Rent @ Rs. 2/- per square yard per annum shall also be payable in advance in the first week of every year (whether forcibly demanded or not). The AGR will be increased @ 15% per annum after expiry of every three years.

3. If the above offer is acceptable to you, please arrange to remit the premium of Rs. 46,330,000/- along with AGR amounting to Rs. 92,660/- for the first year of lease within four months from the date of issue of this offer letter failing which delayed payment charges @ 11.70% per annum or as revised from time to time shall be charged from the date of payment.

Yours faithfully,

Copy to:-  
1. By: DG-Planning, CDMA  
2. By: Director, CDMA  
3. By: C(AM) II, CDMA

By: Director M.I.,  
CDMA, Islamabad.

By: Director S.I.

2

### **Air Pollution Monitoring Training Course for Pak-EPA Officials**

Pakistan is confronted with a number of environmental problems these include: degradation of natural resources, industrial and vehicular pollution, degradation of human health, etc. People are often exposed to adverse environmental conditions and risks, for example exposure to waterborne diseases, indoor and outdoor air pollution and toxic industrial chemicals. The air pollution monitoring activities in Pakistan are at initial stage as compared to developed countries. The current air quality monitoring facilities are inadequate, in scale, technical capability and operational methodology to meet this challenge. Therefore systematic monitoring of air pollution and public awareness is necessary to overcome this catastrophe. SUPARCO is pursuing a comprehensive environmental study program, which include environmental monitoring, atmospheric research, climate change studies, etc. Keeping in view SUPARCO's tremendous experience in environment related activities, a training course on air pollution monitoring is being proposed for Pak-EPA's officials.

#### **THEME OF THE TRAINING**

- The training course would cover the following areas:
- Historical perspective: Need for sensitive specific, and accurate monitoring techniques;
- Monitoring of air pollution and dispersion parameters;
- Effectiveness of air pollution control actions;
- Environmental damage assessment;
- Hands on experience of data acquisition and analysis

The training course will be offered at two levels each of one-week (05 working days) duration separately for field staff & senior staff. It is proposed that each batch may consist of 10 (ten) participants.

#### **DURATION**

05 (five) working days for each course





### PROPOSED DATE

August 2005 & Dec. 2005

The following instructors will conduct the training courses. Their brief biodata is attached as Annexure I.

1. Dr. Badar Ghauri, DCM SUPARCO
2. Mr. R. Jilani, GM SUPARCO
3. Mr. M.Ashiq, GM SUPARCO
4. Miss. Rizla Zareen, GM SUPARCO
5. Mrs. Arifa Lodhi, Manager SUPARCO

### Course venue

The subject course will be conducted at SUPARCO HQ, Karachi.

### Level I: Course for Field Staff: Qualification: BSc, Diploma holders (DAFs) etc.

Participant successfully completing this course will be able to calibrate and operate laboratory air sampling devices and lab. analysis equipment. They will also learn the brief background theory on which sampling/testing devices work. The lectures will cover the following areas:

- ❖ Techniques of ambient air pollutants monitoring  
(Theory & Practical work)
- ❖ Ambient air sampling of particulate matters  
(Theory & Practical work)
- ❖ Noise measurement  
(Theory & Practical work)
- ❖ Stack emission monitoring  
(Theory & Practical work)
- ❖ Air Quality Standards (Ambient & Emission)
- ❖ Maintenance, calibration & repairing of monitoring equipment  
(Theory & Practical work)

### FINANCIAL ASPECT

Course Fee:

SUPARCO's Guest House charges:

Meal / breakfast charges:

22



2

7



Lunch / Dinner charges:

Transport facility/Train/Air Travel:

**Level 2: Course for Senior Staff:**

Participant successfully completing this course will understand how to select sampling methods and instruments appropriate to various sampling needs. They will be able to understand the background theories of each pollutant monitoring. They will also learn about factor affecting sample collection. Topics discussed in lectures and investigation in the laboratories will include methods of calibration, and general techniques for sampling analysis/interpretation.

**Major topics**

- ❖ Air pollution complexities & selection of monitoring instruments
- ❖ Sources and sinks of Air Pollutants  
(Theory & Practical work)
- ❖ Techniques of ambient air pollutants monitoring  
(Theory & Practical work)
- ❖ Noise measurement  
(Theory & Practical work)
- ❖ Stack emission monitoring  
(Theory & Practical work)
- ❖ Maintenance, calibration  
(Theory & Practical work)
- ❖ Techniques for Air Pollution Control
- ❖ Dispersion Modelling

**FINANCIAL ASPECT**

Course Fee:

SUPARCO's Guest House charges:

Meal / break fast charges:

Lunch / Dinner charges:

Transport facility/Train/Air Travel

*21*

Handwritten signatures and initials in black ink, including a large signature and several smaller initials.

Annex-3: Budget for O/M of the Monitoring System

Government of Pakistan  
Pakistan Environmental Protection Agency  
44-E, Office Tower, 3rd floor, Blue Area, Islamabad

No. 1(8)/2005-D.G.

Islamabad, the 14<sup>th</sup> April, 2005

SUBJECT: ESTABLISHMENT OF ENVIRONMENTAL MONITORING STATIONS

Dear Mr. INABA San,

The Pakistan Environmental Protection Agency confirms that the following resources and manpower as provided in the PC-I already approved by the Government of Pakistan shall be made available:

Technical Manpower Listed in PC-I

i)	Project Director	01
ii)	Co-project Director	05
iii)	Technical Officers	45
iv)	Technical Staff	70

Estimated Financial Resources in the PC-I

i)	Establishment Charges (Estimated)	Rs. 60.36 million
ii)	O&M cost	Rs. 18.275 million

2. The above staff and financial resources will be provided by the Federal Government till tenure of the project. The Provincial EPAs, after completion of the project, will take up the responsibility for providing additional financial resources for operating the monitoring equipment/system as per their commitment. In case, the provincial EPAs under some circumstances deviate from their commitment, Pak-EPA would take responsibility and request/arrange the budget from the Federal Government for the purpose.

3. The distribution maps of air pollution are also enclosed.

4. This letter has been issued in response to the Minutes of discussion signed between JICA and Government of Pakistan.

  
14-04-2005  
(Asif S. Khan)  
Director-General

Mr. Mitsunobe INABA  
Deputy Resident Representative  
Japan International Cooperation Agency  
(Pakistan Office)  
3<sup>rd</sup> floor, COMSATS Building G-5/2




## 5. Cost Estimate Borne by the Recipient Country

The project Cost to be covered by Pakistani side will be estimated as below.

Items		Cost
Pak-EPA	<ul style="list-style-type: none"> <li>• Transport and installation of the existing equipment,</li> <li>• Undertakings for the construction such as electricity, water supply/ sanitation, and gas.</li> </ul>	4.5
Sindh-EPA	<ul style="list-style-type: none"> <li>• Move the existing equipment and secure utilities</li> <li>• Set up of the duct and concrete base for draft chamber.</li> </ul>	1.0
Punjab-EPA	<ul style="list-style-type: none"> <li>• Transportation and installation of the existing equipment</li> <li>• Set up of the duct and concrete base for draft chamber.</li> </ul>	0.5
NWFP-EPA	<ul style="list-style-type: none"> <li>• Move the existing equipment and secure utilities</li> <li>• Set up of the duct and concrete base for draft chamber.</li> <li>• Preparation of the desk for new equipment</li> </ul>	1.0
Balochistan-EPA	<ul style="list-style-type: none"> <li>• Move the existing equipment and secure utilities</li> <li>• Set up of the duct and concrete base for draft chamber.</li> <li>• Preparation of the desk for new equipment</li> </ul>	1.0
Others	<ul style="list-style-type: none"> <li>• Bank commission for B/A</li> </ul>	3.1

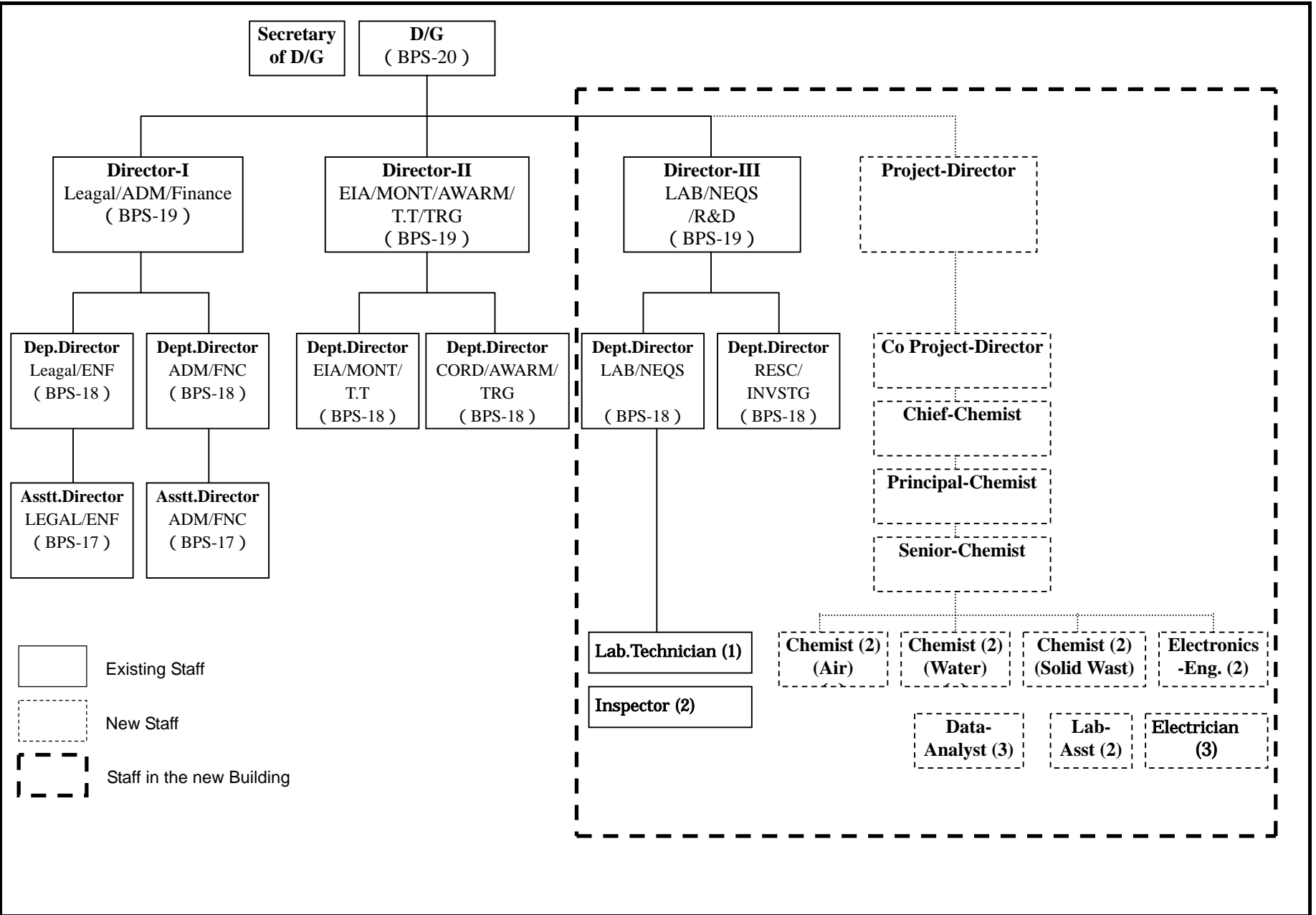
The undertakings related to construction the Central Laboratory for Environmental Analysis are summarized with items and costs as below.

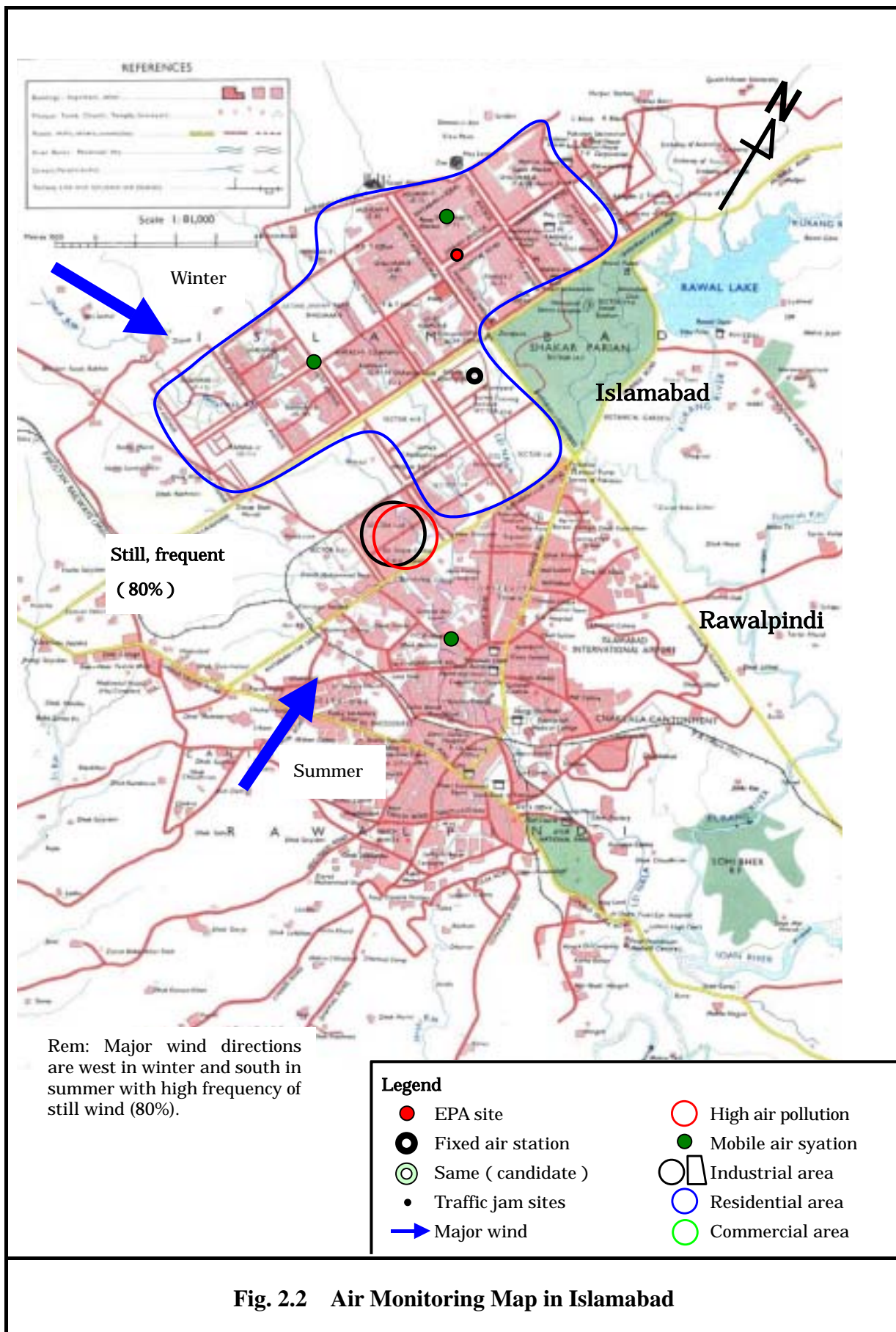
### Break down of Pak-EPA Undertakings

No	Item	Cost ( Rs. 1,000 )
1	Removal of trees (about 20)	60
2	Filling of bank (4500 m <sup>3</sup> @450 Rs/m <sup>3</sup> )	1,012
3	Retaining wall (120 m, 1.2 m high)	1,920
4	Cabling for electricity	45
5	Wiring for telephone (8 lines)	30
6	Piping for water supply	40
7	Connecting with sewerage system	30
8	Connecting with gas line	30
9	Transportation of existing equipment and furniture (3 days)	75
10	Construction for exterior fence (130 m with concrete block and RC column)	960
11	Installation of curtains	270
	Total	4,472

## *FIGURES*

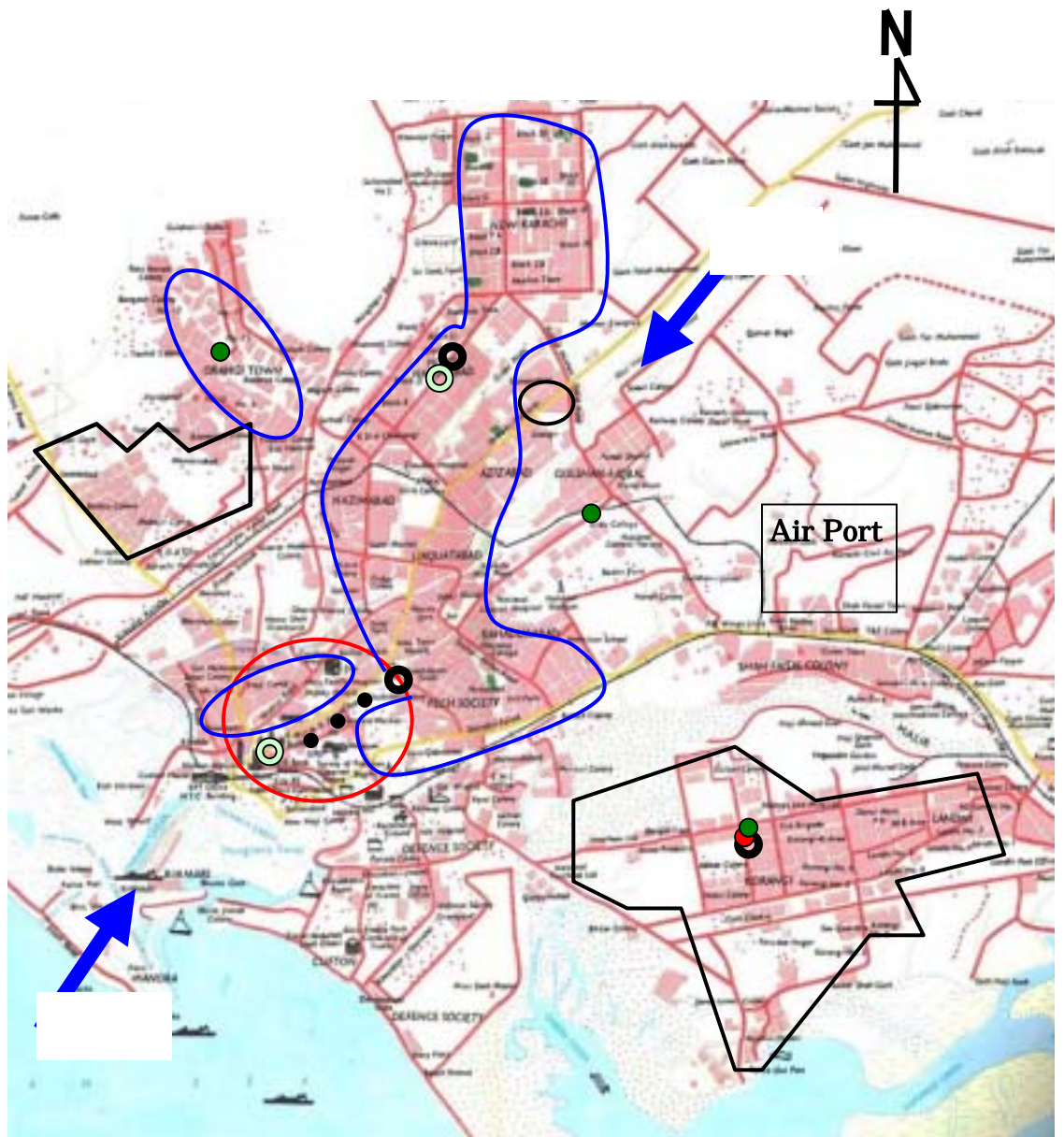
**Fig. 2.1 Organization Chart of Pak-EPA and Newly Employed Staff**





**Fig. 2.2 Air Monitoring Map in Islamabad**



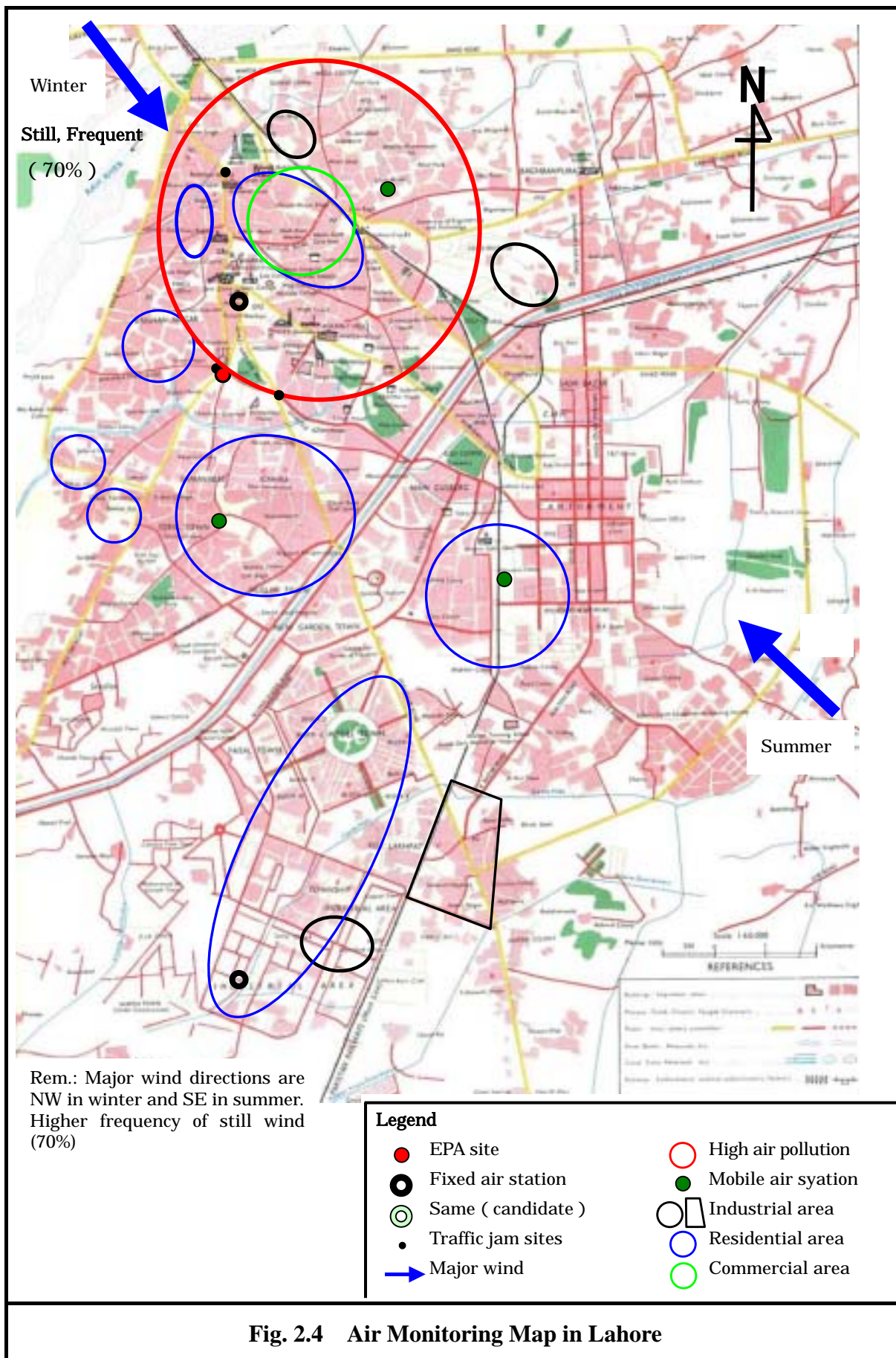


Rem: Major wind directions are NE in winter and SW in winter.

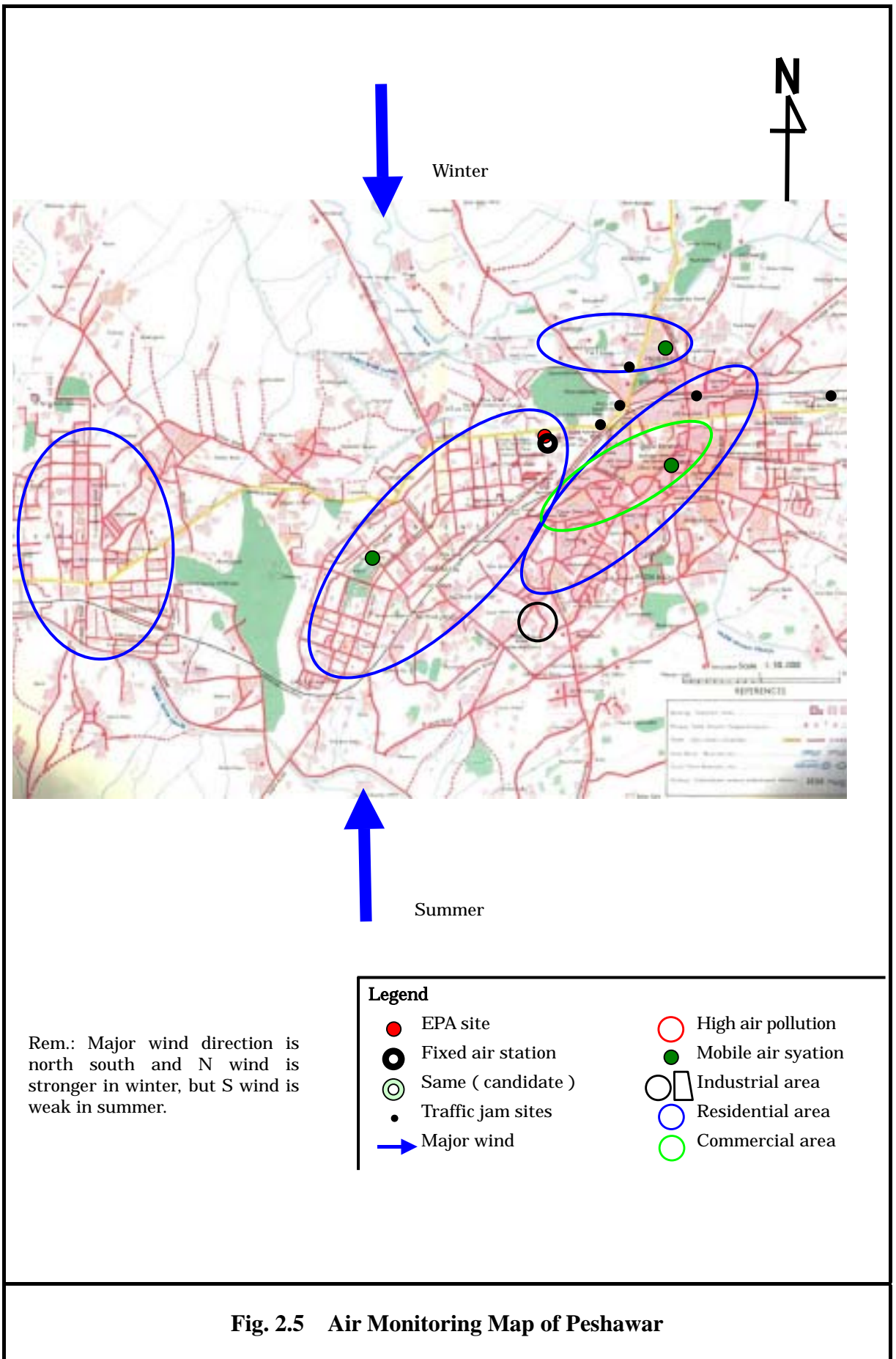
**Legend**

- |                      |                      |
|----------------------|----------------------|
| ● EPA site           | ○ High air pollution |
| ● Fixed air station  | ● Mobile air syation |
| ○ Same ( candidate ) | ○ Industrial area    |
| ● Traffic jam sites  | ○ Residential area   |
| ➔ Major wind         | ○ Commercial area    |

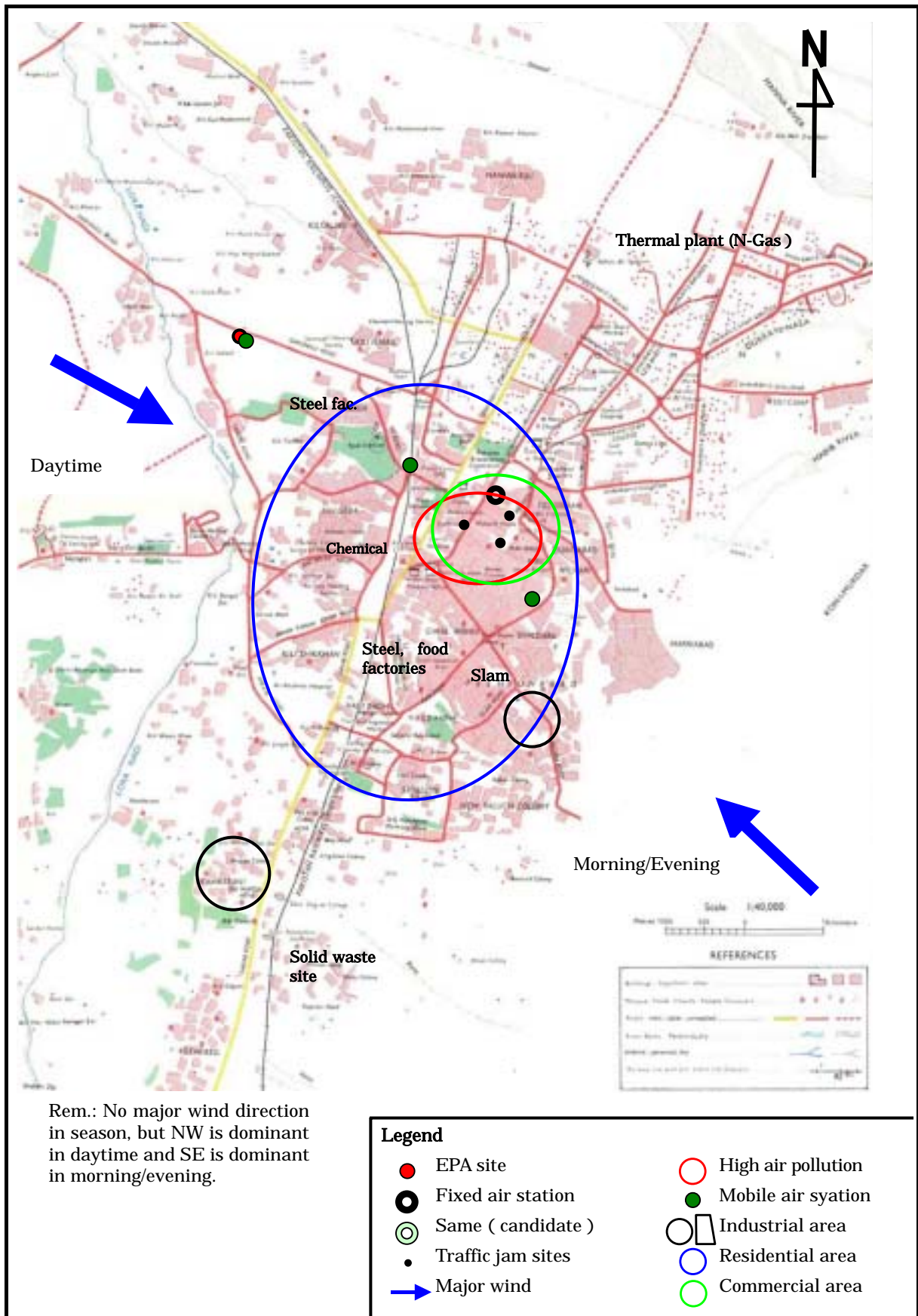
**Fig. 2.3 Air Monitoring Map in Karachi**







**Fig. 2.5 Air Monitoring Map of Peshawar**



**Fig. 2.6 Air Monitoring Map in Quetta**

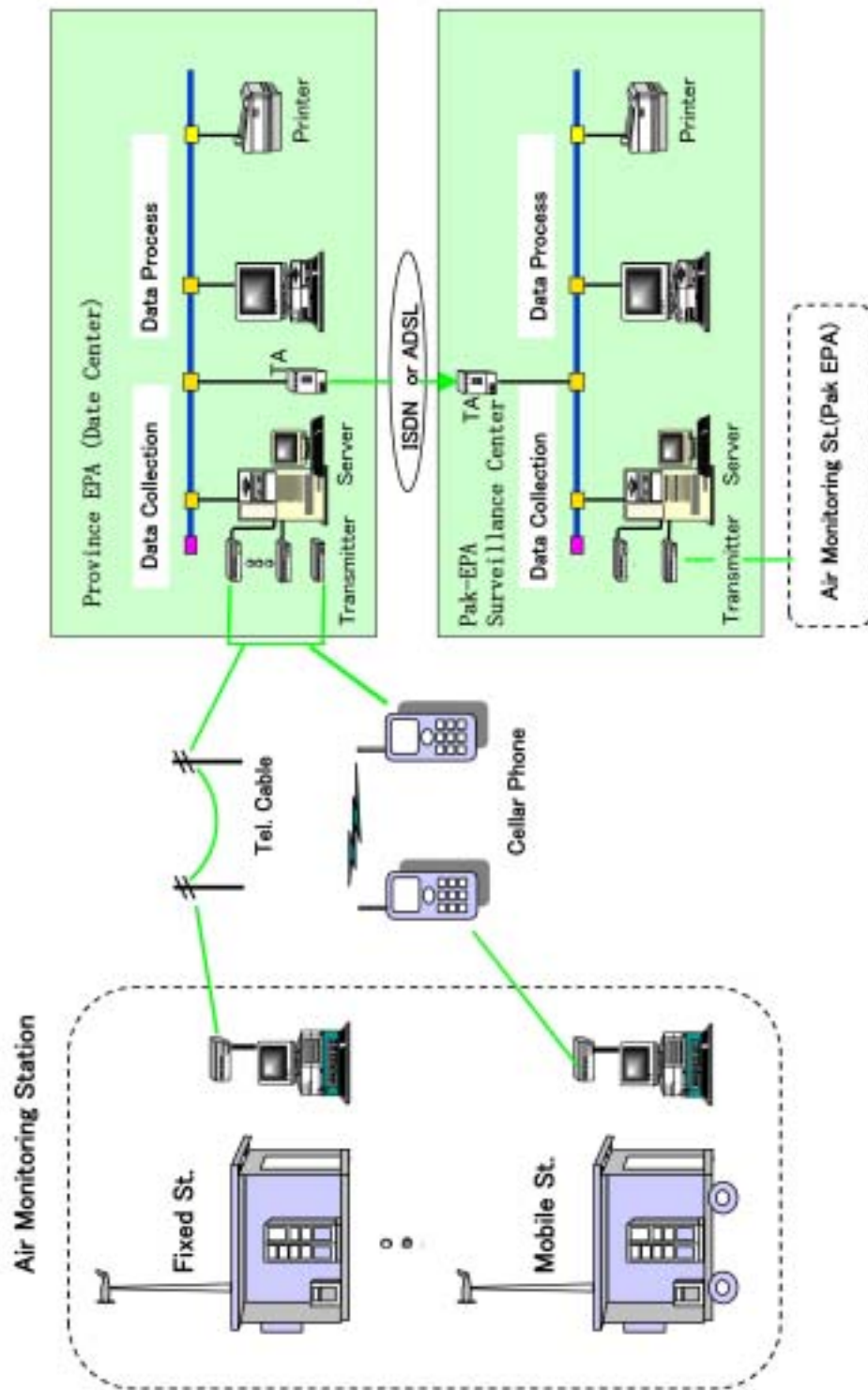
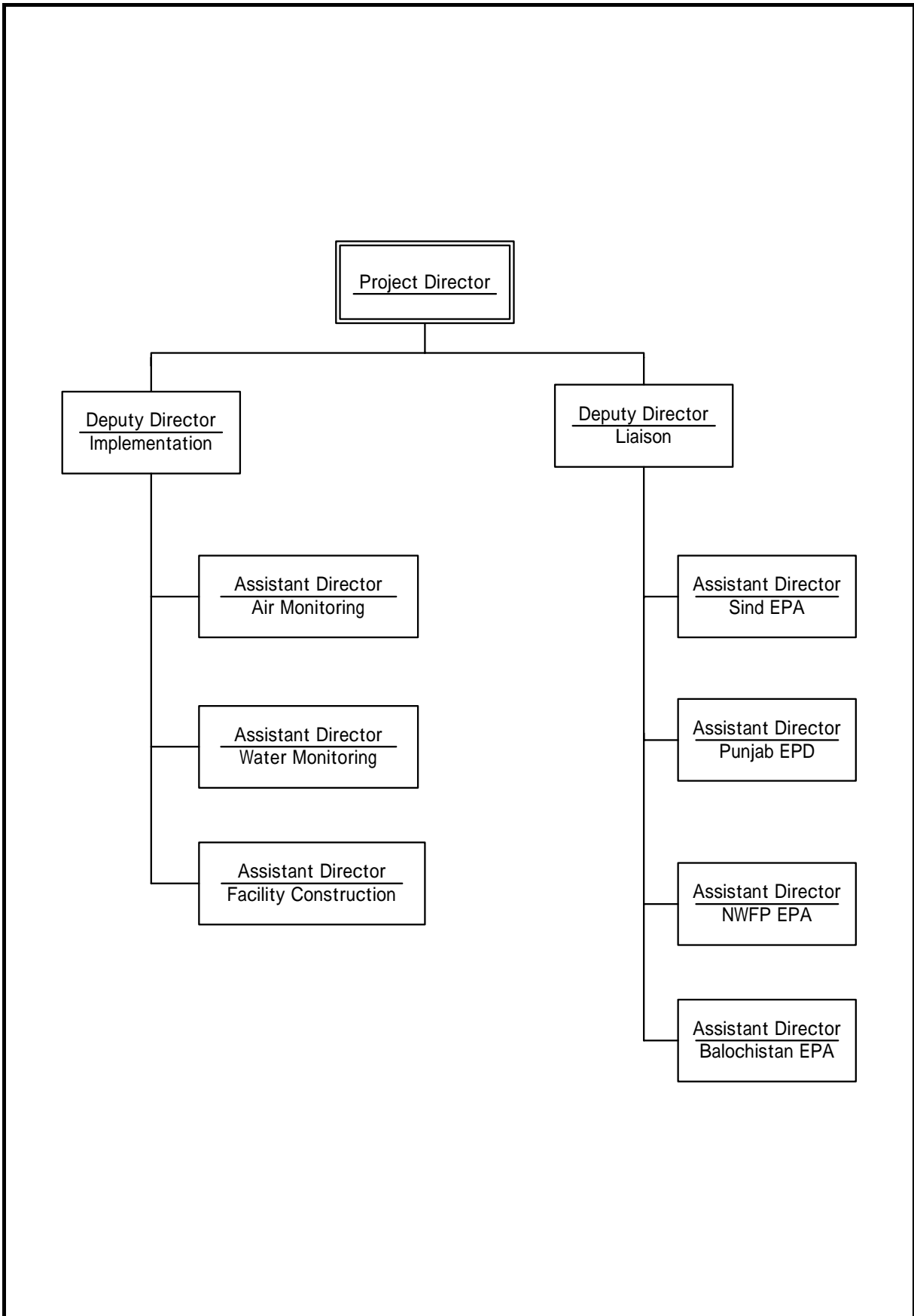


Fig. 2.7 Air Monitoring Telemeter System



**Fig. 2.8 Organization Chart of PMU**

## *APPENDIX TABLES*

Table A-1 List of Requested Equipment

Priority A:Indispensable B:High C:Moderate D:Low  
 PC1: Demand Equipment, PS: Preparation study, Ext: Existing equipment BS: Basic design study technical note  
 PAK: Pak-EPA, SND:Povince Shind-EPA, PJB: Povince Punjab-EPA, NWFP:Povince NWFP-EPA, BAL: Povince Balochistan-EPA

Item	Technical Specification		Quantity					Total	Priority		
	PC-1/PS	Basic Design Study	PAK	SND	PJB	NWFP	BAL				
<b>A Air quality monitoring</b>											
<b>1. Automatic air quality monitoring station</b>											
A-1-1	Fixed Automatic Air Quality Monitoring Station	6 gas analysers of CO, NOx, O <sub>3</sub> , SO <sub>2</sub> , THC and SPM for 2.5 μm, Standard gas w/cylinder and regulator, Standard gas dilution device, Wind speed meter, Wind direction meter, Thermometer – hygrometer, Barometer, Computer w/printer, Compartment w/air conditioner	6 gas analysers of CO, NOx, O <sub>3</sub> , SO <sub>2</sub> , THC and SPM for 2.5 μm, Standard gas w/cylinder and regulator, Standard gas dilution device, Wind speed meter, Wind direction meter, Thermometer – hygrometer, Barometer, Computer w/printer, Compartment w/air conditioner (Mark *; to be examined in detail)	PC1	1	4	4	2	2	13	A
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	2	2	1	1	7	
A-1-2	Mobile Automatic Air Quality Monitoring Station	6 gas analysers of CO, NOx, O <sub>3</sub> , SO <sub>2</sub> , THC and SPM for 2.5 μm, Standard gas w/cylinder and regulator, Standard gas dilution device, Wind speed meter, Wind direction meter, Thermometer – hygrometer, Barometer, Computer w/printer, Compartment w/ air conditioner	6 gas analysers of CO, NOx, O <sub>3</sub> , SO <sub>2</sub> , THC and SPM for 2.5 μm, Standard gas w/cylinder and regulator, Standard gas dilution device, Wind speed meter, Wind direction meter, Thermometer – hygrometer, Barometer, Computer w/printer, Compartment w/air conditioner (Mark *; to be examined in detail)	PC1	1	1	1	0	1	4	A
				PS	1	1	1	0	0	3	
				Ext	0	0	1	0	0	1	
				BS	1	1	1	0	0	3	
<b>2. Data Management and Reporting System in EPA</b>											
A-2-1	Data Processing System in Pak-EPA (Hardware & Software)	Data acquisition and control system. Store, record and display process and experimental data. Software for environmental lab data analysis, monitoring network analysis, data interpretation, statistical description and graphics.	Personal Computer with following functions -Data acquiring from fixed/mobile monitoring station and Prv-EPA. -Database storage & archiving -Data editing and report generating system	PC1	1	0	0	0	0	1	A
				PS	1	0	0	0	0	1	
				Ext	0	0	0	0	0	0	
				BS	1	0	0	0	0	1	
A-2-2	Data Processing System in Prv-EPAs (Hardware & Software)	Data acquisition and control system. Store, record and display process and experimental data. Software for environmental lab data analysis, monitoring network analysis, data interpretation, statistical description and graphics.	Personal Computer with following functions -Data acquiring from fixed/mobile monitoring station. -Database storage & archiving -Data editing and report generating system	PC1	0	1	1	1	1	4	A
				PS	0	1	1	1	1	4	
				Ext	0	0	0	0	0	0	
				BS	0	1	1	1	1	4	
<b>3. Stationary source measuring equipment</b>											
A-3-1	Dust Measuring Unit	Portable high volume air sampler (0 to 800 l/min)	Isokinetic dust sampling unit for stack monitoring. (manual type), Velocity measuring unit (pitot tube, manometer), Dust sampling unit, Moisture measuring unit	PC1	2	5	5	2	3	17	A
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
A-3-2	Stack Gas Analyzer	Nox, SO <sub>2</sub> , O <sub>2</sub>	NOx : chemiluminescence, 0 to 4,000ppm or more, auto-ranging SO <sub>2</sub> : NDIR method, 0 to 5,000 ppm or more, auto ranging O <sub>2</sub> : Zirconia or magnetic force, 0 to 25%	PC1	1	1	2	1	2	7	A
				PS	1	1	1	1	1	5	
				Ext	1	1	1	0	0	3	
				BS	1	1	1	1	1	5	
A-3-3	Portable Gas Analyzer	CO, CO <sub>2</sub> for combustion gas of boiler	NDIR method 0 to 40,000ppm or more, auto ranging	PC1	2	2	2	0	2	8	A
				PS	1	1	1	1	1	5	
				Ext	1	1	1	0	0	3	
				BS	1	1	1	1	1	5	
A-3-4	Oxygen Monitor (Magnet Type)	No specification	(To be deleted)	PC1	2	2	2	1	1	8	D
				PS	0	0	0	0	0	0	
				Ext	1	1	1	0	0	3	
				BS	0	0	0	0	0	0	
A-3-5	Opacity Meter	Smoke density meter, laser beam system	(To be deleted)	PC1	1	1	2	1	2	7	D
				PS	0	0	0	0	0	0	
				Ext	2	0	0	2	1	5	
				BS	0	0	0	0	0	0	
A-3-6	Potable Stack Gas Sampler	CO, SOx, NOx, HC, O <sub>2</sub> , N <sub>2</sub>	Wet type gas collector Absorbing bottles : 2 bottles or more SOx Washing bottle : 1 bottle or more Vacuum pump : 1 unit (Max. Flow 4.5L/min)	PC1	2	2	2	0	2	8	B
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
A-3-7	Orzat - Fischer Gas Analyzer	No specification	To measure stack gas concentration. Analyte : O <sub>2</sub> , CO, CO <sub>2</sub> Absorbing bottles : 4 bottles 1 set of sampling bags and sucking pump for 2 set of Orzat	PC1	2	5	5	2	3	17	B
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
A-3-8	Wet Type Gas Meter	No specification	1) Measurement range : 0.5 to 2L/min. or more Drum Capacity : 1 liter 2) Measurement range : 2.5 to 50L/min. Drum Capacity : 5 liter	PC1	2	5	5	2	3	17	A
				PS	2	2	2	2	2	10	
				Ext	0	0	0	0	0	0	
				BS	2	2	2	2	2	10	
A-3-9	Monitoring Car	No specification	Used for carry the Stack gas monitoring equipment or some '4 Supplemental Equipment' for on Site monitoring works.	PC1	0	0	0	0	0	0	A
				PS	1	1	1	0	0	3	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
<b>4. Supplemental Equipment</b>											
A-4-1	High Volume Air Sampler (HVAS Portable)	High -Volume blower, Typically at a rate of 1.13 - 1.70 m <sup>3</sup> / min (40-60 ft <sup>3</sup> ). Operating temp. -20 to 60oC Particle size separator < 1m	Setting flow rate range: 600 to 1200L/min. or more	PC1	2	2	2	1	1	8	A
				PS	2	2	2	2	2	10	
				Ext	3	1	1	0	3	8	
				BS	3	2	2	3	0	10	
A-4-2	Low Volume Air Sampler	Low -Volume blower typically at a rate of 20-30 liters/min. Operating temp -20 to 60oC. Particle size separator < 10um and <2.5um.	Particle size classification : 10 μm cut Classification method : cyclone or gravity sedimentation Flow rate : 1 to 20 L/min. or more	PC1	2	2	2	1	1	8	B
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
A-4-3	Andersen Air Sampler	No specification	8stages Suction flow rate : 28.3 L/min (= 1 ft <sup>3</sup> /min )	PC1	2	2	2	1	1	8	B
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	



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Item	Technical Specification		Quantity					Total	Priority		
	PC-1/PS	Basic Desingn Study	PAK	SND	PJB	NWFP	BAL				
A-4-4	Vacuumed Pump with Gas Bag	No specification	Gas sampling bags coated with Teflon, Aluminum, Inner volume 5 - 20 liters, Sucking vacuum pump with valve/maximum flow rate 20l/min.	PC1 PS Ext BS	2 0 0 0	2 0 0 0	2 0 0 0	1 0 0 0	1 0 0 0	8 0 0 0	D
A-4-5	Impinger Gas Sampling System (Portable air sampler )	Single set with 10ml capacity	Wet type gas collector ( handy sampler ) Absorbing bottles : 2 bottles or more Inner vacume pump Used for ambient air measuring	PC1 PS Ext BS	2 5 0 9	2 15 0 9	2 15 0 9	1 10 0 9	1 5 0 9	8 50 0 45	B
A-4-6	Particle Counter	Count 1-9,999,999 particles having diameter 0.3-5.0 m. Flow rates 2-3 liters/min. Concertration range 0-3,000,000.	(To be deleted)	PC1 PS Ext BS	2 0 0 0	2 0 1 0	2 0 1 0	1 0 0 0	1 0 0 0	8 0 2 0	D
A-4-7	Gas Detection Tube System	Piston types pump draws 100ml of samples air with toxic gas detection tubes. Measuring ranges both in PPM and % age.	(To be deleted)	PC1 PS Ext BS	2 0 0 0	2 0 0 0	2 0 0 0	1 0 0 0	1 0 0 0	8 0 0 0	D
A-4-8	Rotor Meter	No specification	Ball float type (Corrosion resistant) Applicable gas : Air (at 1 atm, 20degC) 50 mL/min. 100 mL/min. 500 mL/min. 2 L/min. 20 L/min.	PC1 PS Ext BS	2 0 0 1	5 0 0 1	5 0 0 1	2 0 0 1	3 0 0 1	17 0 0 5	A
A-4-9	Mass Flow Meter	No specification	(To be deleted) Temperature Following Current Differential Detector 10 - 500 ml /min. (at 1 atm, 20degC)	PC1 PS Ext BS	2 0 0 0	5 0 0 0	5 0 0 0	2 0 0 0	3 0 0 0	17 0 0 0	D
A-4-10	Thermometer	No specification	(To be deleted)	PC1 PS Ext BS	2 0 1 0	5 0 0 0	5 0 1 0	2 0 0 0	3 0 0 0	17 0 2 0	D
A-4-11	Deposit Gauge	Dust fall samplers with glass bottle having 300mm diameter. Bottle capacity - 20 liter.	Dust fall samplers with glass bottle having 300mm diameter. Bottle capacity - 20 liter. Dust jar	PC1 PS Ext BS	2 1 0 5	2 1 0 5	2 1 0 5	1 1 0 5	1 1 0 5	8 5 0 25	B
<b>B Sound Level measuring</b>											
B-1	Precision Integration Sound Level	With calibrator and data logger	(To be deleted)	PC1 PS Ext BS	1 0 1 0	1 0 1 0	2 0 1 0	1 0 1 0	2 0 0 0	7 0 4 0	D
B-2	Tripod	No specification	(To be deleted)	PC1 PS Ext BS	1 1 0 0	1 1 0 0	2 1 0 0	1 1 0 0	2 1 0 0	7 5 0 0	D
B-3	Level Recorder	for water	(To be deleted)	PC1 PS Ext BS	1 1 - 0	1 1 - 0	2 1 - 0	1 1 - 0	2 1 - 0	7 5 - 0	D
B-4	Piston Phone	No specification	(To be deleted)	PC1 PS Ext BS	1 1 1 0	1 1 1 0	2 1 1 0	1 1 1 0	2 1 1 0	7 5 5 0	D
<b>C Water quality monitoring</b>											
C-1	Fixed automatic water quality monitoring station	Automatic water quality monitoring device, CN meter,	(To be deleted)	PC1 PS Ext BS	1 0 0 0	2 0 0 0	3 0 0 0	1 0 0 0	0 0 0 0	7 0 0 0	D
C-2	Water quality monitoring vehicle	No specification	Wagon type off-road vehicle (disp.-1998cc or more) Seating Capacity; 5-person	PC1 PS Ext BS	1 0 0 1	1 0 0 1	1 0 0 1	1 0 0 1	1 0 0 1	4 0 0 5	A
<b>C-3.Portable water quality monitiring,water,sludge,sampling equipment</b>											
C-3-1	Water Monitoring Kit	Portable 28 water parameters	(To be deleted)	PC1 PS Ext BS	1 0 1 0	1 0 1 0	2 0 1 0	1 0 1 0	2 0 1 0	7 0 5 0	D
C-3-2	Sludge Sampler	No specification	(To be deleted)	PC1 PS Ext BS	1 0 0 0	1 0 1 0	2 1 0 0	1 1 0 0	2 1 0 0	7 3 1 0	D
C-3-3	Water Sampler	No specification	HYROHT type, Capacity: 1000 ml, Fittings: frame with weight, wire (SUS), Hanging chain: approx. 5 m	PC1 PS Ext BS	1 1 1 1	1 1 1 1	2 1 1 1	1 1 0 1	2 1 0 3	7 5 3 5	A
C-3-4	Digital Current Meter	No specification	Type: Electromagnetic type, Accuracy: less than +/-2% or +/-0.5cm/sec, Depth capacity (pressure rate): more than 3kg/cm <sup>2</sup> , Measuring range: 0+/-200cm/sec, LCD display: Digital current speed, Power: dry cell batteries, Battery capacity: more than 15 hrs	PC1 PS Ext BS	1 0 1 1	1 0 1 1	2 0 1 1	1 0 0 0	2 0 0 3	7 0 5 3	A
C-3-5	Ekman Barge Slab Sampler	No specification	Area collected sample: 15 x 15 x 15 (cm), Body material: SUS, Hanging chain: 5 m	PC1 PS Ext BS	1 0 0 1	1 0 0 1	2 0 0 1	1 0 0 1	2 0 0 1	7 0 0 7	A

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Item	Technical Specification		Quantity					Total	Priority		
	PC-1/PS	Basic Design Study	PAK	SND	PJB	NWFP	BAL				
<b>D Laboratory equipment</b>											
D-1	Atomic Absorption Spectrophotometer (AAS)	Wavelength range: 190-900nm, automatic wavelength selection with background correction, auto ignition, hydride generation mercury vapor unit, graphite furnace, Graphite lamp (related lamps), Flame mode, software based on MS Window.	Automatic wavelength selection with background correction, Graphite lamp (related lamps), Flame mode, software based on MS Window. (Hollow Cathode Lamp: Al, As, Be, B, Cd, Cr, Cu, Cr, Fe, Pb, Mn, Hg, Ni, Ag, Zn), Automatic cooling water circulate unit.	PC1	1	1	1	1	1	5	A
				PS	1	0	1	0	1	3	
				Ext	1	1	0	1	0	3	
				BS	1	0	1	0	1	3	
D-2	Attachment of AAS	No specification	Hydride generation unit, mercury vapor unit, Graphite furnace, Graphite lamp (related lamps), Up-grade of software. [Attachment of AAS prepares the matched to existing AAS.] : (Hollow Cathode Lamp: Al, As, Be, B, Cd, Cr, Cu, Cr, Fe, Pb, Mn, Hg, Ni, Ag, Zn), Automatic cooling water circulate unit. *Shindh-EPA: Up grade of the software	PC1	0	0	0	0	0	0	B
				PS	0	1	0	1	0	2	
				Ext	0	0	0	0	0	0	
				BS	0	1	0	1	0	2	
D-3	UV-VIS Spectrophotometer (UV-VIS)	Wavelength range: 190-1100 nm, Spectral band: 2 nm Wavelength display: 0.1 nm, Wavelength accuracy automatic, Absorbance: 0.5 - 3.999, Transmittance: 0.0 - 300%	Double beam scanning type, Tungsten-Halogen and D <sub>2</sub> lamp, Wavelength range:Should cover 190 to 900 nm, Wavelength accuracy: less than 0.3 nm, Bandpass: 0.10 to 5.00 nm *Shindh-EPA: Un grade of the software	PC1	1	1	1	1	1	5	A
				PS	1	1	0	0	0	2	
				Ext	2	1	1	1	1	6	
				BS	0	0	1	1	1	3	
D-4	Gas Chromatograph (GC/ECD,FID)	Oven temperature Ambient: 4 to 450 Advance flow control unit, FID, NPD/FTD & ECD detectors, with all accessories and auto sampler.	Advance flow control unit, Operating temperature: 100 to 450 degrees C, (1.0 degree C step), [FID detector] Sensitivity: Less than 0.015 coulombs /g C, Minimum detectable quantity: 3 pg C/Sec (s/n=2/1), [ECD detector] Minimum detectable quantity: 0.05 pg/C <sub>2</sub> H <sub>5</sub> Cl	PC1	1	1	1	0	0	3	A
				PS	1	1	1	1	1	5	
				Ext	1	1	0	0	0	2	
				BS	1	0*	1	1	1	4	
D-5	Ion Chromatograph	Electrochemical detector with 20 different types of column recorder, auto sampler up to 128 samples, integration and storage of chromatograms, data recorder and all accessories.	Flow rate: 0.5 to 4.0 mL/min, Max. pressure: Approx. 28.0 Mpa, [Detector] Method: Electrolytic conductivity, Measuring Range: 0 to 1000 micro-s/cm, Output: 0 to 10V, Operating temp.: 10 to 40 degree C, Column: Dual column system, Solvent resistance, Integration and storage of chromatograms, data recorder and all accessories.	PC1	1	1	1	0	0	3	A
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
D-6	COD Apparatus	Detection 0 - 1000 mg/l Analyze 6 to 10 samples at a time.	Semimicro Kjeldahl Digesting apparatus with one exhaust pipe, six Kjeldahl flask, (complete set), Flask volume: 500 mL (6 pc), Temp.: Max. approx. 450 degreeC with individual controller, Coiled condenser: 300 mm	PC1	1	1	1	0	0	3	A
				PS	1	1	1	1	1	5	
				Ext	0	1	1	0	1	3	
				BS	1	1	1	1	1	5	
D-7	BOD Apparatus	D.O 0-19.9 mg/l, Resolution: 0.01 mg/l with digital display. (kit-type)	Incubator bottles and incubator. Incubator bottles: Approx 100mm, 100 pcs	PC1	1	1	1	0	0	3	A
				PS	0	0	0	0	0	0	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
D-8	Sulfur Content Analyzer in Fuel	To measure sulfur content in fuel	Analysis method: Fluorescent X-ray analysis (excitation method), Measuring range: 0-6wt%, Continuous measurement error: 0.005wt% standard deviation (at 1wt %), Automatic Calibration: Automatic operation two point Calibration and automatic multipoint	PC1	0	0	0	0	0	0	A
				PS	1	0	0	0	0	1	
				Ext	0	0	0	0	0	0	
				BS	1	0	0	0	0	1	
D-9	Oil Content Meter	To measure oil content in water	Method: Infrared rays absorption method, Measuring Range: 0.1 to 100 mg/L, Reappearance: +0.2 mg/L, Control method: Automatic processing by microcomputer	PC1	1	1	1	0	0	3	B
				PS	1	1	1	1	1	5	
				Ext	0	1	1	0	0	2	
				BS	1	0	0	1	1	3	
D-10	High Performance Liquid Chromatograph (HPLC)	UV-Visible detector 190-900nm, Refractive index detector, Electrochemical detector, auto sampler, all its accessories and different polarity columns and recorder.	(To be deleted)	PC1	1	1	1	0	0	3	D
				PS	0	0	0	0	0	0	
				Ext	0	1	0	0	0	1	
				BS	0	0	0	0	0	0	
D-11	ICP spectrophotometer	Wavelength: 160-800nm, High UV quantum efficiency, Wide Photometric dynamic rang for ppb, RF Generator, ICP Winlab software with full processing power and high resolution graphics.	(To be deleted)	PC1	1	1	1	0	0	3	D
				PS	0	0	0	0	0	0	
				Ext	0	0	0	0	0	0	
				BS	0	0	0	0	0	0	
D-12	Fluorescence X-ray Analyzer	X-Ray analyzer with radioactive isotopic sources, high resolution mercuric iodide detector, Fluorescence, Phosphorescence & Diffraction modes, software with processor and all other accessories.	(To be deleted)	PC1	1	1	1	0	0	3	D
				PS	0	0	0	0	0	0	
				Ext	0	0	0	0	0	0	
				BS	0	0	0	0	0	0	
D-13	Electrophoresis Equipment	No specification	(To be deleted)	PC1	1	1	1	0	0	3	D
				PS	0	0	0	0	0	0	
				Ext	0	0	0	0	0	0	
				BS	0	0	0	0	0	0	
D-14	TOC Analyzer	(TOC)Analyzing samples containing carbon from 2 ppb to 10,000 ppm. Ultra low level sensitivity single or multiple calibration, Non dispersive infra red detector.	Non-dispersive infrared read detector, Method: NIR method, Range: 0 to 10,000 mg/L, Detection limit: 5 µg/L, Analysis time: 10 min	PC1	1	1	1	0	0	3	B
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	0	0	0	0	1	
D-15	Ion Meter with Ion Selective Electrodes	Ion meter different ion selective electrodes, Calibration standards and with all accessories.	(To be deleted)	PC1	1	1	1	0	0	3	D
				PS	0	0	0	0	0	0	
				Ext	0	1	1	0	0	2	
				BS	0	0	0	0	0	0	
D-16	Mercury Analyzer	Photometric range 0-9 g with 0.01g of mercury sensitivity.	(To be deleted)	PC1	1	1	1	0	0	3	D
				PS	0	0	0	0	0	0	
				Ext	0	0	0	0	0	0	
				BS	0	0	0	0	0	0	



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Item	Technical Specification		Quantity	Total	Priority						
	PC-1/PS	Basic Desingn Study				PAK	SND	PJB	NWFP	BAL	
D-17	Polarograph	Photo multiplier detector, reproducibility better than 0.002 for zero and rotational reading, fluorescence display, spectral lines selectable from instrument with all accessories.	(To be deleted)	PC1	1	1	1	0	0	3	D
				PS	0	0	0	0	0	0	
				Ext	0	0	0	0	0	0	
				BS	0	0	0	0	0	0	
D-18	Automatic Titrator	Auto titrate and calculate the results in the end.	(To be deleted)	PC1	1	1	1	0	0	3	D
				PS	0	0	0	0	0	0	
				Ext	0	0	0	0	0	0	
				BS	0	0	0	0	0	0	
D-19	Stereoscopic Microscope	magnification 12, field of view 25mm, working distance 150mm	(To be deleted)	PC1	1	1	1	0	0	3	D
				PS	0	0	0	0	0	0	
				Ext	0	0	0	0	0	0	
				BS	0	0	0	0	0	0	
D-20	Microscope	Different magnification type.	Different magnification type.	PC1	1	1	1	0	1	4	A
				PS	1	1	1	1	1	5	
				Ext	1	2	1	0	0	4	
				BS	1	0	1	1	1	4	
D-21	Glassware	No specification	Volumetric Flask, Pipets, Regent bottle, Beaker and etc.	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	-	-	-	-	-	-	
				BS	1	1	1	1	1	5	
D-22	Laboratory Tools	No specification	Complete sets such as pliers, driver, spanner, cutter, pincers, and nippers to supply shortage	PC1	1	1	1	1	1	5	B
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
D-23	Reagents	No specification	Acetone, Ammonium hydroxide, Butyl acetate, EDTA, Magnesium chloride and etc. to store for 2 years.	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	-	-	-	-	-	-	
				BS	1	1	1	1	1	5	
D-24	Consumables	No specification	Filter paper, pH paper, and drug packing paper, etc. to store 2 years	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	-	-	-	-	-	-	
				BS	1	1	1	1	1	5	
D-25	Refrigerated Sample Storage Chamber	No specification	Capacity of 300 liter, temperature of refrigerator compartment at 4 degree C	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	1	1	0	0	3		
				BS	1	1	1	1	1	5	
D-26	Rotary Evaporator	Rotation speed: 20-200 rpm.	Revolution: Approx. 20 to 180 rpm, Sample flask: Pear-shape flask 1 L, Receiver flask: Round-bottom flask 1 L, Condenser: Cooling area more than 0.1 m3, Vacuum gasket: Teflon + Viton or equivalent	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
D-27	Kuderuna - Danish (KD) Evaporative Concentrator	No specification	(To be deleted)	PC1	1	1	1	1	1	5	D
				PS	0	0	0	0	0	0	
				Ext	0	0	0	0	0	0	
				BS	0	0	0	0	0	0	
D-28	Aspirator w/ Cooling Unit	Cooling aspirator working with 15 liter/min.	Number of Aspirator: 2 pcs, Exhaust volume of water: 15 L/m.n×2 pcs, Tank capacity: 'Approx. 10 L, Regulator with vacuum meter: Possible to connect it with the main unit	PC1	1	1	1	1	1	5	B
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
D-29	Centrifuge	Speed range: 500-16000 rpm, Capacity: 400ml, timer 1 to 60 minutes, refrigeration facility, complete with different types of rotor, AC220V.	Speed range: More than Max. 10000 rpm, Capacity: 400ml, timer More than 30 minutes, refrigeration facility, complete with different types of rotor, Control: Micro computer control, AC220V.	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	0	1	0	1	1	3	
				BS	1	1	1	1	1	5	
D-30	Shaker	Microprocessor control shaker, speed 15 to 500 rpm, programmable.	Shaking method: Reciprocation, Shaking strokes:Should cover 30 to 140 stroke/min., Shaking width: Approx. 40 mm, No. of Separating flask: Should cover 100mLx6 pcs, 300mLx4 pcs, 500mLx4 pcs, 1Lx4 pcs., Setting at shaking time: Max. 60 min or more	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	0	0	0	1	0	1	
				BS	1	1	1	1	1	5	
D-31	Hot Plate	Digital hot plates, Temperature range: 100 to 500 , AC220V.	Range of temperature: Normal temperature-350 , Plate size: 500 x 350 mm, Plate material: Ceramic or ceramic coating or equal goods, Microcomputer control, Digital display	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
D-32	Magnetic Stirrer, Small	Capacity: 1000ml, Speed: 0 to 500 rpm, AC220V.	Capacity: More than 1000ml, Speed: 0 to 800 rpm, AC220V., Speed regulation: Adjustable	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
D-33	Magnetic Stirrer, Large	Capacity: 5000ml, Speed: 150 to 1500 rpm, AC220V, Max. plate temperature 500 stirrer speed 100 to 1500rpm, electronic temperature and speed control.	Stirring capacity: More than 5 liter, Maximum speed: More than 1200 rpm., Speed regulation: Adjustable, Stirring paddle: Teflon coated or equivalent, AC220V	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
D-34	Magnetic Stirrer with Hot Plate	Maximum plate temp. 500 stirrer speed 100 to 1500 rpm, electronic temperature and speed control (programmable).	Stirring capacity: More than 1 liter, Maximum speed: More than 1200 rpm., Speed regulation: Adjustable, Stirring paddle: Teflon coated or equivalent, Heating capacity: More than 300W	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	0	4	0	1	1	6	
				BS	1	1	1	1	1	5	
D-35	Vacuum Pump	Ultimate vacuum to 10-3 torr.	Included in D-44 and D-49.	PC1	1	1	1	1	1	5	D
				PS	1	1	1	1	1	5	
				Ext	0	0	1	0	0	1	
				BS	0	0	0	0	0	0	

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Item	Technical Specification		Quantity					Total	Priority		
	PC-1/PS	Basic Desingn Study	PAK	SND	PJB	NWFP	BAL				
D-36	Oven	Range: 50-500 , Capacity: 50 liters, large area grid shelves, programmable.	Range: ambient to 300 , Capacity: 50 liters, large area grid shelves, programmable.	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	3	4	3	2	1	13	
				BS	0	0	0	1	1	2	
D-37	Microwave Digester	No specification	Microwave power: more than 1000W, Temperature control: all vessels up to 300 degreeC, simultaneously, Pressure control: Hydraulic control of the internal pressure, Vessel cool down: Built-in four-stage high power fan, Vessel material: quartz glass vessels: 25-50ml, Vessel number: more than 6	PC1	1	1	1	1	1	5	B
				PS	0	0	0	0	0	0	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
D-38	Colony Counter	Accurate microbial count, Counter feature: 150mm diameter, well accommodate 70mm & 100mm petridishes.	Display: LED, should cover 000 to 999, Lamp: Fluorescent , Counting System: Manual push button pen, probe, Petri Dish: dia 100 mm or more	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	1	1	1	0	0	3	
				BS	1	1	1	1	1	5	
D-39	Water Bath (Small)	Capacity: 5-10 liters, Temperature 3 above ambient to 100 , stability ±above ambient to 100 , stability ± 0.2 .	Capacity: Approx 10 liters (ex. 270 X 270 X 170mm), Temperature 3 above ambient to 100 , stability ±above ambient to 100 , stability ±0.2 .	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	1	1	
				BS	1	1	1	1	1	5	
D-40	Water Bath (Large)	Capacity 20-50 liters, temp. 3 above ambient to 100 , stability ±0.2 .	Capacity: Approx 30 liters (ex. 920×320×100mm), temp. 3 above ambient to 100 , stability ±0.2 .	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	2	2	1	0	0	5	
				BS	1	1	1	1	1	5	
D-41	CN Ion Distillation Unit with Heater	All glass parts with heating mental.	Heating method: Electric heating, Four ream type (Aplox 3.6Kw, equivalent to JIS K-0102). It can also used for phenol distillation.	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
D-42	F Ion Distillation Unit with Heater	All glass parts with heating mental.	Heating method: Electric heating, Four ream type (Aplox 3.6Kw, equivalent to JIS K-0102). It can also used for phenol distillation.	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
D-43	NH4 Ion Distillation Unit with Heater	All glass parts with heating mental.	Heating method: Electric heating, Four ream type (Aplox 3.6Kw, equivalent to JIS K-0102). It can also used for phenol distillation.	PC1	0	0	0	0	0	0	A
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
D-44	Filter System for Suspended Solid (SS)	Vacuum filtration holders with two or three way valves for independent control with high quality filter papers for gravimetric analysis and vacuum filtration pumps.	Filter holders with flask forfiller paper: dia. 47 mm, glass funnel: ca 300 ml, [Manifold] No. of branches: 3 pc, [Glass filter] Diameter: dia. 47 mm, [Vacuum filtration pump]	PC1	2	2	2	1	1	8	A
				PS	2	2	2	1	1	8	
				Ext	0	0	1	0	0	1	
				BS	1	1	1	1	1	5	
D-45	Analytical Balance,210g - 0.1mg	Maximum loading weights 210g and readability up to 0.1mg.	Type: suspended pan or top loading, Weighting capacity of more than 200 g, Reading of less than 0.1 mg, Allowance of less than ± 0.2 mg, Pan diameter of ca 80 mm	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	2	1	3	2	1	9	
				BS	0	1	0	0	1	2	
D-46	Analytical Balance,220g - 0.01mg Change to Macro Balance 2000g	Maximum loading weights 220g and readability up to 0.01mg.	Max weighting capacity of 2000 g, Allowance of less than 0.1 g, Stabilization timeof less than 2 sec., Pan diameter of ca 100 mm	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
D-47	Low Temperature Incubator	Refrigerated incubator, Temperature ranges: -5 to 50 .	Incubator, Temperature ranges: 5 to 50 . Capacity: Approx. 280 liter, Temperature accuracy: Less than +/- 1 degreeC, Temperature display: Digital	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	1	2	1	0	1	5	
				BS	1	0	1	1	1	4	
D-48	High Speed Homogenizer	To disperse, disintegrate & to homogenize solids in aqaus and organic solvents buffers, system with variable speed motor of 8000-24000 rpm, include beakers and test tube holders.	(To be deleted)	PC1	1	1	1	1	1	5	D
				PS	0	0	0	0	0	0	
				Ext	0	0	0	0	0	0	
				BS	0	0	0	0	0	0	
D-49	Vacuum Filter Unit	Buchner funnels with vacuum filtration pumps, Capacity: filter up to 5-10 litter/min.	Buchner funnels: 90mm (500ml), Flask, filteing: 2000ml, Vacuum pump, Capacity: 25 min/min (Exhaust, aplox 10hPa),	PC1	1	1	1	1	1	5	A
				PS	0	0	0	0	0	0	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
D-50	Furnace	Digitally controllable furnace, Capacity: 600-700 covets. Dual LED display actual and set, Maximum continuous operating temperature 1200 .	Electric tubular furnace, Digital temperature controller, Range of temperature: Normal temperature 1150 and max 1200 , Size on inside: 40×300mm	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
D-51	Muffle Furnace	Ambient to 1200 with temperature control system.	Capacity: approx. 9-litter, Heating element: Completely muffled with no exposure to furnace chamber, Temperature range: More than 1150 degreeC, Temperature accuracy: +/- 1 degreeC, Temperature display: Digital, Temperature control: Thermostatic	PC1	1	1	1	1	1	5	A
				PS	0	0	0	0	0	0	
				Ext	1	1	1	1	1	5	
				BS	1	1	1	1	1	5	
D-52	Laminar Air Flow Cabinet	Air flow cabinet with UV light, Flourescent light and fixture to protect the user & environment from biohazards particulates.	UV light, Flourescent light and fixture to protect the user & environment from biohazards particulates. Type: Desk top type, Air velocity: Approx. 0.45 m/sec., Collection efficiency: More than 99.99% at 3 micro meter, Total dimension (W x D x H): Approx. 750 x 500 x 1135	PC1	1	1	1	1	1	5	A
				PS	0	0	0	0	0	0	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
D-53	Autoclave	Microprocessor control autoclave, programmable both with slow & fast exhaust. Unit include 3-4 shelves and up to 60 minutes average cycle time.	Temp. control range: Should cover 100 to 129 degreeC, Temp. control accuracy: Less than +/- 1 degreeC, Pressure range: 0 to 1.64 kPa, Temp. control: Microprocessor control, Timer: 1 to 60 min., Drum container capacity: More than 50 L	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	1	1	1	0	1	4	
				BS	1	1	1	1	1	5	
D-54	Refrigerator	Maintain temperature to 4 with glass door laboratory refrigerator, Capacity: 600 liters. Uniformity of temperature ±0.5-4 .	(To be deleted)	PC1	1	1	1	1	1	5	D
				PS	0	0	0	0	0	0	
				Ext	1	0	1	0	0	2	
				BS	0	0	0	0	0	0	

Table A-1 List of Requested Equipment

Priority A: Indispensable B: High C: Moderate D: Low  
 PC1: Demand Equipment, PS: Preparation study, Ext: Existing equipment BS: Basic design study technical note  
 PAK: Pak-EPA, SND: Province Sindh-EPA, PJB: Province Punjab-EPA, NWFP: Province NWFP-EPA, BAL: Province Balochistan-EPA

Item	Technical Specification		Quantity					Total	Priority		
	PC-1/PS	Basic Design Study	PAK	SND	PJB	NWFP	BAL				
D-55	Freezer	Ultra low temperature freezer, maintain temperature to -120 with microprocessor control monitor operation & alarm system. Capacity: 600 liters.	(To be deleted)	PC1	1	1	1	1	1	5	D
				PS	0	0	0	0	0	0	
				Ext	1	1	0	0	0	2	
				BS	0	0	0	0	0	0	
D-56	Ice Machine	Ice cube maker, Capacity: 150 Kg/day & storage capacity up to 150 Kg.	(To be deleted)	PC1	1	1	1	1	1	5	D
				PS	0	0	0	0	0	0	
				Ext	0	0	0	0	0	0	
				BS	0	0	0	0	0	0	
D-57	Electrophoresis Equipment	No specification	(To be deleted)	PC1	1	1	1	1	1	5	D
				PS	0	0	0	0	0	0	
				Ext	0	0	0	0	0	0	
				BS	0	0	0	0	0	0	
D-58	Fire Extinguisher (Dry chemical)	No specification	(To be deleted)	PC1	1	1	1	1	1	5	D
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	0	0	0	0	0	0	
D-59	Portable Generator Set	No specification	(To be deleted)	PC1	1	1	1	1	1	5	D
				PS	1	1	1	1	1	5	
				Ext	1	0	1	0	0	2	
				BS	0	0	0	0	0	0	
D-60	pH Ion Selective Meter (Change to PH Meter)	Range: 1.99-19.999, accuracy: 0.002 pH, auto calibration with memorize buffers.	Measuring method: Glass electrode method, Display: pH/mV, Temp., Clock, Temperature compensation range: 0 to 100 degree C (Automatic or manual), Measuring range: pH 0 to 14, 0 to ± 1,999.9mV, 0 to 100 degree C, Resolution: 0.001pH, 0.1mV, 0.1 degree C, Digital output: RS-232C built-in	PC1	1	1	1	0	0	3	A
				PS	1	1	1	1	1	5	
				Ext	1	3	2	1	2	9	
				BS	1	1	1	1	1	5	
D-61	Dissolved Oxygen (DO) Meter	D.O range: 0-1.99% with 1% resolution.	Desk-top type, Measuring method: Diaphragm Galvanic cell or Diaphragm Polarography, Ranges: DO 0 - 20.0 mg/L or more, Accuracy: DO ±0.03 mg/L, Output: RS-232C, Calibration method: Automatic calibration by atmosphere and by solution (zero, span solution)	PC1	1	1	1	0	0	3	A
				PS	1	1	1	1	1	5	
				Ext	2	1	1	1	1	6	
				BS	1	1	1	1	1	5	
D-62	Conductivity Meter	4 digits LCD, MS 0-199.9, with all accessories.	Desk-top type, Measuring method: Alternating current four electrode, Measuring range: 0-7.0 S/m, Repeatability: ± 1 % of F.S., Temp. compensation: 0-50 degree C, Display: Digital, LCD, Calibration: Automatic	PC1	1	1	1	0	0	3	A
				PS	1	1	1	1	1	5	
				Ext	2	2	0	1	2	7	
				BS	1	1	1	1	1	5	
D-63	Turbidity Meter	4 digits LCD, MS 0-199.9, with all accessories.	Desk-top type, Measuring range: Should cover 0 to 999 NTU, Resolution: Better than 0.01 on lowest range, Repeatability: Better than +/- 1%, Sensitivity: Better than 0.01 NTU, +/- 1 digit.	PC1	1	1	1	0	0	3	A
				PS	1	1	1	1	1	5	
				Ext	1	3	2	1	0	7	
				BS	1	1	1	1	1	5	
D-64	Standard Thermometer Set	Range 0-100 , 1-200 , 10-300 , 10-400	Desk-top type, With authorization result book on manufacturer. Issue the proofreading certificate. Measuring range: -56 ~ 0 degree C, 0 ~ 50 degree C, 50 ~ 100 degree C, 100 ~ 150 degree C, 150 ~ 200 degree C, 200 ~ 250 degree C, 250 ~ 300 degree C, 300 ~ 360 degree C,	PC1	1	1	1	0	0	3	A
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
D-65	Pure Water Supply Unit	Compact deionized water production unit, operating capacity 0.5 liter/min, water conductivity not more than 1 S/cm, AC220V.	<b>[Equipment for water pretreatment]</b> Treatment method: Prefilter, Softening water by ion exchange, Feed water: Tap water, Produced water: Distilled water approx. 1.8 liter/hour, Deionized water approx. 0.5 liter/min., Regeneration: Less than twice/day <b>[Pure water equipment]</b> Purification method: RO, Distillation, Ion exchange and Filtration, Production flow rate: More than 1.0 L/min., Monitoring: Conductivity	PC1	1	1	1	1	1	5	A
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
D-66	Water Distillation Unit	Automatic still to monitor water flow and temperature, 1.5 - 2.0 liter/hour with 10 liter storage reservoirs.	This Item is substituted by D-65.	PC1	1	1	1	1	1	5	D
				PS	0	0	0	0	0	0	
				Ext	1	0	1	1	1	4	
				BS	0	0	0	0	0	0	
D-67	Water de-ionizer	Reduce corrosive anions, efficiently control, pH level and inorganic matter	This Item is substituted by D-65.	PC1	1	1	1	1	1	5	D
				PS	0	0	0	0	0	0	
				Ext	1	0	1	1	0	3	
				BS	0	0	0	0	0	0	
D-68	Wastewater treatment equipment	No specification	Waste water containing (General heavy metals, Cyanogen, Hexavalent chromium, Mercury, Alkaline substances), Treatment method: Batch system, Treatment performance: Total 100 ppm, Cyanogen 500 ppm, Mercury 50 ppm, pH 2 - 12	PC1	0	0	0	0	0	0	B
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	
D-69	Flue gas treatment equipment (Fume Hood with Gas Scrubber)	No specification	Fume hood with fixtures and base storage cabinets, controlled exhaust, maximum air flow and emergency exhaust. Water supplies connection & fluorescent light, Vent exhaust fitted with gas scrubbers to trap the toxic gases.	PC1	0	0	0	0	0	0	A
				PS	2	1	1	1	1	6	
				Ext	0	0	0	0	0	0	
				BS	2	1	1	1	1	6	
D-70	Personal Computer	No specification	Desk-top type	PC1	3	3	3	3	3	15	C
				PS	1	1	1	1	1	5	
				Ext	0	0	0	0	0	0	
				BS	1	1	1	1	1	5	

Table A-2 List of Equipment

Priority=A:High B:Moderate D : Low

		Specification	Quantity					Total	Priority
			PAK	SND	PJB	INWFR	BAL		
<b>A. Air Quality Monitoring Equipment</b>									
<b>A-1 . Air Monitoring Station</b>									
	A-1-1	Fixed Automatic Air Quality Monitoring Station CO Monitor/ NO Monitor/ O <sub>3</sub> Analyser/ SO <sub>2</sub> Monitor/ THC Monitor/ SPM Analyser[PM10, PM2.5], Standard syslinder gas (w/ decompressor)[CO·NO·SO <sub>2</sub> ·CH <sub>4</sub> /C <sub>3</sub> H <sub>8</sub> ] Dilution unit of standard gas, Wind direction & speed meter, Thermo- & humidity meter, Barometer, Sunshine meter, Computer (w/printer)/Data loggaer/Telemetry system/UPS/Container(w/air conditioner) *: Container of Pak-EPA is included in facility construction.	1*	2	2	1	1	7	A
	A-1-2	Mobile Automatic Air Quality Monitoring Station CO Monitor/ NO Monitor/ O <sub>3</sub> Analyser/ SO <sub>2</sub> Monitor/ THC Monitor/ SPM Analyser[PM10, PM2.5], Standard syslinder gas (w/ decompressor)[CO·NO·SO <sub>2</sub> ·CH <sub>4</sub> /C <sub>3</sub> H <sub>8</sub> ] Dilution unit of standard gas, Wind direction & speed meter, Thermo- & humidity meter, Barometer, Solar Radiation Meter, Computer (w/printer)/Data loggaer/Telemetry system/UPS/Container(w/air conditioner)/Diesel truck	1	1	1	0	0	3	A
	A-1-3	Data Processing System in Pak-EPA (Hardware & Software) Computer with following functions: -to collect air data from fixed & mobile stations, and from provincial EPAs -to give warning for serious air pollution -to store data as database -to edit data/reporting support	1	0	0	0	0	1	A
	A-1-4	Data Processing System in Prv-EPAs (Hardware & Software) Computer with following functions: -to collect air data from fixed & mobile stations -to give warning for serious air pollution -to store data as database -to edit data/reporting support	0	1	1	1	1	4	A
	A-2	Dust measuring equipment 1. To measure dust flow, 2. To measure moisture contennt, 3. To collect dust	1	1	1	1	1	5	A
	A-3	Stack gas measuring equipment NO <sub>x</sub> : Chemical lumious method, 0 to 2,500ppm or more in free range SO <sub>2</sub> : non-dispersive infrared absorption method, 0 to 1,000 ppm or morein free range O <sub>2</sub> : magnet force method, 0 to 25% CO : non-dispersive infrared absorption method, 0 to 2,000ppm or morein free range CO <sub>2</sub> : non-dispersive infrared absorption method, 0 to 15% or more in free range	1	1	1	1	1	5	A
	A-4	Wet-type stack gas collection equipment (1) Absorption bottle(500ml), (2) So x Washing bottle, (3)Dry bottle, (4) Three way cock, (5) Flow meter :0 ~ 2000ml/min, (6) Mercury Manometer :4.5L/min, (7) Suction pump (max 4.5L/min), (8) Voltage regulator : input 100V output 0 ~ 100V w/variable 5A, (9) Transformer :input 220V output 100V 10A, (10) Gas suction pipe (Glass-filter type), (11) Mercury thermometer, (12) Ribon heater (400W)	1	1	1	1	1	5	B
	A-5	Olzat gas analyzer (1) Gas absorption pipe, (2) Gas buillet 100mL (3) Leveling bottle, (4) Rubber gloves for sampling	1	1	1	1	1	5	B
	A-6	Wet-type gas meter 1)Measuring range : 0.033 ~ 10L/min or more, Drum volume : 1 liter 2)Measuring range : 0.16 ~ 50L/min. Drum volume : 5 liter	2	2	2	2	2	10	A
	A-7	Low-volume air sampler 10µm or more 100% cut Absorption flow : 17.66 L/min	1	1	1	1	1	5	B
	A-8	High volume air sampler Absorption flow: 1000 to 1200L/min Flow accuracy:±5%	3	2	2	3	0	10	A
	A-9	Andersen air sampler Particle size step : 8 Absorption flow: 28.3 L/min	1	1	1	1	1	5	B
	A-10	Impinger gas sampling system Sampling volume ca.0.5 ~ 2.0L/min, Impinger: 2, Mannual regulation for flow & duration, Morter-driven	9	9	9	9	9	45	B
	A-11	Rotor meter Type: float volume meter Flow range: 50 mL/min. 100 mL/min. 500 mL/min. 2 L/min. 20 L/min.	1	1	1	1	1	5	A
	A-12	Dust meter (Deposit gage) Support: flame mesh Sampling bottle : Plastic tank 20L	5	5	5	5	5	25	B
	A-13	Monitoring vehicle Wagon-type (high-roof w/ca. 1500 mm)/ Engine :2900cc or more (Deisel)/2 WD/ Seating capacity :3person	1	1	1	1	1	5	A
<b>W. Water Quality Monitoring Equipment</b>									
	W-1	HEYROHT type Water Sampler HEYROHT type, Capacity: 1000 ml	1	1	1	1	1	5	A
	W-2	Digital Current Meter Electromagnetic type,Measuring Range: 0 ~ ±200cm/sec,Accuracy : less than +/-2%FS or +/-0.5cm/sec, Power: dry cell batteries, Power capacity:15 hr or more	1	1	1	1	1	5	A
	W-3	Ekman Barge Sludge Sampler Area collected sample: 15 x 15 x 15 (cm) / Brass Metal / Messenger with Rope 50m	1	1	1	1	1	5	A

Table A-2 List of Equipment

		Specification	Quantity					Total	Priority
			PAK	SND	PJB	NWFP	BAL		
<b>L. Laboratory Analytical Equipment</b>									
L-1		Atomic Absorption Spectrophotometer (AAS)	Optical: Optical double beam or Electrical double beam or Switchable double beam, Background Correction: BGC-SR and BGC-D <sub>2</sub> or D <sub>2</sub> lamp method or Zeeman method, Measurement mode: Flame and Graphite Furnace modes, (Hollow Cathode Lamp: Al, As, Be, B, Cd, Cr, Cu, Cr, Fe, Pb, Mn, Hg, Ni, Ag, Zn), Water circulator, Mercury vaporizer					3	A
L-2	(1)	Attachment of Atomic Absorption Spectrophotometer(AAS) [NWFP]	1. Graphite Furnace Atomizer 2. Auto sampler(Maximum number of reagent: 50 positions or more) 3.Mercury vaporizer unit 4.Hydride vapor generator 5.Hollow Cathode Lamp :Ag, Al, As, Be, B, Se, Hg:1each 6. Software					1	A
L-2	(2)	Attachment of Atomic Absorption Spectrophotometer(AAS) [SND]	1.Mercury vaporizer unit 2.Hydride vapor generator 3.Hollow Cathode Lamp:Al, Be, Cu, Fe, Hg: 1each 4. Software					1	A
L-3		UV/Vis Spectrophotometer	Double beam optics, Deuterium lump, Halogen lamp, Wave length range: 190 ~ 1100 nm, Wavelength Accuracy: +/-0.3 nm or less, Spectrum bandwidth:2nm or less, Power stabilizer					3	A
L-3(2)		Attachment of UV/Vis Spectrophotometer [SND]	1.Quartz Cell, Flow Cell 2.Halogen lamp 3.D <sub>2</sub> lamp 4.Software					1	A
L-4		Gas Chomatograph (ECD,FID)	Column Oven :8L or more, Temperature range: 100 ~ 450, (1.0 step), Number of program steps :5step or more, [FID detector], Detection limit: 5 pg C/Sec, [ECD detector] Detection limit: 0.05pg以下、Power stabilizer					4	A
L-4(2)		Attachment og Gas Chomatograph[SND]	1.Capillary column 2.Widebore Capillary Column 3.Software					1	A
L-5		Ion Chomatograph	Flow rate: 0.5 ~ 3.0 mL/min, maximun pressure:20.0 Mpa or more, [Detector]: Conductivity, Measuring Range: 0 ~ 1000 μ S/cm,, temperature range.: 10 ~ 40, [Column]: Anion, Cation Analytical column, auto sampler, Power stabilizer, UPS (10min)					5	A
L-6		Sulfur Content Analyzer in Fuel	Measuring method:X-ray fluorecent, Measuring Range: 0-5%, Accuracy: 15ppm, Detection limit : 50ppm					1	A
L-7		Oil content meter	Mesuring method : non-dispersive Infrared absorption, Measuring Range: 0 ~ 100 mg/L, Accuracy: FS±0.2 mg/L					3	B
L-8		Total Organic Carbon Analyzer	Mesuring method: non-dispersive infrared absorption, Measuring Range: 0 ~ 10000 mg/L, Detection limit: 5 μ g/L, Measuring time: 10 min or less, Power stabilizer					1	B
L-9		Microwave Digester	Power: 800W or more, Device for exhausting gases, Oven Capacity: 33L or more					5	B
L-10		COD Analyzing Apparatus	Mantle heater: Mantle heater (6 flasks), Automatic burette set :25mL, COD bottle: 300mL					5	A
L-11		BOD Analyzing Apparatus	Oxygen bottle : Oxygen bottle capacty 300mL, 100 pcs Incubator : Camber Capacity 150L or more, temperature range:10 ~ 30					5	A
L-12		Low Temperature Incubator	Forced Air Circulation Temperature range: -10 ~ 50. Camber Capacity:50L or more, Accuracy: +/- 1, Power stabilizer					4	A
L-13		Oven	Forced Air Circulation, Control Temperature: 40 ~ 260 or more, Capacity: 90 L or more					2	A
L-14		Furnace	Temperature range: ~ 1050, Size: 40×300mm					5	A
L-15		Muffle Furnace	Method : Natural convection, Operating temperature range : 100 ~ 1100, Temp. distribution Accuracy : Within ±7, Internal Capacity : 7 L or more					5	A
L-16		Rortary Evaporator	Rortry Speed: 20 ~ 150 rpm, /Sample flask : 1 L, Receiver flask 1 L / Water Bath Temperature Range : Room temperature+5 to 90deg.C					5	A
L-17		Aspirator w/ Cooling Unit	Circulation pump : 15L/min / Cooling Power: 500W or more					5	B
L-18		Tabletop Type Centrifuge	Max. Speed: 5000 rpm or more / Capacity: 15ml x 32 or more					5	A
L-19		Hot Plate	Operaing Temperature Range : 250 or more / Plate size : 300 x 300 mm or more					5	A
L-20		Magnetic Stirrer (small)	Stirring Capacity: 1000ml / Stirring Speed : 200 ~ 1500 rpm					5	A

Table A-2 List of Equipment

		Specification	Quantity					Total	Priority
			PAK	SND	PJB	NWFB	BAL		
L-21	Magnetic Stirrer (large)	Stirring Capacity: 5000ml / Stirring Speed : 150 ~ 1200 rpm,	1	1	1	1	1	5	A
L-22	Magnetic Stirrers (w/Hot Plate)	Stirring Capacity: 3000ml / Stirring Speed : 400 ~ 1200 rpm / Hot Plate Temperatuer :300 or more	1	1	1	1	1	5	A
L-23	Water Bath (small)	Capacity: 10L or more,Temp. Setting Range : Room temperature+5 to 80deg.C,Temperature Control Tolerance: ±0.5 .	1	1	1	1	1	5	A
L-24	Water Bath (large)	Capacity: 27L or more,Temp. Setting Range : Room temperature+5 to 80deg.C,Temperature Control Tolerance :±0.5 .	1	1	1	1	1	5	A
L-25	Distillation Apparatus (for CN, NH <sub>4</sub> and F)	Mantle heater, Distillation Apparatus 3units (Compliance with JIS K0102)、Flask Capacity:1L	1	1	1	1	1	5	A
L-26	Vacuum Filter Unit	Bufner rote: 90mm (Capacity300ml), Filter bell:1000ml, receiver flask, Glass Fiber Filter : 90mm, Dry vacuume pump :Maximum vacuume 15kpa or less	1	1	1	1	1	5	A
L-27	Filter System for Suspended Solid (SS)	Funnel Unit: 47mm,300 ml, Glass Filter Base、Manifold :Triple Funnel Unit, Glass Fiber Filter: 47 mm, Dry vacuume pump :Maximum vacuume 15kpa or less	1	1	1	1	1	5	A
L-28	Analysis Balance	Capacity 200 g or more, Minimum display 0.1 mg, Accuracy± 0.2 mg	0	1	0	0	1	2	A
L-29	Macro Analysis Balance	Capacity 2000 g or more, Minimum display 0.1 g, Pan size : φ100 mm or more	1	1	1	1	1	5	A
L-30	Clean Bench	(1) Air Circulation Type (2) Frontage Width : 840 mm ~ 1010mm (3) Collection Efficiency : More than 99.99% on 0.3mm particle (4) Inside cleanliness factor : クラス100 (5) Inside Air Velocity : 0.2 m/sec or more(6) Noise level: 65 db or less	1	1	1	1	1	5	A
L-31	Autoclave (Vertical Type)	Operating Temperature : 115 to 121 deg. C or more, Maximum Operation Presser: 0.15MPa or more, Temperature control:Microcomputer control, Chamber capacity:47L or more	1	1	1	1	1	5	A
L-32	Colony Counter	Display: LED, 3 digits (000 to 999), Counting System:Pen, probe, Stage Size (round stage) : φ 100mm or more	1	1	1	1	1	5	A
L-33	Microscope	Trinocular Microscope/ Objective Lens :x4, x10, x40, x100 / Total Magnification : x40 ~ x1500	1	0	1	1	1	4	A
L-34	Shaker	Shaking System :Vertical shaking, Shaking Speed :100 to 300 times/min or more, Shaking Strok :40mm, Timer :0 to 60 min., Separating Funnel Installation Capacity :500ml × 3 or more :300ml × 3 or more :200ml × 5 or more :100ml × 5 or more	1	1	1	1	1	5	A
L-35	Laboratory pH Meter	Desk top type, Measuring Method : Glass Electrode Method, Measuring Range : pH 0.00 ~ 14.00, Resolution : 0.01pH or less、Repeatability : ±0.02pH	1	1	1	1	1	5	A
L-36	Laboratory Type DO Meter	Desk top type, Measuring Method : Polarographic or Membrane galvani、Display : Digital、4 digits、Measuring Range : 0.00 ~ 19mg/L or more, Resolution : 0.01mg/L or less, Accuracy : Within ±0.2mg/L	1	1	1	1	1	5	A
L-37	Desktop Conductivity Meter	Desk top type, Measuring Method : AC2 electrodes, or equivalent、Measuring Range : 0 mS/cm ~ 199 mS/cm or more, Resolution : Within ±0.01 mS/cm, Repeatability : Within ± 0.5% FS	1	1	1	1	1	5	A
L-38	Desktop Turbidity Meter	Desk top type, Measuring Method : Nephelometric/or Integrating sphere method, Measuring Range : 0 ~ 1000NTU or more, Resolution : 0.001NTU or less, Accuracy : Within ±2% at 0~1,000 NTU	1	1	1	1	1	5	A
L-39	Standard Thermometer Set	Measuring Range: -50 ~ 0 , 0 ~ 50 , 50 ~ 100 , 100 ~ 150 , 150 ~ 200 , 200 ~ 250 , 250 ~ 300 , 300 ~ 360	1	1	1	1	1	5	A
L-40	Pure Water Supply Unit	Production Method: Prefiltration - Distillation - Ion exchange- Filtration、Production of Pure Water: Deionized water, Distilled water、Production Capacity Rate : 1.5 L/h (Distilled Water) or more, Distilled Water Collection Rate : 1L/min. or more, Distilled Water Storage Tank : 20L or more	1	1	1	1	1	5	A
L-41	Refrigerator	Capacity : 290L or more / Temperature : 3 to 7 degC or lower	1	1	1	1	1	5	A
L-42	Wastewater Treatment Equipment	Waste water containing (General heavy metals, Cyanogen, Hexavalent chromiun, Mercury, Alkaline substances)Treatment equipment / Operation method : Batch, Treatment Capacity : 20L	1	1	1	1	1	5	B
L-43	Draft Chamber With Gas Cleaning Device	(1) Dimension :900(W) x 750(D) x 2,100(H) mm or more (2) Exhaust Air :12m <sup>3</sup> /min. or more(3) Face Air Velocity :0.25m/sec. or more(4)Hume Duct :PVC/ Gas Cleaning Device :Wet type (Water shower & pack column)	2	1	1	1	1	6	A
L-44	Glass Wares and Laboratory Instruments	Flask·Pipette·Reaget Bottle etc.	1	1	1	1	1	5	A
L-45	Reagents	Aceton· Ammonium chloride· Butyl acetate , EDTA, Nitric Acid etc.	1	1	1	1	1	5	A
L-46	Carrier gas and Combustion gas for Analytical	Gas cylinder for AAS & GC	1	1	1	1	1	5	A

Table A-3 List of Reagent

No.	Reagent	Quantity	Remark
(1)	trans-1,2-Cyclohexanediaminetetraacetic acid monohydrate, min.98%	200 g	F
(2)	1,10 - Phenathroline. H <sub>2</sub> O	10 g	Basic
(3)	1-Amino-2-naphthol-4-sulfonic acid (Ascorbic acid)	100 g	PO <sub>4</sub> -P
(4)	4-Amino antipyrine	250 g	Phenol
(5)	Acetic acid	1 l	Basic & F
(6)	Acetone	1 l	Basic & B
(7)	Ammonium chloride	1 kg	Phenol
(8)	25% Ammonia Solution	1 l	Basic
(9)	Hexaammonium heptamolybdate tetrahydrate	500 g	Silica&PO <sub>4</sub> -P
(10)	Ammonium thiocyanate	500 g	Basic
(11)	Bis[(+)-tartrato] diantimonate( ) dipotassium trihydrate	100 g	PO <sub>4</sub> -P
(12)	Barium chloride, anhydrous	500 g	SO <sub>4</sub>
(13)	Boric acid (H <sub>3</sub> BO <sub>3</sub> )	500 g	B
(14)	Bromophenol blue	1 g	Basic
(15)	Bromophenol red	1 g	Basic
(16)	Bromocresol green: C <sub>21</sub> H <sub>14</sub> Br <sub>4</sub> O <sub>5</sub> S	1 g	Basic
(18)	Cadmium-Copper Soft drops (0.5-2 mm)	200 g	T-N
(19)	Butyl acetate	500 g	Heavy Metals
(20)	Calcium carbonate	500 g	Basic
(21)	Calcium chloride dihydrate	500 g	Basic
(22)	Calcium oxide (powder)	500 g	Basic
(23)	Curcumin	5 g	B
(24)	Sodium p-toluenesulfonchloramide trihydrate	25 g	CN
(25)	Chloroform	2 l	Phenol
(26)	Cupric sulfate.5H <sub>2</sub> O (or copper ( ) sulfate.5H <sub>2</sub> O)	500 g	Phenol
(27)	Dipotassium hydrogen phosphate (anhydrous)	500 g	Basic
(28)	Disodium hydrogen phosphate (anhydrous)	500 g	Basic
(29)	Diammonium hydrogen phosphite	500 g	Basic
(30)	Diphenyl carbazide	25 g	Cr <sup>6+</sup>
(31)	Erichrom black T	5 g	Hardness
(32)	Ethanol (95%)	1 l	Basic
(33)	Ethanol (99.5)	1 l	Basic
(34)	EDTA, disodium salt, dihydrate, ACS/USP Grade	500 g	Hardness, CN
(35)	Ammonium iron( ) sulfate 12-water	500 g	Basic
(36)	Iron( ) chloride hexahydrate	500 g	Basic
(37)	Ammonium iron( ) sulfate hexahydrate	500 g	COD
(38)	Iron( ) sulfate heptahydrate	500 g	Basic
(39)	Formaldehyde solution	250 g	Basic
(40)	D(+)-Glucose	500 g	Basic
(41)	Glycerol	500 g	Basic
(42)	Hydrochloric acid	2.5 l	Basic
(43)	Hydrogen peroxide 30%	1 l	Basic
(44)	Hydroxylammonium chloride	500 g	Hg
(45)	Iodine solution N/10	1 l	Basic
(46)	Isonicotinic acid	25 g	CN
(47)	L(+) Ascorbic acid (crystals)	500 g	PO <sub>4</sub> -P
(48)	Lead( ) acetate trihydrate	500 g	Basic
(49)	Linear-Alkylbenzenesulfonic Acid	10 g	ABS
(50)	ENDO agar	500 g	Coliform
(51)	M FC agar	500 g	Coliform
(52)	Magnesium sulfate.7H <sub>2</sub> O	500 g	BOD
(53)	Manganese sulfate.5H <sub>2</sub> O	500 g	BOD
(54)	Mercury( ) Chloride	500 g	COD
(55)	Mercury( ) sulfate	500 g	COD
(56)	Mercury( ) thiocyanate	500 g	Cl

Table A-3 List of Reagent

No.	Reagent	Quantity	Remark
(57)	Metapresol purple	5 g	Heavy Metals
(58)	Methanol	1 l	Basic
(59)	3-Methyl-1-phenyl--5-pyrazolone	25 g	CN
(60)	Methyl red	25 g	Basic
(61)	Methylene blue	25 g	ABS
(62)	<i>N,N-dimethylformamide</i>	500 g	CN
(63)	<i>N,N-dimethyl -1, 4-phenylenediamine</i>	100 g	S <sup>2-</sup>
(64)	<i>N,N-dimethyl-p-phenylene diamine sulfale</i>	100 g	S <sup>2-</sup>
(65)	<i>N-1-Naphthyl ethylene diamine dihydrochloride</i>	25 g	NO <sub>2</sub> , NO <sub>x</sub>
(66)	Hexane	2 l	Basic
(67)	Nitric Acid (1.38)	3 l	Basic, AAS
(68)	ortho-Phosphoric acid 85%	2 l	Basic
(69)	Oxalic acid	500 g	B
(70)	Pararosaniline base	25 g	SO <sub>2</sub> Sampling
(71)	Phenol	500 g	Phenol & NH <sub>4</sub>
(72)	Phenolphthalein	25 g	Basic
(73)	Phenol red, sodium salt	25 g	Basic
(74)	Potassium hydroxide	1 kg	DO
(75)	Potassium nitrite	500 g	Basic
(76)	Potassium bromide	500 g	Basic
(77)	Potassium chloride	500 g	Basic
(78)	Potassium chromate	500 g	Cl
(79)	Potassium cyanide	25 g	Hardness
(80)	Potassium dichromate	500 g	Basic
(81)	Potassium dihydrogen phosphate	500 g	Basic
(82)	Potassium ferricyanide, 99%	500 g	Basic
(83)	Potassium hexacyanoferrate( ) trihydrate	500 g	Basic
(84)	Potassium hydrogen phthalate	500 g	Basic
(85)	Potassium iodate (anhydrous)	500 g	Phenol
(86)	Potassium iodide (crystals)	500 g	COD
(87)	Potassium nitrate	500 g	Basic
(88)	Potassium permanganate	500 g	Basic
(89)	Potassium hydroxide	500 g	Basic
(90)	Potassium Sulfate	500 g	Basic
(91)	Pyridine	500 ml	Basic
(92)	1-Phenyl-3-methyl-5-pyrazolone: C <sub>10</sub> H <sub>10</sub> N <sub>2</sub> O	25 g	Basic
(93)	Rhodamine B (p-Dimethyl-amino-benzal rhodanine)	25 g	Basic
(94)	Mercury( ) oxide, red	500 g	T-N
(95)	Silica Gel, Medium Granular, Blue	500 g	Basic
(96)	Silica gel, Blue, small granule	1 kg	Basic
(97)	Silver nitrate	500 g	Cl
(98)	Silver sulfate	500 g	COD
(99)	Sodium acetate.3H <sub>2</sub> O	1 kg	Basic
(100)	di-Sodium hydrogen arsenate heptahydrate	500 g	Redual Cl <sub>2</sub>
(101)	Sodium azide (granular, purified)	500 g	DO & BOD
(102)	Sodium bicarbonate	500 g	Basic
(103)	Sodium carbonate (anhydrous)	500 g	Basic
(104)	Sodium chloride	500 g	Basic
(105)	Sodium dihydrogen phosphate monohydrate, 99%	500 g	Basic & CN
(106)	Disodium Hydrogenphosphate	500 g	Basic
(107)	Sodium fluoride	500 g	Basic & F
(108)	Sodium formate	500 g	Basic
(109)	Sodium hydroxide, Pellets	2 kg	Basic
(110)	Sodium hypochlorite (4-6%)	500 ml	NH <sub>4</sub>
(111)	Sodium Iodide	500 g	Basic



Table A-3 List of Reagent

No.	Reagent	Quantity	Remark
(112)	Sodium nitrate (anhydrous)	500 g	Basic
(113)	Sodium nitrite	500 g	Basic
(114)	Sodium sulfate	500 g	Basic
(115)	Sodium sulfate (anhydrous)	500 g	Basic
(116)	Sodium tetraborate (anhydrous)	500 g	Basic
(117)	Sodium thiosulfate.5H <sub>2</sub> O	500 g	DO & BOD
(118)	Tin( ) chloride, anhydrous	500 g	Basic
(119)	Starch, soluble, potato	500 g	BOD
(120)	Sulfanilamide	500 g	NOx
(121)	Sulfamic acid	500 g	Basic
(122)	Sulfanilic acid	500 g	Basic
(123)	Sulfuric acid	1 l	Basic
(124)	Tin (IV)chloride (anhydrous)	25 g	As
(125)	Thymol blue	25 g	Basic
(126)	Trioctylamine: [CH <sub>3</sub> (CH <sub>2</sub> ) <sub>7</sub> ] <sub>3</sub> N	500 g	Basic
(127)	Urea: H <sub>2</sub> NCONH <sub>2</sub>	500 g	Basic
(128)	Zinc, Drops	500 g	Basic
(129)	Zinc acetate	500 g	S <sup>2-</sup>
(130)	Zinc sulfate.7H <sub>2</sub> O	500 g	Basic
(131)	Glasswool (JIS K8251)	500 g	Basic
(132)	Sodium hydrogen-carbonate	25 g	SOx
(133)	Potassium gluconate	25 g	SOx
(134)	Sodium tetraborate (decahydrate)	25 g	SOx
(135)	Acetonitile	500 g	SOx
(136)	p-Hydroxy-benzonic acid	25 g	SOx
(137)	Bis (2-hydroxyethyl)-iminotris (hydroxymethyl)-methan	5 g	SOx
(138)	Phtalic acid	25 g	SOx
(139)	2-Amino-2-hydroxymethyl-1,3-propanediol	25 g	SOx
(140)	Phenol-4-sulfonic acid	100 ml	NOx
(141)	Calcium chloride (2-3mm.granule)	500 g	Basic
(142)	Perchloric acid, 60%	500 ml	Ion chromatography
(143)	Silver nitrate solution 0.1 mol/l	500 ml	( " )
(144)	Nitrobenzene	500 ml	( " )
(145)	Silicon Dioxide	250 g	F
(146)	Alfusone (R)	25 g	F
(147)	Lanthanum oxide	25 g	AAS
(148)	Potassium sulfate	500 g	AAS
(149)	Carbon disulfide	500ml ml	Oil Analysis
(150)	Polycyclic aromatic hydrocarbon kit (16set)	1 ml	Oil Analysis
(151)	Florisil	500 g	Oil Analysis
(152)	Sodiumu sulfite	500 g	Basic
(153)	Methansulfonic scid	500 g	Basic
(154)	Agar, Powder	500 g	coliform
(155)	Pepton P	500 g	coliform
(156)	Lactose monohydrate	500 g	coliform
(157)	Ammonium iron ( ) citrate, Brown	100 g	coliform
(158)	Sodium deoxycholate	50 g	coliform
(159)	Neutral red	25 g	coliform
(160)	Trace Elements in Lake Sediment (NMIJ CRM 7303-a)	60 g	Reference Material
(161)	Benzene	500 ml	basic
(162)	Tolene	500 ml	basic

Table A-4 List of Glassware

No.	Glassware	Quantity		Remark
1-1	Volumetric Flask, 10ml, class A, Borosilicate glass	5	pcs	Indispensable for preparation of standard solution
	Volumetric Flask, 25ml, class A, Borosilicate glass	10	pcs	"
	Volumetric Flask, 50ml, class A, Borosilicate glass	10	pcs	"
	Volumetric Flask, 100ml, class A, Borosilicate glass	10	pcs	"
	Volumetric Flask, 100ml, class A, Borosilicate glass (amber)	5	pcs	" (Preventable for decomposition)
	Volumetric Flask, 200ml, class A, Borosilicate glass	5	pcs	"
	Volumetric Flask, 250ml, class A, Borosilicate glass	5	pcs	"
	Volumetric Flask, 500ml, class A, Borosilicate glass	2	pcs	"
	Volumetric Flask, 1000ml, class A, Borosilicate glass	2	pcs	"
2	Volumetric Pipets, 1ml, one mark, class A, Borosilicate glass	2	pcs	Indispensable for quantitative sampling of samples or reagents
	Volumetric Pipets, 2ml, one mark, class A, Borosilicate glass	2	pcs	"
	Volumetric Pipets, 5ml, one mark, class A, Borosilicate glass	5	pcs	"
	Volumetric Pipets, 10ml, one mark, class A, Borosilicate glass	5	pcs	"
	Volumetric Pipets, 20ml, one mark, class A, Borosilicate glass	2	pcs	"
	Volumetric Pipets, 25ml, one mark, class A, Borosilicate glass	2	pcs	"
	Volumetric Pipets, 50ml, one mark, class A, Borosilicate glass	2	pcs	"
3	Sample bottle, wide mouth, 1000ml	5	pcs	Necessary for sampling and keeping of water samples
4	Regent bottle, 1000ml, glass	5	pcs	Necessary for keeping of reagents
	Regent bottle, 500ml, glass	10	pcs	"
	Regent bottle, 100ml, glass	5	pcs	"
5	Regent bottle, 1000ml, glass, wide mouth	5	pcs	"
	Regent bottle, 500ml, glass, wide mouth	5	pcs	"
	Regent bottle, 500ml, glass, wide mouth(amber)	10	pcs	" (Preventable for decomposition)
	Regent bottle, 250ml, glass, wide mouth(amber)	5	pcs	" (Preventable for decomposition)
6	Filter flask, 500ml, w/side arm	2	pcs	Indispensable as a instrument for filtration
	Filter flask, 1000ml, w/side arm	1	pc	"
7	Erlenmeyer flask, 100ml	5	pcs	Indispensable for preparation of reagents
	Erlenmeyer flask, 200ml	3	pcs	"
	Erlenmeyer flask, 300ml	4	pcs	"
	Erlenmeyer flask, 500ml	2	pcs	"
	Erlenmeyer flask, 1000ml	1	pcs	"
8	Erlenmeyer flask, 24/40 \$joint, borosilicate,500ml	10	pcs	Indispensable as a instrument for decomposition
9	Flat bottom flask, 24/40\$ joint 500ml	5	pcs	Indispensable as a instrument for decomposition
10	Desiccator, glass, 180mm (dia.)	1	pc	Necessary for dry keeping of reagents and samples
11	Test tube, 18(dia.) x 180 (L) mm \$16	20	pcs	Necessary for operation of coloring
12	Test tube, 24(dia.) x 250 (L) mm \$19/18	10	pcs	"
13	Beaker, 30ml, borosilicate glass	10	pcs	Indispensable for heating treatment of samples and reagents
	Beaker, 50ml, borosilicate glass	20	pcs	"
	Beaker, 100ml, borosilicate glass	20	pcs	"
	Beaker, 200ml, borosilicate glass	20	pcs	"
	Beaker, 500ml, borosilicate glass	5	pcs	"
	Beaker, 1000 ml, borosilicate glass	5	pcs	"
	Beaker, 2000 ml, borosilicate glass	1	pcs	"
14	Conical beaker, 200ml	20	pcs	Indispensable for titration of BOD and COD
15	Coiled condenser, 300mm,(24/40 TS Joint)	2	pcs	Necessary for distillation apparatus
	Libeg condenser, 300mm, (24/40 TS Joint)	1	pcs	"
	Fridrsh condenser, 300mm,(24/40 TS Joint)	1	pcs	"