

TECHNICAL NOTE

THE BASIC DESIGN STUDY ON THE PROJECT FOR ESTABLISHMENT OF ENVIRONMENTAL MONITORING SYSTEM IN ISLAMIC REPUBLIC OF PAKISTAN

Based on the agreed Minutes of Discussions (M/D) for the captioned Study signed between the Pakistani side and Japanese side on February 26, 2005, the field study in Pakistan has been completed in close corporation between JICA Study Team and counterparts of the Pak-EPA and Provincial-EPAs.


In the course of the field study, many technical items have been discussed for the Project to be implemented under the Japan's Grant Aid, and both sides agreed of the main items described in attached sheets. This is summarized to further work for the Project in Japan.

Both sides agreed that the Minutes of Discussion (M/D) dated on February 26, 2005 would prevail this Technical Note (T/N), in case any discrepancy or question arises between the M/D and the T/N.

March 18, 2005



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1. Confirmation of the PC-1

The Pakistani side submitted to the Team an OFFICE MEMORANDAM (No. 2 (218) ENV/PD/2005) dated March 3, 2005 of Planning and Development Div, upon an inquiry letter (No. 3 (5) /2002-Dir (EIA)) dated February 28, 2005. This OFFICE MEMORANDAM says that the Pak-EPA may go ahead with the implementation of the Project, while ensuring that the project works would be undertaken as per approved PC-1's scope and financing.

2. Equipment to be provided under Japan's Grant Aid

JICA Study Team submitted to Pak-EPA a list of the equipment (see **Appendix-1**), which was prepared as result of discussions with counterparts of Pak-EPA and Prov-EPAs during the field study. Pak-EPA and Prov-EPAs agreed with the Team about the equipment properly selected for the Grant Aid.

3. Air Monitoring Network System

Pakistani side agreed that the air monitoring network system consisted of fixed monitoring stations, mobile monitoring stations, Prov.-EPAs and Pak-EPA as shown in **Appendix-2** should be connected through best available medium in Pakistan. A fixed amount of monitoring data accumulated in Prov.-EPA will be transmitted to the Data Surveillance Center in Pak-EPA. Both sides agreed that the numbers of fixed and mobile air monitoring stations should be determined by the following three factors: ①financial capability of the provincial EPA, ②human resources to operate the fixed and mobile air monitoring stations, and ③the distribution maps of air pollution. Pakistani side explained that federal resources would be also available to operate and maintain the system. According to this agreement Pakistani side promised the relevant documents to Japanese side by the end of March 2005.

4. The Locations of Fixed Automatic Air Quality Monitoring Station

Pakistani side proposed the candidate sites for the fixed air monitoring stations as shown in the following table. JICA Study Team investigated and verified the appropriateness of each site during the field study. The Team explained that the suitable sites would be finalized among these candidate sites. Pakistani side suggested to consider that the fixed monitoring stations should be located at ground.

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	Candidate Site
(1) Pak-EPA	1) Rooftop of the Data Surveillance & Training Center
(2) Sindh-EPA	1) Rooftop of the EPA's Building, 2) Mazar-i-Quid Park, 3) Rooftop of the Karachi Municipal Cooperation, 4) Rooftop of the Municipal Library 5) Rooftop of the Revenue Office
(3) Punjab-EPA	1) Rooftop of the new EPA building, 2) Rooftop of the Lahore City District Office
(4) NWFP-EPA	1) Rooftop of the EPA's Building
(5) Balotistan-EPA	1) Rooftop of the Commercial Building at the Meezan Market 2) Rooftop of the Quetta City District Office or Town Nazim Office. 3) Rooftop of the Media Place in the City Office

5. Layout Plan of the Data Surveillance / Training Center

Pak-EPA explained to the Team about their layout plan of the captioned building. Upon this the Team explained to Pak-EPA that further work would continue in Japan to finalize the layout plan. The analytical laboratories will be accommodated in this building to meet the requirement of Pakistani side. Pakistani side suggested to consider a basement of the building.

6. Layout Plan of the New Equipment

In order to install the equipment to be provided by the Project, the layout plans of new equipment as well as existing equipment were agreed between Pakistani side and the Team as shown in Appendix-3. The costs related to rehabilitation of laboratories including transportation and installation of the existing equipment shall be bore by Pakistani side.

7. Staffing and Training Plan for the Project

The Pakistani side explained to the Team that a total staff of about 100 would be recruited for Pak-EPA and 4 provincial EPAs within 2 years, as indicated by the PC-1 (approved by ECNEC in December 2004). In this connection the Japanese side requested detailed training plans for new staff and present staff to meet the demand of required capacity building, because PC-I does not describe detailed training plans. The Pakistani side submitted their training plans to the Study Team, as shown in Appendix-4.

8. Construction Schedule of a New Building for Punjab-EPA

Punjab EPA explained to the Team that construction work for a new building for Punjab-EPA would be

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commenced on April 2005 and fully completed by June 2006. Responding to this, the Team explained to the Pakistani side that procurement and installation plan for the equipment would be formulated based on the schedule.

9. Request for Technical Guidance under the Grant Aid (Soft Component)

Pakistan side requested that Technical Guidance (Soft Component) should be provided to the staff of Pak-EPA and Prov.-EPAs in relationship with the Project. Upon this request the Japanese side explained the importance of proper technical guidance, referring to the Soft Component to be designed within the BD Study. The Japanese side also explained that the Soft Component would be designed in Japan based on the training plans of the Pakistani side, as attached in **Appendix-5**.

10. Request for Counterpart Training

Pakistani side requested to the Team that Counterpart Training should be considered in connection with the Grant Aid. The Team explained to Pakistani side that the request would be conveyed to JICA.

11. Request for Laboratory Furniture and Training Equipment/Furniture

Pakistani side requested to consider laboratory furniture and training equipment/furniture. Upon this request Japanese side explained that the request would be conveyed to JICA.

12. Undertakings of Each Government

Both Pakistani and Japanese sides agreed that the following major undertakings should be covered by Japanese side, Pak-EPA and Prov.-EPAs, as presented in the following tables

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(1) Procurement and installation of the Equipment

	To be covered by			Remarks
	Japan	Pak-EPA	Prv.-EPA	
Procurement, transportation and installation of the equipment	O			
Technical guidance for the new equipment	O			Soft Component
To secure relevant utilities and renovation work for the existing laboratories and sites of fixed monitoring station.			O	Before installation work
To set up the existing equipment on the proposed location.			O	Same as above
To transfer and install the existing equipment from existing laboratory to new laboratory		O	O	Same as above (Pak-EPA& Punjab-EPA)

(2) Construction of the Data Surveillance & Training Center

	To be covered by			Remarks
	Japan	Pak-EPA	Prv.-EPA	
To construct a new building for the Project with furniture required for the Project	O			
To fill soil up to the level of the front road on the Project site		O		Before construction work
To remove the trees existing in the Project site		O		Same as above
To bring the utility lines (electricity, telephone, water, gas, sewage etc.) up to connection points on the boundary line of the site		O		
To build permanent fence, gate and other items of exterior work, including gardening with plantations		O		
To facilitate ordinary furniture for staff required in relationship with the Project		O		
To build a well as additional water source beside the piped water supply by CDA		O		

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List of Equipment to be Provided under the Project

PCI: PC-1, PS: Preparatory Study, Ex: Existing, BS: Basis Design Study
 IS: Pak-EPA, KAR: Sindh-EPA, LHO: Punjab-EPA, PSS: NWFP-EPA, QCE: Balochistan

Item	Technical Specification	Quantity					Total			
		PC-1/PS	IS	KAR	LHO	PSS		QCE		
A. Air quality monitoring										
1. Automatic air quality monitoring station										
A-1-1	Fixed Automatic Air Quality Monitoring Station	6 gas analyzers of CO, NOx, O3, SO2, THC and SPM for 2.5µm. Standard gas cylinder and regulator, Standard gas dilution device, Wind speed sensor, Wind direction meter, Thermometer-hygrometer, Barometer, Computer printer, Compartment with conditioner	6 gas analyzers of CO, NO, CO, SO2, THC and SPM for 2.5µm, Standard gas cylinder and regulator, Standard gas dilution device, Wind speed sensor, Wind direction meter, Thermometer-hygrometer, Barometer, Computer printer, Compartment with conditioner (Mark *, to be examined in detail)	PCI	1	4	4	2	2	13
A-1-2	Mobile Automatic Air Quality Monitoring Station	6 gas analyzers of CO, NOx, O3, SO2, THC and SPM for 2.5µm. Standard gas cylinder and regulator, Standard gas dilution device, Wind speed meter, Wind direction meter, Thermometer-hygrometer, Barometer, Computer printer, Compartment w/ conditioner	6 gas analyzers of CO, NOx, O3, SO2, THC and SPM for 2.5µm, Standard gas cylinder and regulator, Standard gas dilution device, Wind speed meter, Wind direction meter, Thermometer-hygrometer, Barometer, Computer printer, Compartment w/air conditioner (Mark *, to be examined in detail)	PCI	1	1	1	0	1	4
2. Data Management and Reporting System in EPA										
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 Pak-EPA. -Database storage & archiving. -Data editing and report generating system	PCI	1	0	0	0	0	1
A-2-2	Data Processing System in Pre-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. -Database storage & archiving. -Data editing and report generating system	PCI	0	1	1	1	1	4
3. Stationary source monitoring equipment										
A-3-1	Dust Measuring Unit	Portable high volume air sampler (8 to 800 l/min)	Isokinetic dust sampling unit for stack monitoring (manual type), Velocity measuring unit (pitot tube, manometric), Dust sampling unit, Moisture measuring unit	PCI	2	5	5	2	3	17
A-3-2	Stack Gas Analyzer	NOx, SO2, O2	NOx: chemiluminescence, 0 to 4,000ppm or more, auto-ranging SO2: NDIR method, 0 to 5,000 ppm or more, auto ranging O2: Zirconia or magnetic flow, 0 to 25%	PCI	1	1	2	1	2	7
A-3-3	Portable Gas Analyzer	CO, CO2 for combustion gas of boiler	NDIR method 0 to 40,000ppm or more, auto ranging	PCI	2	2	2	0	2	8
A-3-4	Oxygen Monitor (Digital Type)	No specification	(To be deleted)	PCI	2	2	2	1	1	8
A-3-5	Opacity Meter	Smoke density meter, laser beam system	(To be deleted)	PCI	1	1	2	1	2	7
A-3-6	Portable Stack Gas Sampler	CO, SOx, NOx, HC, O2, N2	Wet type gas collector Absorbing bottles : 2 bottles or more SDS Washing bottle : 1 bottle or more Vacuum pump : 1 unit (Max. Flow 4.5L/min)	PCI	2	2	2	0	2	8
A-3-7	Oxyen - Fischer Gas Analyzer	No specification	To measure stack gas concentration. Analyte : O2, CO, CO2 Absorbing bottles : 4 bottles Set of sampling bags and making pump for 2 set of Oxyen	PCI	2	5	5	2	3	17
A-3-8	Wet Type Gas Meter	No specification	1) Measurement range : 0.5 to 2L/min. or more Dean Capacity : 1 liter 2) Measurement range : 2.5 to 50L/min. Dean Capacity : 5 liter	PCI	2	5	5	2	3	17
A-3-9	Monitoring Car	No specification	Used for carry the Stack gas monitoring equipment or some 'A Supplemental Equipment' for on Site monitoring works.	PCI	0	0	0	0	0	0
4. Supplemental Equipment										
A-4-1	High Volume Air Sampler (If Available)	High -Volume blower, Typically at a rate of 1.13 - 1.70 m3/min (40-60 ft3). Operating temp. -20 to 60°C/Particle size separator < 1µm	Setting flow rate range: 600 to 1200L/min. or more	PCI	2	2	2	1	1	8
A-4-2	Low Volume Air Sampler	Low -Volume blower typically at a rate of 20-30 liters/min. Operating temp -20 to 60°C. Particle size separator < 10µm and < 2.5µm.	Particle size classification : 10µm cut Classification method : cyclone or gravity sedimentation Flow rate : 1 to 20 L/min. or more	PCI	2	2	2	1	1	8
A-4-3	Anderson Air Sampler	No specification	Hexagon Station flow rate : 28.3 L/min (= 1 ft3/min)	PCI	2	2	2	1	1	8
A-4-4	Vacuumed Pump with One Bag	No specification	Gas sampling bags control with Teflon, Aluminium, lower volume 5 - 30 liter, locking vacuum pump with valve/automatic flow rate 20ft/min.	PCI	2	2	2	1	1	8

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Appendix 1

PCI: PC-1, PS: Preparatory Study, Est Estimating, BS: Basic Design Study
 ES: Pak-EPA, KAR: South-EPA, LJO: Punjab-EPA, PSE: NAFEP-EPA, QJE: Balochistan

Item	Technical Specification	Quantity						Total			
		PC-1/PS		Basic Design Study		Est					
		ES	KAR	LJO	PSE	QJE	BS				
A-4-3	Impinger Gas Sampling System (Portable air sampler)	Single set with 10ml capacity	Wet type gas collector (Impinger sampler) Absorbing bottles : 2 bottles or more Inlet vacuum pump Used for ambient air monitoring		PCI	3	3	3	1	1	8
A-4-6	Particle Counter	Count 1-9,999,999 particles having diameter 0.3-5.0 μm. Flow rates 2-3 liters/min. Concentration range 0-3,000,000.	(To be deleted)		PCI	2	2	2	1	1	8
A-4-7	Gas Detection Tube System	Piston type pump draws 100ml of samples air with toxic gas detection tubes. Measuring ranges both in PPM and % v/v.	(To be deleted)		PCI	2	2	2	1	1	8
A-4-8	Flow Meter	No specification	Ball float type (Corrosion resistant) Applicable gas : Air (at 1 atm, 30degC) 50 ml/min, 100 ml/min, 500 ml/min, 2 L/min, 20 L/min.		PCI	2	5	5	2	3	17
A-4-9	Mass Flow Meter	No specification	(To be deleted) Temperature Following Current Differential Detector 10 - 500 ml/min. (at 1 atm, 30degC)		PCI	2	5	5	2	3	17
A-4-10	Thermometer	No specification	(To be deleted)		PCI	2	5	5	2	3	17
A-4-11	Deposit Gauge	Dust fall samples with glass bottle having 100mm diameter. Bottle capacity - 20 liter.	Dust fall samples with glass bottle having 100mm diameter. Bottle capacity - 20 liter. Counter		PCI	2	2	2	1	1	8
B Sound Level measuring											
B-1	Precision Integration Sound Level	With calibrator and data logger	(To be deleted)		PCI	1	1	2	1	2	7
B-2	Tripod	No specification	(To be deleted)		PCI	1	1	2	1	2	7
B-3	Level Recorder	for water	(To be deleted)		PCI	1	1	2	1	2	7
B-4	Flux Plate	No specification	(To be deleted)		PCI	1	1	2	1	2	7
C Water quality monitoring											
C-1	Fixed automatic water quality monitoring station	Automatic water quality monitoring device, CNF remote.	(To be deleted)		PCI	1	2	2	1	0	7
C-2	Water quality monitoring vehicle	No specification	Wagon type off-road vehicle (4hp, 1995cc or more) Seating Capacity: 5-person		PCI	1	1	1	0	1	4
C-3. Portable water quality monitoring water/diudge/sampling equipment											
C-3-1	Water Monitoring Kit	Portable 25 water parameters	(To be deleted)		PCI	1	1	2	1	2	7
C-3-2	Sledge Sampler	No specification	(To be deleted)		PCI	1	1	2	1	2	7
C-3-3	Water Sampler	No specification	HYDRONIT type, Capacity: 1800 ml, Fittings: brass with weight, wire (SUS), Hanging chain: approx. 5 m.		PCI	1	1	2	1	2	7
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/cm2, Measuring range: 0-1380u/sec, LCD display: Digital current speed, Power: dry cell batteries.		PCI	1	1	2	1	2	7
C-3-5	Ekman Barge Silt Sampler	No specification	Area collected sample: 15 x 15 x 15 (cm), Body material: SUS, Hanging chain: 5 m		PCI	1	1	2	1	2	7

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Appendix 1

PC1: PC-1, PS: Preparatory Study, Est: Esting, BS: Basic Design Study
 E01: Pal-EPA, E02: Sioh-EPA, LHD: Puaib-EPA, P03: NWWP-EPA, QUL: Babochina

Item	Technical Specification	Quantity								
		PC1	PS	Est	BS	Total				
D. Laboratory equipment										
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 (retired lamps), Flame mode, software based on MS Window.	Automatic wavelength selection with background correction, Graphite lamp (retired lamps), Flame mode, software based on MS Window, (Hollow Cathode Lamp: Al, As, Ba, B, Ca, Cd, Co, Cr, Fe, Pb, Mn, Hg, Ni, Ag, Zn), Automatic cooling water circulate unit.	PC1	1	1	1	1	1	5
D-2	Attachment of AAS	No specification	Hydride generation unit, mercury vapor unit, Graphite furnace, Graphite lamp (retired lamps), Up-grade of software. (Attachment of AAS prepares the attached to existing AAS): (Hollow Cathode Lamp: Al, As, Ba, B, Ca, Cd, Co, Cr, Fe, Pb, Mn, Hg, Ni, Ag, Zn), Automatic cooling water circulate unit. *Shinshu-EPA; Up grade of the software	PC1	0	0	0	0	0	0
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: 0.1 - 3.999, Transmittance: 0.0 - 100%	Double beam scanning type, Tungsten-Halogen and D2 lamp, Wavelength range should cover 190 to 900 nm, Wavelength accuracy: less than 0.3 nm, Bandpass: 0.39 to 5.00 nm *Shinshu-EPA; Up grade of the software	PC1	1	1	1	1	1	5
D-4	Gas Chromatograph (GC/ECD, FID)	Oven temperature Ambient: 4 to 450°C Advance flow control unit, FID, NPD/FID & ECD detectors, with all accessories and auto sampler.	Advance flow control unit, Operating temperature: 100 to 450 degree C. (1.0 degree C step), (FID detector) Sensitivity: Less than 0.01% (picogram/g C), Minimum detectable quantity: 3 pg C/Sec (UV-UV), (ECD detector) Minimum detectable quantity: 0.05 pg CH2Cl2 *Shinshu-EPA; Up grade of the software	PC1	1	1	1	1	1	5
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. 30.0 MPa, (Detector) Method: Electrolytic conductivity, Measuring Range: 0 to 1000 micro-mol, Output: 0 to 10V, Operating temp.: 10 to 40 degree C, Column: Dual column system, Solvent resistance, Integration and storage of chromatogram, data recorder and all	PC1	1	1	1	1	1	5
D-6	COD Apparatus	Detects 0 - 1000 mg/l Analyze 6 to 10 samples at a time.	Seawater Kjeldahl Digesting apparatus with one exhaust pipe, six Kjeldahl flask, (complete set), Flask volume: 500 mL (6 pc), Temp.: Max. approx. 430 degreeC with individual controller, Cooled condenser: 300 mm	PC1	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. (B-type)	Incubator bottles and incubator, Incubator bottles: Approx 100nos, 100 pcs	PC1	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 (oxidation method), Measuring range: 0-6wt%, Continuous measurement error: 0.005wt% standard deviation (at 1wt%), Automatic Calibration: Automatic operation two point Calibration and automatic multiplier	PC1	1	1	1	1	1	5
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	1	1	5
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	1	1	5
D-11	ICP spectrophotometer	Wavelength: 160-800nm, High UV quantum efficiency, Wide Photometric dynamic range for ppb, RF Generator, ICP Weak software with full processing power and high resolution graphics.	(To be deleted)	PC1	1	1	1	1	1	5
D-12	Fluorescence X-ray Analyzer	X-Ray analyzer with radioactive isotope source, high resolution accurate iodide detector, Fluorescence, Phosphorescence & Diffraction modes, software with processor and all other accessories.	(To be deleted)	PC1	1	1	1	1	1	5
D-13	Electrophoresis Equipment	No specification	(To be deleted)	PC1	1	1	1	1	1	5
D-14	TOC Analyser	(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: IRR method, Range: 0 to 10000 mg/L, Detection limit: 5 µg/L, Analysis time: 10 min	PC1	1	1	1	1	1	5
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	1	1	5
D-16	Mercury Analyser	Photometric range 0-5 µg with 0.01µg of mercury sensitivity.	(To be deleted)	PC1	1	1	1	1	1	5
D-17	Polarograph	Photo multiplier detector, reproducibility better than 0.001 for area and retention/reading, Decreases display, spectral lines selectable from instrument with all accessories.	(To be deleted)	PC1	1	1	1	1	1	5

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Appendix 1

PCI: PC-1, PS: Prepack Study, Fin Feiling, BS: Basic Design Study
 ISB: Pak-EPA, KAR: Sindh-EPA, LHC: Punjab-EPA, PMS: NWFP-EPA, QUE: Balochistan

Item	Technical Specifications		Quantity					Total	
	PC-1/PS	Basic Design Study	ISB	KAR/LHC	PMS	QUE			
D-18	Automatic Titrator	Auto titrate and calculate the results in the real. (To be deleted)	PCI	1	1	1	0	0	3
			PS	0	0	0	0	0	0
			BS	0	0	0	0	0	0
			IS	0	0	0	0	0	0
D-19	Stannoscopic Microscope	magnification 12, field of view 23mm, working distance 150mm (To be deleted)	PCI	1	1	1	0	0	3
			PS	0	0	0	0	0	0
			BS	0	0	0	0	0	0
			IS	0	0	0	0	0	0
D-20	Microscope	Different magnification type. Different magnification type.	PCI	1	1	1	0	1	4
			PS	1	1	1	1	1	5
			BS	1	2	1	0	0	4
			IS	1	0	1	1	1	4
D-21	Burette	No specification Volumetric Flask, Pipets, Reagent bottle, Beaker and etc.	PCI	1	1	1	1	1	5
			PS	1	1	1	1	1	5
			BS	-	-	-	-	-	-
			IS	1	1	1	1	1	5
D-22	Laboratory Tools	No specification Complete sets such as pliers, driver, spanner, cutter, pinocers, and all types to supply shortage	PCI	1	1	1	1	1	5
			PS	1	1	1	1	1	5
			BS	0	0	0	0	0	0
			IS	1	1	1	1	1	5
D-23	Reagent	No specification Autoclave, Ammonium hydroxide, Ethyl acetate, EDTA, Magnesium chloride and etc. to store for 2 years.	PCI	1	1	1	1	1	5
			PS	1	1	1	1	1	5
			BS	-	-	-	-	-	-
			IS	1	1	1	1	1	5
D-24	Consumables	No specification Filter paper, pH paper, and drug packing paper, etc. to store 2 years	PCI	1	1	1	1	1	5
			PS	1	1	1	1	1	5
			BS	-	-	-	-	-	-
			IS	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	PCI	1	1	1	1	1	5
			PS	1	1	1	1	1	5
			BS	1	1	1	0	0	3
			IS	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 m ² , Vacuum gauge: Teflon + Viton or equivalent	PCI	1	1	1	1	1	5
			PS	1	1	1	1	1	5
			BS	0	0	0	0	0	0
			IS	1	1	1	1	1	5
D-27	Koferson - Dinitro (KDF) Evaporative Concentrator	No specification (To be deleted)	PCI	1	1	1	1	1	5
			PS	0	0	0	0	0	0
			BS	0	0	0	0	0	0
			IS	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 Liter/min*2 pcs, Tank capacity: Approx. 10 L, Regulator with vacuum meter: Possible to connect it with the main unit	PCI	1	1	1	1	1	5
			PS	1	1	1	1	1	5
			BS	0	0	0	0	0	0
			IS	1	1	1	1	1	5
D-29	Centrifuge	Speed range: 500-16000 rpm, Capacity: 400ml, timer 1 to 60 minutes, refrigeration facility, sample 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.	PCI	1	1	1	1	1	5
			PS	1	1	1	1	1	5
			BS	0	1	0	1	1	3
			IS	1	1	1	1	1	5
D-30	Shaker	Microprocessor control shaker, speed 15 to 500 rpm, programmable. Shaking method: Reciprocation, Shaking stroke: Should cover 30 to 140 stroke/min, Shaking width: Approx. 40 mm, No. of Separating flask: Should cover 100ml, 200 ml, 300ml, 400 ml, 500ml, 600 ml, 1L, 4 pcs, Setting at shaking time: Max. 60 min or more	PCI	1	1	1	1	1	5
			PS	1	1	1	1	1	5
			BS	0	0	0	1	0	1
			IS	1	1	1	1	1	5
D-31	Hot Plate	Digital hot plate, Temperature range: 100 to 500 °C, AC220V. Range of temperature: Normal temperature 350°C, Plate size: 300 x 250 mm, Plate material: Ceramic or ceramic coating or equal grade, Microcomputer control, Digital display	PCI	1	1	1	1	1	5
			PS	1	1	1	1	1	5
			BS	0	0	0	0	0	0
			IS	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	PCI	1	1	1	1	1	5
			PS	1	1	1	1	1	5
			BS	0	0	0	0	0	0
			IS	1	1	1	1	1	5
D-33	Magnetic Stirrer, Large	Capacity: 5000ml, Speed: 150 to 1500 rpm, AC220V, Max. plate temperature 300°C stirrer speed 100 to 1500rpm, electronic temperature and speed control. Stirring capacity: More than 5 liter, Maximum speed: More than 1500 rpm, Speed regulation: Adjustable, Stirring paddle: Teflon coated or equivalent, AC220V	PCI	1	1	1	1	1	5
			PS	1	1	1	1	1	5
			BS	0	0	0	0	0	0
			IS	1	1	1	1	1	5
D-34	Magnetic Stirrer with Hot Plate	Minimum plate temp. 50°C stirrer speed 100 to 1500 rpm, electronic temperature and speed control (programmable). Stirring capacity: More than 1 liter, Maximum speed: More than 1500 rpm, Speed regulation: Adjustable, Stirring paddle: Teflon coated or equivalent, Heating capacity: More than 500W	PCI	1	1	1	1	1	5
			PS	1	1	1	1	1	5
			BS	0	4	0	1	1	6
			IS	1	1	1	1	1	5
D-35	Vacuum Pump	Ultimate vacuum is 10-3 torr. Included in D-44 and D-49.	PCI	1	1	1	1	1	5
			PS	1	1	1	1	1	5
			BS	0	0	0	0	0	0
			IS	0	0	0	0	0	0
D-36	Oven	Range: 50-500°C, Capacity: 50 liter, large area grid shelves, programmable. Range: ambient to 260°C, Capacity: 50 liter, large area grid shelves, programmable.	PCI	1	1	1	1	1	5
			PS	1	1	1	1	1	5
			BS	3	4	3	2	1	13
			IS	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 fast-stage high power fan, Vessel material: quartz glass vessels: 25-30ml, Vessel number: more than 6	PCI	1	1	1	1	1	5
			PS	0	0	0	0	0	0
			BS	0	0	0	0	0	0
			IS	1	1	1	1	1	5

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Appendix 1

PCI: PC-1, PS: Preparatory Study, Ext: Estimating, BS: Basic Design Study
 ISB: Pak-EPA, KAR: South-EPA, LHD: Punjab-EPA, PES: NWFP-EPA, QUE: Balochistan

Item	Technical Specification		Quantity					Tons	
	PC-1/PS	Basic Design Study	ISB	KAR	LHD	PES	QUE		
D-38 Coffey Counter	Assess movable count, Counter feature: 150mm diameter, will accommodate 75mm & 100mm petri dishes.	Display: LED, should cover 600 to 999, Lamp: Fluorescent, Counting System: Manual push button pos, probe, Petri Dish dia 100 mm or more	PC1	1	1	1	1	1	5
D-39 Water Bath (Small)	Capacity: 5-10 liters, Temperature 3°C above ambient to 100°C, stability: ±0.2°C above ambient to 100°C, stability ±0.2°C.	Capacity: Approx 10 liters (ex. 270 X 210 X 170mm), Temperature 3°C above ambient to 100°C, stability: ±0.2°C above ambient to 100°C, stability ±0.2°C.	PC1	1	1	1	1	1	5
D-40 Water Bath (Large)	Capacity: 30-50 liters, temp. 3°C above ambient to 100°C, stability ±0.2°C.	Capacity: Approx 30 liters (ex. 900 X 320 X 180mm), temp. 3°C above ambient to 100°C, stability ±0.2°C.	PC1	1	1	1	1	1	5
D-41 CN Inc Distillation Unit with Heater	All glass parts with heating mantle.	Heating method: Electric heating, Four stem type (Appox 3.60m, equivalent to JIS K-0303), it can also used for phenol distillation.	PC1	1	1	1	1	1	5
D-42 F Inc Distillation Unit with Heater	All glass parts with heating mantle.	Heating method: Electric heating, Four stem type (Appox 3.60m, equivalent to JIS K-0303), it can also used for phenol distillation.	PC1	1	1	1	1	1	5
D-43 MSH Inc Distillation Unit with Heater	All glass parts with heating mantle.	Heating method: Electric heating, Four stem type (Appox 3.60m, equivalent to JIS K-0303), it can also used for phenol distillation.	PC1	0	0	0	0	0	0
D-44 Filter System for Suspended Solid (SS)	Vacuum filtration holder 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, filter paper: dia. 47 mm, glass funnel: ca 300 ml, (Mandib) No. of flasks: 3 pc, (Glass filter) Diameter: dia. 47 mm, (Vacuum filtration pump)	PC1	2	2	2	2	2	8
D-45 Analytical Balance, 210g ± 0.1mg	Maximum loading weight 210g and readability up to 0.1mg.	Type: suspended pan or top loading, Weighing 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
D-46 Analytical Balance, 200g ± 0.01mg → Change to Macro Balance 2000g	Maximum loading weight 200g and readability up to 0.01mg.	Max weighing capacity of 2000 g, Allowance of less than 0.1 g, Stabilization time of less than 2 sec., Pan diameter of ca 100 mm	PC1	1	1	1	1	1	5
D-47 Low Temperature incubator	Refrigerated incubator, Temperature range: -5 to 50°C.	Incubator, Temperature range: 5 to 50°C. Capacity: Approx. 200 liter, Temperature accuracy: Less than ±1 degreeC, Temperature display: Digital	PC1	1	1	1	1	1	5
D-48 High Speed Homogenizer	To dispense, disintegrate & to homogenize solids in aqueous and organic solvent buffers, system with variable speed motor of 8000-21000 rpm, include beaker and test tube holder.	(To be deleted)	PC1	1	1	1	1	1	5
D-49 Vacuum Filter Unit	Beaker funnel with vacuum filtration pumps, Capacity: filter up to 5-10 liters/min.	Beaker funnel: 90mm (300ml), Flask, (filter): 2000ml, Vacuum pump, Capacity: 35 liter/min (optional, approx 150Pa)	PC1	1	1	1	1	1	5
D-50 Furnace	Digitally controllable furnace, Capacity: 600-700 coverts. Dual LED display set and set, Maximum continuous operating temperature: 1200°C.	Electric tubular furnace, Digital temperature controller, Range of temperature: Normal temperature 1150°C and max: 1200°C, Size on inside: φ40 X 300mm	PC1	1	1	1	1	1	5
D-51 Muffle Furnace	Ambient to 1200°C with temperature control system.	Capacity: approx. 9-liter, Heating element: Completely sealed 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
D-52 Laminar Air Flow Cabinet	Air flow cabinet with UV light, Fluorescent light and filter to protect the user & environment from biohazardous particles.	UV light, Fluorescent light and filter to protect the user & environment from biohazardous particles. Type: Desk top type, Air velocity: Approx. 0.45 m/sec., Collection efficiency: More than 99.99% at 3 micron size, Total dimension (W x D x H): Approx. 750 x 500 x 1130	PC1	1	1	1	1	1	5
D-53 Autoclave	Microprocessor control autoclave, programmable both with slow & fast cycles. Unit include 3-4 shelves and up to 60 minutes/soak cycle time.	Temp. control range: Should cover 100 to 125 degreeC, Temp. control accuracy: Less than ±1 degreeC, Pressure range: 0 to 1.61 MPa, Temp. control: Microprocessor control, Timer: 1 to 60 min., Drum container capacity: More than 50 L.	PC1	1	1	1	1	1	5
D-54 Refrigerator	Multicase temperature to 4°C with glass door laboratory refrigerator, Capacity: 600 liters, Uniformity of temperature ± 0.5°C.	(To be deleted)	PC1	1	1	1	1	1	5
D-55 Freezer	Ultra low temperature freezer, maintain temperature to -130°C with microprocessor control monitor operation & alarm system, Capacity: 600 liters.	(To be deleted)	PC1	1	1	1	1	1	5
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-57 Electrophoresis Equipment	No specification	(To be deleted)	PC1	1	1	1	1	1	5

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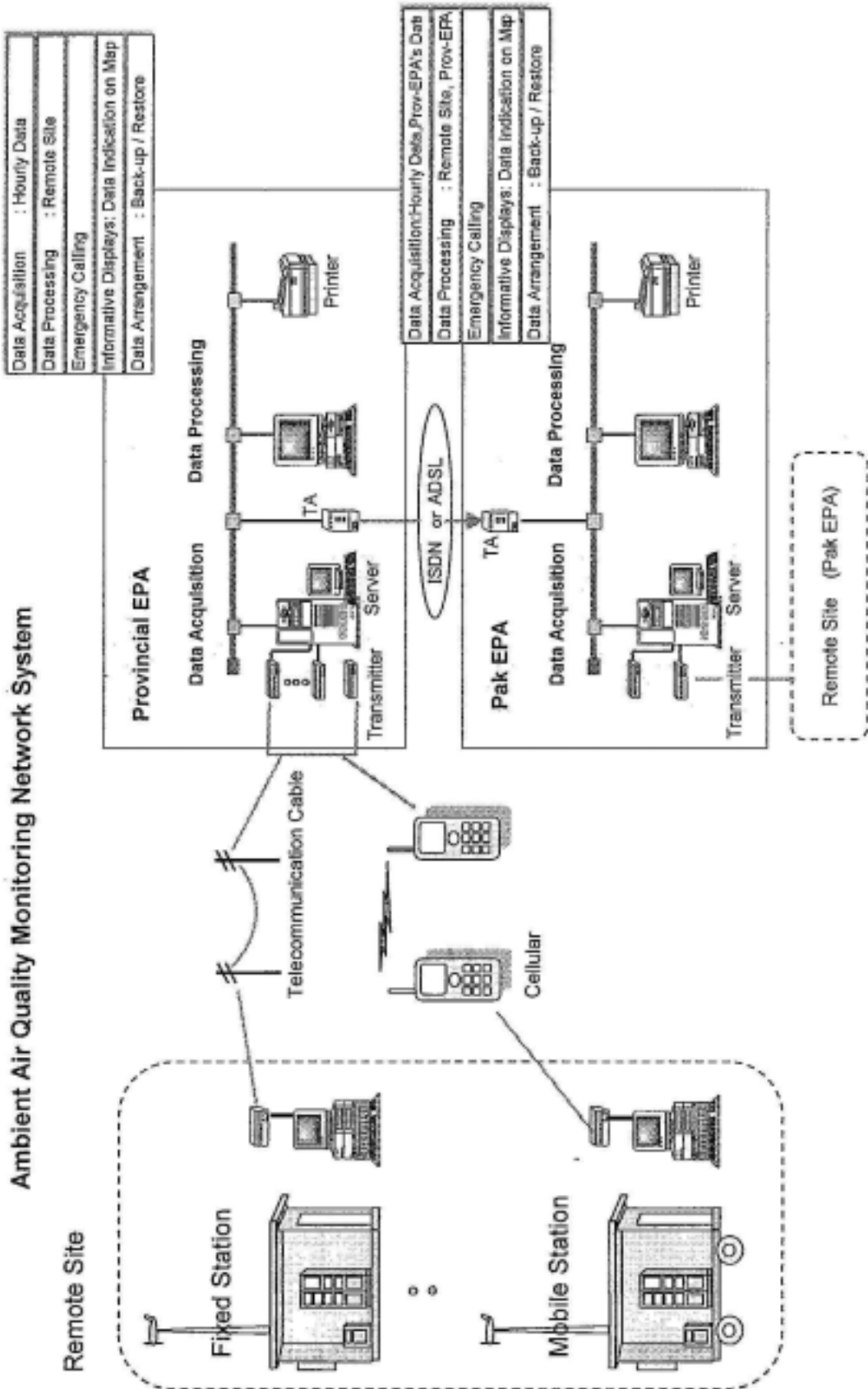
Appendix 1

PCI: PC-1, PS: Preparatory Study, Est: Estimating, RS: Basic Design Study
 ES: Full-EPA, KAR: Study-EPA, LJO: Project-EPA, PSR: SWPP-EPA, QJE: Evaluation

Item	Technical Specification	Quantity					Total												
		ES	KAR	LJO	PSR	QJE													
D-38	Fire Extinguisher (Dry chemical)	No specification	(To be deleted)																
D-39	Portable Gas analyzer Set	No specification	(To be deleted)																
D-40	pH for Selective Meter (Change to pH Meter)	Range: 1.99-9.999, accuracy: 0.002 pH, auto calibration with reference buffer.	Measuring method: Glass electrode method, Display: pH/mV, Temp. Check, 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, RS-485																
D-41	Dissolved Oxygen (DO) Meter	D.O. range: 0-1.99% with 1% resolution.	Dial-top type, Measuring method: Diaphragm-Galvanic cell or Diaphragm Polarography, Range: DO 0 - 20.0 mg/L or more, Accuracy: DO ±0.05 mg/L, Output: RS-232C, Calibration method: Automatic calibration by atmosphere and by solution (zero, span solution)																
D-42	Conductivity Meter	4 digit LCD, MS 6-199.9, with all accessories.	Dial-top type, Measuring method: Alternating current four electrode, Measuring range: 0-1.9 S/cm, Repeatability: ± 1% of F.S., Temp. compensation: 0-50 degree C, Display: Digital, LCD, Calibration: Automatic																
D-43	Turbidity Meter	4 digit LCD, MS 6-199.9, with all accessories.	Dial-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.																
D-44	Standard Thermometer Set	Range 0-100°C, 1-200°C, 50-200°C, 10-400°C	Dial-top type, With authorization result book on manufacturer. Issue for proofreading certificate. Measuring range: -50~ 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~ 350 degree C.																
D-45	Pure Water Supply Unit	Compact deionized water production unit, operating capacity 0.5 Barrels, water conductivity not more than 1 S/cm, AC220V.	[Equipment for water pretreatment] Treatment method: Pre-filter, Softening water by ion exchange, Feed water: Tap water, Produced water: Distilled water approx. 1.8 Barrels, Deionized water approx. 0.5 Barrels, Regeneration: Less than twice/day [Pure water equipment] Purification method: RO, Distillation, Ion exchange and filtration, Production flow rate: More than 1.0 L/min, Monitoring: Conductivity																
D-46	Water Distillation Unit	Automatic still to monitor water flow and temperature, 1.5 - 2.0 Barrels with 10 liter storage reservoirs.	This item is substituted by D-45.																
D-47	Water de-ionizer	Reduce corrosive action, efficiently control, pH level and ionogenic matter	This item is substituted by D-3-45.																
D-48	Wastewater treatment apparatus	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																
D-49	Fine gas treatment apparatus (Face Hood with Gas Scrubber)	No specification	Fume hood with filters and base storage cabinets, controlled exhaust, maintains air flow and emergency exhaust. Water supply connection & fluorescent light, Vent exhaust fitted with gas scrubbers to trap the toxic gases.																
D-50	Personal Computer	No specification	Dial-top type																

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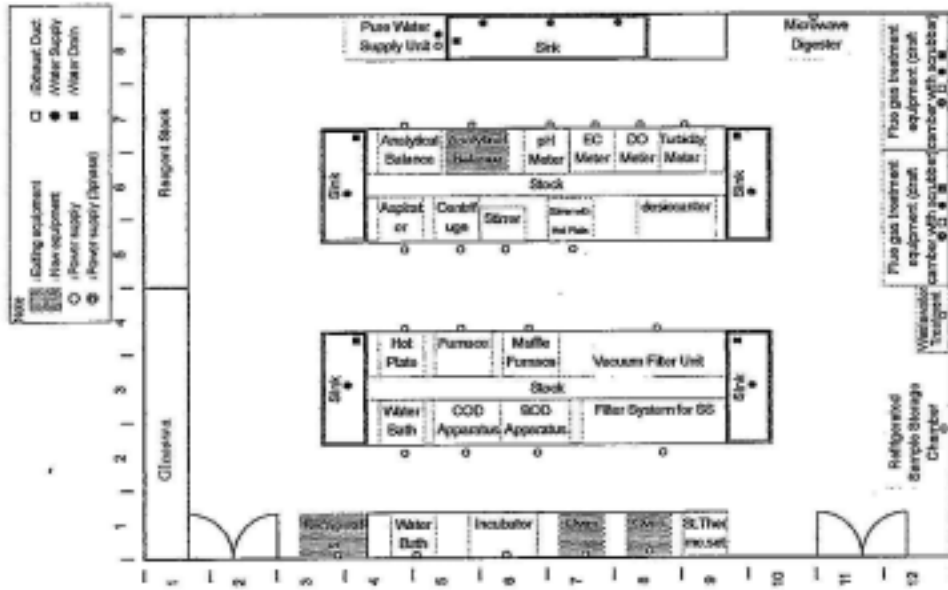
Ambient Air Quality Monitoring Network System



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Pak-EPA RoomID : Pretreatment Room 1

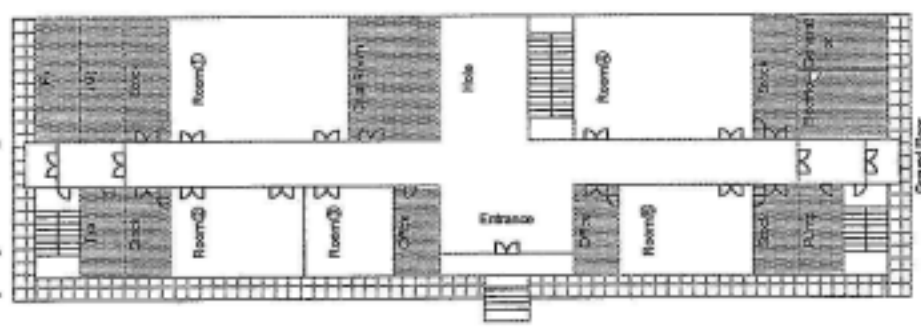


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Appendix-3 Layout Plan of Equipment

Pak-EPA Laboratory layout image

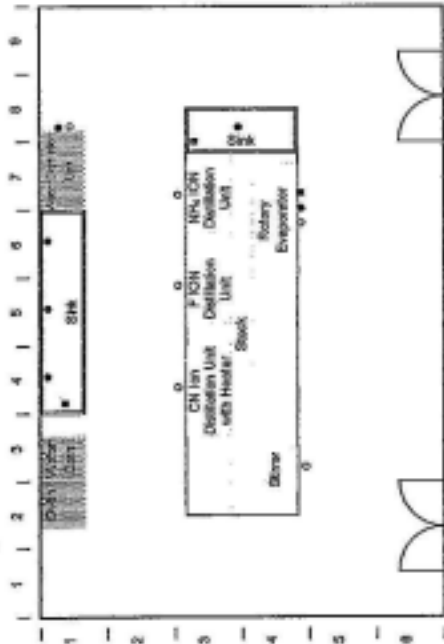


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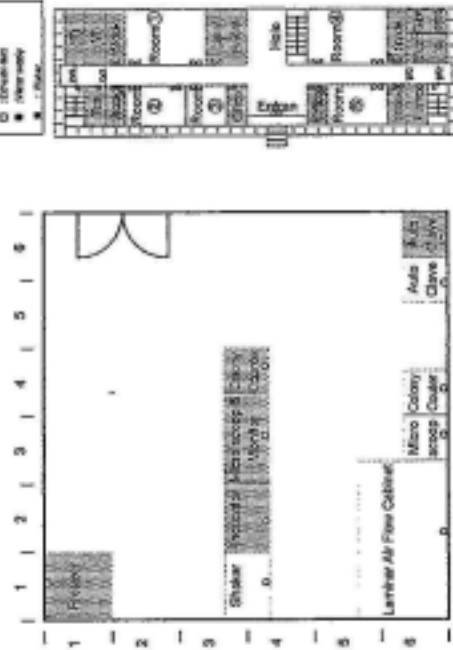
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Appendix-3

Pak-EPA Room② : Pretreatment Room II



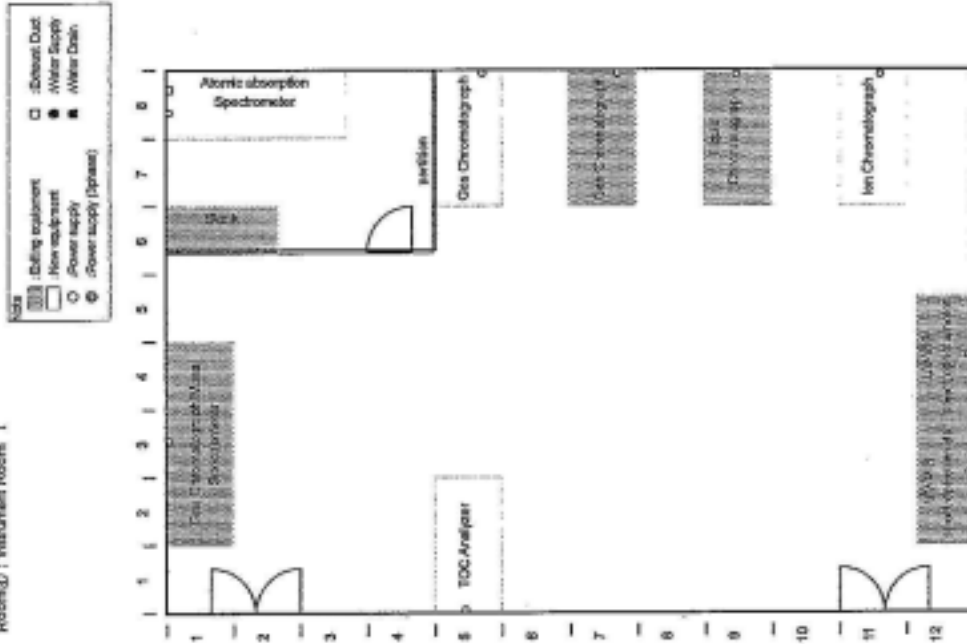
Pak-EPA Room③ : Microbiology Room



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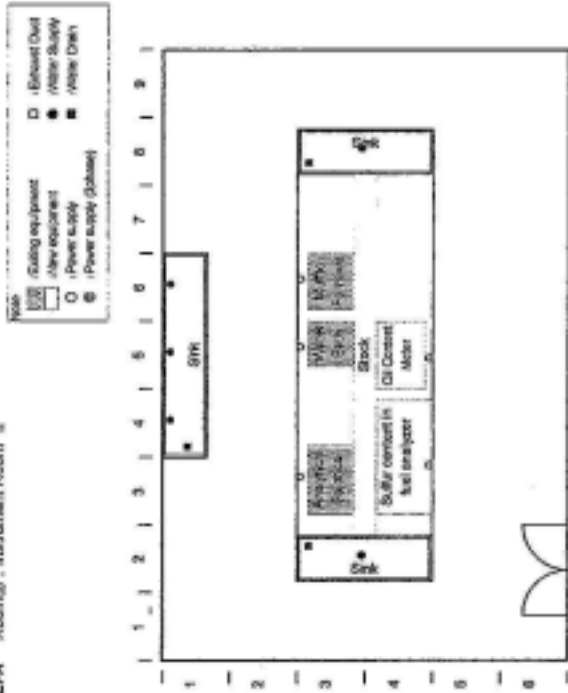
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Pak-EPA Room④ : Instrument Rooms I



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Pak-EPA Room(5) : Instrument Room

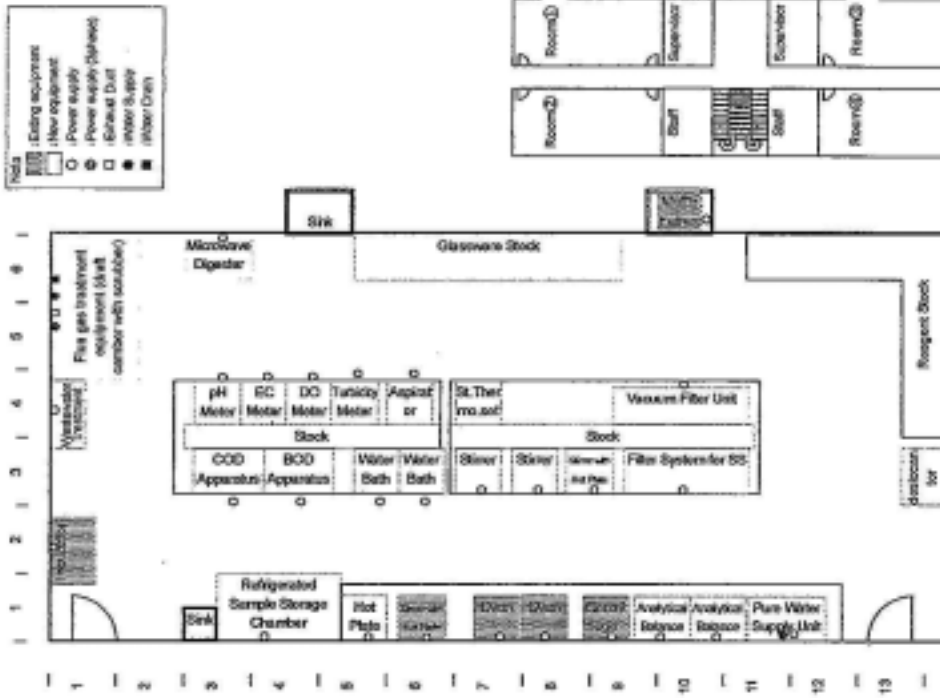


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SINDH-EPA Laboratory layout image

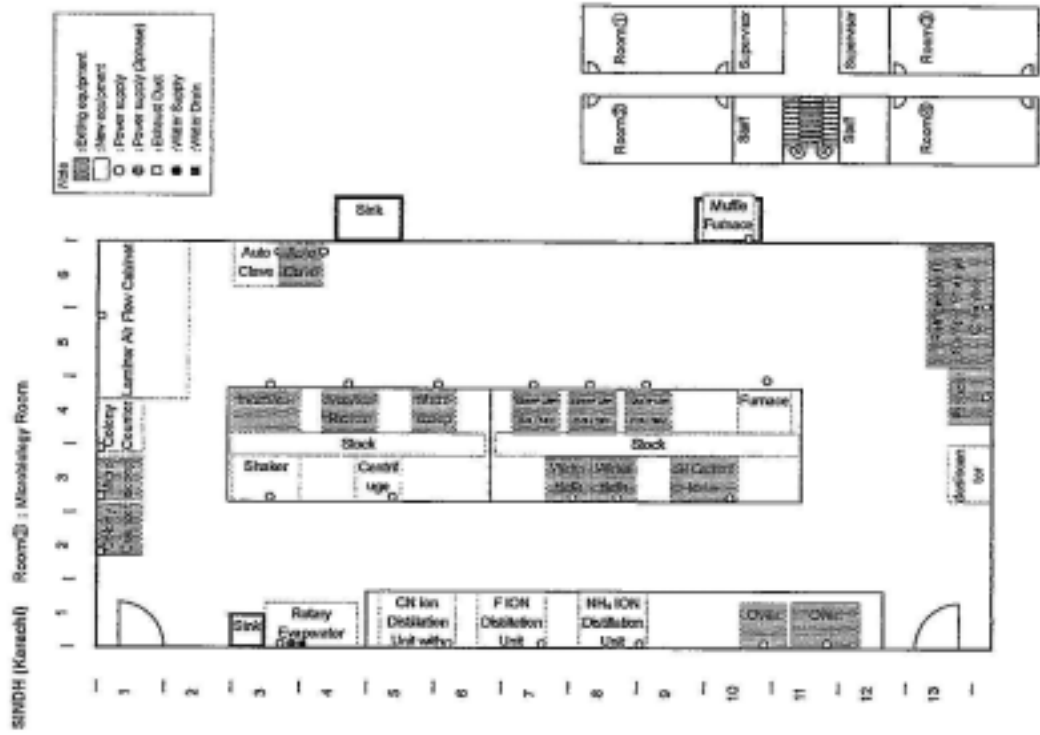
SINDH (Karachi) Room(3) : Pretreatment Room



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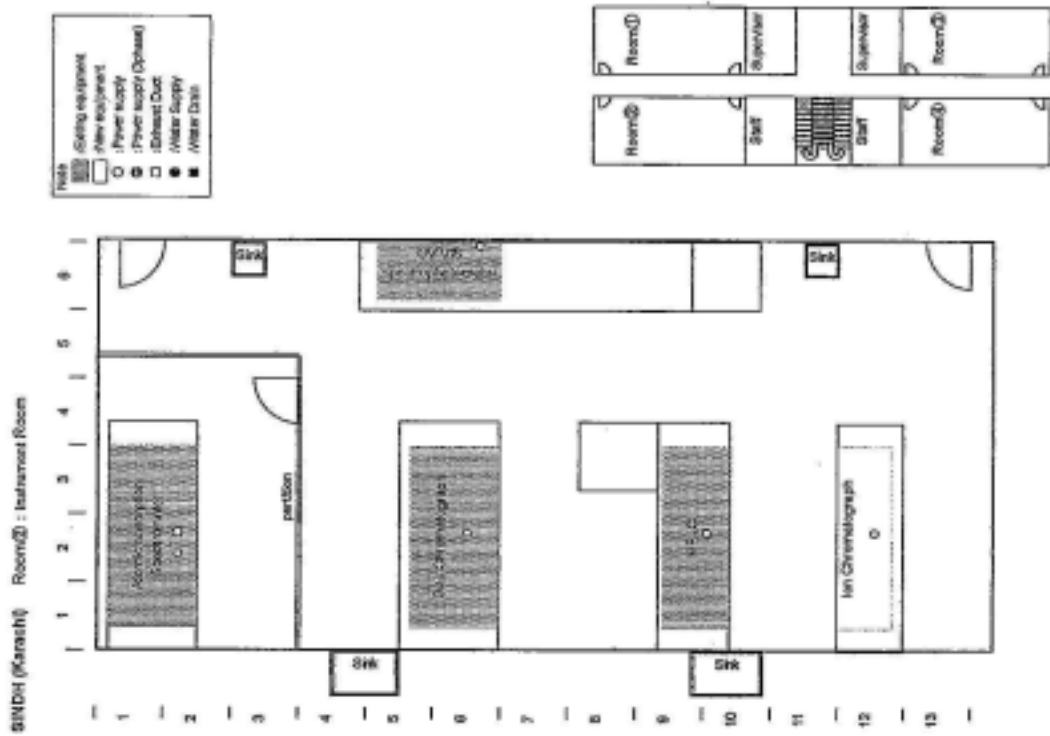
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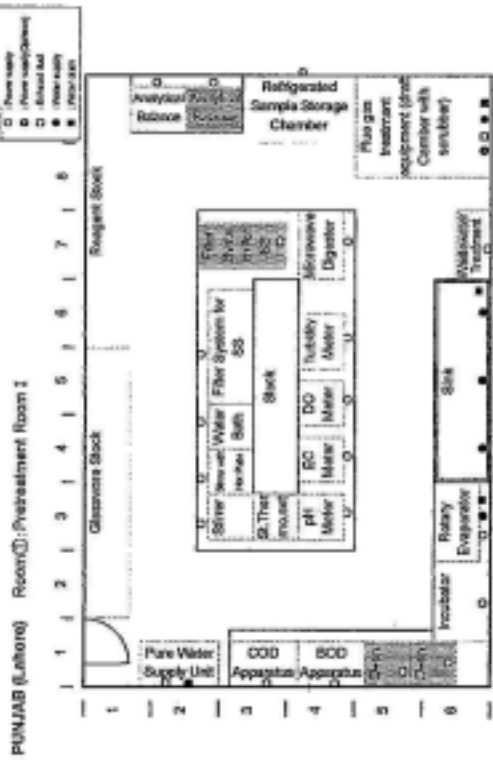
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PUNJAB-EPD Laboratory layout image



PUNJAB (Lahore) Room 2: Pretreatment Room 2



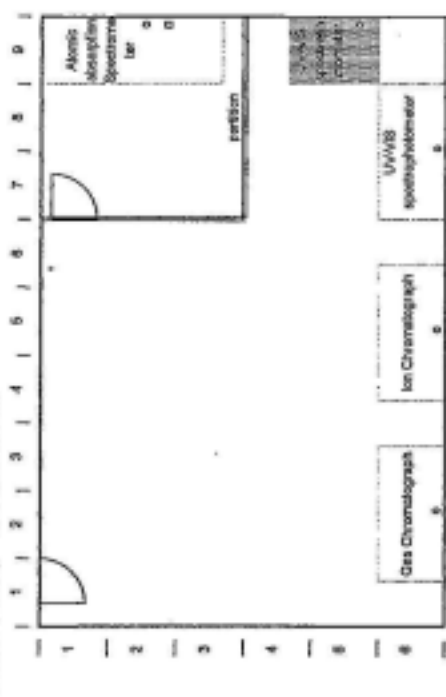
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PUNJAB (Lahore) Room 3: Microbiology room



PUNJAB (Lahore) Room 4: Instrument



PUNJAB (Lahore) Room 5: Related to the atmosphere observation device



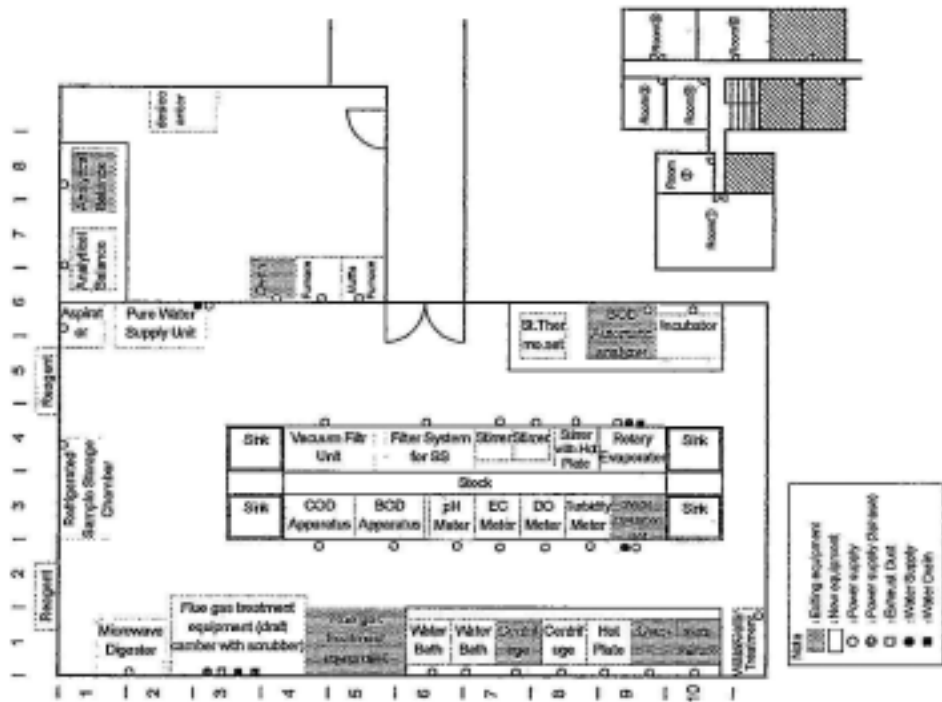
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Appendix-3

NWFP-EPA Laboratory layout image

NWFP (Peshawar) Room①: Pretreatment Room 1, Room②: Analytical Balance Room



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Appendix-3

NWFP (Peshawar) Room②: Pretreatment Room E, Room③: Instrument Room, Room④: Microbiology Room, Room⑤: Stock Room



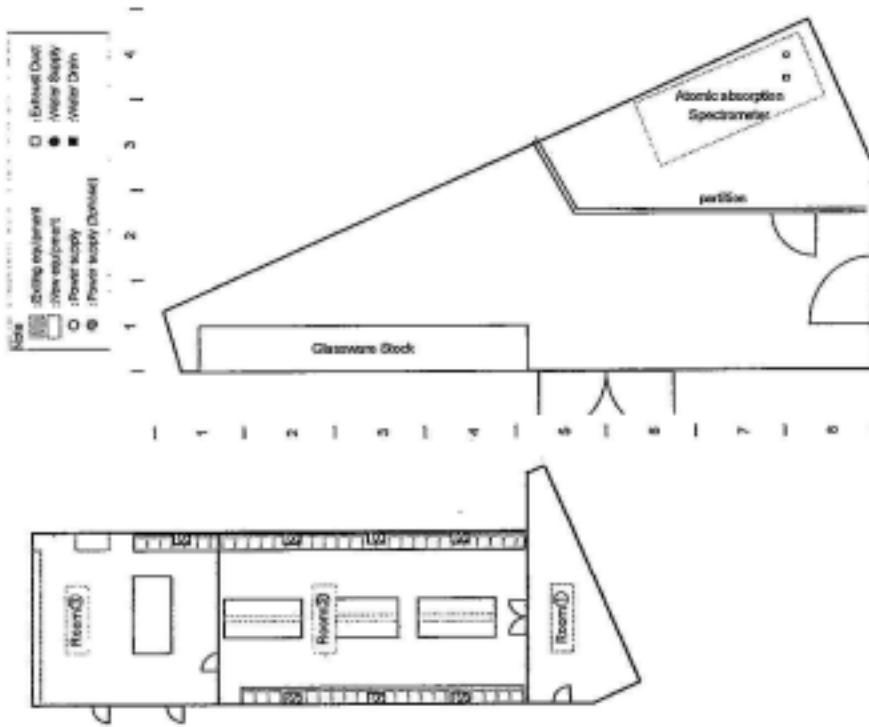
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Appendix-3

BALUCHISTAN-EPA laboratory layout image

BALUCHISTAN (Quetta) Room(0): Atomic Absorption Spectrometer Room

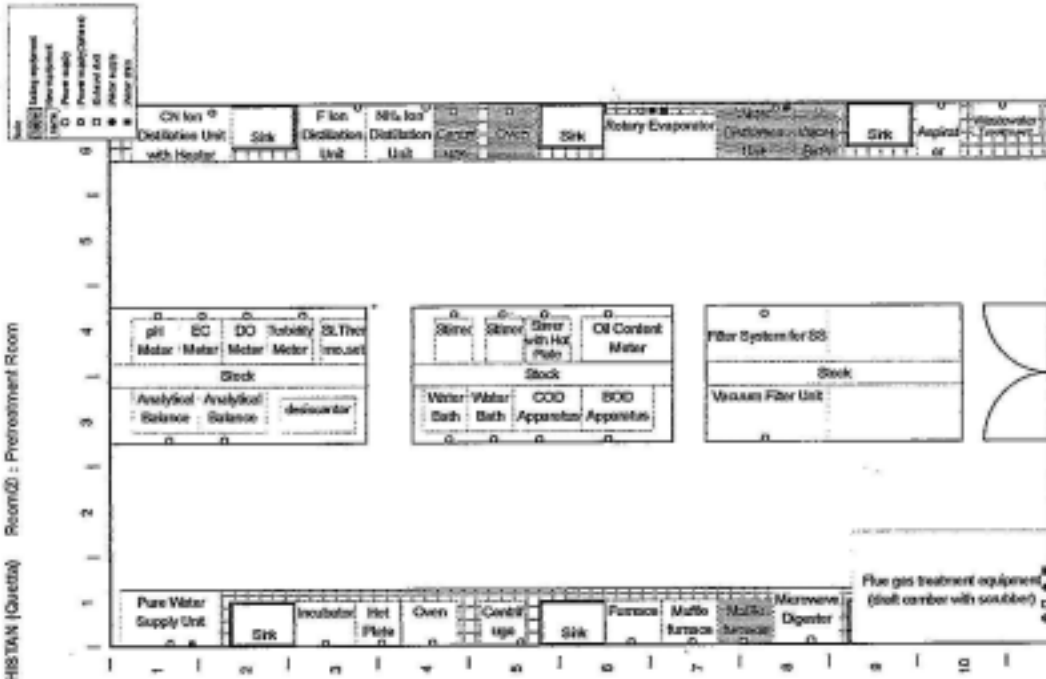


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BALUCHISTAN (Quetta) Room(0): Pretreatment Room

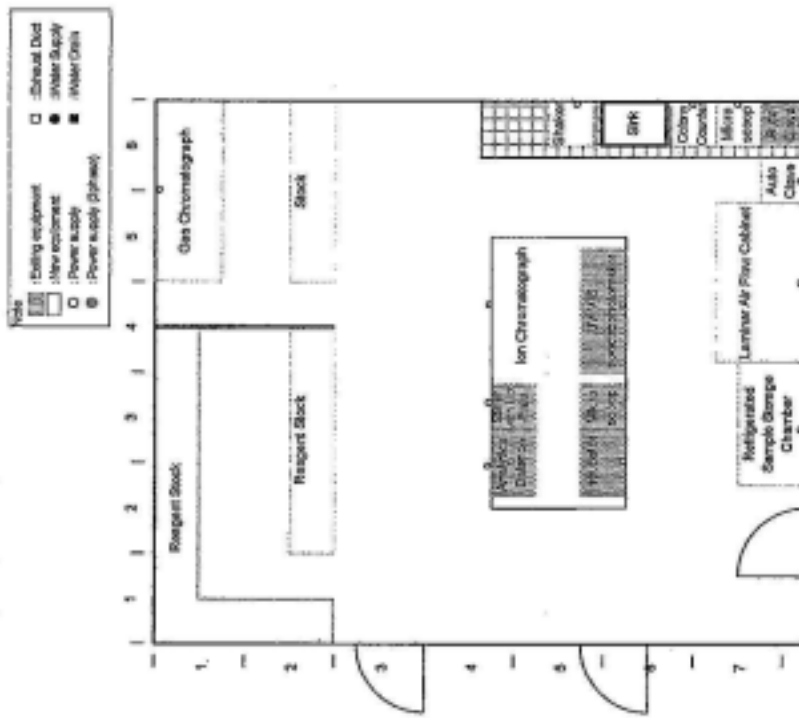


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Appendix-3

BALUCHISTAN (Dawata) Room: : Instrument Room



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Training Courses Proposed by EPA

A. General Environment

Course	Name	Content	Lecture	Practice	Possible Lecturer	Participant	Condition for Participation
G-1	Introduction on Environmental Problems	To introduce the basic problems of our environment on water and ambient air, to explain the governmental roles of EPA and to promote awareness of the population	1 day	0 day	EPA staff, Professors of university, JICA expert.	Pak-EPA and Province industries, students and citizens	None
G-2	Operation of data surveillance center	To design data base, to learn basic concept of computer, and to understand statistical analysis of data, and reliability	5 days	7 days	EPA staff, Professors of university, Engineer of soft ware, JICA experts	Participant Operators of monitoring system for Pak-EPA and Provincial EPA	Completion of A-2, A-3, A-4 and A-5

B. Ambient Air Quality

Course	Name	Content	Lecture	Practice	Possible Lecturer	Participant	Condition for Participation
A-1	Outline of air pollution	To understand definition of air pollution, global environmental issues, control regulation, effect of air pollution on human health, vegetation and formation of acid rain, and sources of air pollution	1 day	0 day	EPA staff, Professors of university, JICA experts	Pak-EPA and Province EPA, students and citizens	None
A-2	Automatic air monitoring instrument	To understand principle of the monitoring instruments such as NOx, SO ₂ , O ₃ , CO, NH ₃ , SPM monitor and meteorological measurement instruments, allocation of the station, operation and maintenance, examination of reliability telemeter system, summarizing data	2 days	10 days	Possible Lecturer Manufacturers of instruments, Professors of university, JICA experts	Participant Pak-EPA and Province EPA	Completion of A-1

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Course	Name	Content	Lecture	Practice	Possible Lecturer	Participant	Condition for Participation
A-3	Manual analysis for air quality	To understand sampling methods, basic concept of measuring, dust fall measurement, acid deposition measurement, methods of analyzing particulate matter, wet measurement, method of gaseous pollutants, methods of analyzing volatile organic compounds	2 days	10 days	Professors of university, JICA experts, senior volunteer	Pak-EPA and Province EPA	Completion of A-1 and A-2
A-4	Emission from mobile sources and control	To understand exhaust gas measurement for motor vehicles. Measuring exhaust gas, automatic measurement, measuring equipment, vehicle testing system and control equipment such as catalytic converter and diesel particulate filter	5 days	2 days	Engineer of instrument producing company, JICA expert	Pak-EPA and Province EPA, Industries	Completion of A-3
A-5	Air pollution predicting techniques	To understand meteorological measuring method, diffusion theory, wind tunnel experiment, emission factor, statistical forecasting method, CMB (Chemical Mass Balance) method	5 days	0 day	Staff of SUPARCO & PCSIR, Meteorological Dept, JICA expert,	Pak-EPA and Province EPA	Completion of A-2 and A-4
A-6	Instrumental analysis for air quality	To understand measurement and operation of the instruments such as UV-VIS spectrometer, Atomic absorption, Gas Chromatograph, Total Organic Carbon Analyzer, Inductive Coupled Plasma, Fluorescence X-ray Analyzer, Ion Chromatograph, High Performance Liquid Chromatograph	5 days each	8 days each	Manufacturers of instrument company, JICA experts, senior volunteer	Pak-EPA and Province EPA	Completion of A-2, A-3 and A-4

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C. Water Quality

Course	Name	Context	Lecture	Practice	Possible Lecturer	Participant	Condition for Participation
W-1	Outline of water pollution	To understand definition of water pollution, global environmental issues, ocean pollution, groundwater quality management, control regulation, effect of water pollution on human health, water body agriculture, and eco system and sources of water pollution	1 day	0 day	EPA professors university, JICA experts senior volunteers	Pak-EPA and Province EPA, industries, students and citizens	None
W-2	Water measurement instrument	To understand principle of the monitoring instruments such as pH, conductivity, COD, and CN monitor and other measurement instruments, allocation of the station, operation and maintenance, examination of reliability, telemeter system, summarizing data	2 days	5 days	Manufacturers of instruments, Professors of university, JOCV	Pak-EPA and Province EPA	Completion of W-1
W-3	Manual analysis for water quality	To understand washing and keeping of glassware, pure water making and purity check, dilution standing solutions, absorption analysis, and titration	1 day	10 days	Professors of university, JICA senior volunteer, JOCV	Pak-EPA and Province EPA	Completion of W-2
W-4	Emission from stationary sources and control	To understand measuring and analytical method of air pollutants in exhaust gas, Measuring flue gas, automatic measurement, fuel test and control equipment	2 days	10 days	Possible Lecturer Engineer instrument producing company, JICA expert	Pak-EPA and Province Industries EPA	Completion of W-1 and W-2

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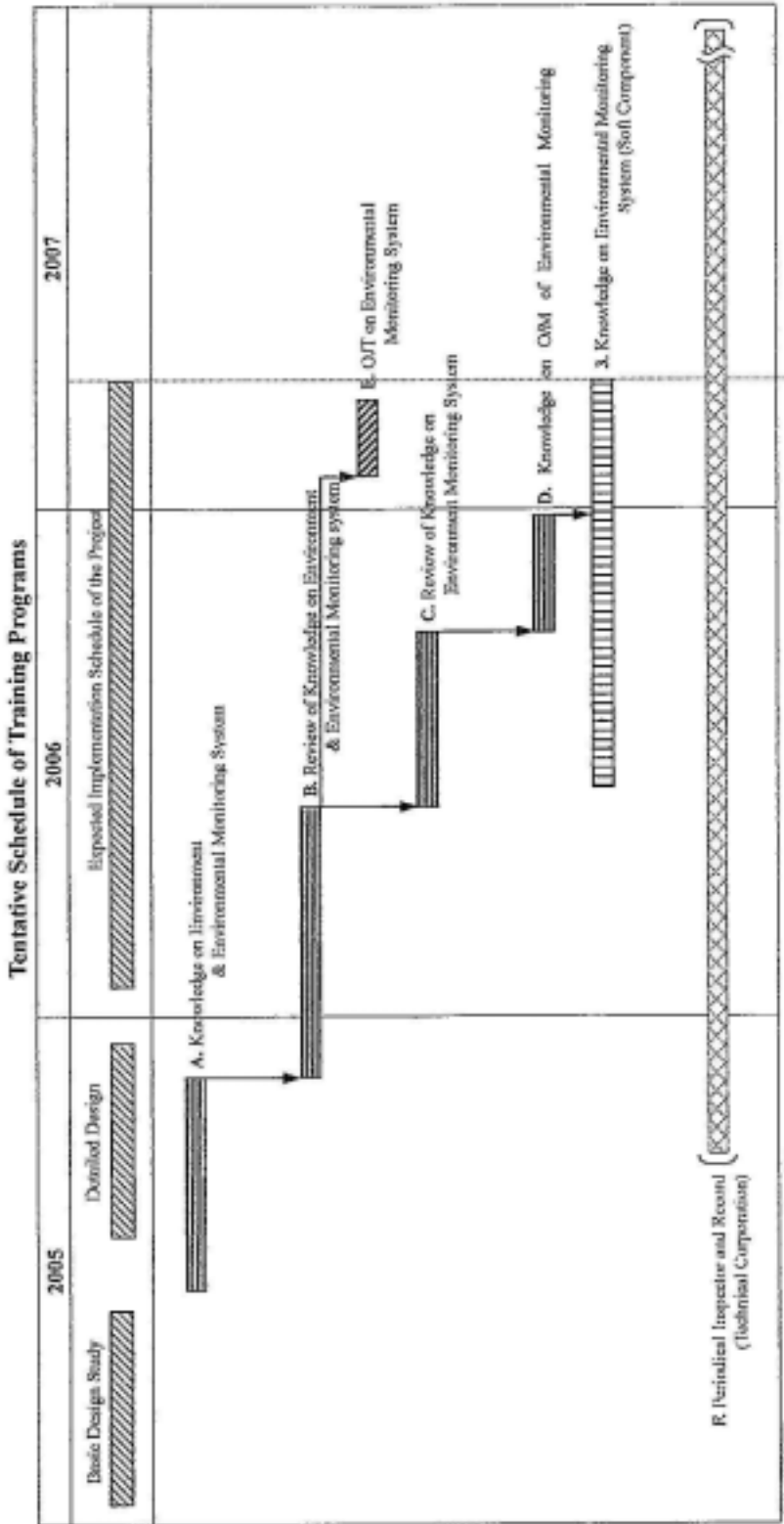
Course	Name	Content	Lecture	Practice	Possible Lecturer	Participant	Condition for Completion
W-5	Waste water measuring methods and countermeasure	To understand measuring and analytical method of effluent from industries and treatment plant, and control equipment.	2 days	5 days	Engineer of instrument producing company, JICA expert.	Pak-EPA and Province Industries	Completion of W-1, W-2 and W-3
W-6	Industrial waste water treatment technology	To understand basic concept, wastewater treatment facilities design, maintenance and operation of treatment plant, pretreatment, wastewater purification by biological treatment, advanced treatment process and reuse, sludge treatment and volume reduction, and some examples	5 days	0 day	Engineer of instrument producing company, JICA expert.	Pak-EPA and Province Industries	Completion of W-5
W-7	Lake Eutrophication	To understand the mechanism of lake eutrophication, pollution sources, and control measure such as removing phosphate and nitrogen including by microbiology method	5 days	0 day	Professors of university, EPA staff, JICA experts, senior volunteer, JOCV	Pak-EPA and Province Industries	Completion of W-5 and W-6

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Appendix-5

Basic Design Study for
the Project for Establishment of
Environmental Monitoring System



NOTE: The Project and all Trainings to be Provided by Japanese Side all Subject to the Japanese Governments Approval

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