

Ex-Post Evaluation of Japanese ODA Grant Aid Project

“Establishment of Environmental Monitoring System in Islamic Republic of Pakistan”

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0. Summary

This project met the needs of Pakistan to monitor environmental degradation nationwide, thus its relevance was high. However, efficiency of the project was medium since a part of the planned output was unrealised. As for the project outcomes, nationwide ambient air monitoring is now conducted and the results are beginning to be used for environmental policy making. On the other hand, regarding industrial exhaust, wastewater and urban sewage, some of the parameters are still unable to be monitored. Although outcomes were realized to a certain extent at the time of evaluation since the Technical Cooperation Project (hereafter, the T/C project) is on-going, effectiveness of this project is also medium. As for the operation and maintenance system and the financial situation, there is a great deal of uncertainty at the time of evaluation. After completion of the federal project (this project's mother project) and the T/C project in January 2012, sustainability of the outcomes of this project is of particular concern.

In light of the above, this project is evaluated to be unsatisfactory.

1. Project Description



(Project Locations)



(CLEAN building, June 2011)

1.1 Background

Pakistan has a total land size of 796 thousand km<sup>2</sup> (2.2 times that of Japan) and a population of around 173 million (2010). There are growing concerns in major cities such as Karachi and Lahore where rapid urbanisation is observed, that deteriorating air and water quality will have adverse effect on people's health. Air pollution is mainly caused by the exhaust from vehicles and factories, while water pollution is caused

by untreated sewerage water.

Since prompt countermeasures were required, the Pakistan Environmental Protection Agency (hereafter, Pak-EPA)<sup>1</sup> and each provincial EPA had been conducting environmental monitoring. Monitoring, however, was only sporadic due to the lack of monitoring equipment and personnel, especially experienced laboratory staff.

In order to constantly monitor the status of environmental pollution and ensure that monitoring results are reflected in environmental administration and policy planning, the Government of Pakistan requested a grant aid from the Japanese Government, to construct a central laboratory and provide equipment (for air and water monitoring) for federal and provincial EPAs for the purpose of establishing a nationwide environmental monitoring system.

Since a T/C project seemed to be necessary to effectively utilise equipment provided to each EPA, the grant aid was approved on the condition that a T/C project would be implemented.

## 1.2 Project Outline

The objective of the grant project is to establish an environmental monitoring system (air and water) at federal and provincial EPAs by constructing a Central Laboratory for Environmental Analysis and Networking (hereafter, CLEAN) and providing monitoring and analysis equipment for CLEAN and provincial EPAs (Punjab, Sindh, KPK<sup>2</sup>, Balochistan).

Grant Limit / Actual Grant Amount	1,238 million yen / 978 million yen
Exchange of Notes Date	August, 2005
Implementing Agency	Environmental Protection Agency of Pakistan
Project Completion Date	March, 2007
Main Contractors	Construction: Tobishima Corporation Equipment: Mitsubishi Corporation, ITOCHU Corporation
Main Consultants	CTI Engineering International Co.,Ltd., Green Blue Corporation
Basic Design	“The Basic Design Study on the Project for Establishment of Environmental Monitoring System,” CTI Engineering International Co.,Ltd., February to June 2005
Detailed Design	October 2005-March 2006
Related Projects	(1) Establishment of Environmental Monitoring System (Technical Cooperation Project, 2009~2011) (2) Dispatch of an expert (Environmental Policy, 2003~2006)

<sup>1</sup> Punjab EPA is under the Environmental Protection Department (EPD). However in this report, when the four provincial EPAs are discussed, “EPA” is used for Punjab EPD as well.

<sup>2</sup> Khyber Pakhtunkhwa (former North-West Frontier) Province

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Nobuko Fujita, Foundation for Advanced Studies on International Development

### 2.2 Duration of Evaluation Study

Duration of the Study: November, 2010 – October, 2011

Duration of the Field Study: February 18 –March 3, and June 27 to July 1, 2011

### 2.3 Constraints during the Evaluation Study

Due to a travel ban by JICA, the field surveys in two of the five targeted provinces, (KPK and Balochistan) were conducted by local consultants only<sup>3</sup>.

## 3. Results of the Evaluation (Overall Rating: D<sup>4</sup>)

### 3.1 Relevance (Rating: ③<sup>5</sup>)

#### 3.1.1 Relevance with the Development Plan of Pakistan

The Pakistan Environmental Protection Act came into effect in 1997, in which new environmental monitoring system was pursued by Pak-EPA and provincial EPAs. The Pakistani Government's Planning Commission announced "The Mid-term Development Framework (2005-2010)" and listed concrete goals for environmental protection as well as a plan to establish a nationwide environment monitoring system. In addition, 111 projects concerning the improvement of the environment were also proposed in the framework. One of projects, the Establishment of Environment Monitoring System (2004-2010, hereafter, the "federal project"), is the mother project of this grant aid<sup>6</sup>.

"Environmental conservation and countermeasures for climate change" is one of 14 pillars mentioned in the Approach Paper for the 10<sup>th</sup> Five Year Development Plan ((2010-2015) which follows the Mid-term Development Plan mentioned above). The plan proposed concrete strategies including the establishment of an effective monitoring system and the formulation and execution of national environmental standards.

Given the importance of environmental monitoring in stated development policies both before and after the project, this project is consistent with the development policies of Pakistan.

#### 3.1.2 Relevance with the Development Needs of Pakistan

In Pakistan, environment degradation is accelerated by the increase in population and in the number of vehicles. The main cause of air pollution in cities is the exhaust from vehicles and the total number of

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<sup>3</sup> Hearings from staffs of those two EPAs were conducted in Islamabad.

<sup>4</sup> A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

<sup>5</sup> ③: High, ②: Fair, ①: Low

<sup>6</sup> Federal projects are implemented with development budget and by contracted staffs outside the routine work of the Ministries. This federal project was approved in October 2004 as a mother project of the grant aid and the T/C project. It will be completed along with the termination of the T/C project, and the activities were supposed to be operationalised (implemented with regular budget) thereafter.

vehicles increased from 2.7 million in 1990 to 6.8 million in 2010<sup>7</sup>. An increase in air pollution from traffic jams is also prominent. Air monitoring data prior to the project shows that SPM (dust) is particularly high in major cities (17 times higher than Japanese standards<sup>8</sup>). Surface water pollution is also a serious issue since most of the wastewater from food, textile, leather, and pulp processing industries, as well as urban sewage is released untreated into the rivers. Since it is important to have a nationwide environmental monitoring system to tackle such pollution, this project was consistent with Pakistan's development needs.

### 3.1.3 Relevance with Japan's ODA Policy

The Japanese Country Assistance Strategy for Pakistan (February 2005) states the overall goal of Japanese assistance as the establishment and development of sustainable society and lists the improvement of urban environments as an important cross-cutting issues. Japanese ODA Charter (2003) also states sustainable development and addressing environmental issues as important agendas.

This project has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy; therefore its relevance is high.

## 3.2 Efficiency (Rating:②)

### 3.2.1 Project Outputs

The planned and actual output of the project was as follows (Table1).

Table 1 : Summary of Outputs

Planned	Actual
(1) Construction of CLEAN (2 stories)	• Change of design to one story <sup>9</sup>
(2) Installation of ambient air monitoring stations at Pak-EPA and provincial EPAs <sup>10</sup> • 7 fixed stations (one each for Pak-EPA, KPK • Balochistan EPAs, two each for Punjab and Sindh EPAs) • 3 mobile stations (one each for Pak-EPA, Punjab, and Sindh EPAs)	• As planned.

<sup>7</sup> including bikes and tricycles (Federal Bureau of Statistics).

<sup>8</sup> Compared with Japanese Ambient Air Standards. Data taken in 8 cities including 5 cities targeted in this project (Preparatory Study for the Project for the Establishment of Environmental Monitoring System in Islamic Republic of Pakistan 2004). Monitoring data of ambient air in 2010 (yearly average) shows that they are 1.6~3.1times higher than Pakistan Air Quality Standard, and 2.8~5.5times higher than that of the Japanese Standard (Data provided by Federal EPA).

<sup>9</sup> Initially it was planned that the laboratory would be on the first floor, and offices, training rooms, and the library would be on the second floor. The Federal EPA had a plan to add a third floor later for more office space.

<sup>10</sup> Ambient air monitoring stations measure CO, NO<sub>x</sub>, O<sub>3</sub>, SO<sub>2</sub>, HC, SPM, wind direction and speed, temperature, humidity and radiation unattended. Data is transmitted to CLEAN and provincial EPAs. For security reasons fixed air monitoring stations are placed on EPA's premises or on roof tops of public buildings. Mobile air monitoring stations use a generator for operating equipment and can be moved to locations such as busy intersections to monitor air for certain period of time. Due to scarcity of fuel for the generator, some EPAs, such as the Punjab EPA, use their mobile station on their own premises.

<p>(3) Installation of air and water monitoring equipment at Pak-EPA and provincial EPAs<sup>11</sup>  Air: stack gas monitoring equipment, gas analyser, monitoring vehicle, dust meter, etc.  Water: water sampler, sludge sampler, digital current meter, etc.</p>	<ul style="list-style-type: none"> <li>• As planned<sup>12</sup></li> </ul>
<p>(4) Installation of laboratory equipment at Pak-EPA and provincial EPAs<sup>13</sup></p> <ul style="list-style-type: none"> <li>• atomic absorption spectrophotometer (for heavy metal analysis), UV/Vis spectrophotometer, gas chromatograph (for analysis of low molecular organic compound in air and water, ion chromatograph (for analysis of inorganic ion in a sample), pure water supply unit, waste water treatment equipment, draft chamber, etc.</li> </ul>	<ul style="list-style-type: none"> <li>• As planned.</li> </ul>
<p>(5) Training for technicians and chemists (soft component)</p> <ul style="list-style-type: none"> <li>• Automatic monitoring of ambient air: operation of equipment, data analysis, maintenance of equipment, etc. (2 participants from each EPA, total of 10)</li> <li>• Stationary source monitoring: same as above (3 participants from each EPA, total of 15)</li> <li>• Water quality monitoring: water sampling, operation and maintenance of equipment, etc. (3 participants from each EPA, total of 15)</li> <li>• 21 days in each subject.</li> <li>• Newly recruited staff receives basic training by Pak-EPA.</li> </ul>	<ul style="list-style-type: none"> <li>• Location was moved from CLEAN to Sindh EPA<sup>14</sup>.</li> <li>• Number of participants: 17 for automatic monitoring of ambient air, 12 for stationary monitoring, 11 for water quality monitoring, total of 40.</li> <li>• 21 days for each subject<sup>15</sup>.</li> <li>• Basic training was cancelled<sup>16</sup>.</li> </ul>

(Source : Hearing from Pak-EPA and provincial EPAs, and document provided by JICA)

The modification of the design of the CLEAN building is explained as follows.

Start of the construction by Japanese contractor was delayed by four months due to a delay in land preparation<sup>17</sup>. This delay shortened the construction period from the planned 11 months to 8 and half months and made completing a two-story building impossible during the remaining contract period. The plan, therefore, was changed to complete the first floor, and leave the second floor to be constructed by the Pakistan side later on.

After the first floor was completed, the Pakistan side had difficulty securing the necessary budget for adding a second floor, (due to further financial problems caused by the global economic crisis). The construction finally started in March 2010, then suspended due to a heavy flood in July. It restarted by June 2011, and the basic structure for the 2<sup>nd</sup> and 3<sup>rd</sup> floors was completed. It is planned to be completed by the

<sup>11</sup> Basically the same equipment was provided for the five EPAs.

<sup>12</sup> At Punjab EPA, although equipment was procured as planned, installation was delayed one year (March 2008) due to a delay in relocation of EPD office. It is reported that there was no inconvenience due to this delay (hearing from Punjab EPD)

<sup>13</sup> Except for the equipment already provided by World Bank and other institutions, basically same equipment was provided to five EPAs. Some equipment such as sulfur content analyzer in fuel and total organic carbon analyzer were provided only to CLEAN.

<sup>14</sup> Completion of the CLEAN building, original training site, was March 2007, right before the project term ended. Therefore the training was conducted at Sindh EPA where the equipment was already installed.

<sup>15</sup> From February 23 to March 15, 2007.

<sup>16</sup> The time for basic training ran out since recruitment of laboratory staffs took longer than planned and had to be waited until right before the soft component training.

<sup>17</sup> Since little waste water stream was running across the construction site, it took time to remove water and filling the land.

end of 2011<sup>18</sup>. However, delays caused some problems as follows.

- ① In the last 4 years, the administration division of Pak-EPA remained in the old EPA office, which is about 30 minutes by car from CLEAN, and only the laboratory staff members were stationed at CLEAN. Due to the absence of the management at CLEAN, there were disciplinary problems<sup>19</sup>.
- ② The T/C project which was supposed to be stationed on the second floor of CLEAN had to stay in the Pak-EPA office as well, which caused a loss of commuting time to CLEAN and inefficiency in providing instructions.

### 3.2.2 Project Inputs

#### 3.2.2.1 Project Cost

Total project cost was 1,009.6 million yen (80% of planned cost), with 978 million yen from the Japan side (79% of the planned cost), and 31.6 million yen (16.4 million Rs. 145% of the planned cost)<sup>20</sup> from the Pakistan side. The cost breakdown is shown in Table 2.

The reasons for the lower than planned cost for the Japan side are the reduction in the construction and management costs due to the design change of CLEAN, and the savings due to competitive bidding.

Table 2: Planned and actual project cost

Japan side (million yen)				
items		plan	actual	difference
facility	Construction of CLEAN	246	200	46
equipment	Ambient air monitoring station	508	333	175
	Air and water monitoring equipment	134	133	1
	Equipment for laboratory analysis	248	216	32
Design and management cost		102	96	6
Japan side total		1,238	979	259

Pakistan side (million Rs.)				
items		plan	actual	difference
Construction cost		8.0	9.7	-1.7
Others		3.1	6.6	-3.5
Pakistan side total		11.1	16.4	-5.2

(Source. Plan: Basic Design Study, Actual: document provided by JICA and Pak-EPA.

Figures for Pakistan side are derived from expenditures during two fiscal year (July 2005~June 2007)

Regarding undertakings required of Pak-EPA, there were delays in securing an access road to the construction site, constructing exterior works, installing electricity and telephone lines<sup>21</sup>. In Sindh, KPK, and Balochistan EPAs, it was conducted as planned<sup>22</sup>. In Punjab EPA, there was a delay in installation of equipment as mentioned before.

<sup>18</sup> Federal EPA (June 28, 2011)

<sup>19</sup> Federal EPA. A senior chemist working as a laboratory manager was assigned in May 2011, although the basic situation has not changed.

<sup>20</sup> Rate at the time of project planning: 1Rs. = 1.96 yen, and 1Rs.=1.93yen at the time of completion.

<sup>21</sup> Federal EPA.

<sup>22</sup> Moving existing equipment, securing utilities, etc.

### 3.2.2.2 Project Period

Project period was within the plan. The planned period was 18.5 months including detailed design and bidding and the actual period was 18 months (October 2005 to March 2007).

Although the project cost/period was within the plan, some of the project output was not realized; therefore efficiency of the project is fair.

## 3.3 Effectiveness (Rating:②)

### 3.3.1 Quantitative Effects

As for the outcome indicators set before the project, ambient air monitoring was accomplished for all possible target cities but in regards to air and water monitoring, many cities remained incomplete by the end of 2007 (the target year). However, after the Technical Cooperation Project started in 2009, there were improvements in monitoring techniques and operation and maintenance, and the target was mostly achieved by the time of the ex-post evaluation (Table 3).

Table 3 Outcome Indicators

Indicator (unit)	Baseline (2005)	Target (2007)	Beginning of T/C project (Feb. – April, 2009)	Ex post evaluation (Feb.2011)
(1)Number of cities able to monitor ambient air	None (partially in Punjab EPA)	5 cities including the capital city of each province	4 cities excluding Balochistan	5 cities including the capital city of each province (*3)
(2)Number of parameters in air monitoring (*1)	4	15 parameters based on the National Environmental Standard	Pak-EPA : 7 Punjab:8 Sindh:7 KPK:NA Balochistan:NA	Pak- EPA : 15 Punjab: 7 Sindh:14 KPK : 13 Balochistan:15
(3)Number of parameters in water monitoring (*2)	6	31 parameters based on the National Environmental Standard	Pak-EPA:23 Punjab:27 Sindh:4 KPK:NA Balochistan:NA	Pak- EPA:31 Punjab:14 Sindh:21 KPK:30 Balochistan:32

\*1 : Number of parameters to be monitored in industrial exhaust gas in 5 cities (Islamabad, Lahore, Karachi, Peshawar, and Quetta)

\*2 : Number of parameters to be monitored in urban sewerage and industrial waste water in the above 5 cities.

\*3 : At the time of ex post evaluation, it was not operational in Balochistan EPA due to a UPS problem, but it was repaired by the T/C project later.

(Source : Basic Design Study for baseline and target, Progress Report (1) 2009, JICA Expert Team for 2009, and hearings from EPAs for 2011)

Detailed progress of each of the above three outcomes is explained below

#### (1) Number of cities able to monitor ambient air

In five cities, the automatic ambient air monitoring stations are installed and data is transmitted to its respective EPA. However, monitoring is sometimes interrupted due to power outages, UPS problems (uninterruptible power system) and other instruments (each parameter is analysed by its respective

instrument, therefore only some of the parameters are measured in some cases)<sup>23</sup>. Also, in Islamabad, Karachi, and Lahore, some instruments turn off automatically in order to avoid damage by heat when outside temperature reaches 45-50 degrees Celsius (inside temperatures become even higher)<sup>24</sup>.

The number of days which air was monitored was 100% in 2007, 50% in 2008, 77% in 2009, and 93% in 2010<sup>25</sup>. Many of the equipment broken in 2008 were repaired after the technical cooperation started in 2009. Although the data transmission system had a problem in Punjab and Balochistan, the problem was fixed as a result of the T/C project's improvement to the transmission system.

		
<p>Water analysis laboratory in CLEAN</p>	<p>A chemist changing parts in a fixed monitoring station (Sindh province)</p>	<p>Mobile air monitoring station (Punjab province)</p>

(2) Number of parameters in air monitoring, and (3) Number of parameters in water monitoring

The soft component training in March 2007 provided instructions for the operation and maintenance of equipment. However, due to a communication problem and constraints (considering participants' educational background and amount of knowledge and technique they had to absorb), the training could not sufficiently cover a wider scope to take appropriate measures in case of equipment problems<sup>26</sup>.

Therefore, many parameters were unable to be monitored as of 2009 due to lack of technique and mechanical failures. By 2011, however, the goals were mostly reached (85% for air and 83% for water) thanks to technical transfer and repair works accomplished by the T/C project. The accomplishment rate and reasons for non-attainment of each EPA are as follows (Table 4).

<sup>23</sup> THC meter, which contains hydrogen) needs to be manually restarted for safety reason after shutdowns caused by outages. Due to fuel shortages and the unavailability of vehicles, THC meters in the monitoring stations far away from an EPA office are often left turned off.

<sup>24</sup> Failure of the air conditioner inside one of the fixed monitoring stations in Punjab is making operations impossible in summer.

<sup>25</sup> Percentage was calculated from the number of days which data was sent from any of the stations in each EPA to CLEAN. It does not include the days which monitors were working but data was not sent due to transmission problems (data provided by Federal EPA).

<sup>26</sup> According to JICA experts and interviews with 21 soft component participants still with EPAs. (Out of the 40 soft component training participants, 27 still work for EPAs.)

Table 4 The accomplishment rate and reasons for non-attainment

	Air monitoring parameters				Water monitoring parameters			
	Able to monitor		Reason for non-attainment		Able to monitor		Reason for non-attainment	
	Number of parameters	Attainment rate (%)	Equipment related	Technique related	Number of parameters	Attainment rate (%)	Equipment related	Technique related
CLEAN	15	100.0	0	0	31	100.0	0	1 (*1)
Punjab	7	46.7	7 (*2)	1 (*3)	14	45.2	15 (*4)	3 (*5)
Sindh	14	93.3	0	1 (*6)	21	67.7	5 (*7)	6 (*8)
KPK	13	86.7	1	1 (*9)	30	96.8	0	2 (*10)
Balochisntan	15	100.0	0	0	32	103.2	0	0
Total	64	85.3	8	3	128	82.6	20	12

Note: "equipment related" includes mechanical problems, shortage of parts and reagent. (\*1)The parameter unable to be monitored is Selenium. (\*2) due to problems of AAS and pure water supply unit (repair scheduled). (\*3)Hydrogen Chloride. (\*4) due to AAS failure. (\*5) the parameters unable to be monitored are Chlorine compound, Anionic surfactants, Pesticide (\*6) Chlorine. (\*7) due to AAS, and GC failure (repair scheduled) and expiration of reagent. (\*8) Fluorine compound, Total cyanide, Sulphite, Ammonia, Silver, Total toxic metals (9)Black smoke. (\*10)Manganese, Sulphur compounds. Source : hearings from each EPA.

This project was planned assuming the T/C project would be implemented in parallel, therefore it could be said that the delay in the start of the T/C project (originally planned in March 2006 but actually started in February 2009) may have been one of the causes for delay in realizing the outcomes of this project<sup>27</sup>. On the other hand, the T/C project was meant to cover the planning of environmental monitoring and its implementation: instruction of staff on operation and maintenance of equipment and repair were not its main purpose.

### 3.3.2 Qualitative Effects

Ambient air monitoring data is sent from a data analyst at each EPA to the data processing room in CLEAN. After compiled according to parameters<sup>28</sup>, daily and monthly averages are calculated and stored. Although there is some data deficiency as mentioned before, CLEAN has started making analysis by seasons and comparisons among cities. Data is simplified as "Air Quality Index" and posted on Pak-EPA's website.

### 3.3.3 Status of equipment use

As mentioned before, ambient air monitoring stations are well used except during outages and mechanical problems (Table 5). Some of the air and monitoring equipment are not used often. As for laboratory equipment, some provinces rarely use certain equipment such as microwave digester and draft chamber. Laboratory technicians gave the lack of knowledge on how to use them as a reason for not using the equipment.

<sup>27</sup> The reason for the delay of T/C project was due to lagged hiring process of laboratory staffs, JICA considered the time was not right for starting the T/C project (hearing from JICA).

<sup>28</sup> Parameters are listed in foot note No.11.

Table 5: Status of equipment use

			CLEAN	Punjab	Sindh	KPK	Balochistan
Air monitoring station	Fixed	"Yes" if used well	Yes	No1 : Yes No2 : Yes	No1 : Yes No2 : Yes	Yes	Yes
	Mobile		Yes	Yes	Yes	—	—
Air/water monitoring equipment		Frequently used (number)	6	4	3	6	6
		Often used (number)	1	0	1	0	0
		Rarely used (number)	0	1(*1)	1(*5)	1 (*7)	0
		Never used (number)	0	0	0	0	0
Laboratory analysis equipment		Frequently used (number)	5	4	3	8	6
		Often used (number)	4	3	1	0	0
		Rarely used (number)	0	1(*2)	2(*6)	0	0
		Never used (number)	0	1(*3)	0	0	2 (*8)
Note				*1: Low volume air sampler *2: Atomic absorption spectrophotometer *3: Draft chamber	*5: Low volume air sampler *6: Microwave digester, draft chamber	*7: High volume air sampler (1 of 3)	*8: Microwave digester, Waste water treatment equipment

(For equipment more than CIF100 million yen and checked in field survey. Source : Federal and provincial EPAs)

This project has somewhat achieved its objectives, therefore its effectiveness is fair.

### 3.4 Impact

#### 3.4.1 Intended Impacts

Realisation of expected impacts of this project is as follows.

##### (1) Contribution to environmental policy formulation

In Pakistan, the National Environmental Quality Standard for Ambient Air was long-awaited and it finally became effective in October 2010. Activities of ambient air monitoring and technical advice from experts in the T/C project contributed to the enactment of the standard<sup>29</sup>.

The result of air monitoring found that, SPM was the most serious air pollution problem in Pakistan, far exceeding the standard. This led to countermeasures such as urban vegetation and raising the quality standard of fuels<sup>30</sup>. In Punjab province, the result of air monitoring is provided to the mayor's office, the Lahore Development Authority, and the water works and sewerage department among others, and proposals are made to respective authorities regarding the promotion of interchanges and higher restriction on exhaust gas<sup>31</sup>.

<sup>29</sup> Federal and provincial EPA hearing. Standards for industrial exhaust and wastewater became effective in 2000.

<sup>30</sup> For example, when Federal EPA conducts Environmental Impact Assessment of inter- provincial highways, they make it mandatory to cover shoulders of the road with vegetation or pebbles, and building road side ditches in order to prevent flying dust. As for fuel, EUROII standard, which has a higher restriction of CO and dust in its exhaust, is now applied to gasoline (from July 2009) and diesel (from July 2012). Also, the upper limit on the sulfur content of fuel was lowered from 1% to 0.5% (Federal EPA hearing).

<sup>31</sup> Punjab EPA hearing.

(2) Countermeasures for industrial exhaust and waste water

The project also contributed to issuing Environment Protection Orders (EPO) related to wastewater and factory exhaust, and Court Orders from the Environmental Tribunal that are more binding (Table 6)<sup>32</sup>. Especially in Punjab EPD, the number of EPOs and court orders increased substantially (Figure 1). However, since some monitoring activities were conducted before the project started, this cannot be solely attributed to the project.

Table 6: Number of Environmental Protection Order issuance

	2005	2006	2007	2008	2009	2010
CLEAN	5	8	33	4	30	20
Punjab	87	150	363	510	696	1600
Sindh	NA	NA	9	NA	NA	20
KPK	86	NA	NA	NA	NA	526
Balochistan	NA	NA	NA	NA	NA	NA

(Source: hearing from EPAs)

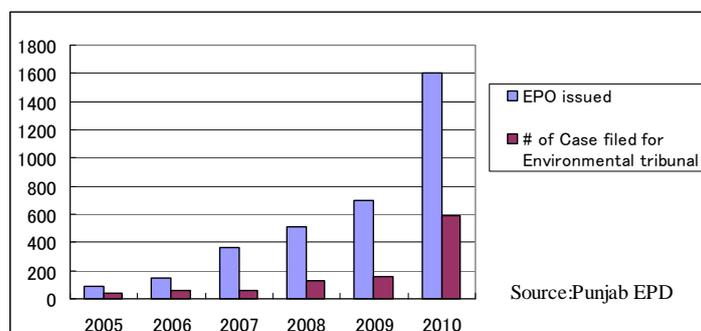


Figure1 : Actions taken for pollutants (Punjab EPA)

(3) Enlightenment for citizens by information disclosure

The result of ambient air monitoring is posted on electronic sign boards along with an environmental protection message in Punjab and KPK provinces. Punjab EPD also provides the data for high school teaching materials.

According to the beneficiary survey (conducted in Punjab and Sindh provinces in February 2011 targeting 92 University students and researchers majoring in environmental studies), information disclosed on EPA website is well utilised by them. 52.0% of the respondents said they have used EPA website and 45.7% said EPA is disclosing enough information concerning environmental monitoring (this exceeds the 34.8% who said they did not). After the T/C project started ambient air monitoring, results have been posted on the web. Such posting is expected to increase environmental awareness among citizens, if the quality of the data is assured.

<sup>32</sup> Hearing from the EPAs. The EPO issues instructions for the installation of pollution reduction equipment and recovery of environment, and imposes fines if instructions are not followed. Court Orders can include: further fines, factory shutdowns or confiscation, imprisonment of persons responsible, and compensation for damages caused (Pakistan Environment Protection Act).

#### (4) Unified monitoring methods among provincial EPAs

Methods of the environmental monitoring before the project were different in each EPA. After this project and the T/C project, however, all provincial EPAs are now using the same methods making it easier to compile and compare monitoring data<sup>33</sup>.

### 3.4.2 Other Impacts

#### (1) Impacts on the natural environment

There was no particular problem found in exhaust and waste water from the laboratories, however, many of the laboratories still have few opportunities to use draft chambers and waste water treatment facilities. Conventional Ph treatment is practiced in case there is ever a failure in the waste water treatment facility.

#### (2) Land Acquisition and Resettlement

There was no resettlement involved in this project, and no problem in land acquisition since the land for CLEAN was unused before its construction.

#### (3) Other Indirect Impact

All laboratories accept University students for research purposes. Punjab EPD accepted 50 University students in the last year, and even more students visit the laboratory. They are planning further collaboration in training and research with the environment-related faculties of Pakistani Universities<sup>34</sup>.

At the time of the evaluation expected impacts had begun to be realised thanks to the T/C project.

### 3.5 Sustainability (Rating:①)

#### 3.5.1 Structural Aspects of Operation and Maintenance

##### (1) Implementation system

It was originally planned that environmental monitoring activities would be continued under provincial budgets after the grant project ended in 2007. However, since the federal project was extended to December 2011, the federal budget was going to cover the cost till then. Therefore, starting from 2012, each province needs to take initiative in continuing monitoring activities.

Pak-EPA, the implementation agency of this project, used to be a part of Ministry of Environment, which was devolved to the provinces in June, 2011. Pak-EPA is now part of Capital Administration Development Division<sup>35</sup>.

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<sup>33</sup> Hearing from provincial EPAs.

<sup>34</sup> Hearing from Punjab EPD.

<sup>35</sup> The 18<sup>th</sup> amendment of the Constitution (June, 2011) devolved 17 Ministries including the Ministry of Environment. Responsibility and budget of environmental administration were transferred to each Province, and federal issues such as ratification and implementation of international treaty, was transferred to the Planning and Development Division under the Ministry of Finance, Revenue, Planning and Development. The Capital

By this administration reform, Pak-EPA will be in charge of environmental administration only in the area covering the capital city. Although, in substance, it is not much different from the previous status, CLEAN's role in the future is unclear. After the Ministry of Environment is devolved, each provincial EPA will, under the provincial government, enact environmental protection acts, and be responsible for the formulation and implementation of environmental policies. In order to continue activities covered in the current federal project, provincial EPAs have to secure necessary personnel and budget starting from 2012. In Punjab, Sindh, and KPK EPAs, follow-up projects are planned and their budgets have been secured. Balochistan EPA is in the process of planning a follow-up project as well<sup>36</sup>.

## (2) Personnel assignment

Originally, the Ministry of Environment intended to hire an additional 101 contract staff (including 75 technical staff)<sup>37</sup> for the federal project, and assign staff to each provincial EPA who would continue working in their assigned province after the federal project was over. However, constitutionally, provincial governments are not obliged to employ anyone hired by the federal government; in fact, they have to follow their own provincial hiring process. Moreover, the original hiring plan was not welcome due to strong local autonomy and ethnic sentiment in Pakistan. On top of that, the Ministry of Environment had a shortage of funds leading to the recruitment of a total of only 30 staff (including only 16 technical staff) as of March 2007. Later, 7 more staff (including 5 technical staff) were hired and some staff left, so that at the time of the evaluation only 23 staff (including 19 technical staff) were remaining (Table 7)<sup>38</sup>.

Table 7: Number of staff at each EPA

	Contracted project staff		Regular staff
	Planned	Actual	
Federal EPA	25(16)	10(9)	74(46)
Punjab EPD	20(16)	5(3)	234(171)
Sindh EPA	20(16)	5(4)	81(37)
KPK EPA	18(14)	3(3)	66(16)
Balochistan EPA	18(14)	0(0)	59(17)
Total	101(75)	23(19)	514(287)

(( )) indicates technical staff. Others are support staff such as drivers. Source: Basic Design Study, Revised PC1, hearing from EPAs and documents provided by T/C project)

All EPAs experienced difficulties in monitoring activities because the actual recruitment numbers did not meet the original plan. Also, the utilisation of monitoring results in environmental policy and urban planning was delayed due to the fact that a senior chemist who was supposed to play a central role at CLEAN in data analysis and utilisation was not hired till 2011.

The contracts for the remaining 23 staff expire in November 2011. Even though regular EPA staff have received the training with the contracted staff, in order to sustain current monitoring activities, it's

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Administration Development Department is under the Cabinet Division of the Prime Minister Secretariat, and responsible for works related to capital which used to be under the devolved Ministries

<sup>36</sup> Hearing from Ministry of Environment

<sup>37</sup> Numbers taken from revised PC-1 (federal project plan). It was 120 according to the Basic Design Study.

<sup>38</sup> After hiring the first 30 staff, repeated requests from the federal EPA to recruit additional staff were denied by the Ministry of Environment on the grounds that there was a budget shortage. Hiring restarted in 2011.

necessary to extend the contracts of the contracted staff who accumulated knowledge and skill and also undertake additional recruitment.

As mentioned before, although provincial EPAs have plans to increase staff, realisation of those plans was not yet foreseeable as of the time of the evaluation.

3.5.2 Technical Aspects of Operation and Maintenance

Before the T/C project started, many of the parameters were not able to be monitored due to a lack of techniques in measurement and maintenance. A deteriorating security situation prohibited Japanese Experts to visit KPK and Balochistan to directly instruct their laboratory staff on even the T/C project<sup>39</sup>.

However, by the time of the evaluation, technical capabilities were greatly improved thanks to the closely supervised training and the on-the-job training of the T/C project. Some technicians mastered not only the operation of the equipment but simple maintenance such as changing parts<sup>40</sup>. If some of these technicians stay at each EPA, a certain level of equipment use, operation and maintenance can be expected. However, currently the activities are conducted under the supervision of Japanese Experts. Whether or not scheduled monitoring continues after the completion of the T/C project in December 2011 will remain to be seen.

3.5.3 Financial Aspects of Operation and Maintenance

(1) Status up to ex-post evaluation

Since 2007, budget for the federal project was tight due to a distressed national budget. Actual disbursement compared to the planned budget was 22.8% in fiscal year 2007-2008, and 58.0% in 2008-2009. The global financial crisis in 2008-2010 and floods in 2010-2011 made the situation even worse and only part of the approved budget had actually been disbursed (Table 8). Shortage of budget led to insufficient maintenance and arrears in salary payments.

Table 8 : Planned and disbursed budget of EPA for the project (million Rs.)

	planned	approved	disburse	disbursed/ planned (%)
FY2006-2007	NA	50.0	24.8	NA
FY2007-2008	47.0	10.8	10.7	22.8
FY2008-2009	51.7	97.0	30.0	58.0
FY2009-2010	NA	113.1	12.0	NA

(The amount includes salary of contracted staff. Source: Federal EPA)

Since it is a federal project till the end of 2011, provincial EPAs waited for the disbursement from the Pak-EPA, consequently their operation and maintenance were insufficient. KPK, however, managed to secure some funds from the provincial budget for operation and maintenance.

<sup>39</sup> Business trip to these two provinces have been suspended since August 2007.

<sup>40</sup> However, there is difference among them in capability, basic knowledge in math and chemistry, and motivation (hearing from laboratory staffs and Experts of T/C project).

## (2) Perspectives after 2012

Since Pak-EPA and each provincial EPA will start their own activities to continue environmental monitoring after 2012, the situation will differ according to the province. As for the prospects of securing sufficient budget for environmental monitoring at each EPA: Pak-EPA,<sup>41</sup> Punjab<sup>42</sup> and KPK<sup>43</sup> EPAs have managed to already secure it until FY2011-2012. Sindh EPA acquired the necessary budget; however, it is for the amount needed for the enlargement of local laboratories and it is not clear if budgets will be used for the EPA laboratory.<sup>44</sup> Balochistan EPA has submitted a request to the provincial government for budget appropriation.

Starting FY 2012/2013, all EPAs will try to shift the budget necessary for environmental monitoring from the development to the non-development side (operationalisation). However, at the moment, it is unclear if it will actually be realised at all the provinces, and necessary budget will be secured in the future.

### 3.5.4 Current Status of Operation and Maintenance

As mentioned before, there are considerable uncertainties whether or not equipment provided for CLEAN and provincial EPAs will be properly maintained and utilised. Frequent power outages and unstable voltage are causing mechanical troubles. At the time of the evaluation, rolling blackouts are carried out in all 5 cities.<sup>45</sup>

In 2010, supply of electricity was 77.6% of the total demand. Future power outlook also tells us this ratio will be 74.6% in 2015 and 73.3% in 2015, and power shedding will continue at least until 2018.<sup>46</sup> For equipment, the current surge which occurs after the power comes back is more serious than power outages itself. For precision instruments in general, voltage fluctuation is assumed to be within 10%. However, actual fluctuations from 230V to 360 V, or 57% were observed in Islamabad and current surges happened 300 times between April and December 2009.<sup>47</sup> The cost of operation and maintenance is estimated at 10 million Rs. in case of Punjab (which is 3 times the amount estimated at the time of planning). The difference is partially due to the devaluation of the Rs. against the yen, which raises the procurement cost of parts of Japanese products, but the main reason is the failure of precision instrument due to outages and unstable voltage.<sup>48</sup>

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<sup>41</sup> It has secured 25 mil.Rs for the fiscal year 2011-2012 to complete the construction of CLEAN, extend contract of laboratory staff, and maintain equipment (Letter from Director General of Pak-EPA, dated October 21, 2011).

<sup>42</sup> 100 million Rs. is already approved by the Provincial Government as a cost for environmental monitoring (hearing from Punjab EPA)

<sup>43</sup> Also, renewal of laboratory building is under way. (hearing from Balochistan EPA)

<sup>44</sup> 38.5 million Rs. is expected to be approved by the Provincial Government to take over Federal project (hearing from Sindh EPA)

<sup>45</sup> Hours of power shedding per day in each city is 4~5h in Islamabad, 6~8h in Lahore, 6~7 h in Karachi, 1~8h in Peshawar, and 10h in Quetta. It is even longer in summer (hearing from EPAs and The Quetta Electric Supply Company).

<sup>46</sup> Pakistan Water and Power Development Authority (<http://www.wapda.gov.pk/htmls/power-index.html>), and Nation, June 30, 2011.

<sup>47</sup> Hearing from T/C project experts.

<sup>48</sup> 1.96 yen/Rs. (Basic Design Study 2005), and 1.00 yen/Rs. (April, 2011)

As for automatic air monitoring stations, the probability of their continued use is high if operation and maintenance cost is provided. However, maintenance cost per station is estimated at 1 million Rs. a year. Although repaired by the T/C project, UPS's durable year is said to be 1-2 years, and even with proper maintenance, periodical replacement will be necessary in the future.<sup>49</sup> Currently, consumables such as filters and spare parts are mostly provided by the T/C project budget. The possibility of procuring substitutes from India and Dubai is being examined to avoid airfreight from Japan (taking the higher yen value into consideration)<sup>50</sup>.

As for air and monitoring equipment, among the ones over 100 million yen CIF, 58.9% broke down in less than 4 years after completion of the grant project. However, due to repair support by the T/C project, 85% of all equipment is in operation as of now (Table 9).

Table 9: Equipment failure rate

	equipment checked	equipment failed in the last 4years		equipment out of order at the time of evaluation	
	number	number	%	number	%
CLEAN	30	16	53.3	3	10.0
Punjab	38	19	50.0	6	15.8
Sindh	34	26	76.5	8	23.5
KPK	23	16	69.6	2	8.7
Balochistan	21	9	42.9	3	14.3
Total	146	86	58.9	22	15.1

(Note: equipment over CIF 100 million yen and checked during field survey. Source: hearing from EPAs)

The equipment is used mostly in activities of the T/C project. After the T/C project is over, it will probably be used in Punjab and KPK EPAs for routine environmental monitoring, while it will be rarely used in Balochistan EPA if today's staff shortage continues. For Pak- EPA, it will depend on securing budget for recruitment of laboratory staff and maintenance. In Sindh, it will depend on if they focus more on central laboratory instead of enhancing local laboratories.

In light of the high maintenance cost required for precision instruments due to unstable power supply and voltage delivery, sustainability of the project will depend on the commitment by each EPA toward environmental monitoring. If Pak- EPA and provincial EPAs can stably acquire budget and staff, equipment especially air monitoring stations will be continually utilised. However this is uncertain considering the implementation system as well as the financial situation, and the operation and maintenance situation.

Major problems are observed in terms of the structural and financial aspects of operation and maintenance, therefore sustainability of the project effect is low.

## 4. Conclusion, Lessons Learned and Recommendations

### 4.1 Conclusion

This project met the needs of Pakistan to monitor environmental degradation nationwide, thus its

<sup>49</sup> 500,000-600,000Rs./unit

<sup>50</sup> Hearing from EPAs

relevance was high. However, efficiency of the project was medium since a part of the planned output was unrealised. As for the project outcomes, nationwide ambient air monitoring is now conducted and its result is beginning to be used for environmental policy making. On the other hand, regarding industrial exhaust, wastewater and urban sewage, some of the parameters are unable to be monitored. Although outcomes were realized to a certain extent at the time of evaluation (in light of the ongoing T/C project), effectiveness of this project is also medium. As for the operation and maintenance system and the financial situation, there is a great deal of uncertainty at the time of evaluation. After completion of the federal project (mother project of this project) and the T/C project in January 2012, the sustainability of the outcomes of this project is of particular concern.

In light of the above, this project is evaluated to be unsatisfactory.

## 4.2 Recommendations

### 4.2.1 Recommendations to the Executing Agency

Pak-EPA and CLEAN, which are now part of the Capital Administration Development Department, will play an important role as a monitoring institution of air and water quality in Islamabad and an institution for training and source of information dissemination of environmental monitoring. In order to play these roles, they need to secure budget to hire competent and experienced staff. The know-how and resources built up by the efforts of both the Pakistan and the Japan sides should be maintained and further developed. Provincial EPAs need to steadily implement successive federal projects by securing personnel and budget for activities, and maintenance. In consideration of the importance of environmental monitoring, monitoring activities should be operationalised in the medium-term so that budgets can be secured without disruption.

### 4.2.2 Recommendations to JICA

After the T/C project is completed, periodical monitoring by JICA Pakistan office should be conducted to check the environmental monitoring activities of Pak-EPA and the provincial EPAs as well as their budget situations. If stagnated EPA is found, they should be encouraged to pursue environmental monitoring. Also, in case of training conducted by EPAs, cooperation such as dispatching Japanese instructors should be considered.

## 4.3 Lessons Learned

### (1) Formulation of a project

This project had an implementation problem since it was formulated based on the assumption that Pak-EPA would lead the project while decentralisation was in progress. Hiring of staff by the central government was much-debated among the Pakistan side and some people questioned if it was realistic<sup>51</sup>. Even if a partner country officially agrees on a project design and minutes are signed, its operability should be carefully examined beforehand.

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<sup>51</sup> Autonomy of the Provinces was guaranteed in the 1973 Constitution.

(2) Compatibility of equipment to the infrastructure situation of a partner country

Outages were already frequent at the time of the Basic Design Study<sup>52</sup>. For providing precision equipment to a country or area with power supply and voltage fluctuation problems, equipment should be selected carefully only after examining the long term power supply outlook.<sup>53</sup>

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<sup>52</sup> Basic Design Study for the Project of Establishment of Environment Monitoring System in the Islamic Republic of Pakistan(2005)

<sup>53</sup> Similar problems are pointed out in the terminal evaluations for the Project for Capacity Development of Environmental Monitoring in People's Democratic Republic of Algeria and the Project for Capacity Development of Environmental Monitoring at the Directorates for Environmental Affairs in Governorates in the Syrian Arab Republic.