NO

BASIC DESIGN STUDY REPORT

ON

THE PROJECT FOR SUPPLY OF EQUIPMENT FOR

REGIONAL ENVIRONMENTAL MONITORING NETWORK (Phase II)

IN

THE ARAB REPUBLIC OF EGYPT

August 2002

JAPAN INTERNATIONAL COOPERATION AGENCY

CTI ENGINEERING INTERNATIONAL CO., LTD.

GREEN BLUE CORPORATION

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PREFACE

In response to a request from the Government of the Arab Republic of Egypt, the Government of Japan decided to conduct a basic design study on the Project for Supply of Equipment for Regional Environmental Monitoring Network (Phase II) and entrusted the study to the Japan International Cooperation Agency (JICA).

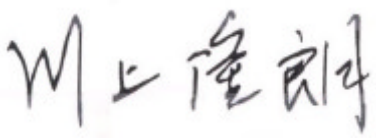
JICA sent to Egypt a study team from April 7th to May 4th, 2002.

The team held discussions with the officials concerned of the Government of Egypt, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Egypt in order to discuss a draft basic design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Arab Republic of Egypt for their close cooperation extended to the team.

August, 2002



Takao Kawakami
President
Japan International Cooperation Agency

August, 2002

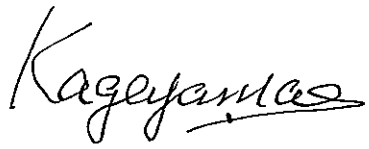
Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Supply of Equipment for Regional Environmental Monitoring Network (Phase II) in the Arab Republic of Egypt.

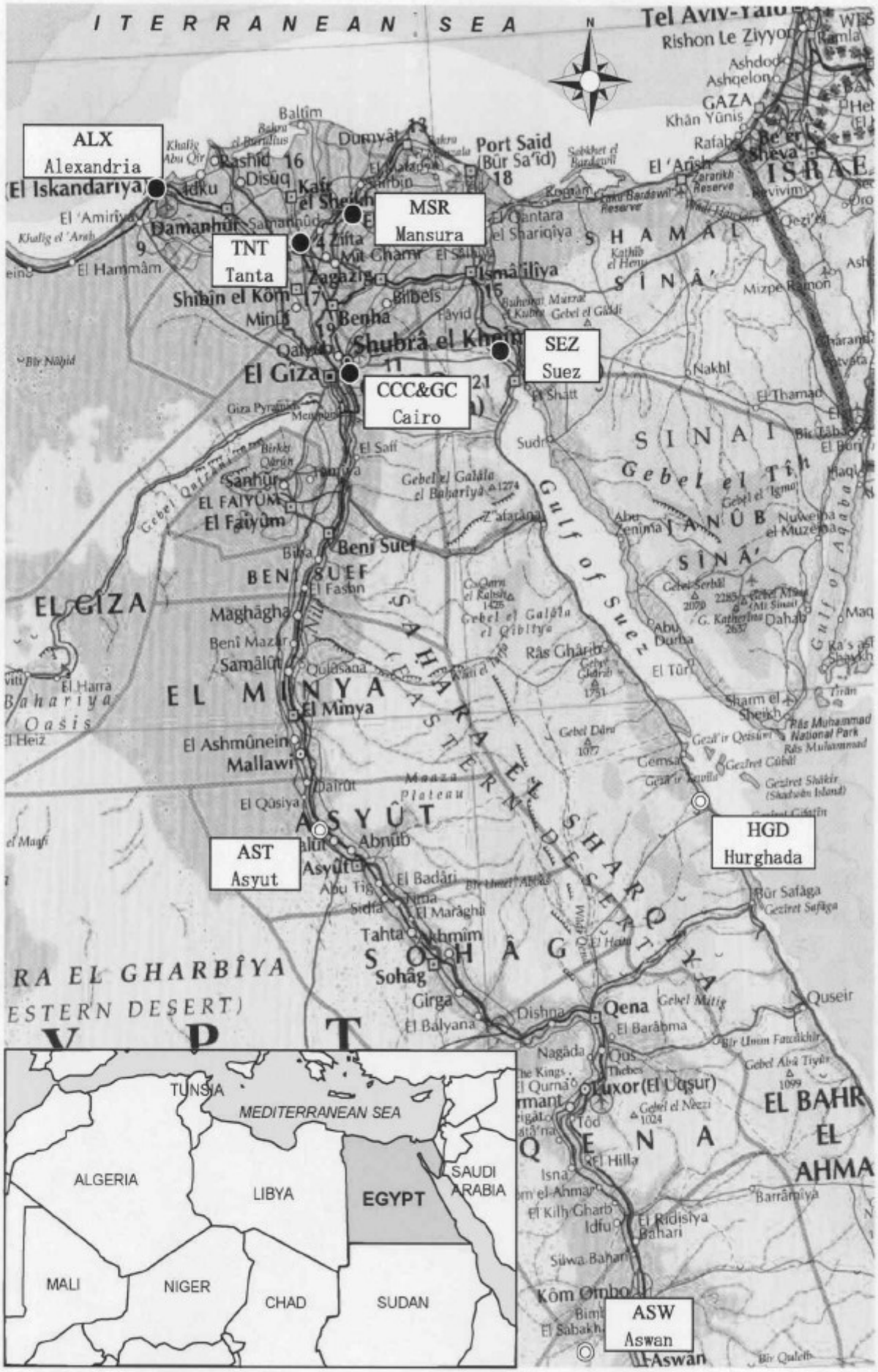
This study was conducted by the joint venture between CTI Engineering International Co., Ltd and Green Blue Corporation, under a contract to JICA, during the period from March 2002 to September 2002. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Egypt and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

Finally, we hope that this report will contribute to the further promotion of the project.

Very truly yours,



Kazuyoshi Kageyama
Project manager,
Basic design study team on
The Project for Supply of Equipment for
Regional Environmental Monitoring
Network (Phase II)
Joint venture:
CTI Engineering International Co., Ltd
Green Blue Corporation



●Existing RBO ◎New R BO

0 100 200 km

PROJECT LOCATION MAP

ABBREVIATIONS

AfDB	:	Africa Development Bank
ASRT	:	The Academy of Scientific Research and Technology, Cairo
BACD	:	Branches Affairs Central Department
CCC	:	Cairo Central Center
CEO	:	Chief Executive Officer
CIDA	:	Canada International Development Agency
DANIDA	:	Danish International Development Agency
DEPA	:	Danish Environmental Protection Agency
EEAA	:	Egyptian Environmental Affairs Agency
EIU	:	The Economist Intelligence Unit, London, UK
EMC	:	Environmental Monitoring Center
EMU(s)	:	Environmental Management Units
EOJ	:	Embassy of Japan in Cairo
GOFI	:	The General Organization for Industrialization
GTZ	:	Deutsche Gesellschaft fur Techniche Zusammenarbeit
IBRD	:	International Bank for Reconstruction and Development
ML	:	EEAA Mini-laboratory Network Facilities
MOD	:	Ministry of Defense and Military Production
MOH	:	Ministry of Health
MOIC	:	Ministry of International Cooperation
MOL	:	Ministry of Labour
MPWWR	:	Ministry of Public Works and Water Resources
NDP	:	National Democrat Party
NRC	:	National Research Center, Cairo
NRI	:	Nile Research Institute, Cairo
ODA	:	Overseas Development Administration
OECC	:	Overseas Environmental Cooperation Center, Tokyo, Japan
RBO(s)	:	Regional Branch Offices
RER/TC	:	Regional Environmental Research and Training Center in Egypt
RIGW	:	Research Institute for Groundwater
TCOE	:	Technical Cooperation Office for the Environment
UNDP	:	United Nations Development Program
USAID	:	United States Agency for International Development
WB	:	The World Bank
WHO	:	World Health Organization
WRC	:	Water Research Center
ALX	:	Alexandria
AST	:	Asyut, Assiut
ASW	:	Aswan
GC	:	Greater Cairo
GOE	:	The Government of Egypt
HGD	:	Hurghada

KEZ	:	Kafr El-Zayat
MSR	:	Mansura
RS	:	The Red Sea
SEZ	:	Suez
TAT	:	Tanta
CEP	:	The Comprehensive Environmental Program, EEAA / WB
EEAP	:	Egyptian Environmental Action Plan; May, 1992, WB
EMTP	:	Environmental Monitoring Training Program
EPL	:	Environmental Protection Law, No.4, 1994
GEAP	:	Governorate Environmental Action Plans
JOCV	:	Japan Overseas Cooperation Volunteers Programme
NIPPP	:	National Industrial Pollution Prevention Programme
ODA	:	Official Development Assistance
OSP	:	Organisation Support Programme
A/P	:	Authorization to Pay
AAGR	:	Annual Average Growth Rate, %
B/A	:	Banking Arrangement
CIF	:	Cost, insurance and Freight
E/N	:	Exchange of Notes
FOB	:	Free on Board
L/A	:	Loan Agreement
M-M	:	Man Months
N/V	:	Note Verbal
PQ	:	Pre-Qualification
R/D	:	Record of Discussions
TOR	:	Terms of Reference

SUMMARY

Industrialization in urban areas of Egypt has remarkably progressed in recent years. However, various environmental problems have arisen from air and water pollution, which even causes a significant threat to public health. Despite these facts, no effective measure has been taken to improve the situation due to inadequate legislation, insufficient number of experts and lack of environmental monitoring equipment.

Under these circumstances, the Government of Egypt enacted the Environmental Law in 1994 and established Egyptian Environmental Affairs Agency (EEAA) as a main governmental body in charge of environmental protection nationwide. EEAA urges to implement environmental management according to the Law and is currently undertaking various projects with the foreign assistance regarding environmental improvement or natural environmental protection. In this context, this project aims to establish eight (8) Regional Branch Offices (RBOs) throughout the country, as part of its strategy for the decentralization of environmental management, and to build up a comprehensive regional environmental monitoring network. With the achievement of this objective, RBO will be able to take the initiative in dealing with regional environmental problems in a close cooperation with the Governorates.

From the above considerations, the Government of Egypt emphasized the necessity of developing capacity of each RBO laboratory and supply of proper equipment for environmental monitoring, and made a request to the Government of Japan in 1995 for the assistance of technical training as well as Grant Aid for the supply of monitoring equipment.

In response to the above request, the Government of Japan implemented "the Project for Supply of Equipment for Regional Environmental Monitoring Network" in 1996 under the Grant Aid, by which the monitoring equipment was provided to CCC and five(5) RBOs (Great Cairo, Alexandria, Tanta, Mansoura and Suez). Furthermore, "Environmental Monitoring Training Project (EMTP) started in 1997 under the project-type technical cooperation program of Japan International Cooperation Agency (JICA) in order to provide training for the laboratory staff. In this regard, the supply of supplementary equipment for the laboratory was also included in EMTP. From a clear view of the project effects, the Government of Egypt again requested to the Government of Japan in October 2000 to procure monitoring equipment under the Grant Aid for the remaining three(3) RBOs in Asyut, Aswan and Hurghada.

Responding to the request, the Government of Japan has decided to conduct a Basic Design Study for the project and entrusted the study to JICA. JICA sent to Egypt the Basic Design Study Team from April 7 to May 4, 2002 for the field survey and data collection. After the technical examination in Japan, the team was dispatched again to Egypt from July 29 to August 6, 2002 for the explanation of the draft report, and as a result of discussions, the Egyptian side basically agreed to the contents of the report.

The project aims to set up eight RBOs in the country for the establishment of an environmental monitoring network. Within the framework of this project, the requested Grant Aid is to focus on the supply of necessary equipment for the three new RBOs, thereby accomplishing the network. The equipment list attached to the request letter was the same as the one submitted with the Grant Aid request in 1996. Therefore, the equipment has been selected with due care and attention. Particularly, the following were taken into account: 1) the frequency of use of the equipment in the existing RBOs; 2) environmental characteristics of the proposed regions; and 3) technical capability of the new RBOs. The summary of the main selected equipment is described as follows:

(1) Common Analytical Equipment

A.A.S Flameless type with flame component	:	Indispensable for analyzing heavy metals designated as standard parameters.
UV/VIS Spectrophotometer	:	Indispensable for colorimetric analysis widely used as fundamental equipment.
FID Gas Chromatograph	:	Necessary for monitoring oil spill in the Red Sea.
Ion Chromatograph	:	Easy handling and extensively used for analyzing inorganic ions.
Stereoscopic microscope	:	Necessary for biological observation.
Mercury analyzer	:	Necessary for analyzing mercury.
Others	:	Handy type pH meter, laboratory pH meter, microscope, etc.

(2) General Laboratory Equipment

Tabletop type centrifuge	:	Basic equipment for laboratory.
Constant temperature oven	:	Basic equipment for laboratory.
Autoclave (vertical type)	:	Indispensable for analyzing coliform as a parameter of water quality standard
Shaker	:	Basic item of equipment for laboratory.
Hot plate	:	Indispensable for decomposition process of samples to analyze heavy metals, etc.
Ion exchanger	:	Basic item of equipment for laboratory.
Water distillation unit	:	Basic item of equipment for laboratory.
Draft chamber	:	Basic equipment for the treatment of noxious gas.
Freezer	:	For the storage of unstable reagents and samples
Monitoring car	:	Necessary for field sampling and observation of water

		and air.
Others	:	Balance, mixer, water bath, ultrasonic cleaner, refrigerator, colony counter, OHP, etc.

(3) Water Quality Monitoring Equipment

Total organic carbon analyzer	:	Useful for analysis of aquatic organic carbon and estimation of diluted COD is made possible.
Handy type DO meter	:	Useful to analyze DO in the field.
Water sampler	:	Necessary for water sampling.
Distillation apparatus	:	Necessary to analyze such parameters as cyanide, ammonia, fluorine
Wastewater treatment equipment	:	Indispensable for the treatment of wastewater from the laboratory.
Water quality analysis (pH, turbidity, DO, conductivity)	:	Useful equipment to analyze water quality in the field.
Monitoring boat	:	Necessary for marine survey and sampling.
Portable VHF radio	:	Necessary for the communication between base station and monitoring boat.
Others	:	Turbidity meter, salt meter, BOD and COD analyzer, Ion analyzer, portable water quality test kit, vacuum filter, handy type GPS, etc.

(4) Air Quality Monitoring Equipment

Mobile unit	:	Comprehensive mobile unit designed for air monitoring around source of pollution or in the factory.
Gas sampler (detector tube)	:	Necessary for analyzing dust in exhaust gas.
Stack gas sampler (for dust)	:	Necessary for the measurement of exhaust gas and gas concentration in work environment.
Portable auto analyzer for stack gas	:	Necessary for continuous measurement of HC/CO, SO_2 and NOx
High-volume air sampler	:	Basic equipment for sampling dust in ambient air.
Ambient air analyzer	:	Necessary for quick measurement of VOCs in roadside and work place
Others	:	Portable black fume monitor, gas meter, mass flow meter, auto-dry desicator,dust meter, PM10meter, etc.

Apart from the items mentioned above, the equipment includes the minimum quantity of consumables such as spare parts, glassware and reagents required for the beginning of operation for each RBO, but in principle these are not supplied to the existing RBOs.

The project shall include not only the procurement and installation of equipment but also technical guidance service, which consists of two components, technical support and management support. For the technical support, it intends to provide technical training to the staff of the new RBO laboratories after the installation of equipment. Meanwhile, for the management support, it is planned to hold seminars aiming at enforcement of the regional environmental monitoring system. In this respect, there will be four(4) experts assigned to render the following services:

(1) On-the-job-training for operation and maintenance of the equipment,

(2) Preparation of Standard Operation Procedure, and

(3) Strengthening of local support system for environmental monitoring.

The implementation period is estimated at 3.5 months for the detailed design and tender administration. It will also require 8 months for the equipment procurement and installation and 3 months for the technical guidance service.

As a project effect, the country's environmental situation will become better known, and administrative guidance will be made possible in such a way that the factories identified as pollution sources are ordered to shut down the operation or to improve treatment system. Thus, the project will certainly contribute to the environmental protection. To be more concrete, the number of monitoring sites as well as factory inspections will increase. It is expected that the annual number of point source monitoring surveys will jump from 500 to 800 approximately if 3RBOs are added. As a result, the administrative measures against polluters will be taken more frequently from 60 at present to95-100 a year.

The number of samples collected by 5RBOs for the ambient monitoring activity is now 660 a year for water quality and 625 for air quality. Should the 3RBOs be added and operated in the near future, these numbers will increase to 1,050 and 1,000 respectively. These data will show the concentration of main physical and chemical parameters in determining the quality of air and water, which may vary depending on the site or area in the country. As a result, the data will serve to prove the necessity of environmental improvement.

The population benefiting from the project is now estimated to be 47.5 millions as they are common residents living in the jurisdiction of 5RBOs. However, if 3RBOs are incorporated, it will increase to 62.5 millions covering the whole population of Egypt.

The optimum project scale as well as the specifications of the equipment have been determined after due consideration on the operation and maintenance capability of the new RBOs. In addition, special care has also been taken to properly coordinate with the existing RBO laboratories and to cover the monitoring items stipulated in the

Environmental Law. The equipment selected as such may be manageable to all staff of the new RBOs if technical training is provided to them for a certain period.

Judging from the above considerations, the project will contribute to the environmental improvement of Egypt so it carries validity to be implemented under the Japan's Grant Aid. However, for the smooth commencement of laboratory operation and management, the following need to be undertaken by the Egyptian side:

(a) To complete the construction of RBO Hurghada by the time agreed upon,

(b) To allocate sufficient budget for the operation and maintenance of 8RBOs from the year 2004, and

(c) To provide training to the new laboratory staff under the responsibility of CCC prior to the technical guidance service under the Grant Aid.

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CHAPTER 1. BACKGROUND OF THE PROJECT

Development policy without consideration for environment has driven the economic growth of Egypt temporarily. However, pollution and natural environmental destruction became serious in the 1990's causing an object of public concern. To tackle such a focal problem, the Government of Egypt enacted the environmental law in 1994 in an effort to lift heavy load for the next generations and established the Egyptian Environmental Affairs Agency (EEAA), a responsible governmental agency for environmental protection, to address environmental issues with the support of foreign countries.

Decentralization of environmental management is the core of national policy directives, so each Governorate should be well prepared to implement environmental monitoring and pollution control at regional level. In this regard, EEAA has planned to establish Environmental Monitoring Network throughout the country consisting of Cairo Central Center (CCC) and eight (8) Regional Branch Offices (RBOs).

To implement this plan, the Government of Egypt emphasized the necessity of developing capacity of each RBO laboratory and supply of proper equipment for environmental monitoring, and made a request to the Government of Japan in 1995 for the assistance of technical training as well as Grant Aid for the supply of monitoring equipment.

In response to the above request, the Government of Japan implemented "the Project for Supply of Equipment for Regional Environmental Monitoring Network" in 1996 under the Grant Aid, by which the monitoring equipment was provided to CCC and five(5) RBOs (Great Cairo, Alexandria, Tanta, Mansoura and Suez). Furthermore, "Environmental Monitoring Training Project (EMTP) started in 1997 under the technical assistance program in order to provide technical expertise for the training of laboratory staff. In this context, the supply of supplementary equipment for the laboratory was also included in EMTP. From a clear view of the project effects, the Government of Egypt again requested to the Government of Japan in October 2000 to procure monitoring equipment under the Grant Aid for the rest of three(3) RBOs such as Asyut, Aswan and Hurghada.

CHAPTER 2. CONTENTS OF THE PROJECT

2.1 Basic Concept of the Project

Industrialization in urban areas of Egypt has remarkably progressed in recent years. However, various environmental problems have arisen from air and water pollution, which even causes a significant threat to public health. Despite these facts, no effective measure has been taken to improve the situation due to inadequate legislation, insufficient number of experts and lack of environmental monitoring equipment.

Under these circumstances, the Government of Egypt enacted the Environmental Law in 1994 and established EEAA as a main governmental body in charge of environmental protection nationwide. Environmental monitoring is considered one of the major activities of EEAA as expressed in its current Five Year Action Plan (2002-2007). EEAA divides the country into eight regions in terms of environmental administration (refer to Fig.2.1) and therefore plans to establish a RBO in each region with the aim of implementing its functions and responsibilities. In this regard, a close cooperation with Environmental Management Unit (EMU) of the Governorate is absolutely necessary in the fields of environmental management and protection.

With the objective of taking proper measures for pollution control, environmental monitoring plan needs to be implemented for collecting data and information on pollution sources in the country. Following the Government policy on the decentralization of environmental management, this project aims to achieve monitoring, focusing on air and water quality at the regional and local levels. In this context, the RBO should manage the monitoring work according to functions and mandates defined under the decree issued in March 2001.

Although five(5) RBOs have already been established in the major cities of the country such as Great Cairo, Alexandria, Suez, Tanta and Mansoura, the capacity of each needs to be further developed to cover its functions as designated by the law. Therefore, EEAA is making continuous efforts with support from foreign countries in promoting institutional strengthening and capacity building as well as enhancing public awareness of environmental issues.

Equipment has been supplied to RBO laboratories under Japan's Grant Aid and operations started in1999. The capacity of laboratory staff has been developed through training under the Japanese Technical Cooperation Program, and as a result, well-trained personnel are dedicatedly involved in the task of operating and managing laboratories.

Based on RBO's mandate and roles, the environmental monitoring system should be further developed and strengthened for pollution control, so that the EEAA has emphasized the need of establishing a complete monitoring network by adding three (3) more RBOs in Asyut, Aswan and Hurghada.

To step forward to the above objective, the monitoring system at regional level should be established at an early stage possible since it ranks high in its strategic priority, and legal actions for environmental protection as well as pollution control will be implemented under the guidance of the Governorate. In this respect, RBOs, on behalf

of the Central Agency, will play an important role in enforcing monitoring system and inspection of the industrial sector. To this end, the project, which comprises the procurement of equipment for air and water quality analysis for the new RBOs, will contribute to the pollution control and environmental improvement. The project also includes the supply of supplementary laboratory equipment for the existing RBOs. In addition, technical guidance service will be provided for the staff of new laboratories to carry out monitoring works effectively and make them sustainable as much as possible. The guidance service includes the following:

(1) On-the-job-training for operation and maintenance of the equipment,

(2) Preparation of Standard Operation Procedure, and

(3) Strengthening of local support system for environmental monitoring.

2.2 Basic Design of the Requested Japanese Assistance

2.2.1 Design Policy

Issues to be clarified and taken into consideration for the basic design of the project are described as follows:

2.2.1.1 Criteria for Selection of Equipment

(1) Details of Request for Equipment

Upon the request from the Egyptian side, equipment was supplied under the following projects; namely, (i) the Project for Supply of Equipment for Regional Environmental Monitoring Network, which was implemented under Japan's Grant Aid from 1996 to 1998 for CCC and five RBO laboratories; (ii) EMTP under the project-typed technical cooperation from 1997 to 2002, which included supply of equipment for CCC and five existing RBOs. In addition, the equipment will be provided under the Grant Aid for three (3) new RBOs and the existing six laboratories as phase II of the above Project .

Careful attention has been paid to the selection of suitable equipment for the project, and following equipment list was prepared as a result of discussions

(a) Equipment List Attached to the Application Form

The equipment list provided in the application for this Basic Design Study was the same as the list provided for the previous project, therefore, careful selection was needed in consideration of the usage condition of the existing equipment and the necessity of equipment for the new RBOs.

(b) Revised Equipment List

After a thorough discussion with the Study Team, the Egyptian side gave priority to items of equipment and materials in the order of necessity considering such factors as activity of each laboratory at the respective

RBOs and operation and maintenance (see Annex-1). Priority ratings were as follows:

Priority A: Considered to be essential for the Project

Priority B: Careful examination of necessity is needed

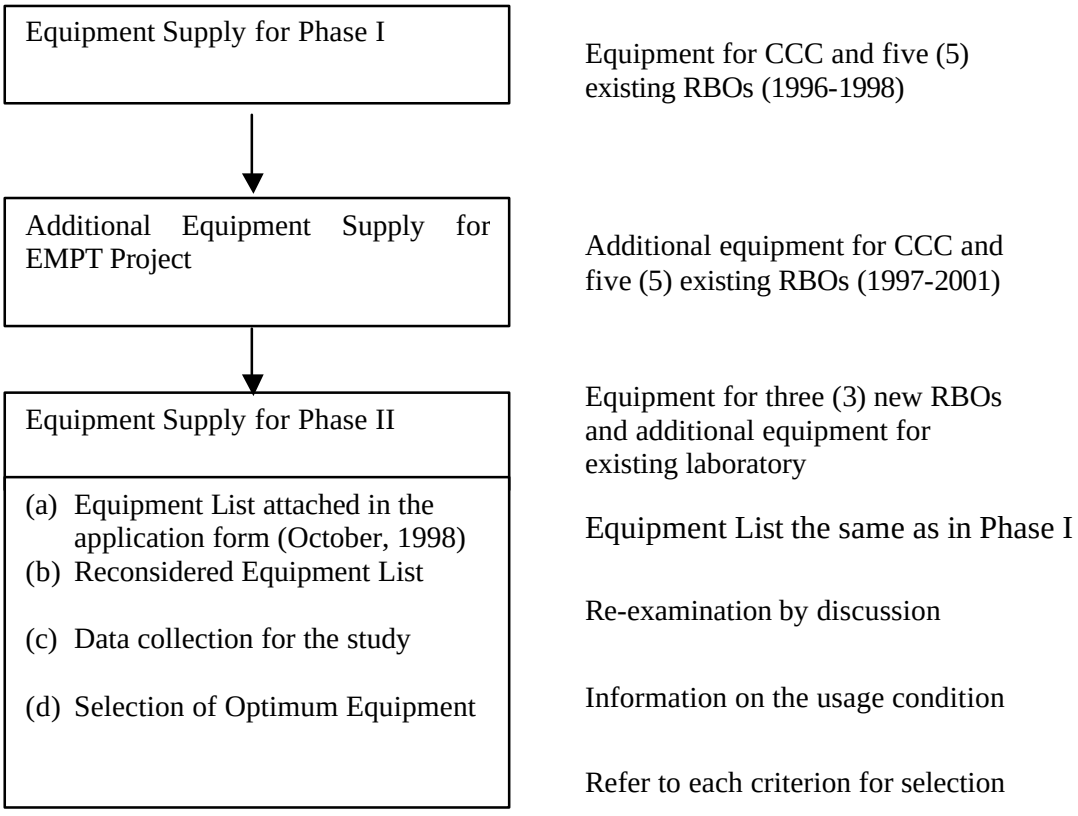
Priority C: Low priority

(i) Required Equipment for New RBOs

A revised equipment list was prepared, i.e., the Egyptian side deleted the unnecessary equipment after a thorough internal discussion on this matter.

(ii) Additional Equipment for the Existing Laboratories

Sufficient investigation was not made because the list of additional equipment for existing laboratories was collected from each existing laboratory just before the Minutes of Discussions had been prepared. Moreover, priority ratings were either B or C.



(2) Concept of the Selection of Equipment

A further examination was made on the revised equipment list as a starting point. The concept of equipment selection and specification is as follows:

(a) Frequency of Practical Use

The Study Team visited each existing laboratory of the five (5) RBOs and the CCC, and examined the frequency of use for the existing equipment. Results of the examination of usage condition are shown in Table 2.1. The selection of equipment was carefully done based on the usage condition of equipment.

(b) Evaluation of Technical Skill and O&M Budget

For implementation of the Project, the contents of equipment have to be examined on the condition that spare parts and expendables can be easily purchased under EEAA's own budget, and a system for after-sales service of maintenance, repair and technical training is to be established. The basic concept is to select equipment that could be easily handled and maintained under the condition stated above, taking the level and experience of local engineers into consideration. Also, the contents and specifications should match the technical level of EEAA staff in operation and maintenance.

On the other hand, the annual budget for operation and maintenance should be sufficient. It is a fact, however, that at present the total amount is not enough for the procurement of expensive spare parts. Hence, the annual budget should be made adequate to cover operation and maintenance (O&M) after the installation of equipment.

(c) Necessary Equipment for Environmental Monitoring

The contents and specifications of project equipment should enable the EEAA to monitor the environmental indicators described in Law No. 4 of Egypt. All equipment should be chosen based on those measurements and analyses in order to monitor the environment and pollution sources as well as support the monitoring activities of EEAA in accordance with the environmental policy of Egypt.

(d) Evaluation of Regional/Environmental Characteristics

The regional/environmental characteristics should be considered in order to select the optimum equipment for each new RBO. Especially, HGD RBO is located at the seacoast of the Red Sea and hence, has a different characteristic from the other RBOs. Therefore, necessary equipment should suit the purpose for environmental monitoring.

(e) Enough Space and Utility for the Installation

Since facilities and space required for the installation of project equipment has been secured, no problem exists in the laboratory layout and the installation of equipment.

(f) Absence of Duplication with Other Donors

It is essential that no duplication of other Donors' activities exist concerning the environmental monitoring network of EEAA.

(g) Budgetary Allocation of the Japanese Side

Some of the requested equipment is very costly. Therefore, elaborate cost estimation is required for the selection of all equipment to match the budgetary allocation of the Japanese side.

(h) Suggestion of JICA Experts

JICA experts had suggested that necessary equipment for new RBOs and additional equipment for the existing laboratories of five (5) RBOs and the CCC is required. The Study Team had referred the suggestion of the JICA experts to effect the final selection of equipment.

(3) Criteria and Selection of Each Item of Equipment

The criteria involve various aspects as mentioned before. The selection of each item of equipment has been carried out considering the aspects of usage frequency, technical skill, O&M budget and items necessary for the environmental monitoring. Regional and environmental characteristics also influence the criteria for selection of equipment. The checklist and criteria are given below. On the other hand, results of judgment regarding the selection of equipment are shown in Table 2.2.

Item	Criteria
Usage Frequency	Less used items should be unacceptable
Technical Skill and O&M Budget	Optimum items for technical skill/O&M budget should be adopted
Necessity for Environmental Monitoring	Useful items for monitoring should be selected (See Table 2.3 –2.4)
Regional/Environmental Characteristics	Marine survey equipment will be selected in case of HGD RBO
Space and Utilities for Installation	New RBOs have enough space and utility for all items
Duplication with Other Donors	No duplication exists with the Project
Budgetary Allocation of Japanese Side	Sufficiently considered
Suggestion of JICA Experts	Sufficiently considered and referred

2.2.1.2 Concept for the Determination of Grade of Equipment

(1) Grade of Equipment

Selected equipment should be satisfactory for the essential condition and minimum requirement of the existing monitoring plan.

The grade of selected equipment should satisfy the minimum essential elements for monitoring or chemical analysis. Compared to the equipment supplied under the previous project, the grade of equipment has been decided based on the following points:

(a) The present usage condition of similar items provided in the previous project should be sufficiently considered. Based on the investigation conducted on the entire equipment, it was found that some equipment were not efficiently utilized because of unsuitable grade and size; hence, the optimum grade was considered again in this basic design study.

(b) Sophisticated equipment such as atomic absorption spectrophotometer and UV-VIS spectrophotometer should satisfy the accuracy and quantitative analysis limit prescribed in the Egyptian Standards.

(2) Required Number of Units

The necessary quantity of equipment is judged by the purpose and usage condition of each piece of equipment. Based on the number of laboratory staffs in the plan and their skills, major equipment for this Project should be one each, in principle, except equipment needed in multiple quantity for blank tests and efficiency of analytical operation.

Furthermore, spare parts, glassware, and chemical reagents are needed to be neither too much nor too little, in reference to the grade in the previous project. Policy details are mentioned in Subsection 2.2.2.2(4).

(a) Equipment for New RBOs

The new RBOs should have enough equipment that can start environmental monitoring of water or air quality at the initiating time. Hence, the grade and scale of equipment was setup in consideration of capability, space and layout of each new RBO building.

(b) Additional Equipment for Existing Laboratories

Additional equipment has been listed and requested for the existing laboratories of RBOs/CCC. The main issues regarding the selection of additional equipment were follows:

- Necessity of sophisticated equipment such as x-ray fluorescence spectrophotometer, gas chromatograph mass spectrometer (GC-MS), and gas chromatograph.
- Available space and layout of existing laboratories and probability of installation of requested equipment.
- Necessity of supplementation of spare parts

2.2.1.3 Operation and Maintenance

There may be three (3) key points to be considered for assessing the capacity of the project implementing agency with regard to operation and maintenance. These are budget allocation, staffing and technical capability for the proper management of RBO laboratories. The budget should be increased corresponding to the additional number of RBOs. Despite the financial difficulties, every possible measure needs to be taken for assuring sufficient budget, and if the budget is successfully appropriated, it is expected to achieve project objective and also to make project effects sustainable.

The laboratory staff will be recruited when the project shows a practical signal for the implementation. Based on the experiences of the phase 1, it is believed that staff recruitment will be carried out on schedule. Should circumstances change in the future due to the improvement of monitoring system, RBO will certainly need more personnel. In this case, RBO will be able to recruit more manpower if the budget allocation is ensured by EEAA.

The new staff should be assigned to the laboratory work after having technical training for a certain period according to the training program of CCC, but so far the training program has not been prepared yet. Nevertheless, the cost required for the training needs to be included in the budget for operation. Meanwhile, technical guidance service, the training provided by Japanese experts under the Grant Aid, will be provided for them at the beginning of laboratory operation.

2.2.1.4 Procurement Method

Equipment supplier shall be selected from Japanese firms through general competitive tendering. Applicants shall be Japanese trading firms incorporated and registered under the laws of Japan and are required to have branch office or business office in Egypt with proper after-sales-service system. Although the project area consists of three (3) sites, these will be brought up in one lot for tendering. For such a package deal, there will be a precondition that the construction of each RBO should be completed before the delivery of equipment.

Some equipment may be available from countries other than Japan and Egypt. In this case, it is necessary to ensure that manufacturer's local agent is on standby at any time for providing maintenance services. Comprehensive judgment is required for the selection of products of the third countries. Needless to say, the price and quality are significant factors in selecting products. However, it is also important to note that the products should be user-friendly and practical, so should be such that operation methods are practically the same as used to be in Phase1.

2.2.2 Basic Plan

2.2.2.1 Overall Plan

(1) Condition of Planning Sites

(a) Surrounding Environment

Conditions of new RBO sites are summarized as follows:

(i) AST

AST is the city located in the Nile riverside about 500km away from Cairo City in the south. Agriculture and manufacturing industry are the main industries. The newly established AST RBO covers the AST governorate in addition to the neighboring three (3) governorates (Beni Suef, Menia, Al-Wadi Al-Geded). Main pollutant sources are chemical fertilizer factories, cement plant and so on. Also, air/water pollution becomes a problem caused by the aluminum factory and sugar mill even in the nearby governorates.

AST RBO is located in an urban district, and there is no house around the RBO building.

(ii) HGD

HGD is located in Al Bhar al Ahmar (Red Sea) Governorate, which faces the Red Sea. The Red Sea has kept its prominent transparency in the world and is a main attraction for tourist. Therefore, the challenge for environmental preservation on mangroves, coral reefs and so on has been eagerly executed. Housing construction has rapidly increased with the advance of urbanization in these several years, and generally, sanitary sewage is drained into the Red Sea through septic tanks.

On the other hand, industrial liquid waste from the Suez coast and oil spill from tankers had been pointed out as great issues. Such marine pollution is also a major concern concerning damage to the coral reef. As the other pollution sources, there are the mining operation located in the suburbs of HGD and the related factory. HGD RBO is situated in the central area and faces the Red Sea.

(iii) ASW

ASW is located in the south at a distance of about 890km from Cairo City and is the governorate where the southern extremity of Egypt exists. The newly established RBO is covered not only by the ASW governorate but also two other governorates (Qena, Sohag) and Luxor City Council. The Nasser Lake, a huge artificial lake made by the construction of Aswan High Dam, is situated in the southern part of ASW. Main pollutant sources are fertilizer plants, sugar mills, paper factories, iron foundries, etc. Furthermore, oil

contamination caused by cruise ships navigating in the Nile River also becomes a problem. Aswan RBO is located in the outskirts of the urban district.

(b) Conditions of Infrastructure

New RBOs are located in areas designated for urbanization, and the road condition is sufficient for the equipment installation. Moreover, the infrastructure for supply of electricity, gas and tap water is well covered so that no problem occurs on the equipment usage.

(c) Buildings for New RBOs

All the buildings for new RBOs are constructed with concrete, and the construction work for interior furnishings and utility facilities of AST and ASW RBOs has been almost completed as of April 2002. As for the HGD RBO, the foundation work was still at the stage of completion and building construction work is planned to start hereafter. Hence, the building of HGD RBO must be completed according to schedule.

(2) Overall Usage Purpose (Environmental Monitoring Plan and Equipment Disposition of New RBOs)

(a) HGD

The environmental monitoring activities implemented by HGD RBO are different from those of other RBOs and are concentrated on marine environmental monitoring, because HGD is located at a coastal area of the Red Sea and enclosed by desert.

The main activity of water quality monitoring is to analyze parameters related to eutrophication and toxic substances in the laboratory after samples of seawater are taken and observation is made using a survey boat. Among them, the survey equipment for transparency of seawater and plankton counter is relevant to eutrophication of the Red Sea.

Moreover, monitoring of oil spill from tankers navigating in the Red Sea can be coped with the gas chromatograph equipped in the SEZ RBO using proper coordination. On the other hand, a mobile unit indispensable for point source monitoring will not be provided because no major factory exists in the vicinity. Laboratory staff can manage air quality monitoring with the use of other equipment.

(b) AST

AST RBO has the monitoring activity consisting of water/air quality analysis for point pollutant sources such as factory effluent and gas emission prescribed in Law No. 4, and ambient monitoring such as river water quality and air quality of residential areas. With respect to this function, monitoring equipment requires the same line up as the other RBOs except HGD RBO. Thus, environmental monitoring equipment

concerning water quality and air quality should have the same performance as those of the existing RBOs.

(c) ASW

Large factories and important surface waters such as the Nile River and Nasser Lake are located within the administrative jurisdiction of ASW RBO. Therefore, monitoring equipment for water quality and air quality should have the same performance as those of the existing RBOs.

2.2.2.2 Equipment Plan

Equipment has been selected for new RBOs and existing laboratories, as shown in Table 2.5. This table also shows the number of existing equipment provided under the previous project. Additional spare parts, glassware and chemical reagents are given in Table 2.6 to Table 2.8, while the number and specifications of main equipment are given in Table 2.9.

The main equipment plan is as follows:

(1) Basic Plan for New RBOs

(a) Water Quality Monitoring Equipment in Laboratory

Water quality monitoring equipment requested by the Egyptian side for use in laboratories of new RBOs is as follows:

- Atomic absorption spectrophotometer [AAS (C-4)] has a high performance, and is able to analyze various heavy metals at once. In view of this advantage, AAS should be indispensable for new RBOs.

- As suggested by the JICA experts and as a result of the investigation made by the Study Team, ion chromatograph is useful for the analysis of various inorganic substances. The ion chromatograph is therefore recommendable to be installed in new RBOs and the existing laboratories.

- Total organic carbon analyzer [TOC meter (W-1)] can easily analyze organic carbon in water quality samples. Therefore, it is advisable to have it provided at new RBOs.

It is recommendable to install the above-mentioned water quality monitoring equipment in consideration of efficiency of monitoring.

(b) General Equipment for Water Quality Monitoring

As requested, general equipment for water quality monitoring consisting of equipment for sampling, equipment for pre-treatment, and equipment for maintenance of laboratory monitoring shall be of the same type as the existing equipment. Main equipment items to be supplied are as follows:

- Semi-micro analysis balance (G-1) is the most fundamental equipment for a laboratory. Accordingly, this equipment should be adopted.

- Indispensable general equipment for laboratory such as centrifuge, oven, autoclave, shaker, hot plate, water bath, incubator and so on should be of the same type as those of the previous project. However, rotary evaporator, automatic titrator and infrared heater should be excluded from this requirement because of low efficiency of the existing ones.

- Necessary equipment for management of the laboratory such as cleaner, locker for reagents and refrigerator will be employed in new RBOs. However, three (3) refrigerators should be installed in each new RBO in lieu of the cold storage chamber (pre-fabricated) that was not requested in order to compensate for capacity.

(c) Mobile Unit for Air Quality Monitoring

There have been problems such as insufficient maintenance and delayed response to breakdown and replacement of parts of the mobile units (A-1) equipped at each RBO for air quality monitoring under the previous project. However, each RBO is of the opinion that air quality monitoring on point pollution sources is important, so that the mobile units may have been used sufficiently. Further, as mentioned later, the technical issues on maintenance have been solved except issues on the budget for repair and spare parts, because EEAA had made a contract with a new agent in order to calibrate and maintain the mobile units. There is currently no problem on the hydrocarbon meter (A-1E) that has not been well functioning under the condition of replacement of the attached hydrogen generator.

(d) Air Monitoring Equipment for Point Pollutant Source

Among the gas emission measuring equipment provided to each RBO in Phase I, the automatic analyzer (A-15, A-16, A-17) for HC/CO, SO_2 and NOx has been much frequently utilized for the on-the-spot inspection of point pollution sources.

Flue gas and dust sampler (A-9) is the equipment based on the methodology described in Japanese Standard JIS Z 8808, and laboratory staffs are already well-trained by JICA experts on the use of this equipment. Although a wet gas sampler (A-10), which collects substances contained in exhaust gas in the absorber is also a fundamental equipment, usage frequency in the daily monitoring work at the existing RBOs has been low except for TNT RBO. On the other hand, the portable black fume monitor of the Ringer Man style (A-3) is suitable for the actual field monitoring, and operating staff will be trained by the JICA experts.

(e) Sampler for General Air Quality and Equipment for Work Place

Egyptian Law No. 4 includes work place ambient parameters among the air quality parameters. Hence, the equipment for work place ambient monitoring such as SPM and gaseous substances is highly necessary, and expected to be of high frequency. Under these circumstances, EEAA has requested the dust meter, which can obtain data in a short time and the VOC meter. Such items of equipment should be investigated for adoption and decision as to specification.

On the other hand, the air sampler (A-20, A-21) used for the dust sampling of ambient air related to the surrounding industrial area indicates a high usage frequency. However, the Andersen air sampler used for the collection of suspended materials in ambient air in order to segregate the diameters of particles has a low performance because of complicated handling. Also, the deposit gauge (A-22) used for sampling of atmospheric precipitation should be excluded from the equipment line up, because of low usage frequency due to out of regulation in the Egyptian law and low necessity.

(f) Portable Automatic Analyzer for Stack Gas

The regional environmental monitoring network managed by RBOs mainly conducts measurement of emission gas through inspection, and results of activities are reported and stored at the headquarters. Although exclusive equipment is needed for sampling and measurement on site, a portable automatic analyzer for SO_2, NOx, and CO (A-17, A-18, A-19) has to be employed due to high performance and convenience.

(g) Other Equipment for Air Quality Analysis

Air quality samples taken in surrounding areas of point pollution sources and stack gas samples are transported and analyzed in the laboratories, except the analysis of parameters on site.

Although laboratory instruments necessary for the analysis of samples is not greatly different from the instruments for water analysis, for example, desiccators for filter paper drying, semi-micro balance for weight concentration measurements, draft chamber for acidic decomposition of the sample, etc., they are considered to be indispensable, at least.

(h) Consideration for Environment and Necessary Equipment

Wastewater and harmful gas emission from laboratory must be fully treated before discharge to the outside, as mentioned below:

- Organic solvent and harmful gas such as acid gas and chlorine gas must be treated by draft chamber with gas cleaning device (G-41) before exhaust to outside.

- All the harmful wastewater must be stocked in portable wastewater chests (W-23B, W-24). Among them, acid and alkali must be

neutralized, and heavy metals must be separated from precipitation tank attached in the wastewater treatment equipment (W-22).

The equipment used for treatment of wastewater and harmful gas generated from laboratory shall be of the same type as that used for the previous project.

(2) Selection of Each Equipment Type for New RBOs

Main equipment that has a different specification from that of the previous project is summarized below:

(a) Atomic Absorption Spectrophotometer (C-4)

Atomic absorption spectrophotometer for new RBOs should be a convertible type able to use both graphite furnace and flame analysis.

(b) General Equipment for Water Quality Analysis

Among the general equipment for water quality analysis requested by the Egyptian side, equipment with specifications different from the previous ones are to be employed, as follows:

- Semi-micro analysis balance (G-1) is advisable to have the maximum weight of 200g.
- Icemaker (G-48) should be half-size according to the usage condition of existing laboratories.
- The water sampler should be changed from the Pettenkohrfer to the Bandon type, because of low performance.

It is advisable to install the above-mentioned water quality monitoring equipment in consideration of efficiency of monitoring.

(c) Mobile Unit (A-1)

The mobile unit used at present is a trailer type towed by an automobile with a cabin (A-1M) where the automatic measurement machine is mounted. Hence, the EEAA had requested that all mobile units should be of one type where the monitoring equipment is loaded directly on the bed of the vehicle for convenience of parking in a garage and passage on narrow roads such as those in the Cairo region.

However, it is essential that air quality be continuously monitored with only the cabin stationed at sites. Hence, a trailer type with minimized size of automobiles and cabins was selected in accordance with the condition of width and road situations in AST and ASW RBOs.

(3) Additional Equipment for Existing Laboratories

Additional equipment for existing laboratories was selected as follows:

(a) Ion Chromatograph and Flame Conversion Unit for AAS

Ion chromatograph (C-12) and flame conversion unit for AAS (C-4A) will be provided at existing laboratories, because of usefulness to monitoring. The gas chromatograph has been requested as additional equipment except for ALX RBO and after discussion with the JICA experts, installation is recommendable only for SEZ RBO. The recommendation is made in consideration of convenience of use together with the HGD RBO that will not be provided with a gas chromatograph as an emergency detector for oil spill in the Red Sea.

(b) X-Ray Fluorescence Spectrophotometer and FT-IR Spectrometer

It needs much O&M cost and high technology to manage a sophisticated equipment such as the x-ray fluorescence spectrophotometer, FT-IR spectrometer and GC-MS. Therefore, the introduction of these sophisticated equipment is difficult in consideration with the budgetary condition of EEAA at present.

(c) Semi-Micro Analysis Balance (G-1)

Semi-micro analysis balance (G-1) is the most fundamental equipment, however, it is advisable to select the balance that has the maximum weight of 200g and figure of 0.0001g instead of the one with the maximum weight of 40g and figure of 0.00001g for performance considerations. This balance should be provided to not only the new RBOs but also the existing laboratories.

(d) High-volume Air Sampler (A-20) and Low-volume Air Sampler (A-21)

Four (4) sets of high-volume air samplers have been provided to GC and ALX RBOs and one (1) set each to the other RBOs. Those high-volume air samplers for the collection of atmospheric dust have been frequently used. Hence, two (2) sets of high-volume air samplers should be supplied to TNT, MSR and SEZ RBOs, because they are efficient to analyze data obtained through the multiple use of these samplers on point pollutant sources at the same time.

Also, two (2) sets of low-volume air samplers should be added for the above three RBOs.

(e) Ambient Air Analyzer (A-28)

The ambient air analyzer, which has been introduced to the CCC under the previous project, was quite useful for workplace monitoring. Hence, it is recommendable to add one unit of this item to each of the existing five (5) RBOs.

(f) Noise Meter (A-32)

Noise meter is frequently used in responding to many complaints from the residents, especially in the Greater Cairo area. Therefore, one (1) set of noise meter should be added to the equipment in GC RBO in response to the request from the Egyptian side.

(4) Spare Parts, Glassware, and Chemical Reagents for New RBOs

In principle, consumables such as spare parts, glassware and chemical reagents for the existing RBO laboratories shall not be provided under the project since CCC is currently in charge of procurement of these items

(a) Spare parts for Existing RBOs

Spare parts of the equipment for the existing RBO laboratories are limited to those of additional one carefully selected for the supply in response to the request of the Egyptian side.

(b) Consumables for New RBOs

According to the results of investigation made by the Study Team, there are several equipment that have not been used sufficiently due to the lack of spare parts such as hollow cathode lamp for AAS, electrodes for pH/DO meter and so on. On the other hand, although enough quantities of spare parts, glassware and chemical reagents for one year were supplied in the previous project, some of them were procured with budget from the EMTP Project. Hence, insufficient spare parts, glassware and chemical reagents have to be selectively procured together with the equipment required for this Project under study. This means that additional spare parts should be supplied apart from the minimum ones usually provided with the purchased equipment. On the other hand, glassware and chemical reagents are indispensable for activities concerning the environmental monitoring, and should be selected as necessary items for the initial operation of laboratory.

(c) Method of Estimation and Selection of Necessary Items and Quantity of Equipment

The method of estimation and selection of necessary items and quantity of equipment has been considered in accordance with the points of view given below.

(i) Interview Survey on Existing Laboratories

Interview survey has been carried out with the existing RBOs, in order to estimate the optimum quantity of glassware and chemical reagents. The optimum quantity has been estimated according to the results of interview survey, and the minimum quantity is regarded as the suitable number for each new RBO. However, the necessary quantity is defined to be apart from the minimum accessories/parts provided with the equipment.

(ii) Necessary Quantity

The procurement of all the spare parts, glassware and chemical reagents independently managed by the EEAA will be more difficult than in the currently existing condition. Hence, enough quantity of spare parts that would allow continuation of the environmental monitoring activities for two (2) years should be prepared apart from the spare parts attached to each item of equipment supplied as a general rule. Further, glassware and chemical reagents should be supplied on the assumption that they are necessary for the initial operation of the laboratory. Each item has been considered, as follows:

- Number of reports on environmental monitoring including inspections made by the CCC and the existing five (5) RBOs had exceeded 1,200 in the last two years. Therefore, it is presumed that each laboratory analyzes more than 100 samples of point sources annually. Moreover, the existing RBOs have recently expanded their activities, consisting of monitoring of not only point pollution sources but also ambient monitoring such as river/lake water sampling and air quality monitoring in residential areas. Thus, new RBOs are expected to analyze more than 100 samples each. Additional spare parts for new RBOs should therefore be supplied in consideration of this quantity of samples.

- Glassware is indispensable to laboratory management and pre-treatment in chemical analysis. Hence, the shortage of glassware will be a hindrance to the management of a new laboratory at the start of monitoring activities. The list of necessary items and quantity of glassware made by the interview survey were investigated as a starting point, and the necessary items were chosen after the clarification of usage purpose and importance of each item. The necessary quantity is the minimum unit in a package. (The usage purpose of each item is given in Table 2.7.)

- Chemical reagents are essential to laboratory management and pre-treatment in chemical analysis, and it is necessary to have them available at the start of operation of the new laboratory. Otherwise, the activities of environmental monitoring would not function well. Necessary items and quantities of chemical reagents were selected based on the list made by the interview survey as the starting condition. Selection was made with the investigation on analytical method and the existence of restrictions on imports to Egypt. Accordingly, necessary quantities are to be the minimum units purchased as one package needed for the start of operations of the laboratory except the reagents related to the measurement of pH. (The usage purpose of each item is given in Table 2.8.)

Basically, the CCC should manage the supply of spare parts, glassware and chemical reagents. However, the supply system has not been functioning efficiently due to shortage of the annual budget. Accordingly, the system of procurement of these items should be improved through the provision of enough funds as soon as possible.

2.2.3 Basic Design Drawing

The layout drawing of project equipment is shown in Fig.2.2.

2.2.3.1 Key Points for the Planning of Equipment Layout

The construction work for interior furnishings and utility facilities of AST and ASW RBOs was almost completed as of April 2002. As for the HGD RBO, the foundation work was still at the stage of completion and building construction work will start soon.

The JICA Study Team obtained the information and drawings related to the building layout of each facility and partition of laboratories after deliberation with the consultants in charge of architecture and design. Based on these facility drawings, draft layout planning of the equipment was made by the JICA Study Team and the consultants concerned during the field study. Furthermore, discussed were the configuration of necessary facilities for electricity, gas, water supply, drainage, air conditioning, ventilation and so on. Through the elaborate discussions, the consistency and problems with the equipment configuration were finally confirmed.

The Egyptian side should be responsible for equipment configuration work. Hence, necessary items of work to be completed before installation of equipment were explained. Further, the JICA Study Team considered that architecture process planning of the Egyptian side and the validity should also be sufficiently confirmed, as well as the possibility of equipment installation, adjustment, and delivery in the construction period.

Draft equipment configuration layout based on the field study results is as shown in Figure 2.1.

2.2.3.2 Basic Concept of Layout Plan

(1) ASW RBO

The building has three (3) floors and among them, the basement has an entrance, parking space, equipment rooms for air compressors, vacuum pump, waterworks, gas cylinders, emergency generator and so on. The first floor has three (3) laboratories, laboratory manager room and staff room with a centrally controlled system of air conditioners. Also, there is a room equipped with a large no-cut power source (UPS) for precise analytical equipment. The UPS line (backup power line) is arranged throughout the laboratory room. Each laboratory room is almost symmetrically designed.

Two (2) laying gas pipes for nitrogen (N_2), nitrous oxide (N_2O), argon (Ar), and propane are arranged in each laboratory room. (However, laying gas pipe made of stainless steel for atomic absorption spectrophotometer will be needed.) The

duct of the draft chamber is equipped in the center part of the laboratory room so that it is possible to connect a duct from any direction. The warm water for laboratory use can be gained through the warm water supply system provided through the solar heating system.

The use and design plan of each room are allocated and made as follows:

- Lab-1: The room is to be used for instrument analysis, and is equipped with an atomic absorption spectrophotometer (AAS: C-4).

- Lab-2: The room is to be used mainly for wet chemical analysis, general chemical analysis, and pre-treatment for quantitative analysis, and is equipped with a draft chamber.

- Lab-3: The laboratory room has a sample preparation space for air quality analysis in which a draft chamber with gas cleaning device will be equipped. The room also has a space for biological analysis.

The arrangement of laboratory tables is considered based on the design made by the Egyptian side. It is recommendable to set side tables by the window as much as possible.

Wall sockets have already been installed at low positions on the wall, so that the setup of side tables along the wall will obstruct their function. The JICA Study Team had notified the EEAA side that it is necessary to avoid arranging equipment at the place of wall sockets, to set up sockets on laboratory tables, and to connect the power source at the time the layout of equipment is considered.

(2) AST RBO

The building of RBO has been constructed under the same design concept, and the basement has an entrance, parking space, equipment rooms for utilities, etc. Moreover, the first floor has three (3) laboratory rooms, laboratory manager room, staff room and so on. The layout of other equipment is almost the same as that in ASW RBO.

The configuration planning of laboratory table has been considered based on the drawing made by the Egyptian side. The position in the sink also had been almost decided. Side tables should be installed nearby the window, if possible.

All the electricity plug sockets are set up in the wall of the laboratory at high positions suitable for equipment placed on the side tables. However, they are unsuitable for equipment placed directly on the floor.

Considering that gas piping will be made hereafter, the EEAA side is reminded that the necessary arrangement for the installation of acetylene piping of the atomic absorption spectrophotometer and other equipment should be made clear on the drawing. The duct of the draft shall be guided to each room, and shall be connectable from either place.

(3) HGD RBO

The building has three (3) floors and among them, four (4) laboratory rooms are to be constructed in the first floor. The construction work has not yet been completed except the foundation. The building under construction will have an entrance, parking space and equipment rooms.

The use and design plan of each room have been allocated and made as follows:

- Lab-1: The room is to be used mainly for wet chemical analysis, general chemical analysis, and pre-treatment for quantitative analysis of water quality, and it will be equipped with a draft chamber. Besides, acid decomposition of air quality samples will be done in this room.

- Lab-2: The room is to be used mainly for biological analysis.

- Lab-3: The laboratory room will be used as a storehouse for the time being.

- Lab-4: The laboratory room is for instrument analysis. Atomic absorption spectrophotometer will be the main equipment to be installed.

The EEAA has been requested not to greatly change the structure and layout of buildings for laboratories, and to carry out the production of laboratory tables and configuration of utilities in reference to the layout plan shown by the Japan side. On the arrangement plan of laboratory tables, the JICA Study Team assumed that the water works (water supply and drainage) are to be located by the window based on the architectural drawing. The necessary water supply/drainage facilities and power source will be informed later.

2.2.3.3 Layout Plan for Each Equipment

The layout plan except for small items that can be moved easily has been considered under the following conditions:

(1) The JICA Study Team considered that the installation location of draft chamber (G-41 and G-42) is away from the window, at an unobstructed wall where it is easy to install the exhaust duct. However, the transfer of location can be considered by circumstances of architecture on the Egyptian side.

(2) Equipment related to washing/drying/making pure water and glassware is to be set with sink at the side table near the window.

(3) It is advisable that no equipment should be put on the central laboratory tables in order to carry out analyses smoothly.

(4) Balance (G-1) and desiccator (A-15) should be arranged in parallel and placed away from the entrance and the draft chamber as well as the water works.

(5) The wastewater treatment equipment should be arranged at the corner of the room.

2.2.3.4 Recommendations for Building and Utility Facilities

For the installation of equipment, it is necessary for the EEAA side to prepare the following facilities as a matter of responsibility:

(1) Since the atomic absorption spectrophotometer is planned to be the flame/flameless dual service type, laying pipes for acetylene (made of stainless steel tube), air and nitrous oxide (N_2O) will be necessary. Besides, it is required to install a small hood for the exhaust and water supply and drainage for cooling water.

(2) If the side tables are placed on the wall, the plug sockets will be hidden due to their low positions at the wall. Hence, additional plug sockets should be installed at the side table for connection with a power cable at the time of production of laboratory tables.

(3) Considering that the exhaust blower is installed in the main body, and the roof of the draft chamber is related to the selected equipment for this Project, it is necessary that the construction work for the roof and bed sill of the exhaust blower be executed by the Egyptian side.

(4) It is advisable that the sink installed at the laboratory table should be large if possible, and the faucet for washing has three (3) outlets.

(5) It is necessary that the balance mount is heavy and stable.

(6) There is a fissure in the sash of the window of AST RBO, and it is recommendable that measures for closing the fissure are taken to preclude dust from entering the laboratory.

2.2.4 Implementation Plan

2.2.4.1 Implementation Policy

EEAA is the implementing agency for the project and will entrust Branch Affairs Department to act as a responsible department for the project management. CCC and RBO will be in charge of operation and maintenance after the provision of equipment

The project aims to procure necessary equipment for monitoring both air and water quality. However, as technical works are also required for the installation of equipment as well as adjustment, Japanese engineers will be dispatched to undertake these works. In this connection, further details are described as follows:

(a) The contractor shall confirm in advance the number of days required for the procedure of customs clearance and ensure the security of route for inland transportation in collaboration with EEAA.

(b) After the supply of equipment, the contractor shall arrange to dispatch manufacturer's engineer as well as its local agent's engineer to the project site for the installation of equipment and test operation. They shall provide operational guidance to RBO staff before handing over the equipment to EEAA.

(c) Branch Affairs Department, the Client's responsible body for the project implementation, will take charge of the management of woks undertaken by the contractor, and CCC will conduct technical inspection after the installation.

With the objective of enhancing project effects and sustainable development, the project shall include technical guidance services for the new RBO staff through on-the-job training.

2.2.4.2 Implementation Conditions

Based on the implementation policy presented above, the following conditions should be fully considered for the smooth implementation of the project.

(1) Construction of RBO Hurghada

As a precondition for the project implementation, the construction of RBO Hurghada should be completed before the delivery of equipment, and utility works in the laboratory need to be carried out prior to the installation of equipment.

(2) Customs Clearance and Inland Transportation

Invoice and shipping schedule for equipment shall be submitted to EEAA in advance to facilitate necessary procedures for customs clearance and delivery, and after the clearance particular attention shall be required for the safety of transportation to each project site.

(3) Approval for the Export of Reagent

Some reagents are considered to be explosive materials or toxic substances, so it is necessary to follow the legal procedure and apply to the Ministry of Economy, Trade and Industry for its export approval.

(4) Import Clearance for Reagents

The import of reagents is strictly controlled in Egypt by the same reasons as mentioned above, it is, therefore, necessary to appoint someone in EEAA to a responsible person for the management of reagents. In this regard, proper measure and collaboration from EEAA will be unavoidable to minimize the time required for the procedure.

(5) Installation of Laboratory Tables

EEAA has agreed to set laboratory tables in each RBO. This work should be completed before the installation of equipment and according to the layout of table arrangement.

(6) Other Relevant Works for the Installation of Equipment

At the time of equipment installation, some adjustment works may be required to connect properly with existing utility systems such as water, electricity and

gas. These works should be carried out without delay under the responsibility of EEAA.

2.2.4.3 Scope of Works

The work shall begin with the tender administration (preparation of tender documents, tendering, contracting) and will include the procurement of equipment, installation of equipment and operation and maintenance services. The scope of works of both the Japanese side and the Egyptian side is summarized as follows:

(1) Undertaking of the Government of Japan

(a) Engineering services including preparation of tender documents, tendering and supervision of the procurement works.

(b) Procurement of equipment from Japan and the third countries (including marine and inland transportation).

(c) Procurement of equipment to be purchased in Egypt and its transportation to the project site.

(d) Installation of equipment in the laboratories and operational adjustment and test run

(e) Technical guidance services for handling of equipment and its operation and maintenance method (Soft Component).

(2) Undertaking of the Government of Egypt

(a) Land acquisition, land leveling and fencing of the site for the construction/installation of facilities.

(b) Construction of RBO buildings and its appurtenant utilities (including electric power and water supply systems and duct installation).

(c) Administrative supports to implement the project smoothly and efficiently such as tax exemption, procedures for import approval and customs clearance.

(d) Institutional arrangement for personnel, financing, and proper operation/maintenance to make the project effective, functional and sustainable.

(e) Smooth procedures for immigration, tax exemption and safety assurance during the stay in Egypt of Japanese experts assigned to the project.

2.2.4.4 Consultant's Supervision

(1) Supervision of Procurement Works

The consultant will provide supervising services to ensure the proper time scheduling and quality control for the equipment to be procured by the contractor and also to confirm that all equipment will be correctly installed and adjusted for the right operation. An engineer, who has various technical backgrounds in environmental monitoring equipment, will be assigned to the project as a supervisor and is expected to expedite the work through discussions with EEAA. As the equipment includes restrictive reagents for import and products from the third countries, the supervisor shall commence necessary procedure to obtain prior approval for the import. He is also in charge of inspecting installation works for equipment as well as operational adjustment. Thus, the supervisor will be engaged in various tasks under the guidance of the team leader. From the above considerations, the supervisor shall be such a person as to satisfy requirements for experience and suitability. The major tasks of the supervisor is as follows:

(a) Meeting and discussions with EEAA and the other institutions concerned of the Government of Egypt.

(b) Inspection of works to be undertaken by the Egyptian side.

(c) Supervision of procurement works for equipment.

(d) Follow-up assistance to prompt customs clearance and import license for the equipment (particularly for reagent).

(e) Inspection of equipment and installation works.

(f) Issuance of certificates as described in the contract.

(g) Submission of reports, documents, etc.

(2) Key Roles of the Supervisor

The supervisor shall take the following into consideration for quality control and schedule management:

(a) Regular meeting shall be held with responsible persons of EEAA and RBO to report the progress of work and schedule.

(b) Prior to the equipment delivery to RBO, it is necessary to confirm that the Egyptian side has completed utility works and installation of laboratory tables under its responsibility.

(c) As almost all equipment are supposed to be import products, the required documents such as shipping schedule and invoice shall be submitted to EEAA to follow the procedure for customs clearance before arriving equipment.

(d) As for import of reagents, which is strictly under control by the Egyptian government, an early action shall be taken to the security office requesting for import license. Furthermore, follow up actions are absolutely important to accelerate administrative procedure for acquiring the license without delay.

(e) Inspection shall be conducted before and after the installation of equipment in RBO laboratory. During the project implementation, care shall be constantly taken to keep watch on work schedule and quality, and all required works have to be properly managed to the satisfaction of EEAA.

(f) Certificate will be issued to the contractor after due completion of installation works. Monthly report shall be prepared for EEAA to inform the progress of works.

(3) Engineers for the Supervising Services

The project consists of the procurement of necessary equipment for environmental monitoring work and the installation/adjustment of the equipment in the RBO laboratories. The team leader and one engineer will be assigned for supervising work, and their services will be rendered according to the schedule of implementation stage. The work involved in their respective assignments is as follows:

(a) Team Leader

Upon the completion of the whole project, the team leader is to be dispatched to the project site for the inspection of installation/adjustment of the equipment.

(b) Equipment Engineer

Prior to the shipment from Japan, the equipment engineer is required to be present for factory inspection. He will stay in Egypt as a supervisor until installation work is properly completed in each laboratory, and upon the completion he will issue the certificate to the contractor.

2.2.4.5 Quality Control Plan

Before manufacturing equipment, supplier and manufacturer(s) shall be called for meeting to discuss details of specifications and quality control method for each item of equipment. It should be noted that factory inspection be conducted before shipping to ensure the quantity, quality and performance of the equipment, and particular attention needs to be paid to packing method in order that no damage is given to the equipment during transportation. With regard to inland transportation from the port of disembarkation to the final destination, transportation method and schedule shall be submitted in advance from the supplier.

As the equipment is sensitive to dust and high temperature, it shall not be stored under the blazing sun. A responsible person from the supplier shall stay constantly with the equipment to keep careful watch on it. Necessary arrangements are required to take an

immediate action if some defective equipment is found by the inspection and test run, which will be conducted after the installation of equipment.

2.2.4.6 Procurement Plan

(1) Selection of Source Countries

Besides Japan and Egypt, possible source countries will be some European countries and USA for the procurement of monitoring equipment. It should be selected taking account of cost and quality of products as well as after-sales services of the manufacturer's local agent.

Although some types of glassware are produced in Egypt, these are limited to beakers and the like, and will not satisfy the requirements in terms of accuracy and quality for the laboratory work. There are some local agents dealing with glassware made in both Japan and Europe with a good reputation for its quality. However, suitability for the equipment is an important factor in selecting the source country of glassware. It should be noted that some problem might occur if foreign-made glassware is used for connecting part to the Japanese equipment.

In addition, it is also important to note that technical knowledge of the local staff is based on the training provided under EMTP. In fact, they become accustomed to using the equipment supplied under Phase I. According to the request from EEAA, possible source countries other than Japan and Egypt will be USA, Germany and France.

From the above considerations, all items of equipment, which may be available either from Egypt or from the third country, are listed in the following table.

Source Country	Equipment	Remarks
Egypt	Copy Machine (G-49), Personal Computer (Arabic/English)(G-58), Boat for Monitoring/Sampling (M-2)	Local agents are available, and listed items are produced and purchased in Egypt.
The Third Country	Ion Chromatograph (C-12), Monitoring Car (G-50), Tint Meter/Turbidity Meter (W-6&7), Portable Water Quality Test Kit (W-32), Mobile Unit (A-1A to A-1N), Zero Gas Generator ((A-7), Span Gas Generator (A-8), Stack Gas Sampler (A-9), Potable HC/CO Analyzer for Stack Gas (A-17), Potable Sox Analyzer for Stack Gas (A-18), Potable Nox Analyzer for Stack Gas (A-19), Ambient Air Analyzer (A-28), Total Dust Meter (A-29), PM 10 Meter (Portable) (A-30), Under Water Video Digital Camera (M-7), Under Water Light Meter (M-8), Binoculars (M-10), Handled VHF Radio (M-13), Zoo Plankton Counting Tray (M-14)	If source country is limited to Japan, fair competitive tendering will not be ensured.

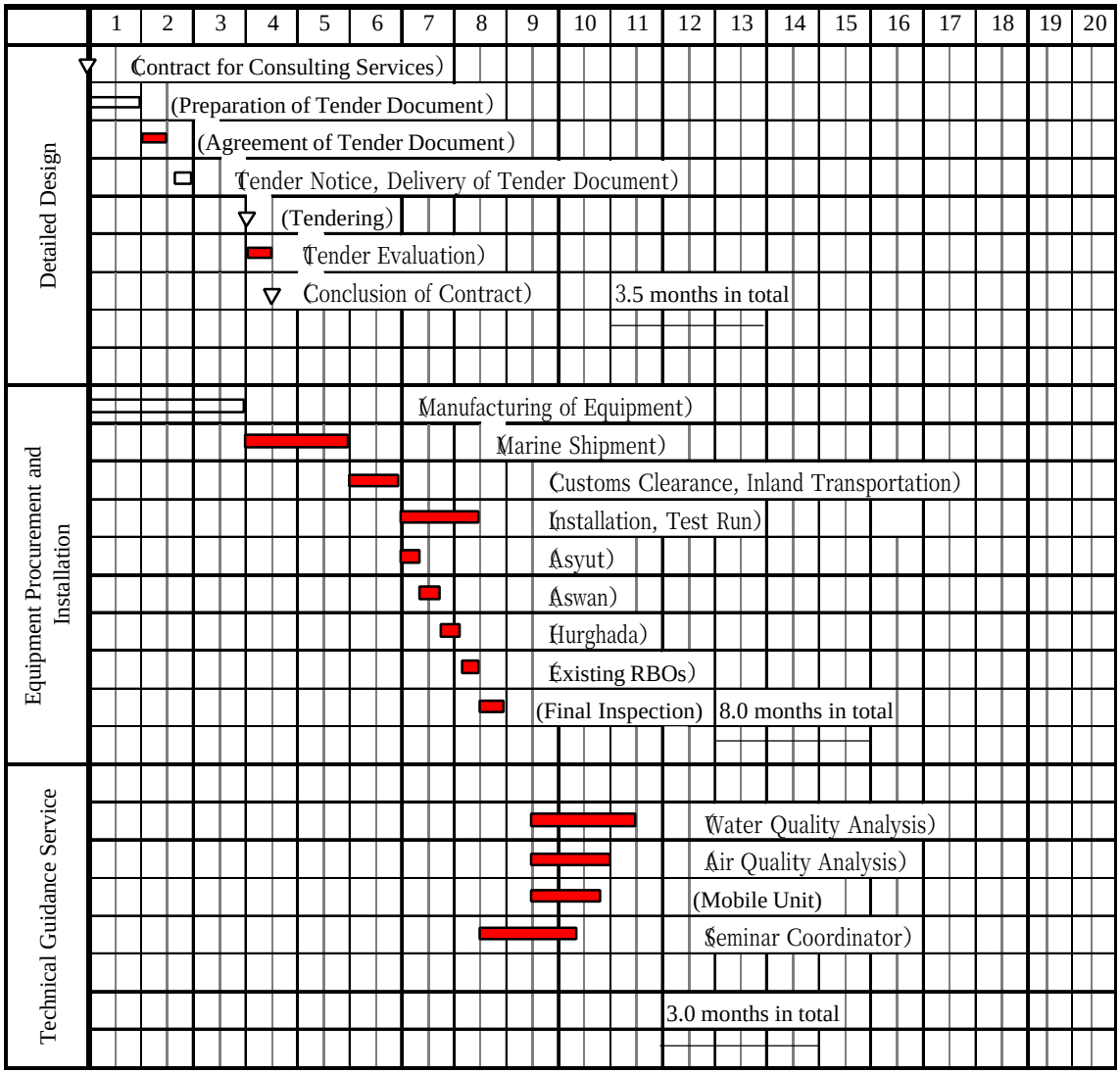
(2) Transportation Plan

The equipment to be supplied from Japan and the third countries will be unloaded at the port of Alexandria, and then delivered by land to Asyut, Aswan and Hurghada. As for reagents, an early shipment will be considered as it consumes a lot of time for customs clearance. Air transportation may be an alternative measure to save time if it is feasible.

2.2.4.7 Implementation Schedule

This Project will be implemented under the Japan's Grant Aid after the Exchange of Notes (E/N) has been concluded between the Government of Japan and the Government of the Arab Republic of Egypt. The implementation period is estimated at 3.5 months for the detailed design and tender administration. It will also require 8 months for the equipment procurement and installation and 3 months for technical guidance service. This schedule is subject to the completion of works, which should be undertaken by the Egyptian side. To be precise, EEAA is required to complete the work without delay such as the construction of RBO buildings and utility works in the laboratories as well as the installation of laboratory tables. In addition, as a pre-condition of technical guidance service, the new staff needs to be placed in the laboratories in advance.

Implementation Schedule



2.3 Obligations of Recipient Country

2.3.1 Undertakings Required to Egypt

Based upon Minutes of Discussions agreed on April 16, 2002 between JICA study team and Egyptian side, it is confirmed that undertakings required to the Egyptian side for smooth implementation of the project are as follows:

(1) To provide data and information necessary for the Project,

(2) To ensure prompt unloading and customs clearance at the port of disembarkation in Egypt and internal transportation of the equipment purchased under the Grant Aid,

(3) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Egypt with respect to the supply of products and services under the project,

(4) To arrange the acquisition of visa and other formalities that may be necessary for the entry of Japanese nationals into Egypt and stay therein for the performance of the work,

(5) To maintain and use the equipment properly and effectively with suitable number of staff assigned for the operation and maintenance and to bear all expenses other than those covered under the Grant Aid,

(6) To procure required parts for maintenance timely and sufficiently,

(7) To use the equipment exclusively for the Project and it shall not be re-exported from Egypt, and

(8) To bear advising commission of Authorization to Pay (A/P) and payment commission to the Japanese bank for banking services based upon the Banking Arrangement (B/A).

2.3.2 Obligations of Egyptian Side

As one of the most important obligations for the Egyptian side, the RBO building is to be constructed unconditionally. Needless to say, it should be completed before arriving the equipment at the designated port in Egypt since it will make a significant impact on overall implementation schedule.

There will be no specific problems for both RBOs of Asyut and Aswan because the construction of building is nearly completed. On the other hand, the construction work for RBO Hurghada, which was undertaken by the Tourism Development Authority (TDA), has been suspended due to the financial difficulties. EEAA took over the ownership from TDA to re-start the work at the earliest time possible and every possible measure has been taken to catch up the delay. The construction of RBO Hurghada must be completed as proposed schedule.

EEAA appropriated about 13 million LE in the budget for 2001/2002, out of which nearly 3 million LE are earmarked for the construction of three (3) RBOs. According to the plan of EEAA, the RBO Hurghada is scheduled to be complete by the end of February 2003.

Apart from the construction of RBOs, the Egyptian side is required to undertake the following works. These are deemed indispensable to start operation of the laboratory.

- Installation of utilities for the laboratory such as electric power supply, water supply, drainage system, etc.,
- Minor adjustment works for the installation of equipment,
- Installation of laboratory tables and sinks, and
- Technical training to be provided by CCC for the new RBO staff.

Among the above 4 items, the first 3 items will be implemented at the construction stage of RBO laboratory, and EEAA clearly understands the importance of these works through the phase 1 of the project. It is planned that technical training will be provided under the guidance of CCC to about 30 new staff members for the three RBO laboratories. According to the schedule submitted by CCC, the training will start from June 2003 for a period of about two (2) months.

The staff members of CCC and existing RBOs have been managing and operating their respective laboratories since 1999 with the assistance of Japanese experts under EMTP. Their technical capabilities and organization are still in the process of development, but their dedication to the environmental monitoring works is so far admirable and appreciated. Although CCC is expected to play significant roles-being an environmental monitoring training center and also providing technical support to the RBO laboratories, it seems to be overloaded if CCC has to provide all technical assistance to the new-born RBO laboratories from the very beginning of its operation since it has limited capacity to cope with requirements. Sampling and pre-treatment are part of its daily routine, so CCC should include these items in its training program. On the other hand, CCC staff is not well practiced in operation and maintenance of the equipment, so that it seems to be not practical if these are included in its training program.

From the above considerations, it is desirable that Japanese expert(s) be dispatched to each RBO at the beginning of laboratory operation to provide technical guidance services to the staff of new RBO laboratories. They will learn proper manner of operation and maintenance of the equipment through the intensive training, and mishandling of the equipment can be prevented and its operation life will become longer as a result. However, this will not release CCC from its obligation. CCC is required to implement its training program as scheduled. It is also important to note that after the technical guidance services CCC should continue to provide the training according to the annual training plan.

2.4 Project Operation Plan

2.4.1 Project Operation System

RBOs belong to Branch Affairs Department in the organization of EEAA as presented in Fig. 2.3. The Secretary General of EEAA serves concurrently as the director of the Branch Affairs Department. The RBO assumes responsibility for implementing regional environmental policy and therefore, particular attention is extensively given to the institutional strengthening as well as capacity building of personnel. As for RBO structure, there are four(4) departments under the manager (refer to Fig.2.4). Laboratory belongs to Environmental Quality Department. The number of staff members of the existing RBO laboratories has increased to 10 to 15 depending upon the region, which is nearly twice as many as that of their debut in 1999, and they have certainly developed their own capability to manage laboratory equipment. In some laboratories the equipment is operated following the operational flowchart, which has been prepared by the staff for their own use. The idea is quite impressive to avoid mishandling of the equipment, and reagents are also stored and managed in proper way. Judging from these facts, it can be said that the existing RBO laboratories are generally well managed.

EEAA plans to recruit competent personnel for the staff members of the new RBO laboratories and not to transfer experienced staff from the existing laboratories. Human resources may be available in Asyut, Aswan and Hurghada to comply with qualifications, because there are university and research center in such regional centers. Based on the successful experiences from the existing RBO laboratories, the new laboratory can be operated and managed with 11 to 12 staff members, and many of them are supposed to be university graduates in chemistry. The staff will be recruited within two months after selecting a competent contractor through tendering, and one month later CCC will provide them with training service for a certain period. The structure of CCC is shown in Fig.2.5

If technical training is provided to the new RBO staff, they will be able to learn appropriate handling methods for equipment as well as chemical analysis methods in a relatively short period. In some existing RBOs, laboratory is managed and operated in satisfactory level. For example, in order to avoid mishandling of equipment, the laboratory staff has prepared standard operation procedure for their own practical use, and computer-based management system is applied to take inventory of consumables such as glassware and reagents. These are regarded as training effects and may be considered as a result of capacity development of the staff.

As for the existing laboratories, technical constraints seem to be very limited because almost all staff members have been trained under Environmental Monitoring Training Project (EMTP) and their technical capabilities have been successfully developed with the equipment procured under Phase 1 of the project. The new staff to be recruited for Phase 2 can be a fair match for those of existing laboratories in terms of technical capability, so they will be able to contribute their technical knowledge to the environmental monitoring works. However, to make these works effective and sustainable, it will be necessary to provide “Soft Component” or technical guidance services in order that they can learn correct use of equipment and maintenance methods.

Staffing Plan for the New RBO Laboratories

Assignment	Number of Persons		Qualification
	Asyut, Aswan	Hurghada	
Laboratory manager	1	1	Preferably M.Sc. with more than 10-15 years of experiences in environmental analysis and monitoring activities
Water quality senior chemist	1	2	B.Sc preferably in the field of chemistry or marine biology with at least 5-6 years of experience in environmental analysis and monitoring in laboratory
Water quality chemist	2	3	B.Sc. preferably in the field of marine biology for Hurghada
Water quality technician	2	3	2 years study in Technical Institute after high school
Air quality senior chemist	1	1	B.Sc preferably in the field of chemistry with at least 5-6 years of experience in environmental analysis and monitoring
Air quality chemist	2	1	B.Sc.
Air quality technician	2	1	2 years study in Technical Institute after high school
Total	11	12	

2.4.2 Operation and Maintenance Methods

At present, EEAA has contracts for maintenance services of equipment with two(2) manufacturer's local agents. One is dealing with analytical equipment such as Gas Chromatograph and Atomic Absorption Spectrophotometer and making a tour once every three(3) months, stopping CCC and five existing RBOs for the repair and maintenance service. So far, technical service and response of the agent seem to be satisfactory, so that it will be desirable to continue the same system, making a contract with the most reliable local agent for the maintenance of the equipment.

With regard to Mobile Unit, there have been troubles at the beginning of phase 1 due to the inappropriate skill and response of the agent. However, there is no serious problem now since the agent has been changed to the new one. The apparatus to be mounted in the car is composed of units of precision equipment and will be certainly required expertise for the inspection and maintenance. To make the maintenance service locally available, the manufacturer provided an intensive training for engineers of the local agent in phase 1. Judging from these facts, it seems to be more convenient for EEAA if the local agent can serve after-sales needs with competent engineers trained by the manufacturer.

For the purchase of spare parts and consumables such as glassware and reagents, CCC is in charge of asking request from each RBO laboratory and totaling quantity of each item requested for making a package deal with a supplier selected by the tendering. However, this procurement process takes time and will be ineffective to cope with increasing laboratory work in the future. It is desirable to allocate the budget to RBO independently for the management of the laboratory, but under the present system it is hardly possible to do it and time-consuming process is still underway for the purchase of spare parts.

Annual budget for the year 2001/2002 for the operation and maintenance of CCC and existing five (5) RBOs is estimated at 1.2 million L.E (260,000 US$), which is about 20 % increase over the previous year. Out of the above amount, 0.7 million L.E are allocated for the purchase of glassware and chemical reagents and the rest of 0.5 million L.E for the contract of maintenance services. If the project is implemented, three (3) more RBOs will be added, and accordingly the annual budget will be further increased amounting to 2.16 million L.E. Details are shown in the table below.

Annual Budget for CCC and RBO Laboratories

(in Million LE)

	2000/2001 CCC+5RBO	2001/2002 CCC+5RBO	2002/2003 CCC+5RBO	2003/2004 CCC+8RBO	Remarks
Purchase of Consumables	—	0.70	0.84	1.26	Reagents, Glassware
Maintenance Service	—	0.50	0.60	0.90	Contract with Agents
Total	1.00	1.20	1.44	2.16	

However, the above amount does not include the cost for the purchase of spare parts, which is estimated at 0.2 million L.E corresponding to nearly 9.3 % of the annual budget. As it seems to be relatively a small amount, EEAA will arrange to appropriate it in the budget of operation and maintenance. In addition, according to the training program of CCC for RBO laboratory staff, the cost should also be estimated as part of the budget for operation.

2.5 Technical Guidance Service (Soft Component)

2.5.1 Background

After handover of the equipment to the RBO, proper operation and maintenance will be a sine qua non for the enhancement of RBO's activities as a role of regional environmental monitoring station. Generally, almost all staff members of new RBO laboratories should have an academic background in chemistry but may be not well practiced in operation and maintenance of the equipment, so some troubles are predictable due to the mishandling of the equipment, and if such situation remains unsolved, the project effects cannot be expected. The technical training to the staff of RBO laboratories is to be provided by CCC as described in the Minute of Meeting agreed between JICA study team and Egyptian side on April 16, 2002. However, there is no clear technical evidence to ensure that CCC is capable of managing all subjects necessary for the commencement of laboratory operation.

At the debut of RBO, all staff members should realize its role and function before taking up their respective assignments. Local stakeholders should also be well informed of the same as a core administrative station for environment. It will help enhance public awareness of environment and may serve to establish support system for monitoring activities.

From the above considerations, the project shall include not only the procurement and installation of equipment but also technical guidance service, which consists of two components, technical support and management support. For the technical support, it intends to provide technical training to the staff of the new RBO laboratories after the installation of equipment. Meanwhile, for the management support, it is planned to hold seminars aiming at enforcement of the regional environmental monitoring system. Thus, the technical guidance service is expected to be a tool for overcoming difficulties that may lie ahead and contribute to the project with sustainable effects.

2.5.2 Outputs (Direct Effects)

Direct effects of both technical support and management support are described as follows:

(1) Technical Support

- To prevent troubles resulting from mishandling of equipment and precise and reliable data will be made available by the correct operation method,
- To improve operation life as a result of acquiring knowledge of operation and maintenance of the equipment,
- To upgrade data recording and processing systems as a consequence of understanding of appropriate manner for equipment operation, and
- To develop capacity of CCC staff so as to provide technical support for the RBO laboratories.

(2) Management Support

- To establish support system for environmental monitoring at regional level incorporating Governorates, cities, universities, institutes, NGOs and other stakeholders, and
- To inform all stakeholders that polluters will be identified and controlled under the leadership of RBO with monitoring data available from quantitative analysis.

2.5.3 Activities (Inputs)

(1) Implementation Method

(a) Technical Support

The equipment can be classified into two (2) types. The one is for water quality analysis which requires one (1) expert as a training instructor and the other one is for air quality monitoring which needs two(2) experts. Participants in the training include four(4) staff members from CCC in order to have training as instructors for the RBO laboratories under the guidance of the Japanese experts. In this regard, the two will be assigned for the water analysis, and the other two will be for the air monitoring.

Expert of Water Quality Analysis

- On-the-job-training for the following main equipment;
  - Atomic Absorption Spectrophotometer (including mercury analyzer),
  - UV/VIS Spectrophotometer,
  - Ion Chromatograph, and
  - TOC meter.
- Preparation of Standard Operation Procedure (Flow Chart) for the following equipment;
  - Basic facilities
  - Atomic Absorption Spectrophotometer and UV/VIS Spectrometer,
  - Ion Chromatograph and TOC meter.

Expert of Air Quality Analysis (1)

- On-the-job-training for the following equipment;
  - SOx, NOx and CO analyzers,
  - Stack gas sampler (for dust).
- Preparation of Standard Operation Procedure (Flow Chart)
  - Equipment for measuring exhaust gas.

Expert of Air Quality Analysis (2)

- On-the-job-training for Ambient Air Monitoring (Mobile Unit);
  - SOx, NOx and CO monitors,
  - Ozon monitor, Hydrocarbon monitor, SPM, Anemometer, Solar radiation meter, etc.
  - Data logger and data processing system
- Preparation of Standard Operation Procedure (Flow Chart)
  - Air monitoring equipment for Mobile Unit

(b) Management Support

Seminar will be held in Asyut, Aswan and Hurghada under the auspices of EEAA/RBO. One Japanese coordinator will assist them in organizing and promoting the seminar. According to the responsibility of both parties, works to be undertaken shall be classified as follows:

Work Responsibilities for Seminar

Work Item	EEAA/RBO	Coordinator
Prior consultation for seminar arrangement	○	○
Collection and compilation of data/information	○	○
- Presentation of environmental protection in Japan		○
- Roles and functions of RBO, and plan of operation	○	
- Pollution sources and monitoring method	○	
- Public complaints and responding measures	○	
- Interlinked collaboration system with EMU and other related stakeholders	○	
Report writing (organization of RBO and regional environmental monitoring system)		○

(2) Implementation Period

The seminar coordinator is scheduled to arrive in Egypt in advance of experts assigned for the technical support, and will start to make necessary arrangements for seminar in project area soon after prior consultation with interested persons of EEAA has been made in Cairo. Seminar will take place in three(3) project areas as mentioned above, and it will take approximately two

weeks to prepare the materials (collection and compilation of data to be used for OHP or Power Point).

Based on the materials prepared for the seminar together with information obtained from seminar attendants, a report will be prepared and shall be submitted to EEAA in five(5) days after the last seminar. The total period required for the seminar coordinator is estimated at 57 days.

With regard to technical support, if all staff members of the new RBO laboratories are called in one place for group training, the training period will be not more than one month. However, ladies are generally not a few for the laboratory staff, and they are not accustomed to living alone away from their family for such a long period, so the group training as such seems to be not realistic. Consequently, the training shall be implemented in each new RBO.

The training period for water quality analysis is supposed to be 16 days at each RBO. In addition, if traveling days are considered, the total assignment period for the expert will be 60 days. One expert of air quality analysis is to provide technical assistance to the laboratory staff for 11 days in each RBO, while the other expert of Mobile Unit will be for 14 days in each RBO except Hurghada. Adding traveling days, the overall schedule of the two experts will be 45 days and 39 days respectively. The technical assistance will be ready to start immediately after the equipment has been installed, tested and adjusted in appropriate manner.

(3) Output Materials

The project will be completed in a single fiscal year, and therefore the technical guidance service shall be rendered within the same fiscal year. Output materials or products are as follows:

Technical Support

Standard operation manual will be prepared as a flow chart in a joint effort with laboratory staff. It can be used not only as a tool to avoid mishandling of the equipment but also as a troubleshooter.

Management Support

With a view to establishing cooperation system with EMU and other stakeholders, advice and information provided by the seminar participants will be collected and compiled in a report. The seminar materials are also considered to be an output.

(4) Method of Service to be Provided

Japanese Consultants will provide the technical guidance service for the following reasons:

- There will be too few authorized specialists in Egypt to deal with environmental monitoring equipment,

- As most of equipment is likely to be Japanese products, it is hardly thinkable to provide service by expert(s) of the third country, and
- Based upon the training experiences provided by Japanese experts under EMTP, it is desirable that the expert of the same nationality provides the guidance service in close cooperation with CCC.

CHAPTER 3. PROJECT EVALUATION AND RECOMMENDATIONS

3.1 Project Effect

To cope with air and water pollution, Egypt has made strenuous efforts to develop environmental monitoring capability with the support from Japan and other donor countries. The project will serve to provide monitoring data and information and is expected to manage regional environment in compliance with standard defined under the law No.4. Environmental monitoring is conducted as an obligation of the responsible agency for every pollution source respecting the standards for industrial waste, work place environment, wastewater discharge into the sea, etc. As a result, the country's environmental situation will become better known, and administrative guidance will be made possible in such a way that the factories identified as pollution sources are ordered to shut down the operation or to improve treatment system. Thus, the project will certainly contribute to the environmental protection.

In addition, all RBO staff members have successfully developed their monitoring capabilities under the guidance of Japanese experts through the project-typed technical assistance, so that the number of monitoring sites will be increased, and particularly, heavy pollution sources need to be monitored more intensively. Factories disobeying the environmental standard or the rule may be punished according to the law. If actual conditions of pollution are clearly known to the public, obviously they become aware of the importance of environmental improvement. Therefore, it is expected that an access be provided to take practical actions for environmental improvement.

From the above considerations, it will be concluded that the project is in line with the Egyptian policy for the decentralization of environmental management, and it will be beneficial and effective to the whole nation of Egypt in the future. The project effect and benefit are further described as follows:

(1) Monitoring of Pollution Sources

As a result of facility reinforcement and capacity building, the number of monitoring sites as well as factory inspections will be increased.

Existing RBOs have reported approximately 1,200 cases of pollution source monitoring since their foundation in 1999. It means that the annual number will be about 500 with respect to point source monitoring, and an average number of monitoring activities per RBO is estimated at 80 to 100. However, this number will further increase if the three new RBOs are in full operation with the equipment provided under the project, and it is expected to be 800 annually in the whole country.

(2) Monitoring Activities

(a) Frequency of Ambient Monitoring

According to the record on ambient monitoring, the existing RBO laboratories have analyzed the following number of samples:

- With regard to water quality monitoring, the survey was conducted three (3) times from the upstream section to the estuary of the Nile, and thereby 54 water samples and 31 sediment samples have been collected. Besides this, there are a number of samples collected from industrial wastewater.

- Air sampling has been conducted by mobile unit and other monitoring equipment, but the number of samples for ambient monitoring is not clearly mentioned.

Recently, the existing RBOs have expanded their activities to undertake not only point source monitoring, but also ambient monitoring such as water quality survey for rivers and lakes as well as air quality survey at some residential areas. The frequency of monitoring and sampling of the existing RBO is as follows:

Frequency of Monitoring Activities of the Existing RBOs

RBO	Water Quality	Air Quality
Alexandria	Frequency is not clear. Sampling is periodically conducted at 8 sites from industrial wastewater discharged to the coastal area. Assuming one sampling/month, total number of samples is 96.	Weekly-based monitoring is implemented at 7 sites, which means 4 times every month. Consequently, the total number of samples will be 336
Tanta	Sampling is conducted every two months at 10 sites for the river and 30 sites for industrial wastewater. The total number is 240 annually.	Monitoring is implemented every 3 weeks for emission gas of 7 factories, road intersections and industrial areas. The total number is about 112 annually
Mansoura	129 samples for the last 2 years.	159 samples for the last 2 years.
Suez	Samples are collected from 4 industries. Monitoring of water resource is implemented every 3 months. The total number is estimated at 20 annually.	The focus of monitoring is cement factory and fertilizer factory. As it is conducted bi-monthly, 24 samples will be collected a year.
Great Cairo	Monthly-based monitoring is conducted for 20 main industries in Cairo. The total number is 240	Monthly-based monitoring is implemented by Mobil Unit at 2 residential sites in the vicinity of industrial area. In addition, 3 to 4 sites are monitored by other equipment. The total number is about 72.
Average	132 samples/year	125 samples/year

The average number of samples collected by each RBO for the ambient monitoring activity will be 132 for water quality and 125 for air quality. With existing 5RBOs it will amount to 660 and 625. Should the new RBOs be operated in the near future, these numbers will increase to 1,050 and 1,000 respectively. These data will show the concentration of main physical and chemical parameters in determining the quality of air and water, which may vary depending on the site or area in the country. As a result, the data will serve to prove the necessity of environmental improvement.

(b) Administrative Measures for Pollution Sources

The installation of facility and equipment will help upgrade monitoring system for air and water, and the inspection of pollution sources can be effectively conducted in response to the complaints of the residents. This approach may provide an access for the public to better understanding of the problem and will lead to the increase of administrative actions for environmental improvement. The abatement of point source pollution will result in the improvement of aquatic environment of the Nile and air quality in industrial areas as well as urban areas.

According to the monitoring record of CCC and 5 existing RBOs, the administrative measures have been taken for over 100 cases, and thereby operation shutdown or amelioration of treatment systems have been ordered. However, if 3 RBOs are added in the monitoring system, it will increase to 95 to 100 cases annually from the present level of 60.

Taking the above into consideration, the project effects are summarized in the following table:

Summary of Project Effect

Present Conditions	Inputs	Project Effects
1. Although equipment have been supplied to 5 RBOs under phase 1 of the Project, 3 more RBOs need to be constructed with proper equipment for the establishment of a comprehensive environmental monitoring network.	Procurement of suitable environmental monitoring equipment to the 3 new RBOs	Upon the completion of monitoring network, pollution sources will be inspected to clear the problem for the improvement of facility. Pollution source monitoring survey will increase from 500 to 800 a year. Administrative instructions to the polluters will increase from 60 to 95-100 annually to improve the situation .
2. Additional equipment is required to the existing RBO labs. for the development of ambient monitoring capability.	Procurement of additional monitoring equipment to the existing 5 RBOs and CCC.	Number of ambient monitoring samples will increase from 660 to 1,050 for water and from 625 to 1,000 for air.

3.2 Recommendations

With the aim of ensuring project effect and its sustainability, it is important to note that the Egyptian side should secure the budget to cover the cost for operation and maintenance of laboratories, so that equipment maintenance and purchase of consumables such as glassware and reagents can be done without a hitch. The budget is obviously a main issue of the discussion to judge managing capability of the project-implementing agency. It may vary from year to year depending upon the state policy or financial situation, so it is necessary to keep a careful watch on it.

With regard to the technical aspect, CCC should continue to provide training to the laboratory staff of RBOs for further development of monitoring activities. CCC is also required to manage the accuracy of analytical data as a reference laboratory. In this regard, the roles and functions of CCC may be quite important to make the project effect sustainable.

Recognizing the importance of the above issues, the Egyptians side will make every effort to find an appropriate way in all sincerity. In addition to CCC-sponsored training, it is advisable that the exchange of personnel between RBOs be considered to learn about different characteristics of environment in the region, which may be mutually profitable for each RBO in terms of capacity building.

Based on EEAA's policy for the decentralization of environmental management, DANIDA and USAID are planning to provide assistance for capacity building as well as management of RBO. Such assistance will help encourage RBO to be the core of regional environmental administration, and it is expected that RBO can take the initiative in securing budget and staff for its own management in the future. Therefore, if a closer connection is built up with such donors, it will be certainly useful for the project to ensure its sustainability.