

**BASIC DESIGN STUDY REPORT  
ON  
THE PROJECT FOR THE ESTABLISHMENT  
OF  
THE ENVIRONMENTAL RESEARCH AND TRAINING CENTER  
IN  
THE KINGDOM OF THAILAND**

**MAY 1988**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

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## PREFACE

In response to a request from the Government of the Kingdom of Thailand, the Government of Japan has decided to conduct a Basic Design Study on the Project for the Establishment of the Environmental Research and Training Center and has entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Thailand a study team, headed by Mr. Toshiro Kojima, Assistant to Deputy Vice-Minister, Minister's Secretariat, Environmental Agency, from November 27 to December 24, 1988.

The team exchanged views with the officials concerned of the Government of Thailand and conducted a field survey. After the team returned to Japan, further studies were made. Then, a mission was sent to Thailand in order to discuss the draft report and the present report was prepared.

I hope that this report will serve for the development of the Project and for the promotion of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Kingdom of Thailand for their close cooperation extended to the team.

May, 1989

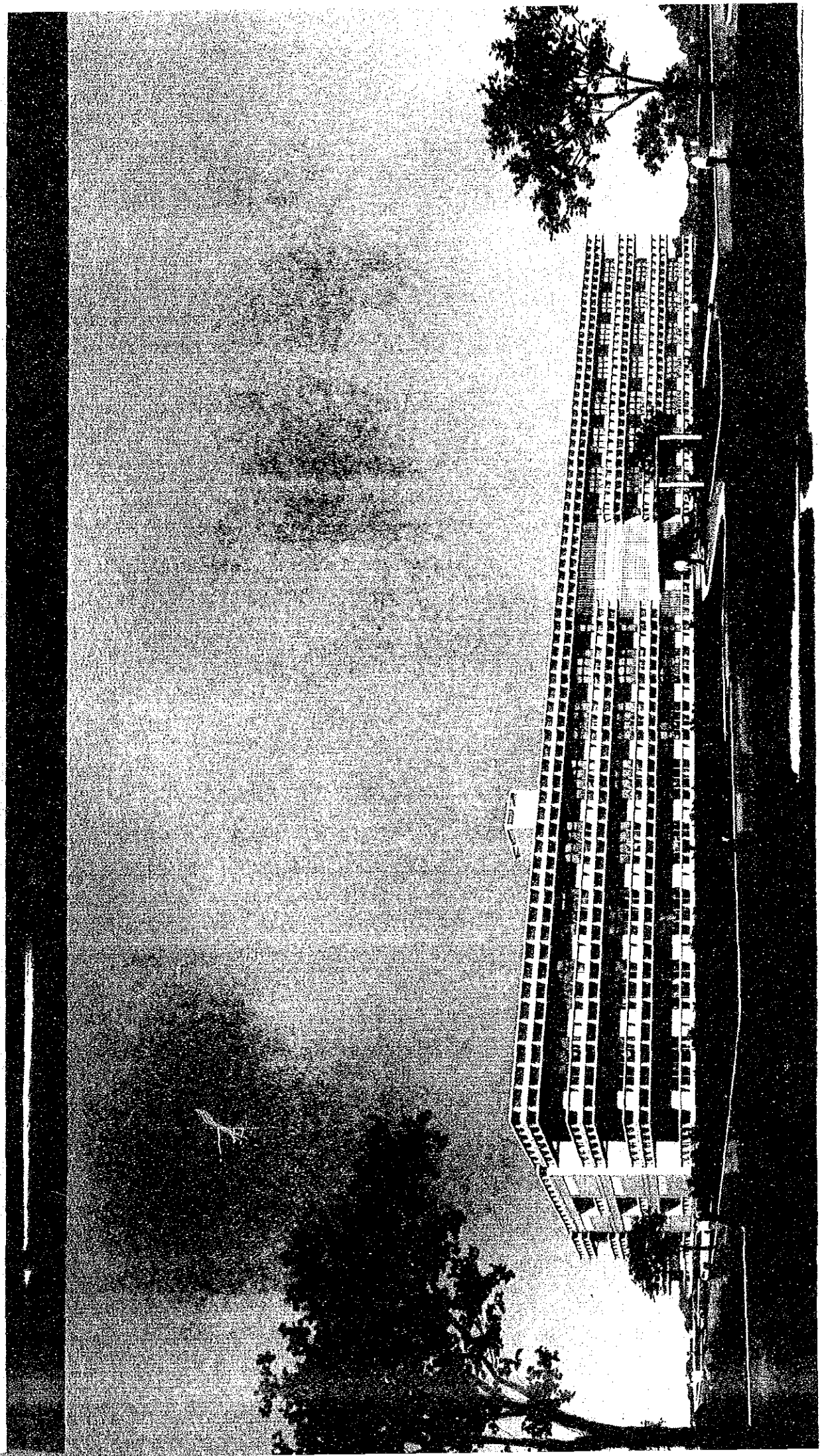


Kensuke Yanagiya

President

Japan International Cooperation Agency



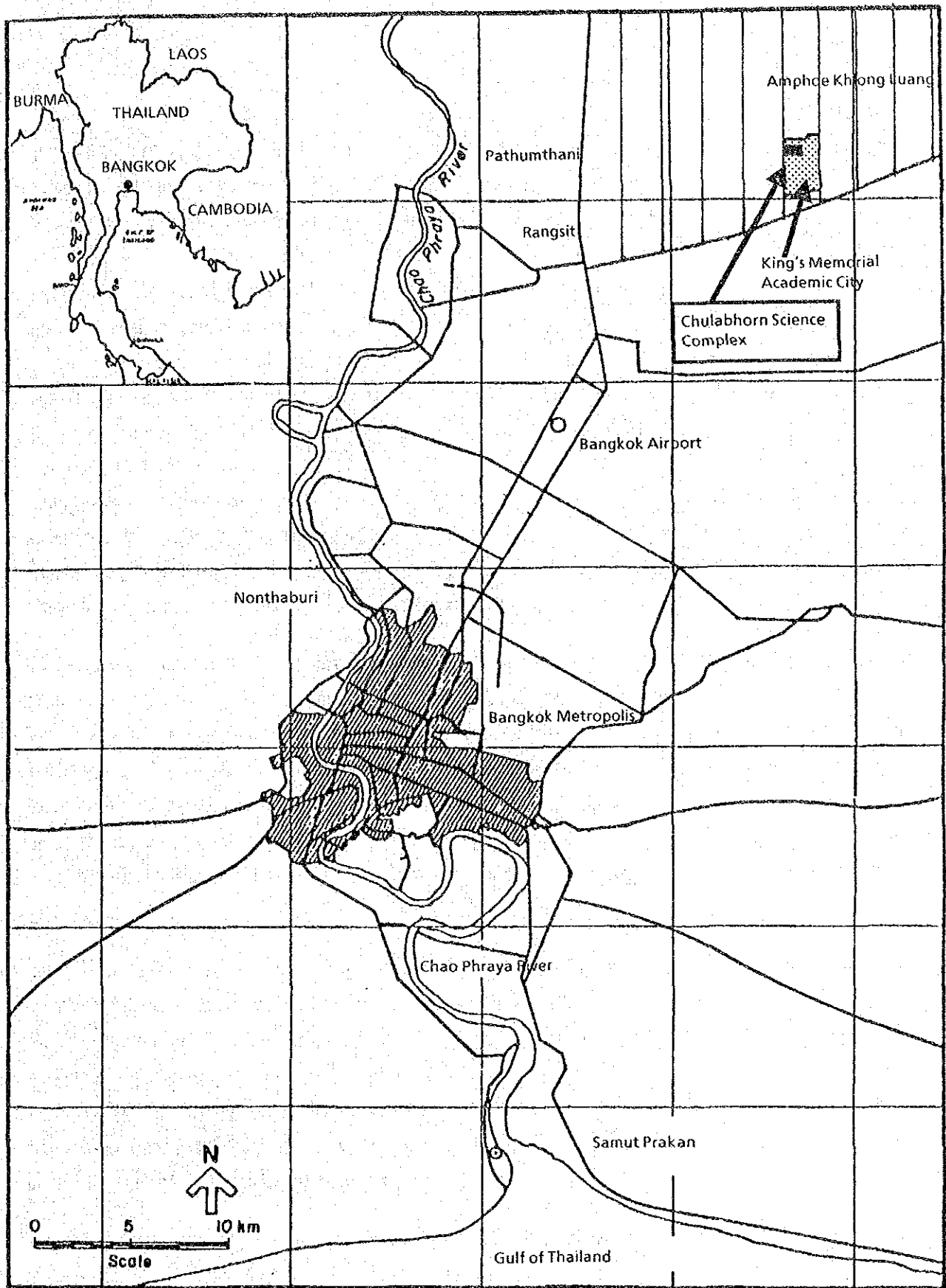


ENVIRONMENTAL RESEARCH AND TRAINING CENTER





# LOCATION MAP AND PERSPECTIVE





## SUMMARY

The mainstay of Thailand's economic development up to today has been agriculture, a sector in which rice cultivation plays the most important part. Efforts which began in the 1960's to diversify Thailand's agriculture and to develop other industries have resulted in high economic growth, quadrupling real GNP and more than doubling per capita income in the last 20 years. This remarkable development has now brought Thailand to the stage of being considered a middle income country. The main factor in the continuous high growth rate of the Thai economy has been the balanced development of agriculture, traditionally the mainstay of the economy, and industries, centering on the manufacturing industry. Various policies are currently being implemented to stabilize the nation's financial situation, to improve the international balance of payments, and to help Thailand progress from being a dominantly agricultural country to become a quasi-industrial country through the readjustment of its economic structure so that the momentum of economic development can be maintained in the future.

However, environmental conditions in Thailand have been worsening in recent years, particularly in metropolitan Bangkok and the surrounding areas, due to the excessive concentration of social and economic activities in these areas following the increased urbanization and industrialization reflecting the rapid economic growth of the country. Problems resulting from water pollution, air pollution, noise and vibration, solid waste, and toxic substances are highly noticeable in these areas and similar problems have begun to be observed in local cities.

The Thai Government earnestly began to make efforts to tackle these problems in 1975 with the enforcement of the Improvement and Conservation of National Environmental Quality Act. However, the lack of adequate knowledge, technical capabilities and experience on the part of those assigned to deal with environmental problems has proved to be a major obstacle to the efficient and effective implementation of environmental policies. Consequently, the existing problems have as yet hardly been dealt with.

Against this background, the Thai Government prepared the Master Plan for the Environmental Research and Training Center in the Kingdom of Thailand to conduct research and training activities and to foster manpower in the field of

environmental conservation with a view to the efficient enforcement of environmental policies, especially those relating to environmental pollution. This Center is intended to act as the national center for pollution prevention, environmental conservation, and harmonious industrial development. In this way it will also contribute to improving the health standard of the Thai people.

The Thai Government subsequently requested the project type technical cooperation and grant aid of the Japanese Government required for the completion of the Master Plan. In response to the request of the Thai Government the Japanese Government has sent the "Joint Preliminary Survey Team for Technical Cooperation and Grant Aid" with the object of confirming the contents of the request of the Thai Government and examining the basic conception of this Center as well as the necessity and appropriateness of the cooperation. The said Survey Team has concluded that "the technical cooperation and the grant aid to be provided in connection with this Center is a project requiring urgent implementation in view of the stage of development of Thailand is experiencing since 1973 and because it is aimed at coping with the environmental problems the country is facing". Under these circumstances, the Japanese Government decided to conduct a Basic Design Study and commissioned its execution to JICA, which sent the Basic Design Study Team to Thailand for a period of 28 days between November 27 and December 24, 1988. The Basic Design was completed based on the field study results and the subsequent domestic study results and the Basic Design Draft Final Report Explanation Team was sent to Thailand for the period between March 12 and 17, 1989.

The Basic Design Study Team discussed and confirmed the contents of the Thai Government's original request, surveyed the project site and studied the arrangement of the infrastructure for the project site. The Study Team also examined the types and sizes of the facilities and equipment suitable for the objectives of the Center, i.e., research and training on environmental conservation and environmental monitoring, and prepared the appropriate Basic Design.

Based on the results of the above-mentioned study, it was concluded that the Center should consist of facilities covering environmental conservation research, environmental conservation training, environmental monitoring, accommodation of trainees, and administrative functions. Subsequently the optimal plan for the Project's implementation was prepared.

In the case of research activities on environmental conservation, practical research directly contributing to environmental conservation policies will be

conducted in five fields, i.e., water pollution, air pollution, noise and vibration, solid waste, and toxic substances. Research themes will include the development of standard measuring methods, identification of pollution sources, revision and/or establishment of environmental standards, and the development of appropriate treatment methods, etc. A total of 28 themes are planned in three stages over a five-year period following the ERTC's opening.

With regard to training activities on environmental conservation, 25 types of training courses will be provided for administrative staff, analysts and researchers in both the public and private sectors who are engaged in environmental conservation in the five above-mentioned fields. The training of 1,875 people in the five years following the opening of the ERTC is planned.

The environmental monitoring division of the ERTC will continue with the existing monitoring work on water pollution, air pollution, noise and vibration, solid waste, and toxic substances. In addition, it will closely cooperate with the research division to examine measures to deal with the environmental pollution spreading throughout Thailand and to establish and consolidate a nation-wide monitoring network. The monitoring of a total of 38 parameters a year is planned after the ERTC's opening and an average of 133 people will be assigned to this field.

The project site is located some 47km north of Bangkok in the Khlong Luang District of Pathumthani Province and the neighboring area consists of farmland with a well-developed canal system. While the area is reputed to be the most developed agricultural area, scores of public laboratories and private factories have advanced into the area due to its recent designation as a new industry promotion district. The site occupies part of the Chulabhorn (Princess of Rama IX) Science Complex under development by MSTE which is in turn part of the some 725ha allocated for the King Rama IX Commemoration City Plan. The site is flat, covers an area of approximately 12ha, and has a rectangular shape with its long axis in the east-west direction. The Thai Government has already commenced the banking, road construction, and service extension work and as all the preparatory work will be completed by the end of 1989, the actual construction of the ERTC and the connection of the site with service lines will not encounter any obstacles.

The planned building is reinforced concrete, three-story building with a total floor area of approximately 8,150m<sup>2</sup>, consisting of research, training, monitoring,

dormitory, and administrative blocks. The main rooms in each block will be as follows :

**Research Block:** Laboratories (water quality, air quality, noise and vibration, solid waste, and toxic substances), section offices, common analysis instruments rooms, meeting room, etc.

**Training Block:** Lecture rooms, seminar room, practice rooms, computer room, audiovisual room, document service room, instructor room, etc.

**Monitoring Block:** Laboratories (water quality, air quality, noise and vibration, solid waste, and toxic substances), section offices, etc.

**Dormitory Block and Other Facilities:**

Bedrooms (to accommodate 48 persons), canteen, administrative offices, meeting room, first aid room, etc.

The planned equipment to be provided to the ERTC will include common analytical instruments, generally used laboratory instruments, and measuring instruments (water pollution, air pollution, noise and vibration, solid waste, and toxic substances.).

The construction of the ERTC will take some 12 months for the first phase and 10 months for the second phase to complete.

The project implementation body on the Thai side is the Office of the National Environment Board (ONEB) and the Secretary General of the ONEB will have overall responsibility for the implementation of the Project. The ERTC will be integrated to the organization of the ONEB with the ONEB taking the central responsibility for the research, training, and monitoring activities. Consisting of five divisions (i.e., Research and Development, Environmental Monitoring and Analytical Service, Environmental Technology Training, Information and Documentary Service Divisions, and Administrative Section), the ERTC will have 98 staff members under the management of the Director and Deputy Directors at the time of its opening. The existing Research, Training, and Monitoring Divisions of the ONEB will be transferred to the ERTC.

The implementation of the Project is expected to result in the following :

- 1) The disorderly exploitation of natural resources and pollution of the environment will be prevented with the implementation of environmental conservation training due to adequate consideration being given to environmental conservation measures at the planning and execution stages of various economic development policies.
- 2) Efficient administration of environmental conservation will be achieved as the ERTC will be able to supply scientifically accurate basic data to government agencies based on the collection of technically uniform environmental monitoring data and a sound understanding of the actual conditions of environmental pollution.
- 3) The execution of basic studies to provide a scientific basis for the establishment of various environmental standards which are suitable for the actual conditions in Thailand, so far delayed due to priority being given to monitoring and analysis activities, which in turn is due to three being inadequate facilities and equipment, will assist in the prevention of environmental pollution.

The ERTC will be the sole facility in Thailand conducting these activities and will be indispensable in regard to maintaining a healthy environment for the Thai people. Its early completion is, therefore, strongly hoped for.

*Project-type technical cooperation* with the dispatch of Japanese experts to Thailand to make the ERTC function more efficiently is also under consideration at present.

The activities of the ERTC are expected to result in a qualitative improvement of the personnel supporting environmental conservation efforts, thereby contributing to the sound socioeconomic development of Thailand. Since there are many Japanese firms have rode into Thailand and are doing business in the country and moreover quite a few of them are engaged in business related to cause the water and air pollution. The promotion of this Project with the grant aid assistance of the Government of Japan is extremely significant in view of Japan's solid experience and high level of technology in the environmental conservation field due to the serious environmental damage suffered in the past, and it is believed that the grant aid in question will prove highly successful.

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## LIST OF ABBREVIATIONS

AIT	Asian Institute of Technology
BMA	Bangkok Metropolitan Administration
BOD	Biochemical Oxygen Demand
CO	Carbon Mono-Oxide
COD	Chemical Oxygen Demand
CU	Chulalongkorn University
DDS	Department of Drainage and Sewerage
DIW	Department of Industrial Works
DMS	Department of Medical Science
DO	Dissolved Oxygen
DOA	Department of Agriculture
DOF	Department of Fisheries
DOH	Department of Health
DSS	Department of Science and Services
DTEC	Department of Technical and Economic Cooperation
ERTC	Environmental Research and Training Center
IEA	Industrial Estate Authority of Thailand
JICA	Japan International Cooperation Agency
KU	Kasetsart University
MOA	Ministry of Agriculture and Cooperatives
MOE	Ministry of Education
MOF	Ministry of Finance
MOFA	Ministry of Foreign Affairs
MOI	Ministry of Industry
MOIn	Ministry of Interior
MSTE	Ministry of Science, Technology and Energy

<b>MOTT</b>	<b>Ministry of Transport and Telecommunications</b>
<b>MPH</b>	<b>Ministry of Public Health</b>
<b>MU</b>	<b>Mahidol University</b>
<b>MWA</b>	<b>Metropolitan Waterworks Authority</b>
<b>NEB</b>	<b>National Environment Board</b>
<b>NESDB</b>	<b>National Economic and Social Development Board</b>
<b>NGO</b>	<b>Non Governmental Organization</b>
<b>NPD</b>	<b>National Police Department</b>
<b>NO<sub>x</sub></b>	<b>Nitrogen Oxides</b>
<b>ONEB</b>	<b>Office of the National Environment Board</b>
<b>PEA</b>	<b>Provincial Electric Authority</b>
<b>PSU</b>	<b>Prince of Songkhla University</b>
<b>PWA</b>	<b>Provincial Waterworks Authority</b>
<b>SO<sub>x</sub></b>	<b>Sulfur Oxides</b>
<b>TISTR</b>	<b>Thailand Institute of Scientific and Technological Research</b>
<b>TOT</b>	<b>Telephone Organization of Thailand</b>
<b>USAID</b>	<b>United States Agency for International Development</b>

## CHAPTER 1 INTRODUCTION



## CHAPTER 1 INTRODUCTION

The economy of Thailand has been continuously expanding since 1987 and annual economic growth of 10% is estimated for 1988. Factors contributing to this favourable growth include the advancement of tourism, expansion of direct investment and the increase in agricultural production. In the past, the mainstay of Thailand's economy was agriculture. Since the late 1960's when the exploitation of the natural gas fields in the Gulf of Siam commenced, however, the Thai Government has been implementing policies aiming at industrial modernization, the development of large-scale industries, financial support and the modernization of small company management, etc., aggressively attempting to foster the manufacturing industry. As a result, the manufacturing industry has been replacing agriculture as the most important industry in Thailand's economy and the progress of industrialization and urbanization has been particularly noticeable in metropolitan Bangkok and its vicinity.

The rapid changes in the urban environment and concentration of the population due to the advancement of industrialization have resulted in environmental problems concerning water quality, air quality, noise and vibration, solid waste and toxic substances, as experienced in cities of most industrialized countries, including Japan. The seriousness of these problems cannot in fact be alleviated by the current environmental conservation measures employed in Thailand and their spread to local cities has already been observed.

The Thai Government enforced the Improvement and Conservation of National Environmental Quality Act in 1975 and established the National Environment Board (NEB) to determine national environmental conservation policies. It also established the Office of the National Environment Board (ONEB) to act as the Secretariat of the NEB to plan general environmental policies under the jurisdiction of the Ministry of Science, Technology and Energy (MSTE) and has introduced various environmental conservation measures since then.

Unfortunately, however, the number of engineers and researchers engaged in environmental conservation in both the public and private sectors is extremely inadequate and the existing environmental problems have not been effectively dealt with due to financial and technical constraints in addition to the shortage of manpower.

Under these circumstances, the Thai Government prepared the Master Plan for the Environmental Research and Training Center (ERTC) to establish and promote environmental policies by means of training those engaged in the field and research on relevant technologies. The Thai Government subsequently made a request to the Japanese Government in 1983 for cooperation for the establishment of the ERTC (original request).

In response to this request, the Japanese Government sent the JICA Request Background Study Team headed by Dr. Michio Hashimoto, then a professor of Tsukuba University, to Thailand for the period between May 22 and May 29, 1985. Based on the Study Team's results, the Japanese Government then sent 2 experts on environmental research and training to Thailand from 1985 to 1988 to prepare the most appropriate environmental research and training plan for Thailand.

Assigned to the ONEB, these experts conducted surveys on possible ways of implemented the planned research and training activities and compiled their survey results in the Master Plan for the Environmental Research and Training Center in Thailand which was submitted to both the Thai and Japanese Government.

Taking this report into consideration, the ONEB made a request to the Japanese Government for grant aid assistance and project-type technical cooperation for the ERTC in August, 1987 via the Thai Government (revised request).

The Japanese Government responded to the revised request by sending the Technical Cooperation Preliminary Study Team headed by Mr. Kazuo Matsushita of the International Affairs Section, Director General's Secretariat, Environment Agency, to Thailand for the period between March 15 and March 22, 1988. The Preliminary Study Team concluded that research and training on environmental conservation are highly necessary to eradicate the bottlenecks in promoting the relevant measures.

Following the above study results, the Japanese Government then sent the Joint Preliminary Study Team for Technical Cooperation and Grant Aid Assistance headed by Dr. Michio Hashimoto, Deputy Director of the International Inland Water Environment Committee, to Thailand for the period between July 25 and August 6, 1988 to confirm the contents of the Thai Government's request and the



necessity, as well as suitability, of the Master Plan for the ERTC and Japanese cooperation.

On the basis of the joint preliminary study results, the Japanese Government decided to conduct a basic design study and commissioned JICA to send the Basic Design Study Team headed by Mr. Toshiro Kojima of the Assistant to Deputy Vice Minister, Minister's Secretariat, Environment Agency, to Thailand for 28 days from November 27 to December 24, 1988. The main items of the Basic Design Study conducted in Thailand were as follows.

- 1) Confirmation of the contents of the Thai Government's request and background of the request.
- 2) Study on the project implementation body and related organizations/agencies.
- 3) Confirmation of the planned activities by the ERTC.
- 4) Survey on the project site and the provision of Project-related infrastructure.
- 5) Examination of the proposed functions of the ERTC, size of the facilities and technical points relating to the construction of the ERTC.
- 6) Reference study on similar facilities and their equipment.
- 7) Consultations with government agencies involved in the establishment of the ERTC.
- 8) Study on the project implementation schedule and budgetary measures to be taken by the Thai Government.
- 9) Collection of data and information required to calculate the project cost.

Following completion of the various studies required for the preparation of the basic design and consultations with Thai officials, the Basic Design Study Team agreed with the Thai Government on the project contents, implementation body, project site and the scopes of work to be separately undertaken by the two governments, etc. The basic agreements were compiled in the Minutes of Discussions which were then signed and exchanged by Mr. Toshiro Kojima, representing the Japanese side, and Mr. Pravit Ruyabhorn, Secretary General of the ONEB, representing the Thai side on December 6, 1988.

Based on the domestic analysis of their field study results, the Basic Design Study Team compiled the basic design and the Japanese Government then sent the Basic Design Draft Final Report Explanation Team of Basic Design Study to Thailand for six days from March 12 to 17, 1989.

The Draft Final Report Explanation Team of Basic Design Study has confirmed the contents of Basic Design and has compiled into the Minutes of Discussions on the Draft Final Report Explanation of Basic Design Study on the basis of confirmation held with Thai officials.

The Minutes of Discussions on the Draft Final Report Explanation of Basic Design Study was signed and exchanged by Mr. Soichiro Seki, the leader of the Draft Final Report Explanation Team of Japan (Assistant Director, International Affairs Division, Minister's Secretariat, Environment Agency), and Mr. Arthorn Suphapodok, Deputy Secretary General of the ONEB on March 16, 1989.

The present report compiles the results of all preceding studies.

The list of the study team members, study schedule, list of those interviewed and the Minutes of Discussions are given in the Appendices.

## **CHAPTER 2 BACKGROUND OF THE PROJECT**



## CHAPTER 2 BACKGROUND OF THE PROJECT

### 2.1 Summary of Environmental Conditions

#### 2.1.1 Background and Current Conditions of Environmental Problems

The population of metropolitan Bangkok has been rapidly increasing due to the inflow of farmers who have lost their jobs in local areas and the shift of workers from local areas to the manufacturing industry in Bangkok, extremely worsening Bangkok's urban functions with the expansion of slum quarters, serious traffic jams and the deterioration of public services.

In addition, the further exploitation of natural gas in the Gulf of Siam has assisted the rapid increase of energy self-sufficiency and the large-scale development of the chemical industry. Rapid changes due to the increasing population pressure and the promotion of industrialization have resulted in serious environmental problems relating to water pollution, air pollution, noise and vibration, solid waste and toxic substances, as experienced by major cities in all industrialized countries, and these problems cannot be contained by the environmental conservation measures currently enforced in Thailand. Moreover, these problems are no longer related to only metropolitan Bangkok and its vicinity but have begun to spread to all major cities in Thailand.

The causes of environmental pollution in Thailand lie with the increase of the environmental loads given below and various types of pollution and the destruction of nature are in progress. The main environmental load factors, their state of increase and the subsequent environmental pollution are as follows.

#### ● Increase in Fuel Consumption

Emission of sulfur dioxides and carbon mono-oxide, etc. from industries and automobiles into the atmosphere → air pollution.

Discharge of waste oil from ships → water pollution.

- **Increase in Agricultural, Forestry and Fisheries Production**

Timber exports (excessive use of natural resources) and increase in agricultural production (expansion of farm-land) → diminishment and destruction of tropical forests.

Increase in fisheries production (development of fishing grounds) → deterioration of fishing grounds through destruction of the ecosystem.

- **Increase in Chemical Use**

Chemical fertilizers and agrochemicals → water pollution and solid deterioration.

Dispersement of chemicals → water pollution and air pollution.

- **Increased Drainage of Domestic and Industrial Waste Water → water pollution.**

- **Increase in Solid Waste**

Solid waste → increase of untreated solid waste. Industrial (hazardous waste) → increase of hazardous waste.

- **Advancement of Urbanization and Industrialization**

Increase in traffic volume and mechanical vibration (industrial activities, construction and transportation) → increase of noise and vibration.

### (1) Water Pollution

Of all Thailand's environmental problems, water pollution is by far the most serious at present. The pollution of rivers and canals is especially facing the serious problem, resulting in a decline of the domestic water quality, damage to fisheries and a reduction in the living environment standard, etc. For example, in the case of the Chao Phraya river which is Thailand's most prominent river, the water pollution is worsening in Bangkok and Samut Prakarn, the country's largest industrial area, with the dissolved oxygen value becoming zero in the dry season, causing death to fish and bad odour. In addition, its contamination by organochlorine pesticides has also been substantiated. The pollution of the rivers is in fact so serious that the lives of the Thai people who largely depend on the usage of water supply from the small canals for their livelihood are directly threatened. The causes of this water pollution are the untreated discharge of domestic waste water, the discharge of insufficiently treated industrial waste water and the discharge of contaminated water from farmland.

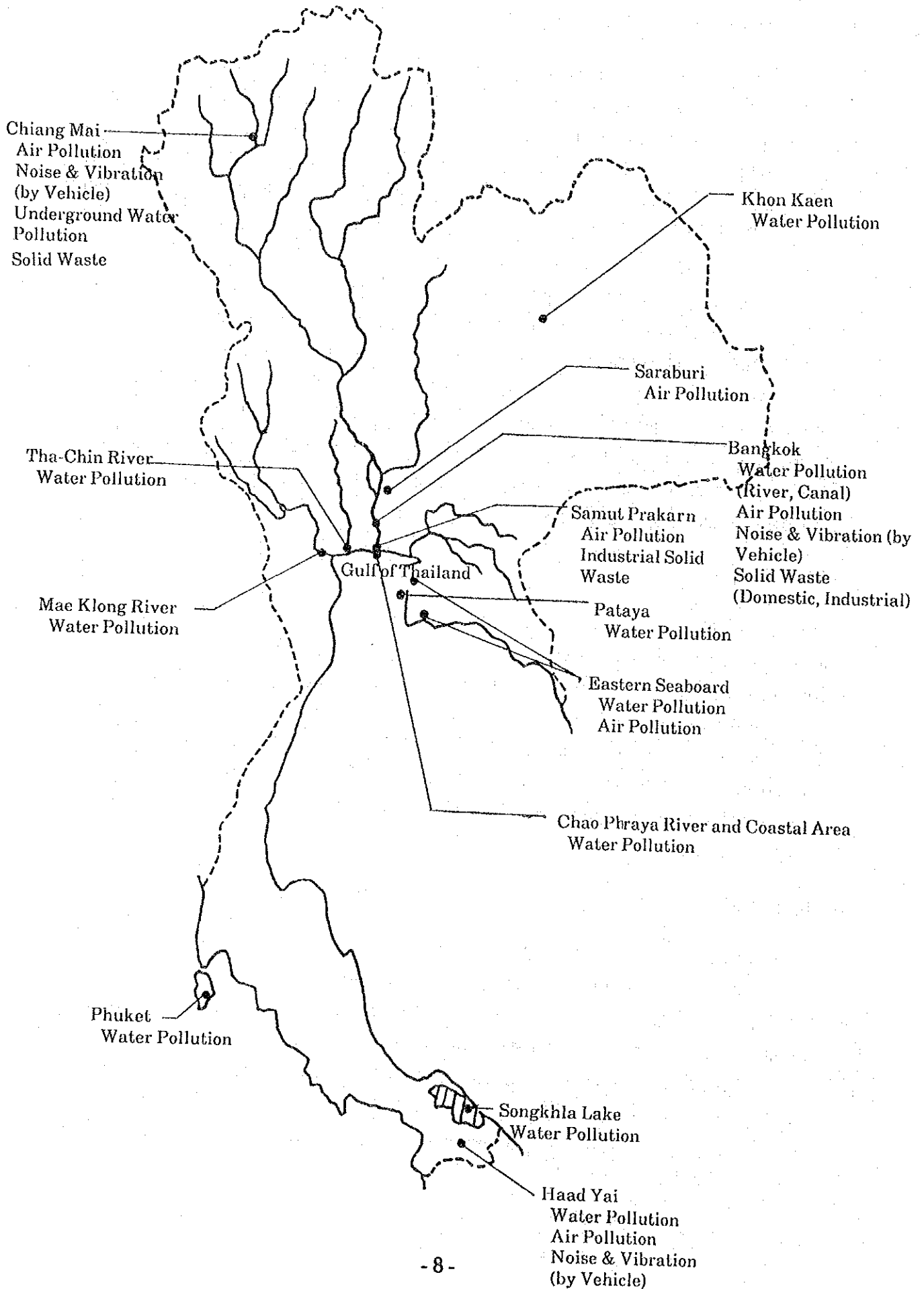
### (2) Air Pollution

Understanding of the actual conditions of air pollution has only begun to advance in recent years and the total picture is as yet unclear. Based on the limited data, however, the densities of carbon monoxide and smokes originally contained in vehicle exhaust gas in the air are believed to be fairly high in Bangkok where all the streets are flooded with every type of vehicle. Air pollution caused by factory exhaust gas may well be rapidly advancing in industrial areas judging from the number of complaints registered by residents in these areas.

### (3) Noise and Vibration

Noise and vibration problems have emerged in cities, particularly in Bangkok, due to the rapid advancement of urbanization and industrialization since the 1960's, as in the case of water and air pollution. The traffic noise in Bangkok caused by cars and by boats using the rivers and canals is extremely serious. In addition, Bangkok's residents suffer from noise and vibration both day and night caused by heavy vehicles, unregulated construction work, high traffic density, large proportion of vehicles which are not properly maintained, poor

# Major Environmental Polluted Area in Thailand





driving manners and an urban structure incapable of preventing noise, etc. The situation is also similar in local cities.

#### (4) Solid Waste

The inappropriate treatment and disposal of waste often results in environmental problems, including water pollution and deterioration of the local sanitation conditions. The disposal of solid waste has become major problem in Bangkok which is an extremely congested city. Only 80% of the generated solid waste is collected and the remainder is disposed of by dumping in the canals, etc., thus increasing the environmental load. As the open dumping method is employed for collected solid waste and nightsoil, problems of bad odour, black water seepage and the propagation of harmful insects have arisen. In recent years, the disposal of hazardous waste transported from abroad has been attracting attention.

#### (5) Toxic Substances

Of all the environmental pollution caused by toxic substances, that caused by agrochemicals is currently the most serious. Since large amounts of agrochemicals are often used without proper handling, the poisoning of farmers, high residual values in agricultural products and the contamination of water and soil have occurred.

### 2.1.2 Environmental Administration Tasks

#### (1) Administrative Problems

Administrative acts relating to environmental conservation in Thailand are (i) the Public Health Act which stipulates the duties and powers of municipalities regarding public health in general, including public nuisances, (ii) the Factory Act which mainly aims at promoting industrial development, (iii) the Poisonous Substances Act which aims at preventing harm to people, flora and fauna caused by toxic substances and (iv) the Improvement and Conservation of National Environment Quality Act.

The concept of a public nuisance adopted in the Public Health Act is vague and lack of revision since its initial enforcement makes it impossible to deal with actual environmental problems.

The Factory Act stipulates the procedures for the establishment and operation of factories but lacks any provision demanding compulsory pollution control.

The Improvement and Conservation of National Environment Quality Act stipulates the establishment of the ONEB, which plans general environmental policies while acting as the Secretariat for the NEB which in turn has overall responsibility for national environmental conservation, the introduction of environmental quality standards and the creation of an environmental assessment system. However, it is not an organic law systematizing all the relevant aspects of environmental protection as in the case of the Basic Law for Environmental Pollution Control in Japan and it is only one factor for environmental conservation. Although it does stipulate the introduction of environmental quality standards, it does not clearly state how these standards should be introduced.

The present environmental administration in Thailand entrusts the ONEB to plan general policies and ministries and agencies to enforce the actual policies in their respective fields of jurisdiction. For example, regulations on waste water and exhaust gas from factories are enforced by the Ministry of Industry while regulations applying to exhaust gas and noise from vehicles and boats are enforced by the Ministry of Transport and Telecommunications and the National Police Department. Regulations on residual agrochemicals are enforced by the Ministry of Agriculture and cooperatives. At present, 8 ministries and 28 departments of the Thai Government have environment-related sections and enforce the relevant policies.

The criteria for legal purposes for environmental control and exhaust gas control, etc. and for environmental assessment have been established by various ministries and agencies pursuant to the acts mentioned earlier. Although the criteria are still inadequate, the rough framework for environmental conservation has been established.

It is unfortunate that the lack of adequate administrative and technical experience on the part of these ministries and agencies, including the ONEB, in the field of environmental conservation due to the short history of administration in this field is a large constraint on the implementation of the existing conservation systems and has made it impossible to develop new policies to reflect changes in the nature of environmental problems.

## (2) Organizations Related to Environmental Conservation

The ONEB is responsible for the planning of general environmental conservation policies while other ministries, agencies, universities, state enterprises and private companies are involved in the actual application of policies controlling water pollution, air pollution, noise, vibration, solid and hazardous waste and toxic substances. These organizations regulate the exhaust gas and waste water from factories, exhaust gas and noise from vehicles and boats and residual agrochemicals depending on their powers and duties while also conducting analysis services, monitoring and inspections, etc. to guarantee the effective enforcement of the regulations. The following table lists the main organizations involved in environmental conservation and their work assignments.

## Work Assignments of Organizations Involved in Environmental Conservation in Thailand

Assignment Organizations	Water Pollution	Air Pollution	Noise and Vibration	Solid Waste	Toxic Substance
Office of the National Environment Board (ONEB)	*Planning of Policies *Evaluation of Environmental Effect *Monitoring Evaluation *Synthesis Study of Antipollution *Services of Analysis	*Planning of Policies *Evaluation of Environmental Effect *Monitoring Evaluation *Synthesis Study of Antipollution *Services of Analysis	*Planning of Policies *Evaluation of Environmental Effect *Monitoring Evaluation *Synthesis Study of Antipollution *Services of Analysis	*Planning of Policies *Evaluation of Environmental Effect *Monitoring Evaluation *Synthesis Study of Antipollution *Services of Analysis	*Planning of Policies *Evaluation of Environmental Effect *Monitoring Evaluation *Synthesis Study of Antipollution *Services of Analysis
Department of Science Services (DSS)	*Services of Analysis	*Services of Analysis		*Services of Analysis	*Services of Analysis
Department of Industrial Works (DIW)	*Planning of Policies *Execution of Laws *Evaluation of Environmental Effect *Monitoring Evaluation *On-the-spot Inspection *Services of Analysis *Treatment	*Planning of Policies *Execution of Laws *Evaluation of Environmental Effect *Monitoring Evaluation *On-the-spot Inspection *Services of Analysis *Treatment	*Planning of Policies *Execution of Laws *Evaluation of Environmental Effect *Monitoring Evaluation *On-the-spot Inspection *Services of Analysis *Treatment	*Planning of Policies *Execution of Laws *Evaluation of Environmental Effect *Monitoring Evaluation *On-the-spot Inspection *Services of Analysis *Treatment	*Planning of Policies *Execution of Laws *On-the-spot Inspection *Treatment
Department of Health (DOH)	*Planning of Policies *Execution of Laws *Evaluation of Environmental Effect *Monitoring Evaluation *Synthesis Study of Antipollution *Services of Analysis	*Planning of Policies *Execution of Laws *Evaluation of Environmental Effect *Monitoring Evaluation *Synthesis Study of Antipollution *Services of Analysis	*Planning of Policies *Monitoring Evaluation *Evaluation of Environmental Effect *Services of Analysis	*Planning of Policies *Monitoring Evaluation *Evaluation of Environmental Effect *Services of Analysis	*Planning of Policies *Monitoring Evaluation *Evaluation of Environmental Effect *Services of Analysis *Treatment
Department of Medical Science (DMS)					*Monitoring Evaluation *Synthesis Study of Antipollution *Services of Analysis
Food and Drug Administration (FDA)					*Planning of Policies *Execution of Laws *Monitoring Evaluation *Synthesis Study of Antipollution *On-the-spot Inspection
Department of Land Transport (DLT)		*Planning of Policies *Execution of Laws *Monitoring Evaluation *On-the-spot Inspection *Services of Analysis	*Planning of Policies *Execution of Laws *Monitoring Evaluation *On-the-spot Inspection *Services of Analysis		
Harbour Department (HD)		*Planning of Policies *Execution of Laws *Monitoring Evaluation *On-the-spot Inspection *Services of Analysis	*Planning of Policies *Execution of Laws *Monitoring Evaluation *On-the-spot Inspection *Services of Analysis		
National Police Department (NPD)		*Planning of Policies *Execution of Laws *Monitoring Evaluation *On-the-spot Inspection *Services of Analysis	*Planning of Policies *Execution of Laws *Monitoring Evaluation *On-the-spot Inspection *Services of Analysis		
Department of Fishery (DOF)	*Monitoring Evaluation *Synthesis Study of Antipollution *Services of Analysis				
Department of Agriculture (DOA)					*Planning of Policies *Execution of Laws *Monitoring Evaluation *Synthesis Study of Antipollution *On-the-spot Inspection *Services of Analysis
Local Public Entity	*Monitoring Evaluation	*Monitoring Evaluation	*Monitoring Evaluation	*Planning of Policies *Execution of Laws *Monitoring Evaluation *Services of Analysis *Treatment	*Monitoring Evaluation
University	*Monitoring Evaluation *Synthesis Study of Antipollution *Services of Analysis *Treatment	*Monitoring Evaluation *Synthesis Study of Antipollution *Services of Analysis *Treatment	*Monitoring Evaluation *Synthesis Study of Antipollution	*Monitoring Evaluation *Synthesis Study of Antipollution *Services of Analysis *Treatment	*Monitoring Evaluation *Synthesis Study of Antipollution *Services of Analysis *Treatment
Public Enterprise	*Monitoring Evaluation *Services of Analysis *Treatment	*Monitoring Evaluation *Services of Analysis *Treatment	*Monitoring Evaluation *Treatment	*Monitoring Evaluation *Treatment	*Monitoring Evaluation
Private Enterprise	*Monitoring Evaluation *Treatment	*Monitoring Evaluation *Treatment	*Monitoring Evaluation *Treatment	*Monitoring Evaluation *Treatment	

### (3) Assigned Work of Environment-Related Organizations

Organizations involved in activities relating to environmental science and their assigned work are given below.

Organization	Outline of Work
<p><u>Public Research Organizations</u></p> <ul style="list-style-type: none"> <li>- ONEB Laboratory</li> <li>- DOH Laboratory</li> <li>- DIW Laboratory</li> <li>- DOF Laboratory</li> <li>- TISTR</li> <li>- DOA</li> <li>- DDS</li> <li>- MWA</li> <li>- IEA</li> </ul>	<p>Water quality analysis, air and noise monitoring, waste composition and toxic substance analysis</p> <p>Sampling analysis of water in general, domestic water and air</p> <p>Water quality analysis of industrial waste water and river water in industrial areas</p> <p>Monitoring of marine environment</p> <p>Water quality analysis, waste water treatment by anerobic digestion</p> <p>Sampling analysis of agrochemicals</p> <p>Water quality analysis of canal water in Bangkok</p> <p>Water quality inspection of domestic water and original water</p> <p>Inspection of waste water from common drainage facilities in industrial estates</p>
<p><u>Universities</u></p> <ul style="list-style-type: none"> <li>- Department of Environmental Engineering, Chulalongkorn University</li> <li>- Department of Environmental Engineering, Chiang Mai University</li> <li>- Department of Environmental Engineering, Khon Kaen University</li> <li>- Environmental Engineering Division, AIT</li> <li>- Institute of Environmental Research, Chulalongkorn University</li> </ul>	<p>Domestic water, waste water treatment, environmental hygiene, industrial hygiene, air pollution control/disposal of radioactive waste, water pollution control, improved hygiene for urban and rural areas</p> <p>Domestic water, training of water pollution specialists, environmental research on North Thailand</p> <p>Domestic water, training of water pollution specialists, environmental study on Northeastern Thailand</p> <p>Common environmental problems in developing countries, especially those relating to domestic water, waste water treatment and solid waste</p> <p>Technical development to serve for development plans and environmental conservation, provision of relevant data and information</p>

Organization	Outline of Work
<b>Private Research Institutes</b> -- Thai Development Institute -- Assessment Consultants (20, including universities and municipal organizations) -- Industrial Waste Water Inspection Organizations (35)	Schematic studies on the development of natural resources and environment Environmental assessment Analysis and reporting of industrial waste water quality

#### (4) Current Conditions and Tasks of ONEB

##### 1) Foundation and Assignments

The ONEB was established to act as the Secretariat of the NEB pursuant to the Improvement and Conservation of National Environment Quality Act enforced in 1975. The Deputy Prime Minister is the Chairman of the NEB and its members consist of the Ministers of Agriculture, Transport and Telecommunications, Interior, Public Health and Industry and the Director General of the National Economic and Social Development Board, etc. The main assignments of the ONEB are as follows.

- a) Submission of environmental conservation policies at cabinet meetings
- b) Recommendations to other ministries and agencies regarding the introduction of environmental quality standards and the implementation of actual policies
- c) Research on environmental conservation
- d) Provision of technical support for other ministries and agencies

The enforcement of the actual regulations on pollution control and improvement work is commissioned to the competent ministries and agencies.

## 2) Organizations

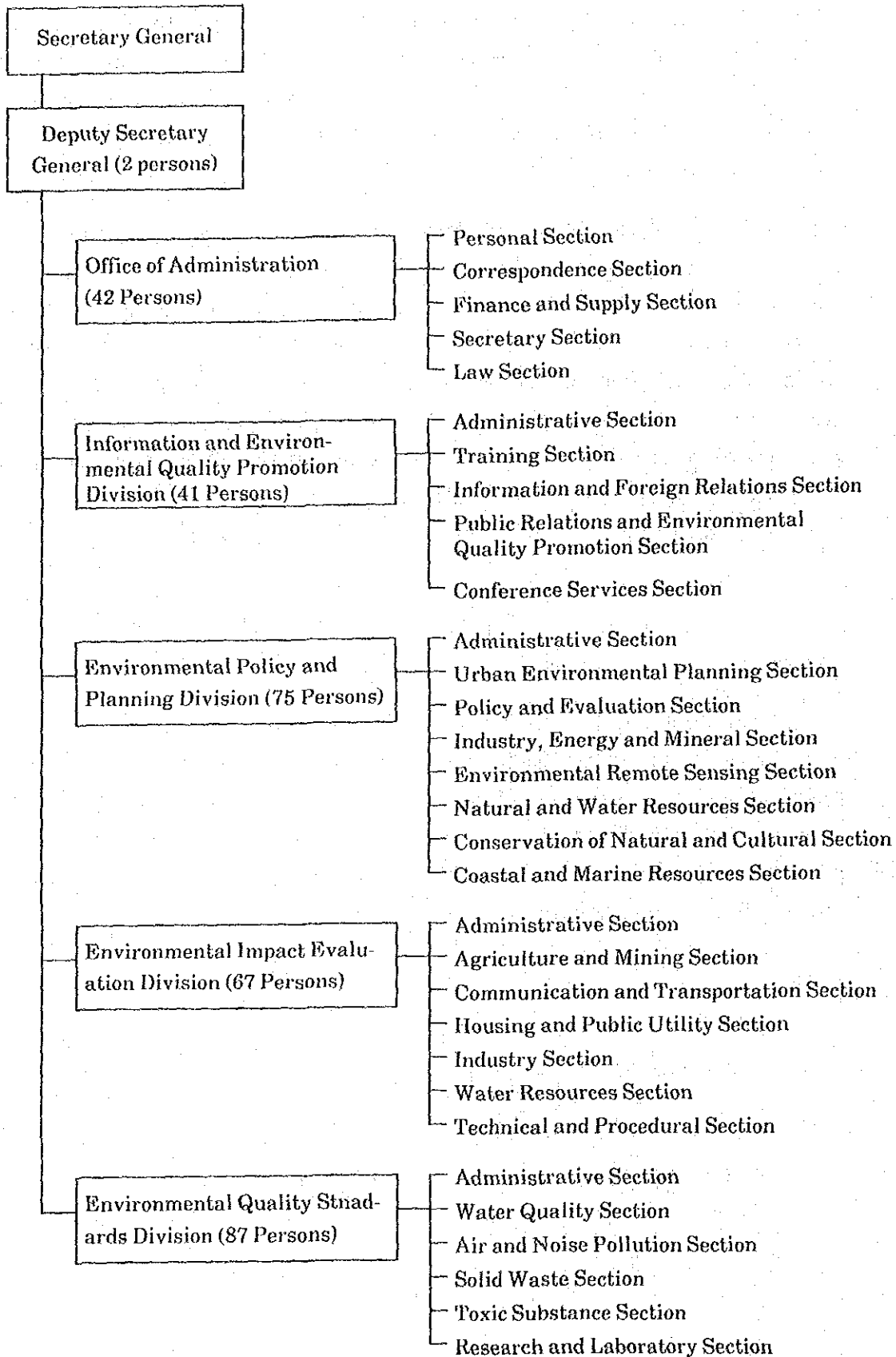
The ONEB is one department under the MSTE which consists of 7 departments, i.e. ONEB, Science Service Department, National Research Council, Office of Atomic Energy for Peace, National Energy Administration, Institute of Science and Technology and Office of the Permanent Secretary.

The ONEB has 5 divisions, i.e. Office of Administration, Information and Environmental Quality Promotion Division, Environmental Policy and Planning Division, Environmental Impact Evaluation Division and Environmental Quality Standards Division, with a total of 31 sections under the control of the Secretary General and 2 Deputy Secretary Generals. At present, it has 317 full-time staff members in addition to part-timers who are employed on a project basis. The number of the ONEB's staff is increasing annually, reflecting the growing importance of environmental conservation in Thailand. (refer to Table 2-1-2)

## 3) Budget

ONEB's budget was 38 million bahts for 1986, 46 million bahts for 1987, and 48 million bahts for 1988. the breakdown of its budgets by item and by field are as shown in Table 2-1-3. Besides the budgets allocated by the Thai Government, ONEB receives about eighty million bahts as funds for its projects from assistance organizations of foreign governments and the United Nations' organizations.

**Table 2-1-2 ONEB Organization Structure**



Number of staff as of October 1988.



#### 4) Monitoring, Research and Training Activities

The ONEB is engaged in the following monitoring, research and training activities.

##### ① Research Projects

- \* Natural purification by such plants as water hyacinth

##### ② Training Activities

Although the ONEB does not possess its own training facilities, it conducted 16 training courses with 3,910 participants between 1986 and 1988 using hotels and other external facilities (see Table 3.3.4)

##### ③ Monitoring Projects

###### a) Water Quality Monitoring (projects lasting specific durations)

- \* Four major rivers (Chao Phraya, Tha-Chin, Mae klong and Bang Praklong)
- \* Eastern Seaboard Development Region and local cities
- \* Songkhla Lake
- \* Major cities in Thailand

###### b) Air Quality Monitoring

- \* Regular automatic monitoring at seven stations in Bangkok
- \* Regular automatic monitoring at five stations in the Samut Prakarn industrial area

###### c) Noise Monitoring

- \* Measurement of traffic noise (irregular)

###### d) Solid Waste Monitoring

- \* Monitoring of solid waste composition in major cities

###### e) Toxic Substances Monitoring

- \* Twenty five provinces throughout the country (analysis of 1,500 samples a year)

#### 5) Current Problems

All ONEB staff, the number of which is rather limited, are currently burdened with such routine work as water and air quality monitoring and

**Table 2-1-3 Annual Budget of ONEB : Item (1986~1989)**

Item	1986 (Baht)	1987 (Baht)	1988 (Baht)	1989 (Baht)
1. Salary	14,091,600	14,811,900	16,341,500	17,794,900
2. Salary for Temporary Staff	2,048,500	2,650,500	3,395,900	3,482,800
3. Expense	9,945,000	9,753,600	10,471,400	10,660,300
4. Public Utility	1,737,400	1,740,400	1,824,000	2,124,000
5. Equipment and Maintenance	2,906,500	3,547,700	6,333,300	8,132,800
6. Subsidised Budget	880,700	1,168,900	2,103,400	2,225,400
7. Others	6,439,000	12,294,000	7,872,900	12,072,000
<b>Total</b>	<b>38,048,700</b>	<b>45,967,000</b>	<b>48,342,400</b>	<b>56,492,200</b>

1989 Budget : ONEB will apply

**Annual Budget of ONEB : Work Plan(1986~1989)**

Work Plan	Fiscal Year			
	1986 (Baht)	1987 (Baht)	1988 (Baht)	1989 (Baht)
1. Environmental Development Plan	21,760,100	22,807,700	26,934,700	32,014,500
2. Environmental Quality Control	8,465,000	16,368,500	13,619,700	15,060,900
3. Toxic Pollution Control Plan	5,465,500	5,426,000	6,032,900	6,009,100
4. Population Distribution and Human Settlement Plan	2,358,100	1,364,800	1,755,100	3,407,700
<b>Total</b>	<b>38,048,700</b>	<b>45,967,000</b>	<b>48,342,400</b>	<b>56,492,200</b>

they cannot possibly deal with the research and training activities required for the planning and enforcement of environmental conservation policies, including the establishment of environmental quality standards.

### 2.1.3 Necessity of Environmental Conservation Research and Training

#### (1) Environmental Conservation Research

The problem of environmental pollution in Thailand began in the 1960's but no special measures were taken until the 1970's when environmental research was started by government laboratories and the environmental engineering departments of some universities.

Such government organizations as the MSTE, MPH, MOI and MOA, etc. have only small laboratories due to their administrative requirements. Of these, the laboratory of the ONEB is the most efficient although it still lacks sufficient research facilities, staff and equipment to deal with the complex, emerging environmental problems. In addition, the staff are heavily burdened with routine work, such as the analysis of water and air quality test samples, and have no time to allocate to identifying the sources of pollution or examining remedial measures which are absolutely necessary in the planning of environmental conservation policies. The situation is the same at other public laboratories and research organizations. While the Chulalongkorn, Chiang Mai, Khon Kaen, Mahidol and Songkla Universities and the AIT do provide environmental science courses, the available equipment is inadequate vis-a-vis providing comprehensive education on environmental control. Moreover, very few practical research is conducted to solve the actual problems.

From the foregoing, it is clear that Thailand's research facilities are grossly inadequate to conduct research on the prevention of a further deterioration of the environmental problems and on the preparation of future conservation measures. From the viewpoint of implementing effective environmental conservation policies and measures in Thailand, therefore, it is imperative that the ONEB not only improve the existing monitoring techniques to identify pollution sources and to introduce environmental quality standards but also conduct practical research in diverse fields while taking the transfer

of technologies to other agencies and research organizations into consideration.

## (2) Environmental Conservation Training

The Thai Government stresses on harmony between social development and the environment and aims at achieving the most efficient social development by the provision of adequate measures for environmental conservation prior to the implementation of development projects. The intentions of the Thai Government vis-a-vis environmental conservation are well described in the National Policies and Implementation Measures for Environmental Development (see 2.2.2).

Acting as the Secretariat for the NEB, the ONEB is responsible for the planning and formulation of general environmental policies and also for coordination between administrative organizations. The actual implementation of these policies is the responsibility of the ministry with the relevant field of jurisdiction. Environmental quality standards, waste water standards and an environment assessment system are currently available, however inadequate. Nevertheless, the lack of sufficient knowledge and technical experience on the part of public organizations, including the ONEB, and private companies involved in environmental conservation due to the short history of administration in the field is a major constraint on the efficient implementation of the existing conservation system and has made it difficult to develop new policies which are capable of responding to new situations.

Consequently, the key to the effective advancement of environmental conservation policies is the improvement of the knowledge, technical expertise and experience of engineers of various levels and administrators working for environment-related public, as well as private, organizations, including the ONEB. In this regard, the improvement of measuring and analysis technologies common to both public and private organizations and the improved reliability of data collected in a uniform manner by all organizations must be achieved.

According to a survey conducted by the ONEB, the number of people requiring environmental conservation training is as high as some 6,000. In addition to Bangkok, there is also a strong demand for such training in local cities which as yet are also affected by environmental pollution but want to acquire the know-how for prevention measures.

Since Thailand has no facility to conduct this type of training, the ERTC should prove extremely significant in regard to consolidating the basis for future environmental conservation efforts in Thailand by improving the technical capabilities and knowledge of those participating through the ERTC's training courses.

## 2.2 Outline of Related Plans and Programmes

### 2.2.1 National Plans

Thailand's 1st National Economic and Social Development 5-year Plan commenced in 1961 and the 6th Plan (October, 1986 - September, 1991) is currently in progress. Thailand's economy and standard of living have conspicuously improved in the 25 period between the 1st Plan and the 5th Plan. Since the commencement of the 6th Plan, especially since 1987, continuous expansion has been seen in tourism, the manufacture of such export-oriented products as textiles, ICs, tinned food, leather goods and wood furniture and such domestic market-oriented industries as the construction material industry and manufacturing industries, including the automobile industry. As a result, the NESDB upwardly revised its economic growth rate forecast from the original 9% to 10.5% in November, 1988.

#### Major Economic Indices

	1985	1986	1987	1988 (forecast)
Real Economic Growth Rate (%)	3.5	4.7	7.1	R 10.5
Consumer Price Increase Rate (%)	2.4	1.9	2.5	R 4.5
Exports (billion bahts)	193	233	301	R 402
Imports (billion bahts)	251	241	334	R 494
Trade Balance (billion bahts)	-58	-8	-33	R -92
Current Account Balance (billion bahts)	-43	-5	-10	R -45
Total Balance (billion bahts)	12	33	34	40
Baht Exchange Rate (Annual Average Against \$US)	27.1	26.2	25.8	25.0
Foreign Reserves (\$US100 million)	30.0	37.7	52.1	R 69.0
Unemployment Rate (%)	7.7	7.2	7.0	7.0
Minimum Wage (bahts)	70	70	73	73

Sources: JETRO Bangkok, Thai Central Bank and NESDB

R: Revised Figure

The first 4 Plans mainly aimed at consolidating the infrastructure of Thailand's economy and consequently did not introduce any special measures vis-a-vis environmental problems. However, the importance of environmental conservation was stressed in the 5th Plan (October, 1981 - September, 1986) and an environmental assessment system was introduced in relation to development activities. The Natural Resources and Environmental Development Programme

was introduced in the 6th Plan as one of the programmes aiming at improving development efficiency, clearly indicating the importance of environmental conservation.

The 3 targets and 10 programmes of the 6th National Economic and Social Development Plan are as follows.

- 1) Improvement of Development Efficiency: 6 Programmes
  - \* Macroeconomic Management Programme
  - \* Human Resources and Social Development Programme
  - \* Natural Resources and Environmental Development Programme
  - \* Scientific and Technological Development Programme
  - \* Developmental Administration Improvement Programme
  - \* State Enterprises Consolidation Programme
- 2) Reorganization of Production Structure: 2 Programmes
  - \* Production, Marketing and Employment Development Programme
  - \* Basic Services Consolidation Programme
- 3) Appropriate Distribution of Income and Prosperity: 2 Programmes
  - \* Urban and Specially Designated Areas Development Programme
  - \* Local Development Programme

Of the 6 programmes aiming at improving the development efficiency, the Natural Resources and Environmental Development Programme recognizes that the rapid economic growth in the last 20 years had led to the excessive consumption of such natural resources as land, water, forests and fish, causing a serious economic imbalance and social tension and therefore, it suggests the following 3 basic policies, (i) efficient implementation of the Important Natural Resources Utilization Plan, (ii) implementation of strenuous efforts to conserve and control natural resources and to prevent the deterioration of the environment and (iii) strengthening of the cooperation between public organizations in view of the continuous development of natural resources. The real economic growth rate for the 6th Plan is forecast at over 5% and the Plan intends the alleviation of the unemployment problem and the unbalanced economy, represented by gaps between regional economies, by means of increasing economic stability through the successful implementation of all 10 programmes.

### **2.2.2 National Policies and Implementation Measures for Environmental Development**

In 1981, the Thai Cabinet decided the National Policies and Implementation Measures for Environmental Development to indicate the basic framework for environmental conservation and relevant administrative measures in Thailand.

The National Policies and Implementation Measures for Environmental Development stresses harmony between social development and the environment and aims at achieving the most efficient social development by introducing appropriate measures prior to the implementation of development activities. The objectives of the policies and measures are as follows.

- 1) Prevention of destruction of the natural environment and natural resources.
- 2) Maintenance of harmony between socioeconomic development and the environment.
- 3) Monitoring of the effects of development plans on the environment.
- 4) Clarification of the powers and duties of public organizations engaged in environmental conservation.
- 5) Preparation of guidelines for education, public relations activities, actions, surveys and research on environmental conservation.

The following guidelines are also given to achieve these objectives.

- 1) Thorough enforcement of environmental acts and regulations.
- 2) Proper provision of environmental conservation budget.
- 3) Promotion of education, training and public relations activities on environmental conservation.
- 4) Coordination between ministries and agencies regarding environmental conservation measures.
- 5) Systematization of environmental quality standards.
- 6) Implementation of environmental assessment



### 2.2.3 Status of ERTC Project

The National Economic and Social Development Plans originally commenced in 1961 with the main objective of consolidating the economic infrastructure, as described in 2.2.2. The successful growth in the subsequent plan periods is largely owed to the plentiful natural resources and the excessive exploitation of these natural resources (forests, land, water and minerals) following large investment in both the agricultural and industrial fields. Lacking efficient environmental conservation measures based on appropriate technologies, however, these development activities had led to serious destruction of the environment, causing the rapid exhaustion of natural resources and extensive environmental pollution.

Against this background, the Thai Government introduced a programme clearly suggesting the importance of balance between exploitation of natural resources and environmental conservation in its 6th Plan commencing in 1987. This programme was given the status of a national plan with the objective of further improving the efficiency of economic development in Thailand.

The National Policies and Implementation Measures for Environmental Development, compiled by the NEB pursuant to the Improvement and Conservation of National Environmental Quality Act (1975) and approved by the Cabinet in 1981, indicates the basic policies for environmental conservation and environmental administration programmes and these policies and measures were promoted for some years prior to their integration to the national plan. As programmes aiming at the urgent improvement of conservation policies and technologies to deal with various types of environmental pollution caused by rapid changes in the socioeconomic structure have now been integrated to the 6th Plan, the efficient implementation of environmental policies can be expected.

The ERTC Project aims at promoting the above National Policies and Implementation Measures in accordance with the programmes at a national level. The Project intends to contribute to the prevention of pollution and to socioeconomic growth in harmony with environmental conservation efforts by assisting and promoting environmental administration through the provision of technical research, training and monitoring for those organizations involved in environmental conservation.

The actual contents of the research, training and monitoring planned in the Project are closely related to the guidelines to achieve the objectives of the

National Policies and Implementation Measures and can be summarized as follows.

- 1) Through enforcement of environmental acts and regulations -- implementation of research to establish common measuring and analysis methods.
- 2) Promotion of education, training and public relations activities on environmental conservation -- implementation of training on environmental control under such themes as current conditions of environmental problems and causes, objectives of environmental policies, environmental control systems, environmental control methodology, coordination of development programmes with environmental policies and natural resources management, etc.
- 3) Coordination of environmental conservation measures between ministries and agencies concerned -- promotion of the ONEB's role as a policy coordinator in addition to the revision of various environmental quality standards, promotion of research on new standards and distribution of research results.
- 4) Systematization of environmental quality standards -- implementation and promotion of research on the revision or new introduction of various environmental quality standards.
- 5) Implementation of environmental assessment -- implementation of upgrading training for engineers in both public and private sectors on technologies, systems, methods and problems associated with environmental assessment and implementation of research to establish criteria for environmental assessment.

## 2.3 Outline of the Request

### (1) Background of the Request

The problem of environmental pollution in Thailand has been worsening in recent years, not only in Bangkok but also in local cities, following the rapid advancement of urbanization and industrialization as described in 2.1 and the ONEB, which is responsible for environmental administration, has been unable to cope with the problem due to insufficient manpower, technologies and finance.

Against this background, the ONEB planned to establish the Environmental Research and Training Center (ERTC) in the Kingdom of Thailand to assist the prevention of pollution and to promote continuous development in harmony with environmental conservation by means of consolidating the basis for environmental administration through research on related technologies and the training of related people and subsequently made a request to the Japanese Government for the provision of grant aid assistance for the ERTC.

### (2) Contents of the Request

The contents of the request made by the Thai Government and the Master Plan for the ERTC Project based on the results of the Grant Aid Assistance and Project Type Cooperation Joint Preliminary Study are summarized as follows.

#### Objectives of the Project

- 1) Implementation of practical research on environmental conservation.
- 2) Training of researchers, analysts and administrative staff involved in environmental conservation.
- 3) Expansion of facilities to achieve a qualitative improvement of research and training.
- 4) Promotion of continuous environmental educational programs for staff at all levels and the fostering of instructors with appropriate technical expertise.

### Project Implementation Body

Office of the National Environmental Board (ONEB),  
Ministry of Science, Technology and Energy

### Project Site

Chulabhorn Science Complex, Tambon Khlong 5, Amphoe Khlong Luang,  
Changwat Phatumthani

### Main Activities

#### 1) Research Activities :

3-stage research on water pollution, air pollution, noise and vibration,  
solid waste and toxic substances

#### 2) Training Activities

##### Technical Training :

Training on analysis and measuring methods for water pollution, air  
pollution, noise and vibration, solid waste and toxic substances.

##### Management Training:

Training on environmental control for all administrator levels

##### Other Training:

Environmental impact assessment, environmental data processing and  
environmental education, etc.

#### 3) Monitoring Activities:

Monitoring of water pollution, air pollution, noise and vibration, solid  
waste and toxic substances

### Personnel Plan

98 full-time staff at the time of opening (230 planned in the future)

### Facilities

#### Research Block:

Laboratories (water pollution, air pollution, noise and vibration, solid  
waste and toxic substances), scanning electron microscope room, computer  
room, constant temperature room, workshop and meeting room, etc.

### **Training Block :**

Lecture rooms, seminar room, practice rooms, audio-visual room, meeting room, document service room, instructor rooms and bedrooms, etc.

### **Others:**

Offices and canteen, etc.

### **Large-scale Experimental Facilities**

#### **Waste Water Treatment Model Plant:**

Model plant to study waste water treatment including oxidation ditch

#### **Air Pollution Monitoring Station:**

Model station for air pollution monitoring

#### **Solid Waste Treatment Model Plant:**

Model plant to study solid waste treatment

#### **Research Farm:**

Farm to study the effects of environmental pollution on plants and vegetation

#### **Waste Treatment Facility:**

Treatment facility for toxic waste water and gas generated by the ERTC

### **Equipment**

#### **Common Analytical Instruments :**

Gas chromatograph-mass spectrometer (GC-MS), X-ray fluorescence spectrophotometer, FT-IR spectrophotometer, scanning electron microscope, atomic absorption spectrophotometer, various types of gas chromatographs, auto analyzer, CHON analyzer and heavy metal waste treatment apparatus, etc.

#### **Generally Used Laboratory Instruments :**

Balance, high speed centrifuge, water distillation unit, clean bench, draft chamber, prefabricated freezed storage chamber and laboratory practice table, etc.

**Instruments for Water Pollution:**

Total nitrogen analyzer, total phosphorus analyzer, TOC analyzer and DO meter, etc.

**Instruments for Air Pollution:**

SO<sub>2</sub> monitor, NO<sub>x</sub> monitor, CO/CO<sub>2</sub> monitor, ozon monitor, oxydant monitor, non-methane HC monitor, various types of air samplers, air generator, gas phase diluter, air pollution monitoring unit and monitoring vehicles, etc.

**Instruments for Noise and Vibration:**

Sound level meter, vibration meter, level recorder and real-time wave analyzer, etc.

**Instruments for Solid Waste:**

Calorie meters, flash point measuring unit and corrosion tester, etc.

**Instruments for Toxic Substances:**

Acid agent distillation unit, etc.

**Other Equipment for Training Purposes**

Computers, audio-visual system, VTR editing sets, vehicles for field practice and maintenance equipment, etc.

In addition to the construction of the ERTC building and the provision of equipment by grant aid assistance, the Thai Government has also requested the provision of project-type technical cooperation for the ERTC Project by the Japanese Government.