

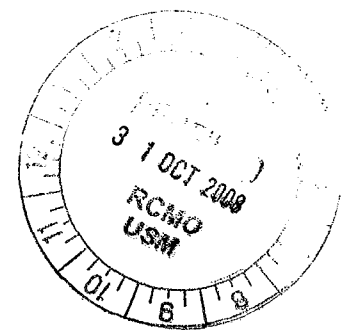


# **Laporan Akhir Projek Penyelidikan Jangka Pendek**

## **Role of Environment Policy and Community Participation on Air Pollution Control in Malaysia : Lessons from Japan**

**by  
Assoc. Prof. Dr. Abdul Rahman Mohamed**

**2004**



# **The Sumitomo Foundation**

## **RESEARCH REPORT**

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Mohamed

**Project Title :** Role of environment policy and  
community participation on air  
pollution control in Malaysia: Lessons  
from Japan

**University :** Universiti Sains Malaysia

**Reg. No. :** 028186

**Duration :** March 2003 to September 2004

“ROLE OF ENVIRONMENT POLICY AND  
COMMUNITY PARTICIPATION ON AIR  
POLLUTION CONTROL IN MALAYSIA:  
LESSON FROM JAPAN”

FINAL REPORT

JULY, 2004

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## **PREFACE**

The title of this project is “Role of Environment Policy and Community Participation on Air Pollution Control in Malaysia: Lesson From Japan”. The funding of this project was granted by The Sumitomo Foundation which funds project in social sciences field that are related to Japan.

The Sumitomo Foundation was established on September 25,1991 by 20 companies of The Sumitomo Group serving as donors. The aim of its establishment is to commemorate the 300<sup>th</sup> anniversary of the Besshi Copper Mine in Ehime, Japan- a cornerstone of the business of the Sumitomo Group. The mission of the Foundation is to contribute to the betterment of human society. To do this end, grants are given to projects in a variety fields or disciplines whose aim are to determine or help solve those problems which confront humanity.

## 1.0 INTRODUCTION

Air pollution is defined as the presence of pollutant in the air, in quantities large enough to produce harmful effect towards human health, vegetation, human property and water ground cycle. The main atmospheric pollutants recognized worldwide are sulfur dioxide ( $\text{SO}_2$ ), ozone ( $\text{O}_3$ ), oxide of nitrogen ( $\text{NO}_x$ ), carbon monoxide (CO), lead (Pb) and particulate matters. The principle sources of these pollutants are human activities especially in industrialized and developed countries. To eliminate these activities would cause such a drastic decrease in the standard of living that this action is seldom considered. The remedy proposed in most industrial countries is to continue the activities but to control the emission of air pollutants from them.

As a developing country, the government of Malaysia put a strong emphasis on environmental protection. Lately, the environmental regulation in Malaysia are becoming more stringent concerning the control of atmospheric pollutant particularly from those produced from combustion system such as from power generation plant. The main pollutant released from power plants are sulfur dioxide ( $\text{SO}_2$ ) and oxides of nitrogen ( $\text{NO}$  and  $\text{NO}_2$ ). For example a coal-fired power plant of 600 MW releases  $1785 \text{ m}^3 \text{ h}^{-1}$  (NTP) of  $\text{SO}_2$  and  $318 \text{ m}^3 \text{ h}^{-1}$  (NTP) of  $\text{NO}_x$  with a concentration of 350 ppm and 125 ppm respectively. The hazards of sulfur dioxide ( $\text{SO}_2$ ) and oxides of nitrogen ( $\text{NO}$  and  $\text{NO}_2$ ) towards the environment can be viewed from three aspects; on human health, properties and visibility.  $\text{SO}_2$  and  $\text{NO}_x$  are considered to be toxic to humans by inhalation. The degree of irritancy depends on the rapidity in which the gas forms sulfuric acid ( $\text{H}_2\text{SO}_4$ ) and nitrous acid ( $\text{HNO}_x$ ) in contact with moist tissue in the respiratory tract. Inhalation of high concentration of vapor may produce severe choking, respiratory paralysis and even death. Chronic exposure to the gas may cause bronchitis, fatigue, altered sense of smell and in some cases, sensation. Animal tests indicate that  $\text{SO}_2$  and  $\text{NO}_x$ , although not itself carcinogenic, assists in the carcinogenic activity of other agents. The destruction caused by  $\text{SO}_2$  and  $\text{NO}_x$  on human properties is also due to the formation of sulfuric acid ( $\text{H}_2\text{SO}_4$ ) and nitrous acid ( $\text{HNO}_x$ ). The formation of  $\text{H}_2\text{SO}_4$  and  $\text{HNO}_x$  in the atmosphere is also known as acid rain. Acid rain can easily corrodes paints on the buildings and as

well as the walls of the buildings. It can also cause metal to corrode faster. In a long run, it causes damage to the paints, walls and metal. In term of visibility, SO<sub>2</sub> and NO<sub>x</sub> form secondary particles in the atmosphere and thus contributes to PM<sub>10</sub> (PM<sub>10</sub> refers to particulate matter of 10 µm or less in diameter) problem, which reduces visibility. These particles, generally in the 0.1 to 1.0 microns size range, are efficient light scatters and is also hazardous to the human health as the human respiratory system is unable to filter it. They also persists in the atmosphere until coagulant and precipitation is used to remove them.

However, being a developing country that is moving towards a fully developed country, a large number of power plants and boilers are required to meet the high consumption in energy/electricity by the industries and the local population. Energy and environmental considerations over the coming years point to greater use of coal as a source of electricity as the Malaysian government is promoting a shift away from the country's heavy reliance on natural gas and oil for electric power generation. As more utilities are forced to make the shift, the production of pollutants (SO<sub>2</sub>, and NO<sub>x</sub>) will definitely increase. With an energy consumption of 13,000 MW (predicted to increase to 30,000 MW in the year 2020), appropriate control technologies has to be implemented in order to protect the human population from the harmful effects of these pollutants. In fact, the Ministry of Science, Technology and Environment of Malaysia have listed air pollution from the industries as one of the 5 main environmental issues in the country. Thus, in order to overcome this problem, appropriate environmental policy and involvement from the community in abiding to these laws will be very crucial.

This fact has aroused the need to re-evaluate the role of environmental policy and community participation in the control of air pollutants particularly from the combustion system in Malaysia. Evaluation of environmental policy will be in terms of whether the current existing regulation in Malaysia are at par with other developed countries in the world to protect its citizens and the citizens around the world from the harmful effects of pollutants. On the other hand, for community participation, it will be evaluated if the industries in Malaysia that are producing the pollutants (it was estimated that 60 % of the



industries in Malaysia are using boilers to generate steam or energy in their operation) are playing their role in controlling and as well as reducing the amount of pollutants released to the environment.

In order to achieve a significant evaluation, the existing environmental policy and community participation must be compared to a developed country. Japan, as a developed country, has been leading the world in environment protection, which includes the control of pollutants from combustion system. In Japan, the environmental regulations are very strict and thus they have a very advance technology in controlling air pollutants from the industries compared to other developed countries in the world. Malaysia, as a developing country that has always taken Japan as an example, such as through the look east policy, has a lot to learn from the Japanese counterpart.

## **1.1 OBJECTIVES**

The objectives of this project are:

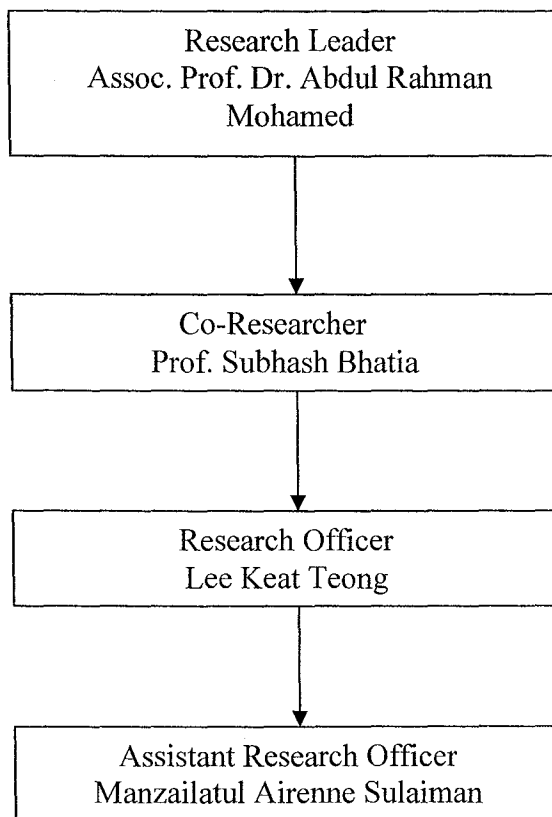
- To develop a database / statistical figures on the emission of pollutants from power plants in Malaysia
- To compare the existing regulations in Malaysia and Japan for the control of atmospheric pollution
- To compare the various technologies used in controlling atmospheric pollution in Malaysia and Japan

## **1.2 SCOPE OF WORK**

Due to the limitation of funding and time, this project is only focused on air pollution released by power generation companies, one of the main contributor of air pollutant to the environment. The data for this research project covers about 86% of the power generation companies in peninsular Malaysia and 90% in Sarawak. On the whole, the data for the research project covers about 88% of power generation companies in Malaysia.

The data presented in this research project were obtained from the questionnaires sent out to the various power generations companies in Malaysia. Visits to Department of Environment were made to obtain further information. The data and information on Japan were obtain from various sources on the internet and annual reports of various power plants in Japan.

## 2.0 RESEARCH TEAM



### 3.0 PROJECT SCHEDULING

The scheduling for the research activities in this project from September 2003 to August 2004 is shown below:

	Activities	2003				2004							
		Sept	Oct	Nov	Dis	Jan	Feb	Mar	Apr	Mei	Jun	July	Aug
1	Collection of information and data from the Department of Environment	x	x										
2	Preparation and sending out questionnaires			x									
3	Collection of information and data from various power generation companies in Malaysia				x	x	x	x					
4	Collection of information and data from the Department of Environment Japan and various power generating plants in Japan								x				
5	Data compilation, comparison work and development of database									x	x		
6	Suggestion on ways to further enhance Malaysia role in air pollution control											x	
7	Report writing												x

## **4.0 METHODOLOGY**

### **4.1 Research approach**

In order to achieve the objectives of this project, this research was carried out according to the following research methodology:

1. To make contacts with the Department of Environment, Malaysia to collect data and information on the existing regulations available for the control of atmospheric/ air pollutants in Malaysia.
2. To collect data and information from the various power generating plants in Malaysia that are contributing to the release of air pollutants (SO<sub>2</sub> and NO<sub>x</sub>).
3. To prepare questionnaires that is to be sent to various power generating plants in Malaysia.
4. To collect data from various sources in the internet on the existing regulation available in Japan to control air pollution.
5. To collect data and information from various power plants in Japan on their role in controlling air pollution.
6. To compile and compare all the data and information collected in Japan and Malaysia and to develop a database on the information obtained.
7. To suggest various regulations that can be implemented by the government of Malaysia to further enhance its role in environment air pollution control. New regulations will also be suggested on how the community can play a far more important role in controlling atmospheric pollution.
8. To suggest a suitable yet cost effective technology that can be used by the various industries in Malaysia based on the technologies available in Japan for air pollution control.
9. Report writing.

## **4.2 Preparation of Questionnaire**

The questionnaires were prepared based on the “ Toolkit for Identification of Dioxin and Furan Releases” developed by United Nations Environment Programme (UNEP) Chemicals. However, some modifications were done in order to obtain the relevant data required in this project.

## 5.0 RESULTS

The results presented in this study were based on the feedback received from the questionnaires sent out to the various power generation companies in Malaysia and our visits to the Department of Environment Malaysia and to selected power plants in Malaysia. On the other hand, the data on Japan were obtained from various sources in the Internet, which includes the annual report from various companies.

### 5.1 Replied questionnaires

A total of 15 questionnaires were sent out to the power generation companies in Malaysia. Out of this, 11 companies responded and the completed questionnaires are given in Appendix 1. Table 1 shows the percentage of the questionnaires based on the number sent out and received.

Table 1: Response of the questionnaires in percentage

Category	Number of companies		
	Sent out	Replied	Replied (%)
Thermal Power Plant	15	11	73.3

#### 5.1.1 SO<sub>2</sub> emission & desulfurization technology

One of the main pollutants released from power plants is sulfur dioxide (SO<sub>2</sub>). Table 2 shows the various sources of SO<sub>2</sub> emissions to the environment by human activities (National Atmospheric Emissions Inventory, 1999). The largest contribution to SO<sub>2</sub> emission is from power plants which account for 65% of the total SO<sub>2</sub> emitted in the year 2000.

Table 2: Source of sulfur dioxide (SO<sub>2</sub>)

Source	Percentage (%)
Power plants	65
Petroleum refining plants	8
Iron & steel industries	4
Other industrial plants	19
Vehicle (transportation)	4

SO<sub>2</sub> is formed when sulfur present in fossil fuels such as coal and oil reacts with air during the combustion process to generate steam/energy in the boiler, as shown in Equation (1).



All kind of fuel contains a certain percentage of sulfur in it. Among all types of fuel, oil and coal have the highest content of sulfur, which amount to 0.1 to 0.5% and 0.5 to 4.0% respectively.

Generally, it was found that the emission of SO<sub>2</sub> from power plants in Malaysia is well under control. Among the 11 power plants surveyed, it was found that Perai Power Plant released the highest SO<sub>2</sub> emission at a value of 172.9 mg/m<sup>3</sup>. Another 7 power plants recorded less than 100 mg/m<sup>3</sup> emission. On the other hand, Stensen Janaelektrik Serdang, Lumut Power Plant YTL Power Station and Stensen Janaelektrik Jambatan Connaught recorded negligible emission of SO<sub>2</sub>.

The low emission of SO<sub>2</sub> from power plants in Malaysia is most probably because most of the power plants use natural gas (which have very low/negligible content of sulfur) as the source of fuel. Apart from that, even for power plants that used coal as a source of fuel like Lumut Power Plant, high rank coal which has a very low content of sulfur is being utilized. The low content of sulfur in coal significantly reduces the amount of SO<sub>2</sub> released from coal-fired power plants. The low emissions of SO<sub>2</sub> from the power plants in



Malaysia therefore diminish the need to install flue gas desulfurization units in all the power plants in Malaysia.

### 5.1.2 NO<sub>x</sub> emission & denitrification facilities

Apart from sulfur dioxide (SO<sub>2</sub>) emission, another main pollutant released from power plants is oxides of nitrogen (NO<sub>x</sub>). NO<sub>x</sub> is formed when nitrogen (N<sub>2</sub>) and oxygen (O<sub>2</sub>) present in the air reacts during the combustion process as shown in Equations (2) & (3).



Generally, it was found that the emission of NO<sub>x</sub> from most of the power plants in Malaysia are within acceptable values due to the use of denitrification facilities in the plants such as low level oxygen combustion, two stage combustion, premix low NO<sub>x</sub> burners, gas turbines-water injection and dry low NO<sub>x</sub> burner.

Sarawak Electricity Supply, which does not use any denitrification technology, was found to emit the highest amount of NO<sub>x</sub> in its three power generation plants in Sg. Biawak, Bintulu and Miri. The amount of NO<sub>x</sub> emitted range from 271.89 to 995.3 mg/m<sup>3</sup>. On the other hand, Lumut Power Plant which uses premix low NO<sub>x</sub> burners to reduce/control the emission of NO<sub>x</sub>, emits a considerably low amount of NO<sub>x</sub> (57.55 mg/m<sup>3</sup>). Contrarily, Stesen Janaelektrik Serdang which do not use any denitrification technology showed that the emission of NO<sub>x</sub> can also be control/reduce up to a minimal value of 15.09 mg/m<sup>3</sup> by reducing the amount of excess air for the combustion process. This was done by adjusting the air speed ratio for the combustion process. Thus, it can be concluded that the use of denitrification facilities is not the only method to guaranty a low emission of NO<sub>x</sub> in the flue gas produced from the power plant. Another effective way would be to control/reduce the amount of excess air as shown by the data obtained from Stesen Janaelektrik Serdang.

### **5.1.3 Particulate matters (PM) & dust and soot removal facilities**

Apart from sulfur dioxide (SO<sub>2</sub>) and oxides of nitrogen (NO<sub>x</sub>), power plants also releases another pollutant which is particulate matters. 81.8% of the power plants in Malaysia use electrostatic precipitator as a dust and soot removal facilities. Thus, the emission of particulate matters is generally quite low for all the power plants in Malaysia. The highest amount of particulate matters emission is 37.95 mg/m<sup>3</sup>, which was recorded by Perai Power Plant. On the other hand, no emission of particulate matters was recorded by Lumut Power Plant, Connaught Bridge Power Plant, Tunku Jaafar Power Station and Genting Sanyen Power Plant.

### **5.1.4 Frequency of monitoring**

Out of the 11 power plants surveyed, 54.5% of them have a 24 hours continuous monitoring system to monitor the air pollution emission. The high percentage of power plants using 24 hours continuous monitoring system indicates that the awareness of monitoring air pollutant emission is very high among the Malaysian power plant authorities. This factor thus puts Malaysia on par with other developed country on monitoring of air pollutant release from power plants. For the remaining power plants, although they have monitoring equipment, but they did not specify the frequency of the monitoring process. The various techniques used by the industries for the monitoring process are portable flue gas analyzer-electrochemical sensor, non-dispersive infra red technology and single beam bi frequency method.

### **5.1.5 Problems in air pollution control**

Generally, most of the power plants (72.7 % of the power plants surveyed) do not face any problem in air pollution control. While the other 27.3% listed either breakdown of air pollution control equipment or the unavailability of air pollution control equipment as the problem encountered.

### **5.1.6 Efforts in reducing air pollution**

More than 50% of the power plants in Malaysia plays an active role in reducing the emissions of air pollutants. This again shows that the environmental awareness among the power plant authorities is relatively quite high although this can be further improve.

## **5.2 Environment policy**

Based on the data obtained from the website of the Ministry of Science, Technology and Environment, Malaysia and the Ministry of Environment Japan, (Appendix 2), we could conclude that the main differences between the Environment policy in Malaysia and Japan are:

- In Malaysia, the environment policy is basically just to maintain a clean and healthy environment while in Japan, their environment policy goes beyond just maintaining a clean and healthy environment. Their policy includes ways to improve their environment in order to have a better environmental condition to live in.
- In Malaysia, the environmental awareness programs are organized by the Department of Environment in all the individual states while in Japan, power plant authorities plays a very important role in promoting environmental awareness program.
- In Malaysia, information about environmental activities and status can only be found from limited sources. Information on the status of the environment is only publicize to the community (published in daily newspapers) when the status of the environment is hazardous to the human population. However in Japan, information about environmental activities and status are announce to the public frequently using various media so that continuous improvement on the environment can be achieved.

Based from the data obtained from the Environmental Quality Act 1974 (Laws of Malaysia, Appendix 3), the website of the Ministry of Environment Japan on Laws and Regulation (Appendix 4) and Regulatory Measures against Air Pollutants Emitted from Factories and Business Sites and the Outline of Regulation (Japan, Appendix 5) there are a few differences on Malaysian and Japanese Environmental Laws. These are:

- Malaysia did not have specific law or regulation for the release of air pollutants from combustion system such as power plants.
- There are gazette in Japan laws the responsibility of the state, local government and citizens in making efforts to control emission and discharge of hazardous air pollutant associated with their daily lives, but in Malaysia only Government and Department of Environment is fully responsible.
- In Japan, Governor of every prefecture (district) is responsible to monitor and survey the level of air pollutant and publish it to the public. In Malaysia the data was private and confidential and only can be access with permission.
- In Japan each prefecture (district) establish it's own emission standard. In Malaysia we are always dependent on the national emission standard.

### **5.3 Community participation**

Based on the information obtained from the Ministry of Science, Technology and Environment, Malaysia, Department of Environment in every state in Malaysia, (Appendix 6), annual report of Department of Environment Malaysia, annual report from various power plants in Japan and various power plants' website in Japan (Appendix 7), the various environmental awareness program held in Malaysia and Japan are:

#### **5.3.1 Various environmental awareness program in Malaysia**

- The activities carried out by Department of Environment, Selangor are Environmental Exhibition, Seminars and Workshop, Talks and Dialogue,

Environmental Promotion by electronic and printed media, Colloquium session, DOE Open Day, Published Printed Materials, Environmental Award and Environmental Week Celebration.

- The activities carried out by Department of Environment, Perlis are Environmental Talk, Dialogue, Environmental Exhibition, Environmental Awareness Camp and Environmental Week Celebration.
- The activities carried out by Department of Environment, Melaka are Radio Interview, Colloquium, Distribution of Brochures, Notice Board Fitted with Environmental Issues, Environmental Talk, Department Exhibition and Environmental Awareness Camp.
- The activities carried out by Department of Environment Kuala Lumpur are Environmental Awareness Camp and KL Environmental Week Celebration.
- The activities carried out by Department of Environmental Perak are Environmental Talk Competition, Radio Quiz Competition, Talks and Seminars , Dialogue, Planting Trees Campaign, Langkawi Award Night, Drawing Competition, Environmental Management Forum and National Conference on Environmental Management 2002.
- The activities carried out by Department of Environment Pulau Pinang are Environmental Talk, Dialogues and Talk with industries and Seminars on Cleansing on Sungai Juru.

### **5.3.2 Various environmental awareness program in Japan**

- The activities carried out by Chubu Electric power Companies are Techno Fair 2002, 21<sup>st</sup> Chubu Electric Environmental Forum, Planting Festivals, Green Curtain Campaign, Questionnaires Postcard and Established the Eco- life club.
- The activities carried out by Kansai Electric power Companies are Planting Activities, Protecting the Natural Environment, Eco-friendly campaign, Eco-family Campaign, Environmental Month Celebration and Symposium.
- The activities carried out by Tokyo Electric Power Companies are Pair Watching, Environmental Education Workshop, Visit to Power Plants, Community Cleaning

Activities, Flower Planting, TEPCO Communion Tour Concert and TEPCO Seminars.

- The activities carried out by Hokkaido power Plants are Celebrating Environmental Month, Planting Activities and Cleaning Campaign.
- The activities carried out by Kyushu Electric Power Companies are Promoting Campaign, Study Tours, Lecture and Talks, Symposium on Energy and Environment and Planting Trees.
- The activities carried out by Tohoku Electric Power Companies are Tree Planting, Environmental Cleanup, Environmental Awareness Month and Distribution Environmental Action Report.
- Other various activities conducted by the power plant includes conservation of the population of rare animals and plants in Japan.

### **5.3.3 Differences in the role of the community in environmental issues.**

- In Malaysia, all the environmental awareness activities are carried out under the Department of Environment supervision while in Japan, all the environmental awareness activities are supervised by the Ministry of Environment. Japan does not have Department of Environment
- In Malaysia, there is an Environmental Week while in Japan there is Environmental Month, which is in June.
- In Malaysia, various activities on environmental awareness program that involves the public/community are conducted by the Department of Environment, while in Japan, these activities are conducted by various power plant companies.
- In Malaysia, power plants do not release their annual report to the public, while in Japan, members of the public/community can obtained the power plans annual report and it could also be access from the internet (for example TEPCO Environmental Highlight 2003 and 2003 Edition Annual Environment Report by Chubu Electric Power Company).
- Power plant in Malaysia do not allow/encourage the public to visit their plant occasionally, but in Japan it is an honour to have visitors from the public to their

plant (in fiscal years 2001, 141,205 visitors visited the Tokyo Electric Power Company).

- In Malaysia, an environmental award is created as a sign of appreciation to individuals, societies or companies that has contributed to the preservation of the environment. However, in Japan, these awards are normally given to the employees of a power plant company.

#### **5.4 Air pollution control technology**

Based on data obtained from the website of power plants in Malaysia and Japan (Appendix 8), it was found that:

- The Japanese counterpart developed their own air pollution control technology, while in Malaysia, most of the technologies used in air pollution control are bought from other developed countries including Japan.
- Basically, the technologies used to control air pollution in Malaysia are similar to the ones used in Japan.

### **6.0 CONCLUSIONS**

Based on the results from this research project, the following conclusions can be made:

- The Malaysia government put a strong emphasis in environmental issues in order to create a clean and safe environment for its citizen and also the people around the world. Thus, this put Malaysia at par with other developed countries like Japan when it comes to conservation of the environment;
- The types of environmental awareness program held in Malaysia is similar to those in Japan. However, the only difference is that the Malaysian government through the Department of Environmental plays an proactive role in organizing

the various environmental awareness program in Malaysia, while in Japan, these activities are carried out by the power plants authorities;

- Although the existing regulation in Malaysia was found to be sufficient in controlling the emission of air pollutants to the environment, more can be included in the regulation to make it better;
- All the power plants in Malaysia are monitoring the release of pollutants into the environment including more than 50% of the power plants have 24 hour continuous monitoring system;
- Emissions of sulfur dioxide (SO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>) and particulates matters from power plants is not a serious environmental problem in Malaysia due to the low emissions of these pollutants and the utilization of appropriate pollutants control technologies;
- Basically, the technologies used to control air pollution in Malaysia are similar to the ones used in Japan;
- Commitment and participation from the various sector; government, industries and public are crucial in order to ensure that the air quality in Malaysia is conserve for generations to come.

## **7.0 RECOMMENDATIONS**

Malaysia, as a developing country has to keep a good balance between technology development and at the same time to conserve the environment. Although the existing regulation in Malaysia was found to be sufficient in controlling the emission of pollutants to the environment, more could be included in the regulations to further improve the quality of air in Malaysia. The following are the recommendations:

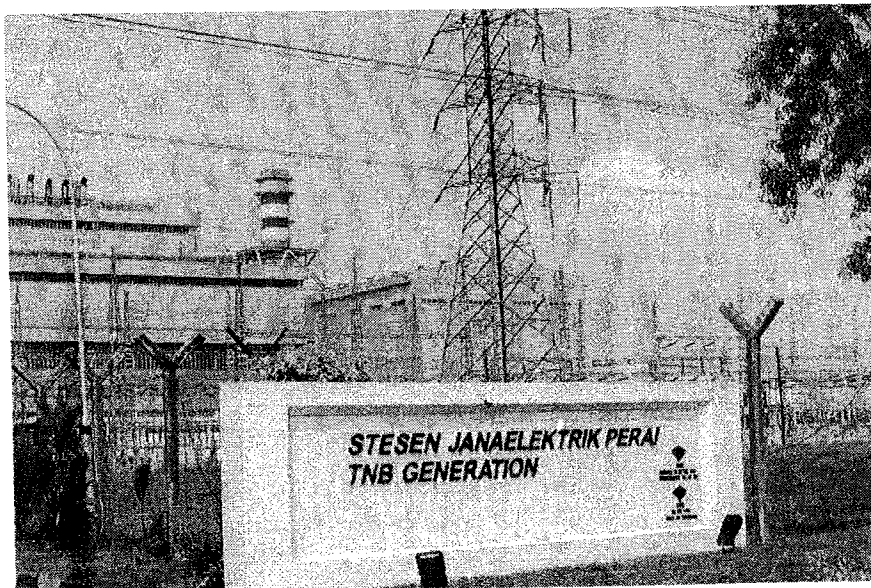
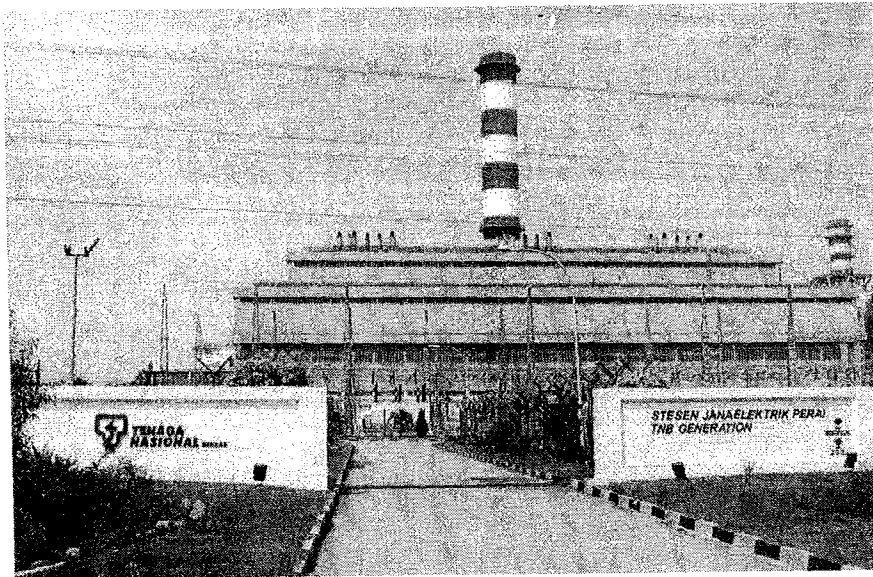
- The regulations in Malaysia should specifically state the maximum emission of each pollutants permitted to be released to the environment by power plants.
- The Ministry of Environment should promote more research and development in designing new technologies in controlling air pollution.

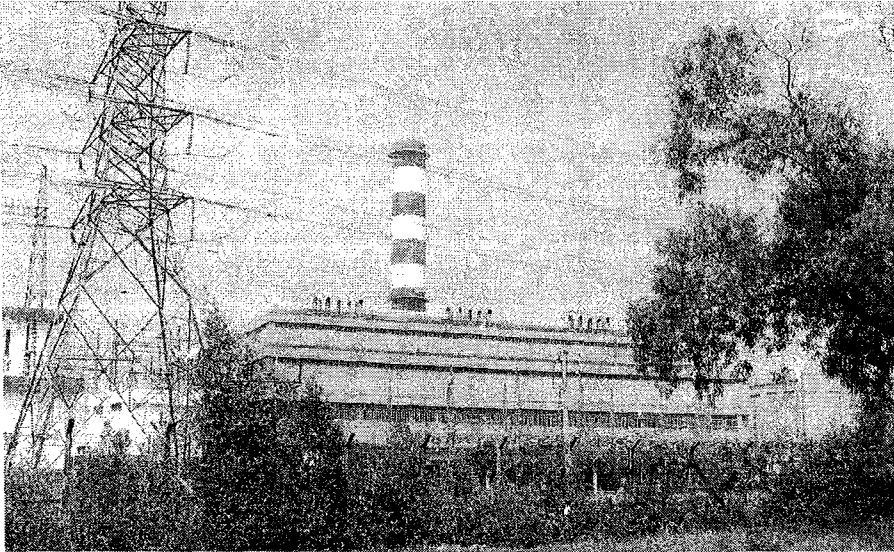


- The Department of Environment in each state should have a continuous information system to inform the public on the environmental condition. This is in order to ensure that the public can take the immediate action to make sure that their safety and environment are preserved.
- The Department of Environment in each state should encourage more public community to support and participate in the activity they organized. The public should have ample knowledge on how to protect their environment and the action to be taken when the environment is polluted.
- The power plants should have a website that can be access by the public so that they can know what activities are currently being held and status of pollutants being released by the respective power plants.
- The power plants should come out with an annual report that includes the company environment policy, the organization of the company, environmental awareness program organized by the companies and the pollutants emission database by the respective power plants.
- The power plants should encourage more members of the public to visit their power generation facilities.
- The public has to actively participate in all the environmental awareness program organized by the Department of Environment.
- The public should make a proactive effort in reporting any activities that may pollute the environment to the relevant authorities.

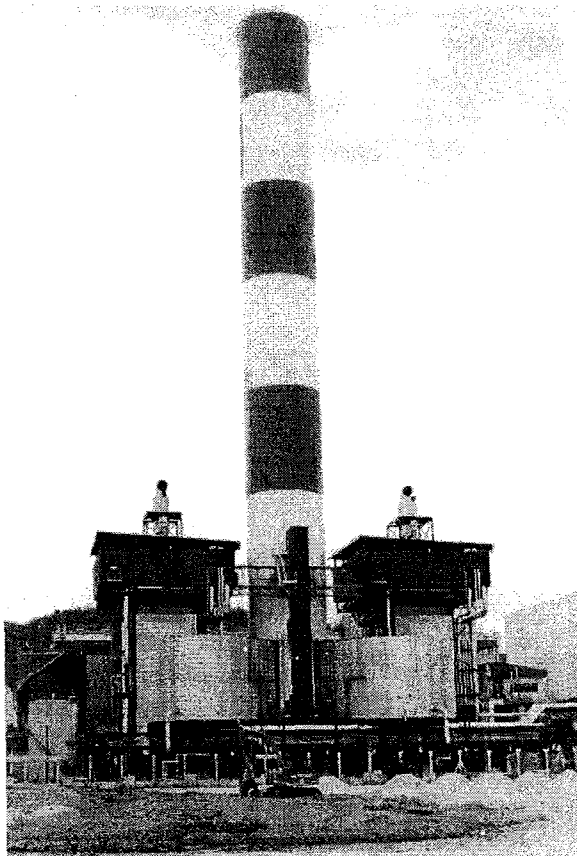
## 8.0 PHOTOGRAPHS OF RESEARCH ACTIVITIES

### 8.1 Visit to Perai Power Plant





## 8.2 Visit to Gelugor Power Plant





8.3 Various activities organized by the Department of Environment, Malaysia



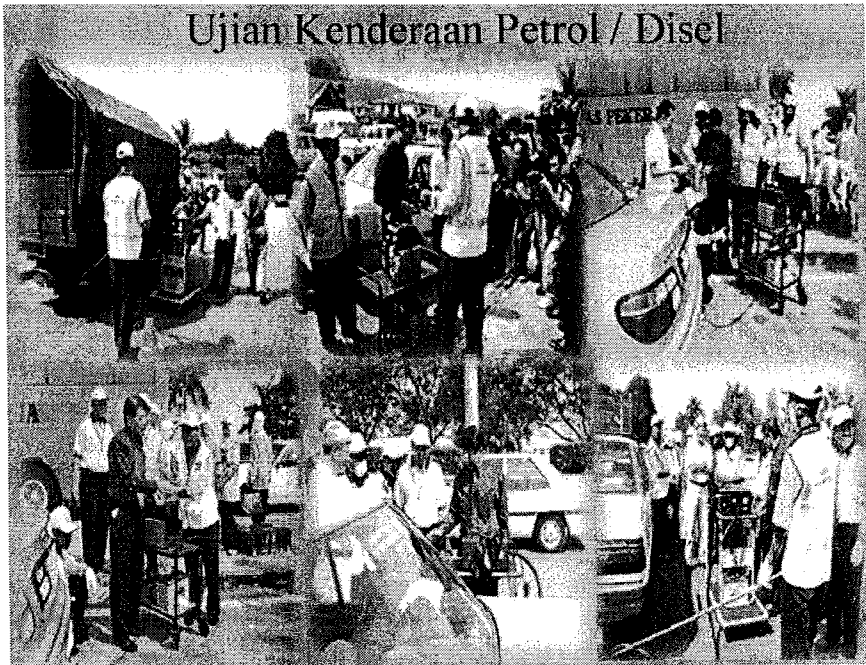
Coloring Contest



Environment Exhibition



Launching of Environmental Week



Inspection of vehicles exhaust

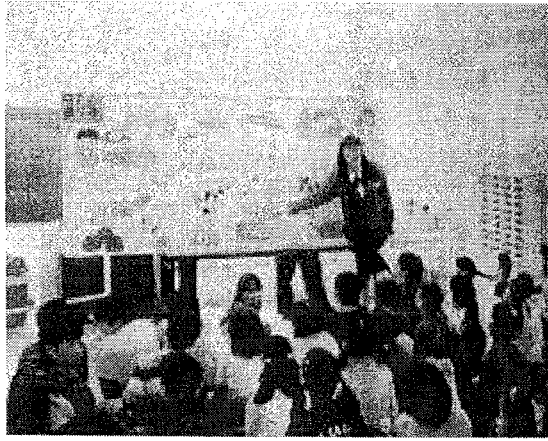
### 8.3 Various activities organized by the various power plants in Japan



Environmental education workshop for students by Sodegaura Thermal Power Station



Environmental education workshop for teachers by Sodegaura Thermal Power Station



Environmental education workshop for elementary students



Community cleaning organized by Tokyo Electric Power Company



Students tour to Okuyahagi Hydroelectric Power Station



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