

Table 9.4.2 Preparation and Implementation Schedule of Control Measures

Control Measures		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
(1) Common to Stationary & Mobile Sources	1-A. Monitoring of Hydrocarbon Concentration in Ambient Air														
	1-B. Reduction of Hydrocarbon Emissions	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	1-C. Reduction of Particulate Matter in Ambient Air	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	1-D. Strengthening of Ambient Air Monitoring System	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
(2) Stationary Sources	2-A. Preparation of Stationary Source Inventory														
	2-B. Enforcement of Emission Standards Decree	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	2-C. Total Emission Reduction Plan														
	2-D. Emission Management System	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	2-E. Combustion Control System	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	2-F. Fuel Conversion	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	2-G. Direct Stack Gas Control														
(3) Mobile Sources	3-A. Preparation of Mobile Source Inventory in Jabotabek														
	3-B. Introduction of New Regulation for Vehicle Emission Gas														
	3-C. Strengthening of Vehicle Inspection Program														
	3-D. Promotion of Unleaded Gasoline Usage	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
	3-E. Acceleration of Turn-over Rate of Aged Vehicles														
	3-F. Promotion of Low-pollution Vehicles														
	3-G. Suppression of Diesel Use in Vehicles														

Note: ----- Preparation  
 ----- Implementation

### Low-Priority Group

- 1-A. Monitoring of Hydrocarbon Concentration in Ambient Air
- 2-E. Combustion Control System
- 3-C. Strengthening of Vehicle Inspection Program
- 3-D. Promotion of Unleaded Gasoline Usage
- 3-F. Promotion of Low-pollution Vehicles

### **9.4.2 Strategic Plan of Proposed Control Measures**

#### **(1) Common to Stationary and Mobile Sources**

#### **1-A Monitoring of Hydrocarbon Concentration in Ambient Air**

##### 1-A.1 Background

Three hour average concentration of total hydrocarbon in ambient air monitored during the Study at all the automated continuous monitoring stations exceeded the current national standard. This is the first indication of hydrocarbon pollution in Jabotabek based on scientific certified data.

The national standard value is  $160 \mu\text{m}^3$  (or 240 ppb as methane) of total hydrocarbons in average of three hours. Hydrocarbons are separated into methane and non-methane (NMHC) in the air pollution field. The Indonesian standard value of total hydrocarbons is in the same order with the Japanese guideline value of NMHC (200 to 310 ppb).

Methane is said to be one of substances to warm up the global temperature. NMHC together with NOx under the sunlight produce photochemical compounds known as oxidants or ozone. Annual average data of oxidant at Pulogadung exceeded the current DKI Jakarta standard ( $30 \mu\text{m}^3$  or 15 ppb as O<sub>3</sub>). At EMC monitoring station, almost 3% in numbers of one hour average ozone monitored data in one year exceeded the national standard. Other stations showed only 0.1 to 0.3% of excess in numbers.

##### 1-A.2 Purpose

The purpose of this project is to find the trends of hydrocarbons concentrations in ambient air together with ozone and NOx using automated continuous monitoring equipment existed in Jabotabek. At least three years monitoring and accumulation of

data are needed to find the trends. Will the concentrations be constant at the current level, increasing, or decreasing?

#### 1-A. 3 Consequences

- ① Institutional Benefit - BAPEDAL will obtain indication to make policy for control of hydrocarbons and photochemical reactants.

a) Methane increasing: Major sources of methane are a) emissions from the ground or water bed generated by natural fermentation of organic substances such as garbage, manure, deposit of leaves, etc., b) leakage from natural gas tanks and CNG vehicles, c) belch and fart of animals, d) leakage from mining of fossil fuels, etc.

b) NMHC increasing: Major sources of NMHC are a) emissions from automobiles, especially from two stroke motor cycles and diesel engines, b) leakage from carburetors, and LPG and gasoline tanks of vehicles, gas stations, distributors, etc., c) evaporation from fresh painting, and production of paint and other chemicals, d) illegal garbage incineration (usually combustion at low temperature), e) leakage from mining of fossil fuels, etc.

#### 1-A. 4 Competent Authority

BAPEDAL is in charge of data compilation for further decision. BAPEDAL should receive related data from EMC and KPPL monthly. When additional monitoring stations are added in other Kabupatens in Jabotabek, those Kabupatens are to report monthly the data to BAPEDAL. EMC, KPPL, and BLH of each Kabupaten (after stations are installed) have to operate and maintain the monitoring stations under custody by its own budget.

#### 1-A. 5 Legal and Institutional Arrangement

It is necessary to reinforce staff in duty in L-BLH, and to enact "Air Pollution Control Law".

#### 1-A. 6 Tasks

- ① EMC and KPPL shall keep operation and maintenance of ambient air monitoring stations and present data to BAPEDAL monthly on hydrocarbons (T-HC, NMHC), NO<sub>x</sub>, and O<sub>3</sub>
- ② BAPEDAL shall compile and analyze data, and decide for further actions, such as inventory study, promulgation of emission standards, etc. For the time being, BAPEDAL shall try to reduce HC emissions from possible measures described in the section followed in this Chapter.

#### 1-A. 7 Time Schedule

Task	1997		1998		1999		2000		2001		2002~	
①												
②												

#### 1-A. 8 Resources

For EMC and KPPL, the work is the routine and required no additional personnel nor equipment. BAPEDAL shall assign one engineer for the Task ②. One fourth of work load in a month is enough.

#### BAPEDAL

Wage:	Engineer	1	× Rp. 300,000 × 12 × 1/4 =	Rp.	900,000
	Clerk		1/2 of the above		450,000
Office expenses:	30 % of the wages				<u>405,000</u>
Total					Rp. 1,755,000

### **1-B Reduction of Hydrocarbon Emissions**

#### 1-B. 1 Background

All the data of total hydrocarbon concentration in ambient air monitored during the Study exceeded the national standard. This is the first indication of hydrocarbon pollution in Jabotabek. The proposed national standard value is 160 micrograms/m<sup>3</sup> (or 240 ppb as methane) of total hydrocarbons in average of three hours.

Hydrocarbons are separated into methane and non-methane (NMHC) in the air pollution field. The Indonesian standard value of total hydrocarbons is in the same order with the Japanese guideline value of NMHC (200 to 310 ppb).

Methane is said to be one of the substances to warm up temperature of the globe. NMHC together with NOx under the sunlight produce photochemical compounds known as oxidants or ozone. Annual average data of oxidant at Pulogadung exceeded the current DKI Jakarta standard (30 micrograms/m<sup>3</sup> or 15 ppb as O<sub>3</sub>). At EMC monitoring station, almost 3% in numbers of one hour average value of ozone exceeded the proposed national standard. Other stations showed only 0.1 to 0.3% of excess in numbers.

There are many supposed sources of hydrocarbon emissions in Jabotabek. However, it is premature to predict contributions of the sources to the airborne hydrocarbons and plan control measures against them.

Hydrocarbon emissions from vehicles are regulated by the standard at idling stages (Ref. 104). The JICA Team found Reid vapor pressures of various gasolines were reasonably lower than those of non-tropical countries.

#### 1-B. 2 Purpose

The purpose of this project is to reduce hydrocarbon emissions into ambient air as much as possible by awareness or attention of people.

- ① to enforce prohibition of throwing away of garbage, manure, or agricultural waste into river or on the ground,
- ② to regulate illegal garbage incineration by imposing severe penalty,
- ③ to give better services of garbage collection
- ④ to stop leakage from tanks by careful maintenance,
- ⑤ to enforce emission standard of vehicles (Ref. 104),
- ⑥ to control emissions from two stroke motor cycles by introducing four strokes, the new model less emission two strokes, or catalytic converters.
- ⑦ to install carbon canisters to absorb evaporated HC from carburetors and gasoline tanks.

### 1-B. 3 Consequences

- ① Environmental Benefit - It is impossible to estimate a quantity of reduced amounts at this stage, because of uncertainty of source contributions to air borne hydrocarbons. The above purposes ⑤ and ⑥ are already on-going under the Blue Sky Program in cooperation with DKI, and HUB, GAIKINDO and PASMI.
- ② Institutional Benefit - BAPEDAL can strengthen its organization by involving in various pollution control issues.

### 1-B. 4 Competent Authority

BAPEDAL should spearhead the project by presenting idea for the reduction to each authority in charge, national or local. Authorities in charge are as follows:

Local BLH garbage and organic waste:

- a) land fill and discharge to river, illegal incineration, or open burning
- b) improvement of garbage collection system

HUB, GAIKINDO, PASMI and DLLAJK in relation with HC emissions from mobile sources

BAPEDAL drafting emission standard of two stroke engine vehicles

### 1-B. 5 Legal and Institutional Arrangement

It is necessary to reinforce staff in duty in L-BLH, and to enact " Air Pollution Control Law".

### 1-B. 6 Tasks

- ① BAPEDAL shall implement PR using newspapers, TV, billboards, pamphlets, and stickers for stopping illegal dumping together with HUB, and local BLHs. The scenarios of the PR for garbage dumping are a comparison of illegal dumping and cleaner sites - stress on bubbling of methane from dirty pond, governmental regular services of garbage collection with smiles of people, etc.
- ② BAPEDAL shall prepare for the legal and institutional arrangement for its involvement

- ③ Local BLH shall purchase two garbage transportation vehicles each year for newly addition and for replacement.
- ④ BAPEDAL shall ask for cooperation of owners and operators of HC tanks in order not to emit or spill too much HC into ambient from vents, drains, pipings, or their joints of the tanks. PR for good maintenance, installation of chillers or charcoal absorbers, and recycle use of drains and spills is the first thing to carry out by BAPEDAL.
- ⑤ Under the Blue Sky Program, BAPEDAL is planning to introduce ECE-83 emission regulation for newly produced vehicles. In the meantime before the introduction, BAPEDAL shall ask for cooperation of GAIKINDO and PASMI to install carbon canisters in each newly produced vehicles. The JICA Team did not check every vehicle whether it has designed may be possible for its equipment without any change of vehicle configuration.

#### 1-B. 7 Time Schedule

Task	1997	1998	1999	2000	2001	2002~
①						
②						
③						
④						
⑤						
Implementation						

#### 1-B. 8 Resources

PR costs for the HC emission awareness and possible precautions, shared be BAPEDAL, HUB, and four BLHs:

Advertisement on News Papers:

Half page (monochrome) for 2 papers in 6 occasions in a year

$$40,000,000 \times 12 = \text{Rp.480,000,000}$$

TV telop, daily for two months in a year on 2 channels

$$1,500,000 \times 60 \times 2 = \text{Rp.180,000,000}$$

Production Fee

$$\text{Rp.200,000,000}$$

Pamphlets, A4 color, 4 pages, 100,000 copies

Original Plate  $320,000 \times 4 = \text{Rp.1,280,000}$

Printing  $500 \times 100,000 \times 4 = \text{Rp.200,000,000}$  **Rp.201,280,000**

Total **Rp.1,061,280,000**

#### BAPEDAL

Wage Officer and clerk  $1 \times 450,000 \times 28 \times 1/3 = \text{Rp.4,200,000}$

Office expenses 30% of the above **Rp.1,260,000**

Subtotal **Rp.5,460,000**

	1997	1998	1999	total
Wage	780,000	2,340,000	2,340,000	Rp.5,460,000
PR		176,880,000		176,880,000
Total	780,000	179,220,000	2,340,000	182,340,000

#### HUB

Wage: Officer and clerk  $1 \times 450,000 \times 28 \times 1/5 = \text{Rp.2,520,000}$

Office expenses: 30% of the above **Rp.756,000**

Subtotal **Rp.3,276,000**

	1997	1998	1999	total
Wage	468,000	1,404,000	1,404,000	Rp. 3,276,000
PR		176,880,000		176,880,000
Total	780,000	179,220,000	2,340,000	180,156,000

#### Each BLH of four provinces

Wage: one officer and clerks for this project

Assume - the same as BAPEDAL

Wage: three officers and clerks for annual routine work

$10 \times 350,000 \times 12 = \text{Rp.42,000,000}$

Office expenses: 30% of the above **Rp.12,600,000**

Subtotal **Rp.54,600,000**

Investment for two garbage cars in each year

$2 \times \text{Rp.300,000,000} = \text{Rp.600,000,000}$



	1997/9~	1998	1999	total until 1999
Wage, project	780,000	2,340,000	2,340,000	5,460,000
Wage, routine	18,200,000	54,600,000	54,600,000	127,400,000
Garbage Cars	—	600,000,000	600,000,000	1,200,000,000
PR	—	176,880,000	—	176,880,000
Total	18,980,000	833,820,000	656,940,000	Rp.1,509,740,000

Note: From 2000, the same expense with 1999's shall be budgeted in each administration.

## 1-C Reduction of Particulate Matter in Ambient Air

### 1-C. 1 Background

TSP and SPM monitored values during the Study exceeded sometimes the current national and DKI standards. Particulate matter (PM) (see Supporting Report: Appendix 2.3 for definition) consists of the primary PM as emitted from sources, the secondary PM as generated in the air from gaseous and/or PM by chemical reaction or physical phenomena, and resuspended PM by winds or vehicle movements. Examples of the secondary PM are sulfuric fume produced by oxidation of SO<sub>2</sub>, inorganic sulfate particulates produced by the reaction of metals and SO<sub>x</sub>, and organic solid particulates produced by oxidation or agglomeration of gaseous hydrocarbons, etc.

The evaluation of the dispersion simulation model shows low ability for SPM and the model can not be used for the prediction of SPM concentration. Then, the CMB method may be placed as a complementary to the dispersion simulation model.

Meanwhile, the CMB analyses in the Study found that the major contributor was diesel smoke to SPM, and diesel smoke and soil to TSP. PM emission from diesel engines can be eliminated with diesel traps or diesel particulate filter (DPF) equipped at gas exhaust tails. Although the DPF is technically developed, economically it is still premature.

### 1-C. 2 Purpose

The purpose of this project is to reduce PM emissions from dried soils by addressing directly to general people, although the reduction amount is unpredictable. Soil PMs are generated from the following by winds and vehicle movements. Vehicles will grind the soil PM once on the road repeatedly to smaller and smaller in size.

- ① unpaved and dried side walk,

- ② dried construction sites,
- ③ soiled cars and their tires,
- ④ shipment of uncovered waste soils,
- ⑤ un-grassed or un-wet soil of green tree plantation beside roads,
- ⑥ illegal dumping of house dusts on roads,
- ⑦ wetting road surface with dirty sewage, etc.

There are many other possible methods to reduce PM emissions by directly addressing to people. However, those are already under consideration by Blue Sky Program or by this Report, such as a) regulation of illegal open burning (Item 1-B above) will reduce PM emission in addition to HC, b) HC emissions from motor cycles and diesel engines under Blue Sky Program will reduce the secondary PM emissions, and c) SOx reduction from fuel combustion including diesel under the Blue Sky and the Study's additional measures will reduce the secondary PM.

#### 1-C. 3 Consequences

- ① Environmental Benefit - Reduction amounts are unaccountable. However, PM reduction will be visible in public eyes.
- ② Institutional Benefit - BAPEDAL's involvement to the Movement of national Discipline (Gerakan Displin Nasional)
- ③ Social Benefit - People's awareness of pollution mitigation

#### 1-C. 4 Competent Authority

BAPEDAL is in a position to urge BLH to implement plans given in the above 'Purpose'.

#### 1-C. 5 Legal and Institutional Arrangement

No legal arrangement is needed in addition to the existed ones. Institutional arrangement is needed to enforce the existed regulations more strictly, and to reinforce staff in duty in BLH.

### 1-C. 6 Task

- ① BAPEDAL shall negotiate with MOH and local BLHs how to enforce regulations. PR to people, addition of inspectors, and increment of penalty are some of considerations among others for enforcement.
- ② Local BLHs shall implement the results of the discussion immediately by starting one by one from the possible plan. Local BLHs shall pay attention on this matter as routine work.

### 1-C. 7 Time Schedule - on-going

Task	1997	1998	1999	2000	2001	2002~
①						
②						

### 1-C. 8 Resources

PR Costs for the stopping dried soil suspension campaign, shared by 6 organizations involve in 1998:

Advertisement on News Papers:

Half page (monochrome) for 2 papers in 6 occasions in a year

$$40,000,000 \times 12 = \text{Rp. } 480,000,000$$

TV telop, daily for two months in a year on 2 channels:

$$1,500,000 \times 60 \times 2 = \text{Rp. } 180,000,000$$

Production Fee:

Rp. 200,000,000

Pamphlets, A4 color, 4 pages, 100,000 copies:

$$\text{Original Plate } 320,000 \times 4 = \text{Rp. } 1,280,000$$

$$\text{Printing } 500 \times 100,000 \times 4 = \text{Rp. } 200,000,000 \quad \text{Rp. } 201,280,000$$

Total

Rp. 1,061,280,000

BAPEDAL - one officer for 1/3 of his load for four months in 1997 and 1998:

$$\text{Wage Officer and clerk } 1 \times 450,000 \times 8 \times 1/3 = \text{Rp. } 1,200,000$$

Office expenses

30% of the above

360,000

subtotal

1,560,000

	1997	1998	1999	total
Wage	780,000	780,000	--	1,560,000
PR		176,880,000	--	176,880,000
Total	780,000	177,660,000	--	178,440,000

MOH and each local BLH require Rp. 176,880,000 for the share of PR costs.

## **1-D Strengthening of Ambient Air Monitoring System in Jabotabek**

### **1-D.1 Background**

Ambient air quality is changing always by meteorological conditions, socio-economic activities. The monitoring system has to be able to collect data including those changes for comprehension of long term air quality and for implementation of proper measures to keep environmental air quality clean.

There are six monitoring stations in DKI Jakarta and one at EMC in Tangerang. These stations can not cover the expanding Jabotabek to monitor.

### **1-D.2 Purpose**

The project is to establish a comprehensive monitoring system over Jabotabek, and to centralize information at local BLH office of each Kabupaten and DKI and also in BAPEDAL as the center of Jabotabek air quality control. Data will be telemetered to each center from individual stations in the territory.

### **1-D.3 Consequences**

- ① Environmental Benefit - No direct reduction of pollutants is expected by implementing this project. However, air quality data in Jabotabek will be centralized and used for planning of various countermeasures against air pollution.
- ② Institutional Benefit - monitoring and evaluation in Kabupatens in Jabotabek will be materialized from nothing.
- ③ Environmental Benefit - This project will be an example of other industrialized and polluted regions in Indonesia.

#### 1-D. 4 Competent Authority

BAPEDAL shall invest and install all the necessary monitoring equipment for the project, besides existing equipment in DKI Jakarta. EMC has to train laboratory experts of each Kabupaten how to operate and maintain the equipment. local BLH of each Kabupaten and KPPL of DKI Jakarta are responsible to operate and maintain the equipment by own budget, and send data to BAPEDAL through telemeter system.

#### 1-D. 5 Legal and Institutional Arrangement

It is necessary to reinforce staff in duty in local BLHs, BPPI and L-PU, and to enact " Air Pollution Control Law".

#### 1-D. 6 Tasks

- ① BAPEDAL shall determine sites of monitoring stations. Total 25 stations including existing ones are enough in Jabotabek. Monitoring items are SO<sub>2</sub>, NOx, O<sub>3</sub>, CO, SPM, HC, and surface meteorological conditions.
- ② BAPEDAL shall arrange for necessary legal supports for its relation with local administrations.
- ③ BAPEDAL shall arrange for fund and install monitoring system under contract with vendors. The same type of equipment is recommendable from the easiness of maintenance.
- ④ BAPEDAL shall organize human resources.

KPPL and local BLHs shall prepare for operation and maintenance with a cooperation of EMC. Maintenance is the most important for generation of accurate data.

### 1-D. 7 Time Schedule

Task	1997	1998	1999	2000~
①				
②				
③				
④				
⑤				
Operation				

### 1-D. 8 Resources

Initial investment to purchase monitoring equipment will cost Rp. 17,306,000,000 for BAPEDAL.

Wages, office expenses, maintenance fee, electric cost, etc. in each organizations are as follows. Details are presented in the next Chapter.

	1997	1998	1999	2000	2001~
BAPEDAL	12,080,000	11,911,000	34,180,000	—	—
DKI	1,980,000	2,845,000	230,635,000	440,760,000	440,760,000
Bogor	1,570,000	2,285,000	50,165,000	270,880,000	270,880,000
Tangerang	1,570,000	2,285,000	47,058,000	230,845,000	230,845,000
Bekasi	1,570,000	2,285,000	44,300,000	191,510,000	191,510,000

Note: From 2001, each local administration will require the same amount of expenses annually.

### 1-D. 9 Remarks

Location of the monitoring station shall be 30 m apart from a nearest stack and 3 m apart from a building or a tree. Road curb station shall be within 5 to 20 m from the curb.

Maintenance of the monitoring equipment is the most important to generate accurate data. Budgets for human resources and materials, and also for subcontract with a vender agent for heavy maintenance shall be allocated without saving.

Details of the plan are described in Chapter 10.

## **(2) Stationary Sources**

### **2-A Preparation of Stationary Source Inventory**

#### **2-A.1 Background**

Under the Blue Sky Program, BAPEDAL is considering strengthening the emission standards of stationary sources (Ref. 110) by introducing additional kinds of industry to the current ones, and also to implement arbitrary on-the-spot stack gas monitoring. BAPEDAL needs the whole picture of stationary sources in Jabotabek.

In the Study, 91 factories within more than 2,000 factories in Jabotabek were investigated for their emissions by questionnaires, interviews, and emission measurement. Therefore, necessary technologies and know-hows for the inventory preparation are accumulated in BAPEDAL and EMC. Also KPPL of DKI Jakarta has conducted similar activities.

#### **2-A.2 Purpose**

The purpose of this project is to prepare a whole picture of emissions from the stationary sources in Jabotabek. Key items included in the inventory are location, type of processing (example: combustion), type of material processed (example: MFO), flow rate of the material, stack height and diameter, its location, exhaust gas rate and temperature, pollutant concentrations in the exhaust gas, type of exhaust gas cleaning equipment installed, operation pattern (example: day time only or 24 hours continuously).

#### **2-A.3 Consequences**

- ① No direct emission reduction by accomplishment of this project,
- ② Institutional Benefit - BAPEDAL will obtain tremendous institutional power by having the inventory, such as;
  - a) Comprehension of total air pollutant emissions
  - b) Planning of emergency countermeasures
  - c) Issuance of various reports
  - d) Strengthening of relation between BAPEDAL and local BLHs
  - e) Development of EIA management process
  - f) Development of partnership with industrial communities
  - g) Centralization of pollutant emission information

#### 2-A.4 Competent Authority

BAPEDAL has to spearhead the project by organizing project team. local BLH or equivalent of DKI Jakarta and Kabupatens of Bogor, Tangerang, and Bekasi collect information and data in each region and submit them to BAPEDAL for compilation and evaluation.

#### 2-A.5 Legal and Institutional Arrangement

It is necessary to reinforce staff in duty in local BLHs, and to enact " Air Pollution Control Law".

#### 2-A.6 Tasks

- ① BAPEDAL shall organize a project team. The project team shall review previous studies
- ② Project team member of each Kabupaten shall identify stationary sources in each territory.
- ③ BAPEDAL shall arrange for the necessary legal support to the inventory study.
- ④ Project team member of each Kabupaten shall survey with questionnaires in each territory.
- ⑤ BAPEDAL shall train technicians for emission measurement. At least two technicians of each Kabupaten are required.
- ⑥ BAPEDAL shall purchase necessary analytical equipment and hand-over them to each local BLH. EMC of BAPEDAL supports the project by standing as stack gas measurement experts.
- ⑦ BAPEDALDA is responsible to measure emissions at sites and maintain the equipment
- ⑧ BAPEDAL in total of Jabotabek and each Kabupaten in each territory shall compile respective stationary source inventory



## 2-A. 7 Time Schedule

Task	1998			1999			2000			2001			~
①													
②													
③													
④													
⑤													
⑥													
⑦													
⑧													

## 2-A. 8 Resources

### Investment

The equipment investment is Rp. 1,425,000,000 for BAPEDAL payable in 1999. The equipment includes analyzers for SO<sub>x</sub>, NO<sub>x</sub>, PM, H<sub>2</sub>O, Gas Velocity, CO, O<sub>2</sub>, and transportation car, and also laboratory equipment. Total 5 sets will be required for each local district and one for EMC for training.

### Personnel Requirement

BAPEDAL needs two core officers in the project. Technicians are required 5 from DKI, 3 from Tangerang, and 2 each from Bogor and Bekasi. Annual expenses are as follows:

	1997	1998	1999	2000	2001
BAPEDAL	—	18,720,000	18,720,000	18,720,000	6,240,000
EMC	—	—	—	5,120,000	—
DKI	—	35,100,000	10,530,000	16,770,000	16,770,000
Bogor	—	14,040,000	4,212,000	10,452,000	10,452,000
Tangerang	—	21,060,000	6,318,000	12,558,000	12,558,000
Bekasi	—	14,040,000	4,212,000	10,452,000	10,452,000

Note: from 2001, each organization will require the same amount of expenses annually.

## 2-A. 9 Remarks

At least one of officers in charge at BAPEDAL and each Kabupaten has to be an engineer who can understand a processing of a factory and can evaluate a magnitude of emission rate based on the processing capacity. The engineer has to identify the reasons why the measured or reported data is different from the similar data collected in the past or published one such as by US-EPA (Ref. 208).

The project shall be continued forever, by renewing data constantly upon receiving reports from factories when newly opened, revamped, remodeled, capacity changed, or else.

Measurement equipment shall always be well maintained and calibrated. The equipment may need to be replaced with new ones within five to seven years depending on the use-frequency and maintenance rightness. Each Kabupaten is responsible to the equipment for maintenance, repair, calibration, and renewal.

This plan will be elaborated in detail Chapter 10.

## **2-B Enforcement of Emission Standard Decree**

### 2-B. 1 Background

BAPEDAL issued the State Minister Decree on stationary source emission standards (Ref. 110) which covered four industries (Iron and Steel, Pulp and Paper, Coal fired Steam Power Plants, and Cement), and remaining industries as all other industries in combination. There is a clause for the four industries in order to fulfill the following: to install and operate monitoring instruments to measure the emissions from their stacks, to install and operate air quality monitors, to carry out daily recording of emissions, and to submit reports of monitoring results to local governor of the first level and to BAPEDAL.

BAPEDAL has entered an agreement with 43 factories in Java for the on-the-spot emission measurement. This approach may be suitable in Indonesia. However, without enforcement clause in itself, the effort will become only effective to show how to measure and how BAPEDAL is conscious on the air pollution.

### 2-B. 2 Purpose

To include more specific industries in the fulfillment clause and to enforce the decree including penalty and fine

### 2-B. 3 Consequences

- ① Environmental Benefit - No emission reduction by implementing this plan,
- ② Institutional Benefit - BAPEDAL will become easier to enforce the Emission Standard Decree. Accordingly, BAPEDAL will obtain the same tremendous institutional power.

### 2-B. 4 Competent Authority

BAPEDAL spearheads the project. PU, PERIND, and TAM are to be consulted.

### 2-B. 5 Legal and Institutional Arrangement

It is necessary to reinforce staff in duty in L-BLH, and to enact " Air Pollution Control Law".

### 2-B. 6 Tasks

- ① BAPEDAL originates inclusion of specific industries in the Decree and plan for enforcement. This task is on-going in BAPEDAL, and will be continued until the major industries such as electric power, food and beverage, chemical and pharmaceutical, textile, car fabrication are covered. It will be within 2001. BAPEDAL has to negotiate with each association of the industries about the enforcement and materialize one by one.
- ② BAPEDAL also needs to obtain agreement from the Ministries in charge of the industries; such as PU, PERIND, and TAM.
- ③ BAPEDAL shall prepare and publish required legal documents.

### 2-B. 7 Time Schedule

Task	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
①														
②														
③														
Implementation of Plan														

## 2-B. 8 Resources

BAPEDAL's two officers will need to work about 25% of their work loads. After implemented in 2002, their work load will not be changed. However, checking of emission gas shall be continued by local administration offices in Kabupatens. Stationary inventory group can work for the same purpose. Following table is calculated monthly wage to be Rp. 300,000, clerk support to be 1/2 of the officers wage, and office expenses to be 30% of the total wage.

Rp.					
1997/9~	1998	1999	2000	2001	2002
1,170,000	35,100,000	35,100,100	35,100,000	35,100,000	140,400,000

## **2-C. Total Emission Reduction Plan**

### 2-C. 1 Background

There may be an area unattainable to the ambient air standards, even if all the surrounded industries have observed the emission standards. The simulation result of this Study showed such area in Tangerang where many small industries grouped in. The total emission reduction plan is an effective tool in the case, as evidenced in Japan.

### 2-C. 2 Purpose

The purpose of this project is to prepare for implementation of the total emission reduction measure when it becomes necessary, probably after 2006.

### 2-C. 3 Consequences

- ① Environmental Benefit - There is no emission reduction from sources by this measure alone. BAPEDAL has to prepare measures how to reduce emissions in addition to the emission standard. Such measures are 'Fuel conversion' and 'Direct Stack gas control' described later.
- ② Institutional Benefit - BAPEDAL can have a practical control measure in an industrial area congested with various kinds and sizes, by having understanding and agreement of the industries, when the plan is ready to implement, and when the emission standard is found to be not possible to keep air quality of an area under the ambient air quality standard (probably after 2006).

#### 2-C. 4 Competent Authority

BAPEDAL shall spearheads this project, and PU, PERIND, DKI, and each Kabupaten in Jabotabek shall be involved.

#### 2-C. 5 Legal and Institutional Arrangement

Following arrangement will be needed to be included in "Air Pollution Control Law" which should be published to support the Act of Basic Provision for Management of Living Environment currently under revision; a) BAPEDAL shall have a decisional position of total emission allowance in an specific area under the Act: - the allowance and the area shall be decided by predicting from the monitored trends an excess of ambient air quality over the standard in the future, b) Local administration shall be given a power to negotiate and reach agreement with industries for the total emission control under the assistance of BAPEDAL.

Besides, it is necessary to reinforce staff in duty in BAPEDAL and local BLHs.

#### 2-C. 6 Tasks

- ① BAPEDAL shall organize and chair a committee to study the plan. The committee members are representatives of PU, PERIND, DKI, and each Kabupaten in Jabotabek.
- ② The committee shall study on Japanese experiences of the total emission control; effectiveness, legal preparation requirements, relations between the central and local governments, negotiation with the industrial sector, etc.,
- ③ Discussion on the plan; the preliminary decision on employment of the plan to be reached within 2001,
- ④ Preparation of legal and institutional requirements

### 2-C. 7 Time Schedule

Task	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
①														
②														
③														
④														
Implementation of Plan														

### 2-C. 8 Resources

No equipment investment is required for this project. As task needs to be started from 2001, wage calculation for BAPEDAL is not carried out.

## **2-D Emission Management System**

### 2-D. 1 Background

The emission management system is to back up the State Ministry Decree of the emission standard (Ref. 110) which obligates the four specific industries to monitor and report emissions. The system is to reduce emissions from factories by the factory owners' and operators' awareness of pollution. It is materialized in Japan and effective for the reduction by the legal duties of the factory side in various aspects of emission control, including measurement and data reporting of emissions, property control of raw materials and fuels, inspection and maintenance of pollution control and monitoring equipment, efforts to reduce emissions routinely and at emergency.

### 2-D. 2 Purpose

The purpose of this project is to prepare for institution of the emission management system, in order to materialize it as soon as possible and before 2002 when the air pollutant emissions from factories are anticipated to become serious.

### 2-D. 3 Consequences

- ① Prediction of emission reduction amounts from sources by this measure is unaccountable. However, when the study is concluded, BAPEDAL is ready to call for cooperation of the industry sector by instructing their legal obligation.
- ② The results of the instituted system can be expected to be immense for BAPEDAL by having periodical emission reports of reliably measured data

from industries, and by being contributed of devoted efforts from industries to reduce emissions.

#### 2-D. 4 Competent Authority

BAPEDAL shall spearhead for the institution of the system. PU, PERIND, DKI, and each Kabupaten in Jabotabek shall be involved.

#### 2-D. 5 Legal and Institutional Arrangement

It is necessary to make arrangement for enactment of "Act of Pollution Control", although there will be no special need to reinforce institutional capacity.

#### 2-D. 6 Tasks

- ① BAPEDAL shall organize and chair a committee to study the system. The committee members are representatives of PU, PERIND, DKI, and each Kabupaten in Jabotabek. Study on Japanese experiences of the emission management system; effectiveness, legal preparation requirements, reaction from the industrial sector, etc.,
- ② Discussion on the system; the preliminary decision on employment of the plan to be reached within 1998,
- ③ Preparation of legal and institutional requirements

#### 2-D. 7 Time Schedule

Task	1997	1998		1999			2000		2001		2002~	
①												
②												
③												
Institute the system												

#### 2-D. 8 Resources

There is no initial investment required for BAPEDAL. The committee has to be held once in a month for 8 months with 10 people from outside. Two BAPEDAL officers have to devote 25% of their work load until 2001 when the system is targeted to be instituted.

**BAPEDAL Expenses**

Rp.

	1997/9~	1998	1999	2000	2001
Wage and overheads	1,170,000	3,510,000	3,510,000	3,510,000	3,510,000
Committee Expenses	400,000	400,000	—	—	—
Total	1,570,000	3,910,000	3,510,000	3,510,000	3,510,000

**2-E Combustion Control System****2-E.1 Background**

Well controlled combustion saves energy consumption and accordingly generates less SO<sub>x</sub> and PM than mal-controlled one. The control is possible by installing sophisticated instrument and/or by well trained combustion engineers. In Jabotabek, there are many industries combusting fuel oils in small or large facilities without having the appropriate control instrument.

BAKOREN (Energy Regulation Agency) is educating 50 people in a 4 day course annually for energy saving, aiming to observe the Nomar 43-1991 (Ref. 195).

**2-E.2 Purpose**

The purpose of this project is to find out possibility of inclusion of emission control lectures and practice in the BAKOREN courses and prepare for instituting the combustion control system in the industries from 2006 when the air pollution from the stationary sources would become serious.

**2-E.3 Consequences**

- ① **Economic Benefit** - The current energy saving policy aims 20% energy reduction in the industry sector by 2000 which is a great benefit for industries economically.
- ② **Environmental Benefit** - 20% of reduction of SO<sub>x</sub> and the primary PM emissions can be expected from the industries burning corresponding fuels.
- ③ **Concentration of NO<sub>x</sub> in stack gases** may be a little higher than the current value because of higher combustion temperature. However, as stack gas rate is less than the current one, the total NO<sub>x</sub> emission amount will not change substantially.



- ④ Institutional Benefit - BAPEDAL can have its connection in each industries through which BAPEDAL can send messages related with pollution issues.

#### 2-E. 4 Competent Authority

BAPEDAL, BAKOREN, and Ministry of Industry and Trade(PERIND)

#### 2-E. 5 Legal and Institutional Arrangement

It is necessary to reinforce staff in duty in BPPI and local BLHs, and to enact "Energy Saving Act".

#### 2-E. 6 Tasks

- ① BAPEDAL shall negotiate with BAKOREN to include topics of air pollution control in its energy save courses - possibly one day lecture and mentioning during the combustion practice
- ② BAPEDAL shall also negotiate with BAKOREN to give incentives (appraisal fee and/or certificate) to the trained engineers
- ③ BAPEDAL shall prepare a text book - the contents of the textbook are a) air pollution in general, b) relation of combustion and air pollution, c) example of stationary source emissions in Jabotabek (use the results of the Study), d) how to control air pollution
- ④ BAKOREN shall continue the training course.
- ⑤ BAPEDAL shall prepare for organization of the trained engineers for mutual communication of the results of their work on pollution control by 2006

#### 2-E. 7 Time Schedule

Task	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
①														
②														
③														
④														
⑤														
Organization of trained engineers														

## 2-E. 8 Resources

This is an addition to the on-going project by BAKOREN. Therefore, initial investment is not calculated. BAPEDAL's personnel requirement is a) one officer for 10% load from 1997 and beyond, one engineer for two months in 1998 for preparation of textbook, dispatching one instructor to the training course in every month for Rp. 20,000 per two days from 1998.

1997/9~	1998	1999	2000~
Rp. 702,000	Rp. 2,112,000	Rp. 942,000	Rp. 942,000

## **2-F. Fuel Conversion**

### 2-F. 1 Background

Fuel conversion is one of measures to back up the total emission reduction plan described before in this Chapter. In DKI, an electric company has converted its fuel to natural gas instead of fuel oil and small industries have also converted to kerosene from higher sulfur oil.

According to the simulation model study, SO<sub>x</sub> concentration will exceed the ambient air quality standard in 2010 in an industrially congested area where considerably high sulfur oil is predominantly used, if no additional countermeasures other than the stationary source emission standard.

Oils concerned as fuels of the stationary sources in Jabotabek are MFO, HSD, and IDO. Sulfur contents are respectively 3.2%, 0.4% and 1.3% according to the PERTAMINA specification (Ref. 142), and also 1.96 - 2.46%, 0.19 - 0.4%, and 0.52 - 0.55% according to the analyses of the Study. The Ministry Decree of the emission standard (Ref. 110) prohibited to burn MFO in Indonesia, because it emits more than the standard value from its sulfur contents, if no further treatment is applied to MFO or stack gas.

The effectiveness of 0.1% sulfur was demonstrated in the Study by the simulation model at the area of the east side of Ci Sadane in south of Tangerang Kotamadya.

#### 2-F. 2 Purpose

The purpose of this study is to prepare for the supply of low sulfur diesel oil in Jabotabek from 2006. More specifically, it is to reduce sulfur contents of HSD from 0.19% to 0.1%, in order to meet future demand in an area designated as the total emission control area.

#### 2-F. 3 Consequences

- ① Environmental Benefit - When the low sulfur HSD is forced to use, SO<sub>x</sub> emission will be reduced to at least one third from the current emission, by accounting the current average sulfur contents.
- ② Environmental Benefit - The low sulfur HSD produced will be applied for mobile source fuel (see section (3) of this chapter).
- ③ Social Demerit - Higher cost is unavoidable for the low sulfur HSD. BAPEDAL needs to consider assistance to consumers in the specific area.

#### 2-F. 4 Competent Authority

BAPEDAL shall spearhead for the plan, and negotiate with PERTAMINA for production and distribution.

#### 2-F. 5 Legal and Institutional Arrangement

It is necessary to reinforce staff in duty in L-BLH, and BPPI, and enact " Air Pollution Control Law".

#### 2-F. 6 Tasks

- ① BAPEDAL shall study on and prepare for the necessary legal and institutional arrangement.
- ② BAPEDAL shall negotiate with PERTAMINA for possibility of low sulfur diesel oil.
- ③ PERTAMINA shall design and construction the required processing plants. The technologies are already established to produce sulfur contents as low as 0.05%.

## 2-F. 7 Time Schedule

Task	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
①														
②														
③														
Production and distribution														

## 2-F. 8 Resources

PERTAMINA's initial investment requirement for construction of 1,000,000 kl/year of low sulfur diesel plant by hydrodesulfurization is about Rp. 136,000,000,000. The capacity is only estimated for Jabotabek requirement in 2010. PERTAMINA has enough time to study an appropriate capacity considering the whole nation.

BAPEDAL's requirement is personnel for task ①, and ②. One officer with 25% load is estimated, namely, Rp. 1,755,000 annually from 1998 to 2003 (Rp. 585,000 for 4 months in 1997) including clerk support and office expenses.

## 2-G. Direct Stack Gas Control

### 2-G. 1 Background

Stack gas control is one of measures to back up the total emission reduction plan described before in this Chapter. According to the simulation model study, SO<sub>x</sub> concentration will exceed the ambient air quality standard in 2010 in an highly industrialized area where considerably high sulfur oil is predominantly used, if no additional countermeasures other than the stationary source emission standard.

In the world, stack gas cleaning processes are commonly used to remove SO<sub>x</sub> directly from the stack gas. One such plant was considered last year by BAPEDAL for a coal power plant outside of Jabotabek. Taller stacks are also employed for a kind of stack gas control. This measure is to disperse pollutants far away in order to avoid falling down of un-dispersed pollutants in the vicinity. Although this measure is against the principle of the Ministry Decree of emission standard (Ref. 110) because of falling down of once emitted SO<sub>x</sub> in somewhere as acid rain, it is suitable for smaller factories with smaller emission rates and lacking of engineering and fund for stack gas cleaning plants.

## 2-G. 2 Purpose

This study project is to prepare for the possible application of stack gas cleaning or taller stack measure to factories in highly industrialized area from 2006.

## 2-G. 3 Consequences

- ① Environmental Benefit - When the stack gas cleaning process is applied for the factories, SOx emission will be reduced equally with the reduction design rate of the plant.
- ② Environmental Benefit - When the taller stack measure is applied, without changing SOx emission rate, the ground level concentration of SOx is reduced.
- ③ Economical Benefit - Taller stacks are usually inexpensive to stack gas cleaning or fuel conversion. Therefore, they are economical to industries.
- ④ Institutional Benefit - By carrying out this project, BAPEDAL will obtain strong engineering experiences in selection of stack gas cleaning and taller stacks, and also in processes of industries.

## 2-G. 4 Competent Authority

BAPEDAL shall decide for the application of the two control measures of stack gas control. BAPEDAL needs cooperation of appropriate industries for the study. For the legal and institutional arrangement, BAPEDAL needs to negotiate with concerned ministries such as PU, and PERIND for the drafting.

## 2-G. 5 Legal and Institutional Arrangement

Official governmental supports are needed to promote the measures. Besides, it is necessary to enact "Air Pollution Control Law".

## 2-G. 6 Tasks

- ① BAPEDAL shall study application of two control measures within the year of 2003 by selecting a typical plant for each measure (examples; a power plant for the stack gas cleaning study of MFO combustion, and a small boiler owner for the taller stack study).

- ② BAPEDAL shall prepare an institutional arrangement for governmental support of the measures including low interest fund allocation, no tax for the initial investment, etc.
- ③ Design and construction of a stack gas cleaning plant for two years (The taller stack needs less period for the construction.)

#### 2-G. 7 Time Schedule

Task	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
①														
②														
③														
Implementation of measures														

#### 2-G. 8 Resources

As the investment is required from 2006 when the measure is supposed to be implemented, the cost is not estimated here.

For the preparation from 2003, BAPEDAL needs to allocate one full time officer. The cost is Rp. 7,020,000 from 2003 to 2005 for three years, including clerical support and office expenses.

#### (3) Mobile Sources

##### **3-A Preparation of Mobile Source Inventory in Jabotabek**

##### 3-A. 1 Background

The Team presented to BAPEDAL and EMC the Mobile Source Inventory Study Guidelines in August, 1996, and again its elaborated edition in June, 1997. The Guidelines illustrated tasks needed to prepare the inventory by using published emission factors. The Team prepared the mobile source emission inventory of Jabotabek following to the Guidelines and explained how to estimate the inventory to the Indonesian counterparts at various occasions. Therefore, BAPEDAL has the necessary technologies to do so, if the emission factors are known for Jabotabek.

There are two kinds of the cycle mode. One is used to certify newly produced

vehicles of their emission rates, and is not subjected to frequent changes. Indonesia intends to use the ECE mode, because it is widely accepted in countries where Indonesia plans to export the vehicles. The other is site specific local cycle mode in order to estimate realistic emission factors. In Jabotabek, idling stages seem to be predominant on the congested urban roads, because traffic signal intervals are so long, and the traffic is highly congested. The individual segmental patterns composing the Jabotabek cycle mode will be completely different from those of the ECE mode which BAPEDAL is planning to introduce for the certification. The local mode and the local emission factors shall be established for the accurate emission inventory of mobile sources in Jabotabek. The emission factors can be established using a chassis dynamometer system based on the local modes.

Ministry of Communication (HUB) has a chassis dynamometer system which can measure pollutants in exhaust gas of light duty vehicles such as taxis, passenger cars and motor cycles. This system will be applied for the ECE cycles to issue certificates of newly produced vehicles. From the viewpoint of emission inventory study, another system of the chassis dynamometer system is required under the control of BAPEDAL.

This project plan is elaborated in Section 10-4 in details.

### 3-A.2 Purpose

The purpose of this project is to inventory of mobile source emissions in Jabotabek.

### 3-A.3 Consequences

- ① No direct emission reduction by accomplishment of this project,
- ② Institutional Benefit - BAPEDAL will obtain tremendous institutional power by having the inventory, such as;
  - a) Comprehension of total air pollution emissions
  - b) Planning of emergency countermeasures
  - c) Issuance of various reports
  - d) Strengthening of relation between BAPEDAL and Ministry of Communication, and local transportation agencies
  - e) Development of partnership with GAIKINDO and PASMI
  - f) Centralization of pollution emission information
- ③ Institutional Benefit - BAPEDAL will accumulate know-how to establish emission factors of specific areas where traffic modes are different from

Jabotabek and where vehicle emissions are critical for ambient air quality.

#### 3-A. 4 Competent Authority

BAPEDAL is in charge of the inventory preparation. BAPEDAL needs a foreign consultant to establish the Jabotabek emission factors. Ministry of Communication shall be asked for joining to the study. Local agencies of transportation in respective Kabupatens (DKI, Bogor, Tangerang, and Bekasi) are responsible to generate traffic data.

#### 3-A. 5 Legal and Institutional Arrangement

No special arrangement is required. However, by carrying out this project, BAPEDAL can strengthen its technical capability, extend its management, and expand its organization in relation to the mobile source emissions.

#### 3-A. 6 Tasks

- ① BAPEDAL should organize a task force team composed of representatives of HUB, local governments, GAIKINDO and PASMI; total around ten people. BAPEDAL should find a consultant capable for the tasks to be followed.
- ② BAPEDAL shall keep the vehicle production and sales in Jabotabek updated with the help of GAIKINDO and PASMI.
- ③ Each local traffic agency should report updated traffic volume to the task force team collected as a routine work.
- ④ BAPEDAL should prepare a test plan of drive cycle establishment for individual local agencies.
- ⑤ BAPEDAL should carry out the road tests of the drive cycles.
- ⑥ BAPEDAL should analyze the data and develop the Jabotabek test cycle modes.
- ⑦ BAPEDAL should specify the chassis dynamometer system with an emission gas analyzer train, issue a bid package, analyze the bid, and issue purchase order.
- ⑧ BAPEDAL shall supervise the construction work carried out by subcontractors.
- ⑨ BAPEDAL shall train its operators with the assistance of the manufacturers.
- ⑩ BAPEDAL shall generate emission factors of light duty vehicles using its chassis dynamometer system under the Jabotabek test cycle and ECE cycle for comparison.



- ⑪ BAPEDAL should also ask exporters of vehicles in other categories than the light duty gasoline vehicles.
- ⑫ BAPEDAL should analyze the emission test data and determine average emission factors for HC, CO, and NOx.
- ⑬ BAPEDAL should estimate the mobile source inventory in Jabotabek.

### 3-A. 7 Time Schedule

Task	1997	1998	1999	2000	2001	2002	2003	2004
①								
②								
③								
④								
⑤								
⑥								
⑦								
⑧								
⑨								
⑩								
⑪								
⑫								
⑬								

### 3-A. 8 Resources

Cost data:

One officer wage with supporting clerk and office expenses	Rp. 7,020,000/year
One chassis dynamometer system (import portion)	Rp3,850,000,000
ditto (local portion)	Rp5,000,000,000
ditto Annual Officers and Operators Expenses	Rp 54,054,000/year
ditto Annual Operation and Maintenance	Rp 306,950,000/year
Road tests including rental vehicles and man-powers	Rp 54,140,000
One consultant, monthly fee	Rp. 40,000,000/Month
One consultant, expenses in Jabotabek	Rp. 15,000,000/Month
One round airfare of a overseas trip	Rp. 7,000,000

	1998	1999	2000	2001	2002	2003	2004
Officer Wage	10.53	10.53	10.53	10.53	1.76	1.75	14.04
Task meetings	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Chassis Dynamo.		3,850	2,500	2,554.05	361.00	361.00	--
Road test	--	28	28.14		--	--	--
Consult's M. Fee	--		240	480	240	--	--
C. in Jabotabek	--		90	180	90	--	--
Consultant's Trip	--		14	14	7	--	--
Total	11.13	3,889.13	2,883.27	3,239.18	700.36	363.35	14.64

in million Rp.

### **3-B Introduction of New Regulations for Vehicle Emission Gas**

#### **3-B. 1 Background**

BAPEDAL is considering to introduce emission regulation for newly produced light duty gasoline vehicles in Indonesia under the Blue Sky Program. The regulation is said to be equivalent to ECE-83, Revision 1 (Ref. E/ECE/324). The chassis dynamometer system is required to certify vehicles to be produced by observing the regulation. There is no such system in Indonesia. It is the heavy investments to have the system in private production companies. Therefore, Ministry of Communication (HUB) is the best organization to operate the system for the certification.

HUB has one train of chassis dynamometer system in Bekasi. The system is operable except the exhaust gas analysis unit.

Around 150 to 250 cars shall be tested in a year for the certification for the whole production in Indonesia, assuming 230,000 light duty cars produced and one each in 2000 cars to be tested. Two trains of the chassis dynamometer systems are required.

#### **3-B. 2 Purpose**

To renovate and expand chassis dynamometer system existed in Bekasi.

#### **3-B. 3 Consequences**

- ① There is no direct reduction of emissions by enlarging the dynamometer system.

- ② Indirect Environmental Benefit - the benefit is quite large as evidenced in the simulation results of the Study, through the possible introduction of certified less emission vehicles.

#### 3-B. 4 Competent Authority

HUB in charge of construction and operation of the chassis dynamometer system. EMC of BAPEDAL can assist to train operators of the gas analysis system equipped with the dynamo-system.

#### 3-B. 5 Legal and Institutional Arrangement

It is necessary to enact "Road Transport & Motor Vehicle Law", while there will be nothing special to be further arranged for its institutional aspect.

#### 3-B. 6 Tasks

- ① HUB shall investigate the existing unit for possible repair in subcontracting from the vender
- ② HUB shall specify equipment, issue a bid package, analyze the bid, and issue purchase orders for repair work and additional one complete train. BAPEDAL (EMC) shall be involved for the preparation of the gas analysis unit specification.
- ③ HUB shall supervise the construction work carried out by subcontractors. The work shall be completed before 2001.
- ④ HUB shall train its operators with the assistance of the manufacturers.

#### 3-B. 7 Time Schedule

Task	1997	1998	1999	2000	2001	2002~
①						
②						
③						
④						
In operation						

### 3-B. 8 Resources

#### Initial investment by HUB

Assuming the damaged exhaust gas analyzing unit is unable to repair, HUB needs to import one train of chassis dynamometer unit and two trains of the exhaust unit.

One Dynamometer: Rp. 1,400,000,000

Two Exhaust: Rp. 4,900,000,000

For local construction portion, included are foundation, housing of  $400 \text{ m}^2 \times 2$  floors, air condition, installation, laboratory; Rp. 5,000,000,000

Total investment of HUB Rp. 11,300,000,000

#### Operation cost of HUB

Wages: 3 engineers and 12 operators, 10% clerical support and 30% of office expenses

$3 \times 450,000 \times 1.3 \times 1.1 \times 12 =$  Rp. 23,166,000

$12 \times 300,000 \times 1.3 \times 1.1 \times 12 =$  Rp. 61,776,000

Total Manpower Cost / Year Rp. 84,942,000

Annual Operation and Maintenance (2 systems) Rp. 613,900,000/year

See details in Section 10.4

BAPEDAL requirement: Negligible small

### **3-C. Strengthening of Vehicle Inspection Program**

#### 3-C. 1 Background

HC concentration in ambient air is exceeded at all monitoring stations in Jabotabek, especially high at stations in area congested with vehicles. HC and CO, the latter one is under the ambient air quality standard, are the major emissions from vehicles while idling, and their emission concentrations indicate maintenance levels of vehicles. The vehicle inspection program is on-going following to the emission gas standard (Ref. 104) and promoted by the Blue Sky Program. However, there is a lack of enforcement procedures. Also shortage of inspection units and inspectors is foreseeable.

### 3-C. 2 Purpose

To involve BAPEDAL in training of inspectors and to make possible for BAPEDAL obtaining and publication of idling test data

### 3-C. 3 Consequences

- ① Environmental Benefit - Vehicles at the idling stage emit the most concentrated CO and HC. In Jabotabek, main streets are almost packed with vehicles in the idling stage. According to the test conducted in Japan, periodically inspected and maintained vehicles emit half of CO concentration compared to that of un-inspected vehicle (Source: White Paper on Pollution, 1970, tested with 100,000km used vehicles). Therefore, by having well maintained vehicles, Jabotabek should be cleaner than before. Moreover, PM emission will also be reduced by periodical maintenance.
- ② BAPEDAL's Benefit - Regular publication of idling test data will cause people's awareness of that vehicle owners and users are air polluters. Consequently, it becomes easier for BAPEDAL to educate people in air pollution issues.

### 3-C. 4 Competent Authority

Local administration offices of traffic are in charge of testing and enforcement. BAPEDAL shall train inspectors for emission measurement.

### 3-C. 5 Legal and Institutional Arrangement

It is necessary to reinforce staff in duty in DLLAJK as well as local BLHs. Any arrangement from legal point is least needed.

### 3-C. 6 Tasks

- ① BAPEDAL shall negotiate with each local administration for intrusion of BAPEDAL in the respective local vehicle inspection unit
- ② BAPEDAL (EMC) shall dispatch instructors to train idling test inspectors of local administration offices in Jabotabek for equipment operation and maintenance.
- ③ BAPEDAL shall obtain idling test emission data of all vehicles from each local inspection unit in Jabotabek, and compile, evaluate, and publish it

periodically. Similar to BAPEDAL's appraisal in PROKASI Program, competition between areas under different inspection units will be effective for the purpose.

- ④ BAPEDAL has to examine occasionally local inspection units on their work.

### 3-C. 7 Time Schedule

Task	1997	1998			1999			2000			2001			2002~	
①															
②															
③															
④															

### 3-C. 8 Resources

BAPEDAL needs to allocate one officer from 1997 and beyond with his 25 % capacity load and dispatch one lab technician to instruct how to handle the idling test equipment on one day for ten times in 1998.

1997/9~	1998	1999~
Rp. 438,750	Rp. 1,855,000	Rp. 1,755,000

## **3-D. Promotion of Unleaded Gasoline Usage**

### 3-D. 1 Background

This is a must to carry out before introduction of Emission Regulation of New Vehicles as pointed out in Section 9.2.2 (3). This project should be completed before 2001 when the Emission Regulation will become effective according to the Blue Sky Program.

PERTAMINA has already estimated the required investment for annual requirement of unleaded gasoline of 10,000,000KL in the whole Indonesia.

### 3-D. 2 Purpose

To give incentive people to buy unleaded gasoline and accordingly to increase

number of gas stations to sell the unleaded gasoline

### 3-D. 3 Consequences

- ① Environmental Benefit - Lead emission is reduced proportionally to the rate of unleaded gasoline sales in gasoline engine vehicles, although lead concentration in ambient air is below the national or DKI standard currently.
- ② Environmental Benefit - Life of catalyst which is installed at the tail pipes of vehicles to meet ECE-83 regulation becomes longer. As a result, CO, HC, and NOx emissions from the vehicles equipped with catalyst are kept as designed for longer without increment.
- ③ Social Demerit - If unleaded gasoline price is higher than the leaded one and no more sales of leaded one, people will be oppressed.

### 3-D. 4 Competent Authority

BAPEDAL, PERTAMINA, and GAIKINDO.

### 3-D. 5 Legal and Institutional Arrangement

Any special arrangement for legal and institutional aspects will not be required.

### 3-D. 6 Tasks

- ① BAPEDAL shall negotiate with PERTAMINA to accelerate its expansion plan of unleaded gasoline production. New plants will need 3 years for design and construction. If fund for the initial investment is the critical item, one solution is to raise the price of leaded gasoline as a polluter pay policy and to allocate the raised portion for the investment.
- ② PERTAMINA together with BAPEDAL shall PR for unleaded gasoline and banning of leaded one in 1998 and .
- ③ PERTAMINA shall add more service outlets of unleaded gasoline in the existing stations in Jabotabek and the surrounded area.

### 3-D. 7 Time Schedule

Task	1997	1998	1999	2000	2001	2002~
①						
②						
③						
Plant construct						
Expanded supply of unleaded gasoline						

### 3-D. 8 Resources

PERTAMINA published its initial investment be Rp. 700,000,000,000 for 10 million kl of annual unleaded gasoline production to supply for the whole Indonesia. A plant of one third capacity for Jabotabek in 2010 is estimated to be around the half of the cost: Rp. 350,000,000,000

Remodeling of service stations is negligible. PERTAMINA shall also cover the half of the PR cost of unleaded gasoline with BAPEDAL. Refer to Section 1-B (Reduction of Hydrocarbon Emissions).

1998	Rp. 250,000,000
1999	250,000,000

BAPEDAL's requirements are for PR and one officer for 10% of his work load.

	1997	1998	1999
PR	-	250,000,000	250,000,000
Wage, etc.	468,000	720,000	720,000
Total	468,000	250,720,000	250,720,000

### 3-E. Acceleration of Turn-over Rate of Aged Vehicles

#### 3-E. 1 Background

According to the simulation model study, almost all existing vehicles should be replaced with the newly regulated ones by 2010, in order to satisfy ambient air quality standards of NOx in meeting with the anticipated growth of Jabotabek area.



### 3-E. 2 Purpose

To plan how to accelerate the retirement of aged vehicles.

### 3-E. 3 Consequences

- ① Environmental Benefit - If materialized, reduction of NO<sub>x</sub>, HC, CO, and PM emissions is foreseeable. The anticipated NO<sub>x</sub> reduction was demonstrated in the Study by the simulation model.
- ② Economic Benefit - Prospects to vehicle manufacturers are predictable.
- ③ Social Demerit - Negative reaction from users of the aged vehicles are anticipated.

### 3-E. 4 Competent Authority

BAPEDAL and HUB (Ministry of Communication)

### 3-E. 5 Legal and Institutional Arrangement

It is necessary to reinforce staff in duty in DLLAJK and local BLHs.

### 3-E. 6 Tasks

- ① BAPEDAL shall prepare for legal and institutional arrangement for the purpose in cooperation with HUB; required governmental support system for the replacement to the new from the aged vehicles (such as low interest fund, and less tax for the new purchase), encouraged replacement (such as increment of tax or inspection fee by age)
- ② BAPEDAL shall continuously pay attention on air quality data from curb side monitoring stations (Thamrin, KPPL, Gambir, and Ragunan), after 2001 when the emission regulated vehicles are introduced. And if the annual average data at any station shows increment of NO<sub>2</sub> more than 1.5 times of 1996 data, BAPEDAL shall make effective the replacement plan. The time will be after 2004.

### 3-E. 7 Time Schedule

Task	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
①														
②														
Implementation of Plan														

### 3-E. 8 Resources

BAPEDAL will require to assign two officers with their work loads of 10% in 2001 and 2002 and 25 % in 2003 through 2005. PR will not be needed. BAPEDAL can rely on news media for negative PR and people will aware of the idea.

Wages, clerical supports, and office expenses;

Rp.				
2001	2002	2003	2004	2005
1,404,000	1,404,000	3,510,000	3,510,000	3,510,000

### 3-F. Promotion of Low-pollution Vehicles

#### 3-F. 1 Background

Under the Blue Sky Program, low-pollution vehicles are promoted in taxis and buses by converting current diesel to LPG or CNG which emit less SO<sub>x</sub>, PM, and visible smoke.

#### 3-F. 2 Purpose

To plan how to promote low-pollution vehicles; Almost 100% of taxis and 50% of buses are needed to use low pollution fuels in 2010, according to the assumption of the Study by the simulation model.

#### 3-F. 3 Consequences

- ① Benefit - 100% less of SO<sub>x</sub>, and PM emission
- ② Demerit to people - Higher fare of taxis and buses
- ③ Prospect of vehicles remodeling industries - benefit for economics

#### 3-F. 4 Competent Authority

BAPEDAL, TAM (Ministry of Mine and Energy), HUB, PERTAMINA, Local administrations, and related Industry Sectors

#### 3-F. 5 Legal and Institutional Arrangement

It is necessary to reinforce staff in duty in local administrations.

#### 3-F. 6 Tasks

BAPEDAL has been negotiating with relevant authorities and organizations about plans to promote low-pollution vehicles in commercial fleet. Following items are reminded for BAPEDAL to be included in the discussion:

- ① Legal and institutional arrangement - How to keep public transportation fares not so high; Temporal governmental support will be required for purchase of cleaner fuel by vehicle owners.
- ② Increment number of fuel service stations by PERTAMINA, (CNG needs high pressure pump stations or replacement with filled-up cylinders); at least 250 LPG stations in 2010 (current number of gas stations in DKI - 500),
- ③ BAPEDAL shall ask to keep record of fuel type of registered commercial vehicles to local administration offices

#### 3-F. 7 Time Schedule

This project has already started under the Blue Sky Program.

#### 3-F. 8 Resources

One person in BAPEDAL shall be assigned to be a key person in negotiating with others. His work load will be 10% for this promotion project in one year. It is Rp. 702,000 including clerical support and office expenses.

### **3-G Suppression of Diesel Use in Vehicles**

#### 3-G. 1 Background

Current prices of motor vehicle fuels are favor to diesel by almost half of gasoline; Rp. 380 vs. Rp. 700 per liter. If this difference continues in the coming years, it will

promote usage of diesel vehicles greatly. This was exactly the way Japan came along and failed to control airborne NOx and SPM concentration in heavy traffic areas. Diesel vehicles emit more NOx and SPM than gasoline vehicles. If the ratio of diesel vehicles exceeds the current one estimated in Chapter 7, NOx and SPM problem will newly come up along roads.

Meanwhile, according to the simulation study, several places along congested roads have SOx concentration above the ambient air standard in 2010. These places are affected by the sulfur contained in Solar diesel oil (0.396% by analyses). Supply of low sulfur Solar will be required from 2006. It is a time when the same low sulfur diesel oil is required for stationary sources in industrially congested areas. Of course, the year and capacity of low sulfur Solar requirement are depend on the year and effectiveness of the diesel use suppression policy materialization.

### 3-G. 2 Purpose

To suppress usage of diesel (Solar) as vehicle fuel and to replace high sulfur diesel (Solar) with low sulfur one

### 3-G. 3 Consequences

- ① Environmental Benefit - Suppression of possible leap of SOx, NOx and PM emissions from diesel vehicles
- ② Environmental Benefit - Reduction of SOx emission from Solar, proportional to reduction of sulfur contents in the oil
- ③ Environmental Benefit - Reduction of secondary PM caused by SOx emission
- ④ Economical Benefit - Reduction of corrosion rate in diesel engines

### 3-G. 4 Competent Authority

BAPEDAL, PERTAMINA, GAIKINDO

### 3-G. 5 Legal and Institutional Arrangement

No legal arrangement is required in addition to the existed system.

### 3-G. 6 Tasks

- ① BAPEDAL shall negotiate with PERTAMINA and GAIKINDO on the possibility of suppression of diesel oil usage in vehicles. Target year of the materialization of the negotiation will be 2002 in consideration of the decision

of the low sulfur plant capacity. There are two ways to suppress the diesel use; to raise the consumer price of diesel, or to raise costs (investment, maintenance, tax, etc.) of vehicles.

- ② BAPEDAL shall negotiate with PERTAMINA on the possibility of the low sulfur Solar production for mobile sources in Jabotabek (5,000,000 kl/year in 2010). Banning of current Solar in Jabotabek shall also be planned at the same time. Technically it is possible to produce 0.05% sulfur diesel oil which is actually in the world market. The price can be higher than the current price.
- ③ PERTAMINA shall design and construct the required plant and distribute the product in Jabotabek.

### 3-G. 7 Time Schedule

Task	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
①														
②														
③														
Production and distribution														

### 3-G. 8 Resources

PERTAMINA's investment will be Rp. 300,000,000,000 for construction of the new plant starting its design from 2003.

BAPEDAL has to assign one officer with his load of 10%. The cost including his wage, clerical support, and office expenses is Rp. 702,000 from 1998 to 2003.

### 9.4.3 Evaluation on Proposed Strategy

#### (1) Evaluation from Institutional and Legislative Points of View

##### 1) Countermeasures common for Stationary and Mobile Emission Source Controls

The preparations regarding institutional or legislative aspects as summarized in Table 9.4.3 are definitely essential in order to implement the countermeasures common to stationary and mobile emission source controls.

**Table 9.4.3 Institutional/Legislative Necessity for Countermeasures Common for Stationary and Mobile Emission Source Controls**

Countermeasures	Reinforcement of staff in duty *	Enactment
1-A. Monitoring of Hydrocarbon Concentration in Ambient Air	BAPEDAL and local BLHs	Air Pollution Control Law
1-B. Possible Reduction of Hydrocarbon Emissions	BAPEDAL and local BLHs	Air Pollution Control Law
1-C. Reduction of Particulate Matter in Ambient Air	local BLHs	(Waste Act and Revised Environment Act)
1-D. Strengthening of Ambient Air Monitoring System	local BLHs, BPPI and PU	Air Pollution Control Law

Note: 1) \* means that reinforcement of staff in charge and/or establishment of new section will be required in case no current section meet task.

2) ( ) means that current law and/or act can meet the task.

##### 2) Countermeasures for Stationary Emission Source Control

In general, the following preparations regarding institutional or legislative aspects are definitely essential in order to implement the stationary emission source control :

- Reinforcement of staff in duty in BAPEDAL, local BLHs and BPPI ; and
- Enactment of 'Air Pollution Control Law', 'Act of Pollution Control Manager System' and 'Energy Saving Act'.

More specifically, Table 9.4.4 shows institutional/legislative necessity to carry out each countermeasures in the future. That is, the necessity means insufficiency found in the present institutional/legislative framework of the

Jabotabek area.

**Table 9.4.4 Institutional/Legislative Necessity for Countermeasures for Stationary Emission Source Control**

Countermeasures	Reinforcement of staff in duty *	Enactment
2-A. Stationery Source Inventory	BAPEDAL and local BLHs	Air Pollution Control Law
2-B. Enforcement of Emission Standards Decree	local BLHs	Air Pollution Control Law
2-C. Total Emission Reduction Plan	BAPEDAL and local BLHs	Air Pollution Control Law
2-D. Emission Management System	(current staff in duty in BAPEDAL and PERIND)	Pollution Control Manager System
2-E. Combustion Control System	BAPEDAL, BPPI and local BLHs	Energy Saving Act
2-F. Fuel Conversion	local BLHs and BPPI	Air Pollution Control Law
2-G. Direct Stack Gas Control	BAPEDAL	Air Pollution Control Law

Note:1) \*See the note in Table 9.4.3.

2) ( ) means that current staff in duty and they can meet the task.

### 3) Countermeasures for Mobile Emission Source Control

In general, the following preparations regarding institutional or legislative aspects are definitely essential in order to implement the mobile emission source control :

- Reinforcement of staff in duty in BAPEDAL, DILAJK and local BLHs ; and
- Enactment of 'Air Pollution Control Law' and 'Act of Model Certification System'.

More specifically, Table 9.4.5 shows institutional/legislative necessity to carry out each countermeasures in the future. That is, the necessity means insufficiency found in the present institutional/legislative framework of the Jabotabek area.

**Table 9.4.5 Institutional/Legislative Necessity for Countermeasures  
for Mobile Emission Source Control**

Countermeasures	Reinforcement of staff in duty*	Enactment
3-A. Preparation of Mobile Source Inventory in Jabotabek	BAPEDAL	(no necessity)
3-B. Introduction of New Regulations for Vehicle Emission Gas	(current staff in duty in BAPEDAL and HUB)	Road Transport & Motor Vehicle Law
3-C. Strengthening of Vehicle Inspection Program	DLLAJK and local BLHs	(Road Traffic Law, Blue Sky Program and Automobile Exhaust Standad)
3-D. Promotion of Unleaded Gasoline Usage	(current staff in duty in BAPEDAL and PERTAMINA)	(Blue Sky Program)
3-E. Acceleration of Turn-over Rate of Aged Vehicles	DLLAJK and local BLHs	(Road Traffic Law)
3-F. Promotion of Low-pollution Vehicles	BAPEDAL	(Blue Sky Program and Soft Loan Program)
3-G. Suppression of Diesel Use in Vehicles	(current staff in duty in PERTAMINA)	Air Pollution Control Law

Note:1) \*See the note in Table9.4.3.

2) ( ) means that current stuff, law, standard or program can meet the task.

#### 4) Necessary Staff of BAPEDAL

At present, only 10 staff out of 200 BAPEDAL personnel belong to the Department for Air Pollution Control. The technical staff of this department are to play quite an important role in cooperation with personnel of the other national and local organizations concerned, in order to realize the various countermeasures proposed under the anti-air-pollution strategy. The next table roughly estimates the number of full-time department personnel for preparation and/or implementation in line with the scheduled time horizon.

Year	~2000	2001~2005	2006~2010
Required BAPEDAL Staff	15	30	40
Incremental Personnel	5	20	30

Note : (Incremental Personnel) = (Required BAPEDAL Staff) - 10

It shows that BAPEDAL has to allocate or newly employ 5 more staff by 2000



and 2005 respectively, and 20 more staff after 2005 to successfully carry out the proposed countermeasures. Eventually, the BAPEDAL staff in charge of air pollution should amount to 4 times of the current number.

(2) Evaluation from Financial Point of View

Not only is it important to identify sources of funds, but methods of cost recovery have also to be identified. There are four (4) possible sources of finance, as below. Each cost item in the proposed countermeasures has been allocated to one of these sources.

- The Government of Indonesia itself,
- The private sector,
- Multilateral or bilateral grant funds, or
- International loans

The Government of Indonesia will be responsible for determining which method or fiscal measure will be appropriate in each item. In selecting the most appropriate method of cost recovery there are a number of basic factors which BAPEDAL and the Ministry of Finance will undoubtedly take into consideration, as below :

- Any new form of taxation must be implementable ;
- New taxes should be as simple as possible ;
- New taxes must be socially equitable and accepted by society ;
- Increases to the level of existing forms of taxation should be kept as small as possible in order to be socially acceptable ; and
- Political rather than technical factors often determine the form and magnitude of fiscal measures.

The proposed strategy requires controls on each and every source, and thus may not be cost-effective in terms of balancing the costs and nominal benefits of pollution control. An alternative and complementary approach that deserves to be considered is the introduction of market-based incentives, based on the "polluter pays" principle (PPP), such as pollution charges and pollution-based fuel taxes.

If the Government wishes to recover costs on the principle that the polluter should pay, then a tax or levy directed specifically at the polluter may be favored. For example, to meet the cost of removing lead from petrol the Government could increase the tax on petrol per liter. Alternatively, if the view is taken that the beneficiaries should pay (i.e. those who no longer suffer from lead pollution), a poll tax per capita would be sufficient to pay for the countermeasures. However, it is for the Government to select the most appropriate cost recovery method, taking into account political and social factors which are beyond the Study Team's knowledge.

#### 1) Cost-recovery Methods for Countermeasures for Stationary Emission Source Control

The greatest capital cost is that of introducing improved pollution control measures in industrial premises. It is proposed that the main source of funds should be the private sector (the owners of industries). Some funds may be available from sources such as the 'soft loans' provided as part of a Japanese aid program aimed at improving pollution control in industry. The Government would be responsible for some of the capital costs, recurrent costs and annual costs (operating costs, management of the program and a public awareness campaign). It is considered likely that grant funding will be available for training and technical assistance.

If the private sector is made responsible for a major part of the total cost, the GOI costs could be recovered by a flat rate tax per registered company, a company tax per employee, a poll tax per capita, or additional income tax per employee. A further option would be to tax every industrial premise, but as records of these are incomplete, it would be difficult to apply this system of revenue collection effectively.

#### 2) Cost-recovery Methods for Countermeasures for Mobile Emission Source Control

The greatest capital cost is that of modifying the existing refineries to enable them to produce lead free petrol. In comparison to the other mobile emission source control measures, this countermeasures in total is extremely expensive. It is proposed that main source of funds should be the private sector (which owns the polluting vehicles). The Government would be responsible for the rehabilitation of existing testing centers and the construction of new ones, using international loan funds, and for the annual maintenance of these from its own resources. GOI

annual costs would include additional staff, management and the cost of a public awareness program. It is considered likely that grant funding will be available for training and technical assistance. If, as recommended, the private sector is made responsible for the main costs, the GOI and loan costs could be recovered by a tax on all fuel including diesel one, an additional annual license fee on all vehicles or inspection fee/fine on poorly maintained vehicles. These options are merely indicative but they do show that cost recovery is achievable. And for PERTAMINA, possibly with Government assistance, to obtain the large amount of finance required from international sources.

Alternatively the GOI could increase income taxes per employee or introduce a poll tax per capita. These options are merely indicative but they do show that cost recovery is achieved. The revenue mobilization potential of the proposed pollution taxes is considerable. These revenues would provide a ready source of funds for the recommended investments to expand the supply of gas and CNG, and to implement the other countermeasures.

Given the difficulty of measuring pollutant emissions directly at the source, a practical indirect approach is to add pollutant charges to the price of fuel, based on the level of emissions associated with the use of the fuel, in the form of a pollution based fuel tax. For example, the fuel tax on gasoline could be based on road vehicle uses.

### 3) Financial Consideration of the Proposed Strategy

Most of the countermeasures consisting of the proposed strategy are in principle not to generate any direct income through their implementation, because they are not public services or infrastructure projects such as highway construction and water supply management which have possibility to earn money. Therefore, it is unreasonable and unrealistic to quantitatively calculate financial IRR by comparing present values of nominal costs and revenues accrued to each countermeasures.

Herewith, through comparison of the predicted average annual cost of the strategy with annual budget trends for environmental management, its financial consideration and necessary arrangement of cost recovery were roughly and qualitatively analyzed for the period from 1997 to 2000.

Table 9.4.6 is a summary of average annual cost (1997-2000) roughly estimated for each countermeasures. The annual cost of wage and PR cost ranges from 1

million to 1.5 billion Rp, depending on the extent of input resources of each countermeasures. Some countermeasures costs zero since their preparation or implementation stage is supposed to commence after 2001. The countermeasures requiring a high expenditure involves construction works and installment of expensive equipment/facilities to be handled mainly by BAPEDAL and PERTAMINA. BAPEDAL has to arrange approximately 1,000 million Rp. for wage and PR cost annually, while local Governments of DKI Jakarta and the other three (3) Kabupatens included in Jabotabek are to annually prepare about 780 million Rp. and 2,100 million Rp. respectively. However, a major part of initial investment cost (some 486 billion Rp.) is to be covered by PERTAMINA's budget.

On the other hand, Tables 9.4.7 and 9.4.8 show quite limited data open to the consultants, on the national/local budget and actual expenditure for environmental sectors. Most of data is only for such abstract items as 'environmental management' or 'natural resources and environmental development', so that it was hardly possible to identify net expenditures purely for the subsector of air pollution control.

Financial consideration and cost recovery could be qualitatively judged as below, considering indications from comparison of total annual cost of the strategy with the recent budget trend read in the tables. Overall, implementation of the countermeasures included in the proposed strategy is financially practicable, when national and international trend of increasing stress on financial support to pollution control is taken into due consideration.

**Table 9.4.6 Average Annual Cost (1997-2000) of Proposed Countermeasures by Agencies in Charge**

(Unit : million Rp.)

Agencies Measures	BAPE- DAL	EMC	DKI Jakarta	Other 3 Kabupatens	MOH	PERTA- MINA	IIUB	Total in round
1-A	2							-
1-B	179*		503	1,510			179	2,370
1-C	178*		177	531	177			1,060
1-D	20 (17,306)		78	51				150 (17,310)
2-A	19 (1,425)	5	23	21				70 (1,420)
2-B	35							40
2-C	No cost up to 2000							-
2-D	4							-
2-E	1							-
2-F	2					(136,000)		(136,000)
2-G	No cost up to 2002							-
3-A	30 (10,205)							30 (10,210)
3-B							699 (11,300)	700 (11,300)
3-C	2							-
3-D	501*					(350,000)		500 (350,000)
3-E	No cost up to 2000							-
3-F	1							-
3-G	No cost up to 2001							-
Total in round	970 (28,940)	-	780	2,110	180	(486,000)	880 (11,300)	4,920 (526,240)

Notes : 1) The data shown in this table are wage and PR cost except in ( ).

2) \* means that the data include PR cost.

3) ( ) shows equipment/facilities initial investment cost and foreign consultant fee.

## **BAPEDAL**

Average annual cost (about 1,000 million Rp.) of wage and PR cost for the strategy implementation is about 140% of FY1997 budget allocated to the Department for Air Pollution Control. Considering an increasing trend of the budget toward the future, 1,000 million Rp. can be covered by its budget.

On the other hand, equipment/facilities initial investment cost and foreign consultant fee is more than forty times of FY1997 budget allocated to the Department for Air Pollution Control. Even if its budget has an increasing trend toward the future, 30 billion Rp. has to be covered by raising the additional funds.

## **DKI Jakarta (L-BLH, KPPL)**

Annual cost (about 780 million Rp.) can be covered within its regular budget system, because actual expenditure for the environmental sector was over 7,000 million Rp. even in FY1994 when its environmental budget was lowest of the recent five (5) years.

## **Kabupatens of Bogor, Tangerang and Bekasi (L-BLH)**

Data of local budget for environmental sector for each Kabpaten has not been available. But the figure of 2,909 million Rp. as actual expenditures for natural resources and environmental development in Jawa Barat Province indicates that the annual cost of over 2,000 million Rp. prepared by these Kabupatens will be far beyond their regular budgets only for air pollution control. Alternatively, this financial deficiency can be solved with a special budget for 'Control of Environmental Impact' already fixed from FY1997 (Table 9.4.8).

## **PERTAMINA**

The cost to be arranged by PERTAMINA is huge as construction and equipment are included in the countermeasures most concerned with PERTAMINA. Therefore, some part of expenditures should be supported with international soft loan or grant programs. Potential international sources are relatively easy to find, because multilateral or bilateral financial agencies such as World Bank and OECF tend to assist more and more to the environmental sectors including air pollution control.

# **EMC, MOH and HUB**

It can be evaluated that annual costs to be prepared by these organizations are financially practicable because their total annual budget sizes are relatively large compared with the costs assigned to them for the strategy implementation.

**Table 9.4.7 Known Budget Data for Environmental Management including Air Pollution Control**

(Unit : million Rp.)

National Budget for Environmental Management						FY1995 (%) <sup>1)</sup>	FY1996 (%)	'96 /'95	FY1997 (%)	'97 /'95
	1990	1991	1992	1993	1994					
Grand Total	474 bil. <sup>5)</sup>	302 bil. <sup>5)</sup>	334 bil. <sup>5)</sup>	383 bil. <sup>5)</sup>	452 bil. <sup>5)</sup>	517 bil. (100)	N.A. <sup>2)</sup>	---	350,000 (100)	0.7
BAPEDAL						18,000 (3)	25,000	1.4	33,000 (9)	1.8
- Other ministries or agencies						499 bil. (97)	---	---	317,000 (91)	---
BAPEDAL						18,000 (100)	25,000 (100)	1.4	33,000 (100)	1.8
- Department (SMU) for air pollution control <sup>3)</sup>						220(1)	350(1)	1.6	700(2)	3.2
- Other departments (SMUs)						17,780 (99)	24,650 (99)	1.4	32,300 (98)	1.8
Department (SMU) for Air Pollution Control						220 (100)	350 (100)	1.6	700 (100)	3.2
- for stationary sources and monitoring						N.A.	200 (57)	---	250 (36)	---
- for mobile sources						N.A.	0(0)	---	350 (50)	---
- for ambient air quality standards						N.A.	150 (43)	---	100 (14)	---
Special Budget for "Control of Environmental Impact" Program Transferred to Local Governments <sup>4)</sup>						0	0	---	11,750	---

Notes : 1) The Indonesian fiscal year (FY) is from April to March.

2) Not available (N.A.) means that the data is unknown due to their strict secrecy.

3) SMUs mean "Strategic Management Units" which have autonomy and separate input, operation and output systems within BAPEDAL.

4) This special budget was fixed under INPRES (Instruction from President) first from FY1997.

5) Statistik Keuangan Pemerintah Pusat (Central Government Financial Statistics) 1994/1995, pp.11-12 (Table 6), BPS

Source : BAPEDAL

### EMC, MOH and HUB

It can be evaluated that annual costs to be prepared by these organizations are financially practicable because their total annual budget sizes are relatively large compared with the costs assigned to them for the strategy implementation.

**Table 9.4.7 Known Budget Data for Environmental Management including Air Pollution Control**

(Unit : million Rp.)

National Budget for Environmental Management						FY1995 (%) <sup>1)</sup>	FY1996 (%)	'96 /'95	FY1997 (%)	'97 /'95
	1990	1991	1992	1993	1994					
Grand Total	474 bil. 5)	302 bil. 5)	334 bil. 5)	383 bil. 5)	452 bil. 5)	517 bil. (100)	N.A. <sup>2)</sup>	---	350,000 (100)	0.7
- BAPEDAL						18,000 (3)	25,000	1.4	33,000 (9)	1.8
- Other ministries or agencies						499 bil. (97)	---	---	317,000 (91)	---
BAPEDAL						18,000 (100)	25,000 (100)	1.4	33,000 (100)	1.8
- Department (SMU) for air pollution control <sup>3)</sup>						220(1)	350(1)	1.6	700(2)	3.2
- Other departments (SMUs)						17,780 (99)	24,650 (99)	1.4	32,300 (98)	1.8
Department (SMU) for Air Pollution Control						220 (100)	350 (100)	1.6	700 (100)	3.2
- for stationary sources and monitoring						N.A.	200 (57)	---	250 (36)	---
- for mobile sources						N.A.	0(0)	---	350 (50)	---
- for ambient air quality standards						N.A.	150 (43)	---	100 (14)	---
Special Budget for "Control of Environmental Impact" Program Transferred to Local Governments <sup>4)</sup>						0	0	---	11,750	---

Notes : 1) The Indonesian fiscal year (FY) is from April to March.

2) Not available (N.A.) means that the data is unknown due to their strict secrecy.

3) SMUs mean "Strategic Management Units" which have autonomy and separate input, operation and output systems within BAPEDAL.

4) This special budget was fixed under INPRES (Instruction from President) first from FY1997.

5) Statistik Keuangan Pemerintah Pusat (Central Government Financial Statistics) 1994/1995, pp.11-12 (Table 6), BPS

Source : BAPEDAL.



**Table 9.4.8 Actual Expenditures for Natural Resources and Environmental Development**

(Unit : million Rp.)

Province	FY1990 (%)	FY1991 (%)	FY1992 (%)	FY1993 (%)	FY1994 (%)
DKI Jakarta	18,868 (52)	24,896 (54)	25,082 (58)	39,493 (57)	7,348 (15)
Jawa Barat	691 (2)	1,296 (3)	1,358 (3)	1,928 (3)	2,909 (6)
All Provinces	36,034 (100)	46,005 (100)	43,204 (100)	69,326 (100)	49,798 (100)

Sources : Statistik Lingkungan Hidup Indonesia (Environmental Statistics of Indonesia) 1995, p.369 (Table C.II.1.12), BPS, 1996; for data between FY1990 and 1993, Statistik Keuangan Pemerintah Daerah Tingkat I (Financial Statistics of the First Level Local Government) 1991/1992 - 1994/1995, pp.110-111 (Tables 6.9 and 6.10) and 149 (Table 7.18), BPS ; for data of FY 1994

### (3) Evaluation from Social Point of View

Indonesia is one of the most rapidly developing nations in Asia, building various kinds of factories and holding a lot of vehicles both for commercial and private purposes. Besides, it has been recently predicted that the average annual growth rate of GDP for the whole nation will keep about 7.3 % between 1990 and 2010. Among others, development within the Jabotabek region including Jakarta is remarkable. But this development phenomenon concurrently has brought and will bring about air pollution in the Jabotabek area.

The Indonesian Government has put a high priority on environmental conservation including air quality upon the 1992 UN Environmental Development Conference in Rio de Janeiro. Indonesia is also an important role in international actions against the global warming issue. These concern and prioritization of the Government have been reflected on the national budget allocated to BAPEDAL and the local budget for environmental activities of provinces.

It is difficult to say about reaction of local people to the proposed strategy or countermeasures, without some detailed social survey. But as far as hearing from the counterparts and steering committee members from each local area in Jabotabek is concerned, there is no social objection against the anti-air-pollution projects partially because implementation of the strategy does not particularly cause adverse social impacts such as a large scale of resettlement. On the contrary, local people's comments strongly requesting future air pollution control associated with the increasing traffic volume have been often read on the newspapers. And the above-mentioned governmental direction toward environmental conservation including

improvement of air quality is most likely supported by the local residents in Jabotabek.

Overall, the proposed strategy can be regarded as acceptable to the local society of the Jabotabek region, although the following consideration should be taken to obtain people's understanding :

- 1) Taxation and subsidization for cost-recovery or promotion of the countermeasures should be carefully materialized so that local people and related industries are not impressed with financial unfairness ;
  - 2) Effective penalty and fine should be set up and implemented. Otherwise, polluters would violate the standard unless penalty and fine exceeds the benefits ; and
  - 3) Governmental agencies concerned at central or local levels should actively appeal potential health risks due to air pollution as well as social benefits from the proposed strategy and countermeasures.
- (4) Evaluation from Environmental Point of View

The proposed strategy consisting of the various countermeasures for both stationary and mobile emission source control is undoubtedly improvement-oriented for environment, especially for air-pollution abatement. Therefore, all the countermeasures could be evaluated as environmentally acceptable in general.

In strengthening of monitoring system, any negative impacts due to jamming and station installation cannot be thinkable since the system is supposed to utilize telephone cables and to occupy quite limited space.

However, environmental impact assessments under the AMDAL procedure should be carried out to prevent negative impacts on environment including soil and water, when such activities as movement of factories and establishment of filling stations or inspection centers necessitate a large area or affect natural or living conditions.

## CHAPTER 10 ACTION PLANS

### 10.1 Introduction

The proposed strategy consists of 18 countermeasures (4 common to stationary and mobile sources, 7 for stationary sources, and 7 for mobile sources). All these countermeasures have to be prepared and implemented from now on in order to attain the strategic goal of compliance with air-quality standards in the Jabotabek region by 2010. Out of the 18 countermeasures, 8 were classified into the 'high priority' group as shown in Figure 9.4.1.

From these 9 countermeasures with high level of priority, the next three (3) were selected from the viewpoint of grasping of the most important and basic data in order to manage the air quality in Jabotabek area effectively. And these countermeasures will be formulated in detail as action plans from the section 10.2. It does not mean that the other 5 countermeasures, which have not been selected, have lower priority compared with these three. This selection simply reflects current lacking situation of basic data, which will be essentially important to accelerate the other proposed countermeasures.

- 1-D. Strengthening of Ambient Air Monitoring System
- 2-A. Preparation of Stationary Source Inventory
- 3-A. Preparation of Mobile Source Inventory in Jabotabek

Action plan for '1-D. Strengthening of Ambient Air Monitoring System' is for general purpose to collect data continuously. Action plan for '2-A. Preparation of Stationary Source Inventory' is to support '2-B. Enforcement of Emission Standards Decree' and other measures related to stationary sources. Finally action plan for '3-A. Preparation of Mobile Source Inventory in Jabotabek' is necessary to collect essential data for establishment of emission factors of running vehicles in Jabotabek.

Each action plan is presented in the order of (1) Action Justification, (2) Objectives, (3) Scope, (4) Time Schedule, (5) Required Resources, (6) Strengthening of Institutions and Legislations, and (7) Evaluation.

## 10.2 Strengthening of Ambient Air Monitoring System (1-D)

### (I) Action Justification

In Jabotabek intermittent grab-sampling monitoring of ambient air has been generating valuable data at first by BMG from 1970s, followed by MOH and KPPL. However, ambient air quality has been changing always, cyclically or not, by meteorological conditions, socio-economic activities, and so on. Air quality monitoring system has to be able to collect data including those changes for comprehension of long term air quality and for implementation of proper measures to keep environmental air quality under the national or local standards. The standards usually use one hour, one day, and one year as for the time span of average value. Moreover, as long term exposure to air pollutants is serious and as the long term average value is applied to evaluate the degree of exposure to their receptors, continuous monitoring is essential.

Continuous monitoring is rather new to Jabotabek. There are seven full scale stations and one for only SPM as in Figure 10.2.1. The history of each station can be found in Table 10.2.1. Except Gambir and Ragunan stations, all other stations had been mobilized to generate accurate data for the Study from January 1996 for one year under the cooperation of the Indonesian and JICA Teams. However, seven stations are not enough in the rapidly expanding region of Jabotabek. Much attention should be paid in Kabupatens of Bogor, Tangerang, and Bekasi.

Table 10.2.2 lists the monitoring items for air pollution and the methods of the monitoring stations, and Table 10.2.3 is similar but for meteorological observation, which is also important to evaluate air quality data.

**Table 10.2.1 History of Each Automated Monitoring Station**

Station Name	History
EMC	Equipment presented by JICA; Operating from 1993 under the guidance of JICA Expert
Pulogadung and Pluit	Equipment transferred to KPPL from EMC; Operating from 6/1994
KPPL	All renewed (HC & O <sub>3</sub> added) for the Study by JICA; Operating from 1/1996
Thamrin	Operating from 4/1992 by KPPL; HC and O <sub>3</sub> Analyzers (newly added) from 1/1996
Gambir and Ragunan	Operating from someday in 1996 by KPPL
Cibinong	Only SPM monitoring; Equipment by JICA for the Study

**Table 10.2.2 Monitoring Items and Methods of Each Automated Station**

Items	Measurement Method	EMC	Pulo Gadung	Pluit	Tham rin	KPPL	Gambir	Ragu nan	Cibi nong
SO <sub>2</sub>	Solution-conductivity method	●				●	●		
	Continuous UV fluorescent		●	●	●			●	
NO <sub>x</sub>	Absorptiometry using solvent	●				●	●		
	Continuous chemiluminescence		●	●	●			●	
Ox	Absorptiometry using neutral KI	●				●	●		
O <sub>3</sub>	Continuous UV absorptiometry		●	●	●			●	
CO	Non-dispersion infrared absorption	●	●	●	●	●	●	●	
SPM	B ray absorption method	●	●	●	●	●	●	●	●
HC	Gas chromatograph (FID)	●	●	●	●	●	●	●	

**Table 10.2.3 Meteorological Observation**

Items	Instrument	EMC	Pulo Gadung	Pluit	Tham rin	KPPL	Gambir	Ragu nan
Wind Direction	Wind vane	●	●	●	●	●	●	●
Wind Velocity	Anemometer	●	●	●	●	●	●	●
Temperature	Electrical Resistance	●	●	●				●
Humidity	Hair Hygrometer	●	●	●				●
Solar Radiation	Pyranometer	●						
Net Radiation	Net Pyrradiometer	●						

**(2) Objectives**

The main purpose of this action plan is to improve air quality data acquisition system in Jabotabek and to enable BAPEDAL and local agencies a) to evaluate current air quality in comparison with the specific air quality standard, b) to understand short term effects of near-by stationary sources, c) to evaluate effects of control measures implemented on air quality, d) to accumulate data for planning of air pollution control measures, of municipal development, of land utilization; and for analyses of pollutant dispersion mechanism.

By implementing the action plan, the project will accomplish following objectives:

- Improvement of monitoring and evaluation system in Kabupatens in Jabotabek
- Development of environmental impact management process in BAPEDAL and others
- Centralization of air quality data in Jabotabek into one
- Pilot project of similar ones needed for other industrial regions in Indonesia

### (3) Scope

The project is mainly to a) decide sites of monitoring stations, b) arrange for legal support c) install required equipment, d) organize human resources, and e) prepare for operation and maintenance.

Ambient air quality is monitored with automated continuous analyzers operated and maintained by agencies of DKI Jakarta and Kabupatens of Bogor, Tangerang, and Bekasi. Each local agency is to analyze the data to manage its own ambient air. As air pollutants disperse naturally into wider area, the data is centralized into BAPEDAL to manage air quality in Jabotabek, as in Figure 10.2.2. It is designed to install local monitoring stations, four central and BAPEDAL data acquisition stations. Data will be transmitted between the stations through telemeter systems, once in every hour.

#### Task 1 : Determination of Sites of Monitoring Station

Simple methods are commonly applied to determine locations of automated continuous ambient air monitoring stations. However, in Jabotabek the computer simulation of the Study has located places where meaningful concentration of pollutants may frequently appear. Meanwhile, by anticipating population to be around 25,000,000 in Jabotabek in 2000 and by allocating one station for 1,000,000 people, 25 stations are to be installed as the primary target. Existing 6 full scale stations in DKI Jakarta should remain as they are to keep continuation of data. Additional 19 stations are to be newly installed; 4 in DKI Jakarta, 6 in Bogor, 5 in Tangerang, and 4 in Bekasi by population distribution. Figure 10.2.3 is one suggestion of locations of 25 stations in Jabotabek.

After the decision of the locations, the person in charge in BAPEDAL has to look one by one around the locations and decide the exact site. The sites are better to be owned by governments, central or local, in order for easiness to put under custody with possibly free of charge. BAPEDAL may need to draw contracts with such owners. For the selection of the site, following must be considered:

- a) There should be neither any stack, nor other stationary facility that emits pollutants within 30 m around an air sampling port.
- b) An air sampling port of a general area monitoring station must also be 3 m apart from a building or other (such as a tree) and within 1.5 and 10 m above the ground.
- c) A road curb monitoring station has to be located within 5 and 20 m from the curb of the road and its air sampling port must be located 3 m above the ground.