

**ANNEX**



**SCOPE OF WORK**

**FOR**

**THE STUDY OF ENVIRONMENTAL EFFECTS**

**OF COAL FIRING POWER STATIONS**

**AND INTEGRATED STEEL MILL**

**DECEMBER 1980**

This Scope of Work is agreed by the following two authorities concerned;

The Jurong Town Corporation,  
Government of the Republic of Singapore.

Japan International Cooperation Agency,  
the Official Agency responsible for the implementation  
of technical cooperation programmes of  
the Government of Japan.


To confirm the aforementioned, the Scope of Work is herewith attached  
and signed by the responsible personnel of the said authorities  
concerned.

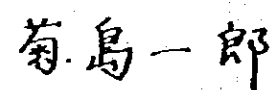
Date: 19th December 1980

Issued at: Singapore


For the Jurong Town Corporation,  
Government of the Republic of  
Singapore.

For Japan International  
Cooperation Agency,  
the Government of Japan.

  
\_\_\_\_\_  
YING YEK HANG  
PRINCIPAL DIRECTOR (TECHNICAL)  
JURONG TOWN CORPORATION  
GOVERNMENT OF THE REPUBLIC OF  
SINGAPORE

  
\_\_\_\_\_  
ICHIRO KIKUSHIMA  
LEADER OF THE JAPANESE  
PRELIMINARY SURVEY TEAM  
DEPUTY DIRECTOR  
ENVIRONMENTAL PROTECTION GUIDANCE  
DIVISION  
INDUSTRIAL LOCATION & ENVIRONMENTAL  
PROTECTION BUREAU  
MINISTRY OF INTERNATIONAL TRADE AND  
INDUSTRY

IN THE PRESENCE OF:-

  
\_\_\_\_\_  
LIM SAK IAN  
SENIOR DIRECTOR, ENGINEERING  
JURONG TOWN CORPORATION

  
\_\_\_\_\_  
AKIHIRO MITARI  
HEAD, INDUSTRY DIVISION  
MINING & INDUSTRIAL PLANNING  
AND SURVEY DEPARTMENT  
JAPAN INTERNATIONAL COOPERATION  
AGENCY

**1. Introduction**

In response to the request of the Government of the Republic of Singapore, the Government of Japan has agreed to extend the technical assistance to conduct the study on the environmental effects of coal firing power stations and the integrated steel mill which will be sited in the new industrial estates of the Republic of Singapore, which assistance is given in accordance with the laws and regulations in force in Japan.

The study will be carried out through The Japan International Cooperation Agency (hereinafter referred to as JICA), which is the official agency responsible for the implementation of technical cooperation programmes of the Government of Japan, in close cooperation with the Government of the Republic of Singapore and authorities concerned.

**2. Objectives**

The objectives of the study are:-

- (1) To conduct the field survey in terms of air and water qualities within and at surrounding areas of Pulau Seraya, Jurong, Pulau Tekong, where the proposed coal firing power stations and the integrated steel mill are to be sited.
- (2) To conduct the simulation study by computers based on the data obtained from the above said field survey and to assess the estimated pollution loads when these plants are in operation.

3. Scope of the study

3-1 Survey Areas

- (A) Pulau Seraya, the proposed site of the coal firing power station and its surrounding areas,
- (B) Pulau Tekong, the proposed site of the coal firing power station and the integrated steel mill, and its surrounding areas.
- (C) Other areas mutually agreed to be surveyed.

3-2 Survey Plan

(A) Air Quality Survey

i) Long Term Measurement

- a) Sulphur dioxide (SO<sub>2</sub>) concentration
- b) Wind directions and velocity at ground surface
- c) Net radiation
- d) Temperature

Notes: Period of measurement - 1 year

ii) Short Term Measurement

- a) Vertical profile of wind directions and velocity

Notes: Period of measurement - two days each at two stations.

iii) Simulation - Simulation of sulfur dioxide (SO<sub>2</sub>)

(B) Water Quality Survey

i) Measurement

- a) Current directions and velocity
- b) Chemical Oxygen Demand (COD)
- c) Water temperature and salinity

Notes: Period of measurement - 2 weeks per measuring point for the above (a), once per measuring point for the above (b) and (c), and 1.5 months in total including preparation works.

ii) Simulation - Simulation of COD and temperature

4. Time Schedule

As shown in ANNEX I (Subject to change)

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5. Report

5-1 Interim Report

- i) 30 copies.
- ii) The interim report will be submitted in English to the Government of the Republic of Singapore within 5 months after the completion of the simulation for water quality survey.
- iii) The interim report will contain the results of the water quality survey and refer to the progress of air quality survey.
- iv) The Government of the Republic of Singapore will provide the comments to JICA through the Embassy of Japan within 1 month after receipt of the interim report.

5-2 Draft Final Report

- i) 30 copies
- ii) The draft final report will be submitted in English within 4 months after the completion of the simulation for air quality survey.
- iii) The Government of the Republic of Singapore will provide the comments to JICA through the Embassy of Japan within 1 month after receipt of the draft final report.

5-3 Final Report

- i) 50 copies together with 50 copies of abstracts.
- ii) The final report will be submitted in English within 2 months after receipt of the comments of the draft final report.

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6. Contribution of the Government of the Republic of Singapore

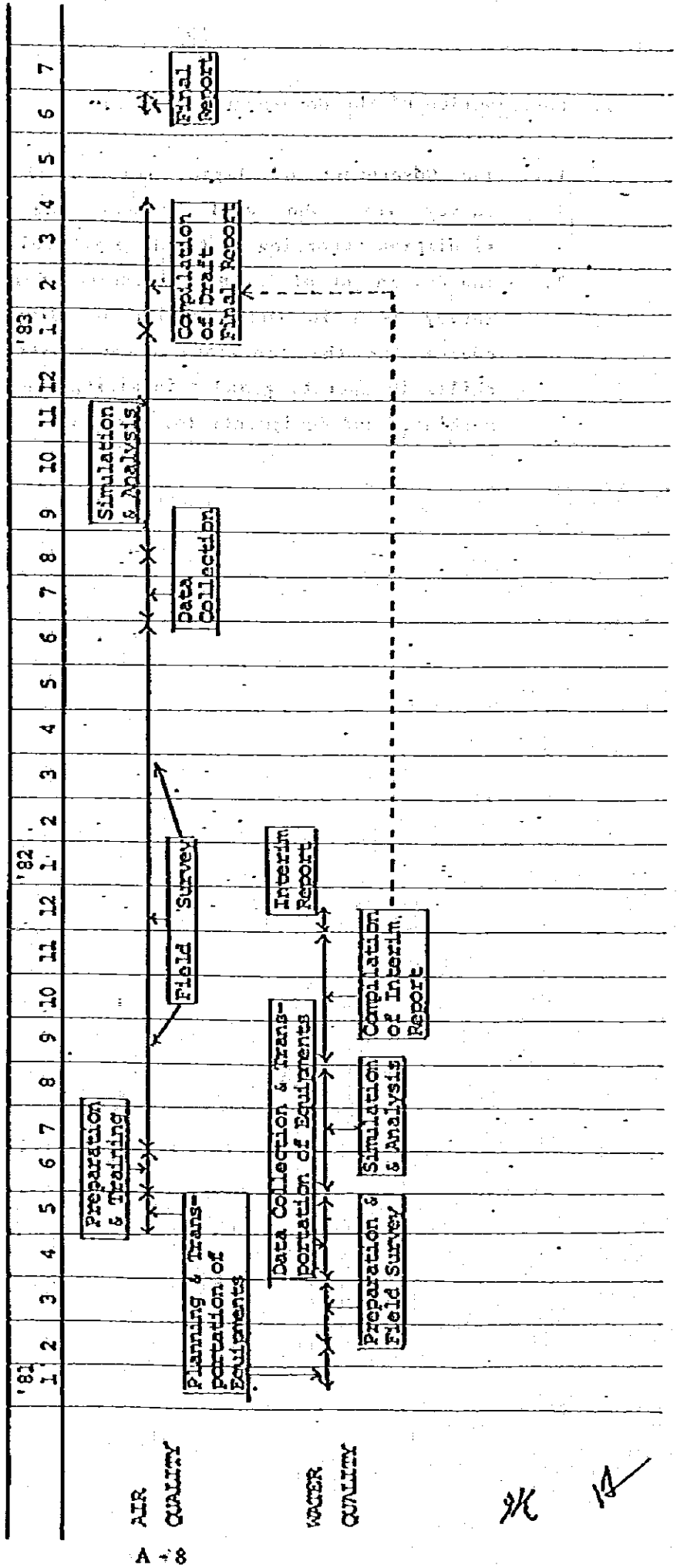
1. The Government of the Republic of Singapore will assign a qualified counterpart to be responsible for liaison and cooperation with the team conducting the survey. (hereinafter referred to as Survey Team)
2. The Government of the Republic of Singapore will provide the Survey Team with the necessary and available information and data.
3. The Government of the Republic of Singapore will make arrangements for the Survey Team to visit the authorities concerned.
4. The Government of the Republic of Singapore will provide the Survey Team with an office, sites for monitoring stations, laboratory testing facilities; storage space, temporary site office, transportation and boats as are necessary for the survey (ANNEX II)
5. The Government of the Republic of Singapore will exempt the Survey Team from taxes and duties on machinery, equipments and materials brought in Singapore by the Survey Team.
6. The Government of the Republic of Singapore will exempt the members of the Survey Team from any tax, including import and export duties imposed on the members' personal effects.
7. The Government of the Republic of Singapore will make an effort to ensure the securities of machinery, equipments and materials brought in Singapore by the Survey Team.



7. Contribution of the Government of Japan

1. The Government of Japan, through JICA, will provide a Survey Team who will conduct the field survey and simulation according to the Time Schedule (ANNEX I)
2. The Government of Japan will conduct during the stay of the Survey Team in the Republic of Singapore the training course for the Singapore counterparts to further their skills in operating and maintaining the necessary measuring machinery and equipments for the period of the field survey.

TIME SCHEDULE FOR THE STUDY OF ENVIRONMENTAL EFFECTS OF COAL FIRING POWER STATION AND INTEGRATED STEEL MILL IN THE REPUBLIC OF SINGAPORE



AIR QUALITY

WATER QUALITY

JK 12

The Detailed Information on Provision  
of Facilities by the Government of  
The Republic of Singapore

**(1) Air Quality Survey**

1. **Monitoring Stations**  
About 7 monitoring stations are to be established in the surrounding areas of the proposed sites. The land or places for these monitoring stations should be provided.
2. **Electricity Supply**  
The electricity connection and supply for monitoring stations at mutually agreed sites should be provided by the Government of the Republic of Singapore.
3. **The Facilities to Accomodate the Chemical Reagents**  
The facilities for storage, preparation of chemical reagents and distilled water should be provided at Jurong Town Corporation's Laboratory or National University of Singapore's Laboratory.
4. **The Government of the Republic of Singapore will provide necessary personnel for the daily operation and maintenance of the monitoring stations.**

**(2) Water Quality Survey**

1. **The Laboratory Testing Facilities for Chemical Analysis**  
The laboratory testing facilities for chemical analysis of aqueous samples shall be provided, at Jurong Town Corporation's Laboratory or National University of Singapore's Laboratory.
2. **The Storage Space for the Measuring Equipments and Materials**  
The storage space to be provided for the measuring equipments and materials shall be big enough for opening of the packages and adjusting the equipments.
3. **The Small Boats for Survey**  
The Survey Team will require 3 small boats for about 20 days in total. The Government of the Republic of Singapore will provide the Survey Team with such number of boats as are necessary for the survey.

**[3] Handling of Measuring Equipments**

All the measuring equipments necessary to conduct the field survey will be, in principle, brought in and out by the Survey Team. The Government of the Republic of Singapore is requested to provide facilities and arrangement on the followings:-

- (a) Custom clearance including loading and unloading
- (b) Inland transportation
- (c) Packing and unpacking

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**MINUTES OF MEETINGS**

**FOR**

**THE STUDY OF ENVIRONMENTAL EFFECTS**

**OF COAL FIRING POWER STATIONS**

**AND INTEGRATED STEEL HILL**

**DECEMBER 1980**

THE STUDY OF ENVIRONMENTAL EFFECTS  
OF COAL FIRING POWER STATIONS  
AND INTEGRATED STEEL HILL  
DECEMBER 1980

THE STUDY OF ENVIRONMENTAL EFFECTS  
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DECEMBER 1980

**MINUTES OF MEETINGS**

**FOR**

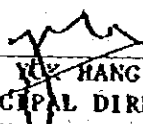
**THE STUDY OF ENVIRONMENTAL EFFECTS**

**OF COAL FIRING POWER STATIONS**

**AND INTEGRATED STEEL MILL**

**19TH DECEMBER 1980**

**CONFIRMED BY:**

  
YING YEE HANG  
PRINCIPAL DIRECTOR (TECHNICAL)  
JURONG TOWN CORPORATION  
GOVERNMENT OF THE REPUBLIC OF  
SINGAPORE

菊島一郎  
ICHIRO KIKUSHIMA  
LEADER OF THE JAPANESE  
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ENVIRONMENTAL PROTECTION  
GUIDANCE DIVISION  
INDUSTRIAL LOCATION & ENVIRONMENTAL  
PROTECTION BUREAU  
MINISTRY OF INTERNATIONAL TRADE AND  
INDUSTRY

MINUTES OF MEETINGS

The Japanese Preliminary Survey Team and the Singapore Counterpart had discussion on the Environment Effects of the Coal Firing Power Stations and Integrated Steel Mill and the following were mutually agreed upon.

Data of the Proposed Coal Firing Power Stations and the Integrated Steel Mill**(A) Coal Firing Power Station**

- i) The Japanese side requested for information on the proposed coal firing power station.
- ii) After discussion with the Singapore side which included P.U.B., the assumptions given in Appendix A were agreed upon.
- iii) It was indicated that one coal firing power station will be on Pulau Seraya and one on Pulau Tekong. (See Appendix D)

**(B) Integrated Steel Mill**

- i) The Singapore side indicated that the proposed steel mill will use about eight million tons of iron ore per year and producing about one million tons of steel product by the direct reduction process using coal.
- ii) The Japanese side requested for technical information similar to those in Appendix A.
- iii) The Singapore side replied that it is not in a position to provide, except that the location will be in Pulau Tekong (See Appendix D). However, it will try to obtain the information requested by the Japanese side at the earliest possible date.
- iv) It was mutually agreed that this matter will be further discussed and resolved when the next water quality survey team visits Singapore.

**(C) Data on Emission Sources (Present & Future 1990)****(a) Air Quality**

- i) The Japanese side requested for emission data both present and future and suggested that if such data is not available then a survey be carried out to obtain the same.
- ii) The Singapore side agreed to carry out such survey.
- iii) The Japanese side indicated that these data should be made available by June 1982.
- iv) The Singapore side agreed to the above.

(b) Water Quality

- i) The Japanese side requested for effluent data present and future including industries located on the southern islands and suggested if such data is not available then a survey be carried out to obtain the same.
- ii) The Singapore side agreed to carry out such survey.
- iii) The Japanese side indicated that these data should be made available by May 1981.
- iv) The Singapore side agreed to the above.

(c) Malaysian Development Plan (North of Straits of Johore)

- i) The Japanese side requested information regarding industrial development plan immediately north of the Straits of Johore.
- ii) The Singapore side replied that it is not in a position to do so.
- iii) It was mutually agreed that effects of the Malaysian developments shall not be considered.

(D) Monitoring Points

Based on survey carried out by Japanese Preliminary Survey Team, the following monitoring points were agreed upon.

(a) Air Quality

- i) SO<sub>2</sub>, wind direction, wind velocity - 7 points
- ii) Net radiation - 1 point
- iii) Vertical distribution of temperature - 1 point
- iv) Pilot balloon observation - 2 points

(b) Water Quality

- i) Current direction, current velocity - 10 points (around the two proposed sites)
- ii) Water temperature, salinity, COD observation. - 30 points (around the two proposed sites)

(c) Clearance from Competent Authorities

The Singapore side will arrange and obtain necessary clearance from the competent authorities to conduct the above surveys.

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(E) Simulation Methods

- i) The Japanese side stated that for SO<sub>2</sub> diffusion calculation, Plume Puff model will be adopted and predict a yearly concentration of SO<sub>2</sub>.
- ii) As for water temperature and COD diffusion calculation, FEM (Finite Element Method) will be adopted.
- iii) The Singapore side agreed to the above methods.

(F) Evaluation on the Environmental Effects and Impacts

- i) The Japanese side enquired about the environmental ambient standards of SO<sub>2</sub> and COD.
- ii) The Singapore side replied that it has only the emission standard but not the ambient standard.
- iii) The Japanese side stated that it will predict the levels of SO<sub>2</sub> and COD from the coal firing power stations and integrated steel mill.
- iv) The Japanese side stated that it will also be able to predict the total levels of SO<sub>2</sub> and COD in the year 1990 if adequate data on the emission are collected from the survey referred in para C.
- v) It was mutually agreed that if no ambient standard is indicated by the Singapore side, the Japanese side will not be in a position to comment on the levels of SO<sub>2</sub> and COD and in any case further evaluation will have to be carried by the Singapore side.

(G) Maintenance of monitoring stations

- i) The Japanese side requested the Singapore side to provide the necessary personnel for the daily operation and maintenance of the monitoring stations as indicated in Appendix 'B'.
- ii) Singapore side agreed to provide the personnel required.

(H) Survey Schedule

- i) The Japanese side mentioned that the schedule may need to be altered. Such alteration will be mutually discussed and agreed upon.
- ii) The Singapore side agreed to the above.

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5(I) Contributions

(4)

- i) The Japanese side requested that land and sea transport for future survey team and equipments and their local counterparts be provided in accordance with schedule in Appendix 'C'.
- ii) The Singapore side agreed to provide the same.
- iii) At the commencement of the survey, the Japanese side will arrange for all the equipments to be delivered to Jurong Town Hall. The Singapore side will arrange for the transportation of the equipments from the Jurong Town Hall to the various monitoring stations and will be responsible for the setting up of the stations.
- iv) On completion of survey, the Singapore side will arrange for transportation of all equipments from the monitoring stations back to Jurong Town Hall and the Japanese side will arrange to collect the same from Jurong Town Hall.

(J) Datas/Reports

- i) The Singapore side requested that information supplied to the Japanese side shall be treated as confidential materials. Similarly the results and report of the study are to be treated also as confidential.
- ii) The Japanese side agreed to the above.

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Assumption on Coal Firing  
Power Station

Generated Output	350 MW x 2
Fuel	Coal Calorific Value 7,000 Kcal/kg Sulphur 1% (wt%) Consumption $154 \times 10^4$ t/year (operation rate 70%)
Stack	Gas Volume $182 \times 10^4$ Nm <sup>3</sup> /h Gas Temperature 150°C (without desulfurization of flue gas) Gas Discharge Velocity 30 m/s Height 200m
Cooling Sea Water	Amount 29.4 m <sup>3</sup> /s Temperature difference 7°C
Effluent	Volume 1,200 m <sup>3</sup> /d COD 160 mg/l

NOTE:

The sites of stacks and outlets are as shown in Appendix D

ON THE MAINTENANCE OF MONITORING STATIONS

	Qualified Persons	Regular Persons
1 SO <sub>2</sub> Monitor	<p>Once every 20 days:-</p> <p>a Absorption solution and chart sheet, ink should be refilled or replaced</p> <p>b Calibration of monitor should be conducted</p> <p>c Chart data for last 20 days should be sent to Japan through JICA, Singapore</p>	<p>Once per everyday he should check the monitoring station whether it is operating properly without any trouble or not</p>
2 Wind Speed Meter	<p>Same as above but no calibration required</p>	<p>Same as above</p>
3 Net Solar Radiation Flux Meter and Air Thermometer	<p>Same as No (2) above</p>	<p>Same as No (1) and (2) above</p>

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TIME SCHEDULE FOR FIELD SURVEY IN SINGAPORE (AIR QUALITY)

Description	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	388	390	392	394	395
Travel & Official Visits																																
Number of Persons	4	4																														
1. Site Selection																																
N. of Person	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
2. To set equipments & training																																
N. of Person	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
3. Surveillance & Pilot Balloon																																
N. of Person																																
4. Observation																																
N. of Person																																
5. Travel to Japan																																
N. of Person																																
6. Travel to S'pore																																
N. of Person																																
7. Withdrawal of Equipments																																
N. of Person																																
8. Travel to Japan																																
N. of Person																																

INDIVIDUAL TIME SCHEDULE FOR FIELD SURVEY IN SINGAPORE (WATER QUALITY)

Description	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40																																							
Travel & Official Visits	←																																																																														
Number of Persons	2	2																																																																													
1. Site Selection Jurong Area	←																																																																														
N. of person	2	2	2	2	2																																																																										
N. of ships	1																																																																														
2. Site Selection Tekong Area	←																																																																														
N. of person	2	2	2	2	2																																																																										
N. of ships	1																																																																														
3. Travel of Survey Team	←																																																																														
N. of person	6																																																																														
4. Preparation	←																																																																														
N. of person	8	8	8	8	8																																																																										
5. Setting of Equipments	←																																																																														
a) Jurong	8																																																																														
N. of person	2																																																																														
N. of ships																																																																															
b) Tekong	8																																																																														
N. of person	2																																																																														
N. of ships																																																																															
6. Observation & Withdrawal																																							←	←																																							
N. of person	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8																																								
Local employ	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)																																								
N. of ships	3	2	3	2	(3)	(3)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																																									
7. Travel to Japan																																							←	←																																							
N. of person																																							4																																								

Withdrawal  
Reserve

Observation

130



**MINUTES OF MEETINGS**

**FOR**

**THE STUDY OF ENVIRONMENTAL EFFECTS**

**OF COAL FIRING POWER STATIONS**

**AND INTEGRATED STEEL MILL**

**FEBRUARY 1981**



**MINUTES OF MEETINGS**

**FOR**

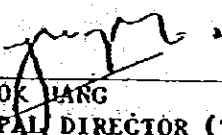
**THE STUDY OF ENVIRONMENTAL EFFECTS**

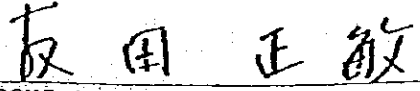
**OF COAL FIRING POWER STATIONS**

**AND INTEGRATED STEEL MILL**

**21ST FEBRUARY 1981**

**Confirmed by:**

  
\_\_\_\_\_  
**YING YOK LANG**  
**PRINCIPAL DIRECTOR (TECHNICAL)**  
**JURONG TOWN CORPORATION**  
**GOVERNMENT OF THE REPUBLIC OF**  
**SINGAPORE**

  
\_\_\_\_\_  
**HASATOSHI TOMODA**  
**ENVIRONMENTAL PROTECTION GUIDANCE**  
**DIVISION**  
**INDUSTRIAL LOCATION & ENVIRONMENTAL**  
**PROTECTION BUREAU**  
**MINISTRY OF INTERNATIONAL TRADE AND**  
**INDUSTRY**  
**FOR JAPAN INTERNATIONAL COOPERATION**  
**AGENCY**

Minutes of Meeting

The Japanese Survey Team and the Singapore Counterpart had discussion on the Environmental Effect of the Coal Firing Power Stations and Integrated Steel Mill and the following were mutually agreed upon.

Data of the Proposed Coal Firing Power Stations and the Integrated Steel Mill

(A) Coal Firing Power Station

- (i) The Japanese Side worked out a revised set of assumptions on the proposed coal firing power stations.
- (ii) After discussion with the Singapore Side which included the P.U.B., the assumptions given in Appendix 'A' were agreed upon.
- (iii) These assumptions will supersede those contained in Appendix 'A' of Minutes of Meetings dated 19th December 1980.

(B) Integrated Steel Mill

- (i) The Japanese Side showed a set of draft assumptions on the proposed integrated steel mill, studied and calculated based on the data provided by the Singapore side.
- (ii) After discussion with the Singapore Side, which included E.D.B., the assumptions given in Appendix 'B' were agreed upon.
- (iii) These assumptions will be adopted for the purpose of the study.
- (iv) The location of the stacks and effluent points are as indicated on the plan (Appendix 'C') attached.

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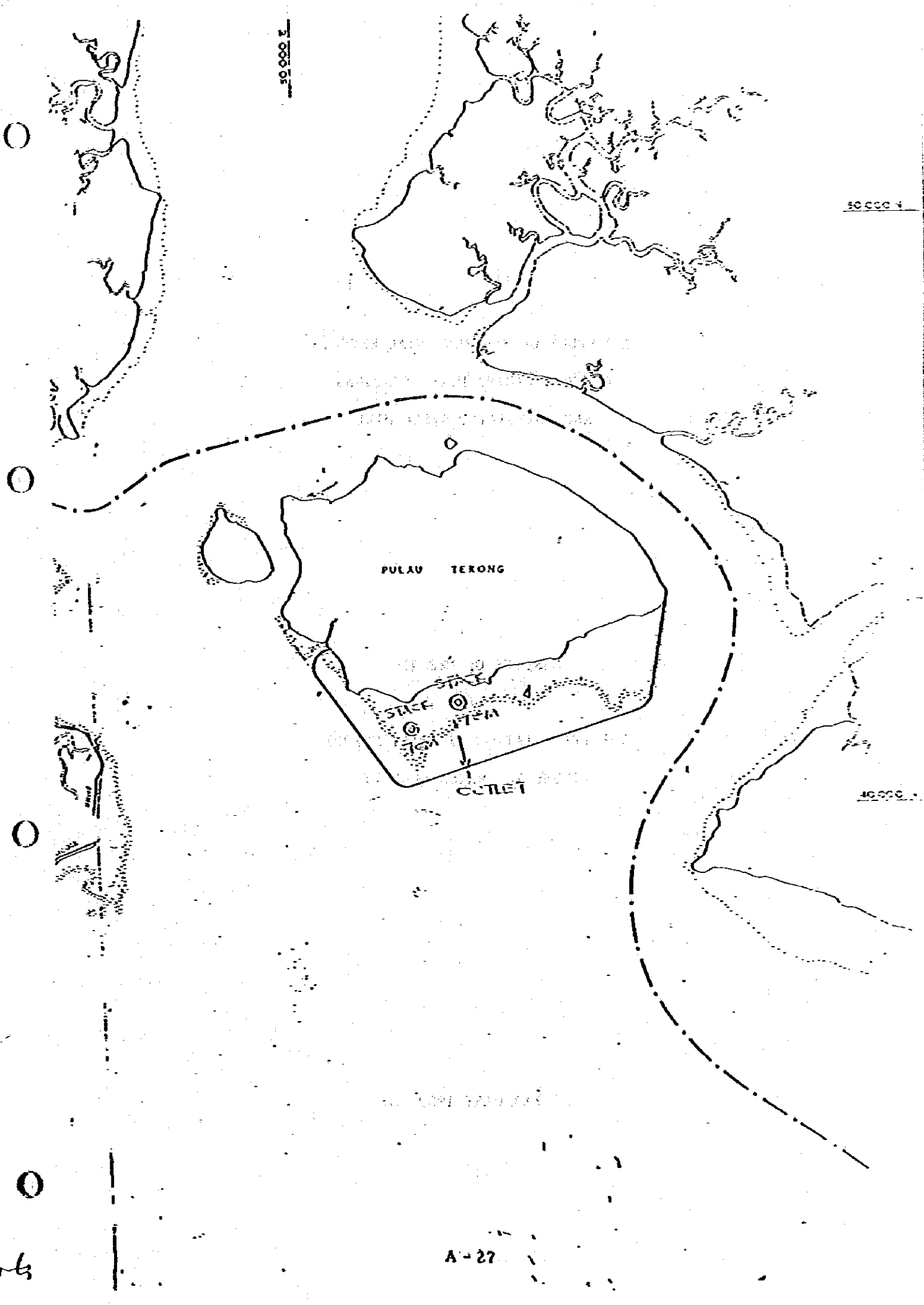
## Assumption on Coal Firing Power Stations

Location	P. Seraya	P. Tekong
General Capacity	750 MW (250 MW x 3)	700 MW (350 MW x 2)
Fuel Calorific value Sulfur Consumption	Coal 27 MJ/kg 1% (wt) 1.7 Mt/year	Coal 27 MJ/kg 1% (wt) 1.6 Mt/year
Stack Height Gas Temperature Gas Volume Gas Discharge Velocity	183 m 150°C 2,650,000 Nm <sup>3</sup> /h 25 m/s  (without flue gas desulfurization)	183 m 150 °C 2,470,000 Nm <sup>3</sup> /h 25 m/s  (without flue gas desulfurization)
Cooling Sea Water Volume Temperature Difference	110,000 m <sup>3</sup> /h 8.3°C	100,000 m <sup>3</sup> /h 8.3°C
Effluent Volume (COD) Mn	1,500 m <sup>3</sup> /d 50 mg/l	1,500 m <sup>3</sup> /d 50 mg/l
	(Boiler air heater washing effluent, after neutralisation & mixing with water treatment plant effluent)	

Assumption on Integrated Steel Mill

Location	Pulau Tekong
Production Process	Grate Kiln and Electric Arc Furnace Steelmaking
Ore Feed	Lump Ore (Fe 62.6%, S 0.018%) 800 x 10 <sup>4</sup> t/year
Product	Bar and Wire Rod 100 x 10 <sup>4</sup> t/year Balance (reduced iron) for Export
Reductant	Coal (S 1%wt) Calorific Value 30 MJ/kg Consumption 336 x 10 <sup>4</sup> t/year (Operation rate 83%)
Fuel	Heavy Oil (S 3%wt) Consumption 431 x 10 <sup>3</sup> kl/year(Grate Kiln) 357 x 10 <sup>2</sup> kl/year(Reheating Furnace)
Stack	Grate Kiln Process Gas Volume 5 x 10 <sup>6</sup> Nm <sup>3</sup> /h Gas Temperature 1000°C (without desulfurization of flue gas) SO <sub>2</sub> Volume 3,500 Nm <sup>3</sup> /h Gas Discharge Velocity 30 m/s Height 170 m  Reheating Furnace Gas Volume 6.3 x 10 <sup>4</sup> Nm <sup>3</sup> /h Gas Temperature 500°C SO <sub>2</sub> Volume 100 Nm <sup>3</sup> /h Gas Discharge Velocity 30 m/s Height 70 m
Effluent	Volume 9,300 m <sup>3</sup> /day (10% of total used water)  (COD) Mn 7 ppm





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PULAU TEKONG

STACK  
TOWER  
STAKE  
4

CUTLET

40 000

ts

**THE STUDY OF ENVIRONMENTAL EFFECTS  
OF COAL FIRING POWER STATIONS  
AND INTEGRATED STEEL MILL**

**MINUTES OF MEETING  
OF  
THE PRESENTATION OF DRAFT REPORT  
VOLUME 1 - WATER QUALITY**

**FEBRUARY 1982**

## MINUTES OF MEETING

The Japanese study team for the Water Quality Survey of the Study of Environmental Effects of Coal Firing Power Stations and Integrated Steel Mill in the Republic of Singapore (Hereinafter referred to as "The Team"), sent by the Japan International Cooperation Agency (Hereinafter referred to as "JICA"), presented to the Singapore authorities a report entitled "DRAFT REPORT ON ENVIRONMENTAL EFFECTS OF COAL FIRING POWER STATIONS AND INTEGRATED STEEL MILL IN THE REPUBLIC OF SINGAPORE VOLUME 1 - WATER QUALITY".

The following is a summary of the meetings and discussions:

### **1 Schedule of Meetings and Participants**

The schedule of meetings and participants are listed in Annexes 1 & 2.

### **2 Presentation of the Draft Report**

**2.1** The Team presented the Draft Report which has been prepared based on the objectives, the scope of work, and information described in the following record of discussions:

- Scope of Work dated 19 December 1980
- Minutes of Meeting dated 21 February 1981

The presentation was made by highlighting the features of the study and results.

**2.2** The Singapore authorities and the Team exchanged views on the Draft Report.

- 1** The Singapore authorities expressed satisfaction and appreciation for the dedication, efforts and hard work put in to complete the study.
- 2** A preliminary review of the Draft Report indicates that the contents of the Report are objective.

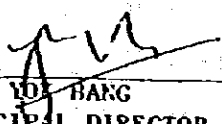
4 The Singapore authorities expressed the intention of making questions in order to clarify the contents of the Draft Report, if necessary


The Team replied to the Singapore authorities that such questions should be made to JICA's office in Singapore by 28 February 1982. The answers will be made in written form outside the final report.

3 Final Report of Volume 1 - Water Quality

The Draft Report of Volume 1 - Water Quality will be considered as final.

The Final Report of Volume 1 - Water Quality will be submitted to the Singapore authorities by the end of April 1982.

  
YUNG YEE BANG  
PRINCIPAL DIRECTOR (TECHNICAL)  
JURONG TOWN CORPORATION  
FOR GOVERNMENT OF REPUBLIC OF  
SINGAPORE

  
YOICHI SUZUKI  
LEADER OF THE JAPANESE  
WATER QUALITY SURVEY TEAM  
FOR JAPAN INTERNATIONAL  
CO-OPERATION AGENCY

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**ENVIRONMENTAL STUDY**  
**WATER QUALITY SURVEY**

**Presentation of Draft Report**

**Venue: VIP Lounge, Jurong Town Hall, Singapore**

**Time: 9.00 am - 10.00 am**

**Date: 4 February 1982**

**Member Lists**

**Japanese Report Team**

**Mr Yoichi Suzuki - IPCAJ, Leader, Water Quality Survey Team**  
**Mr Kihachi Inagaki - IPCAJ, Co-ordinator**  
**Mr Kisaburo Nakata - HITI**  
**Mr Masaya Konno - HITI**

**Singapore Counterpart (JTC)**

**Mr Tang I Fang - Chairman**  
**Mr Francis Mak - General Manager**  
**Mr Ying Yok Hang - Principal Director (Technical)**  
**Mr Lim Sak Lan - Senior Director (SME)**  
**Mr Tan Suan Yong - Senior Principal Civil Engineer**  
**Mr Hee Ah Mui - Senior Civil Engineer**

**ENVIRONMENTAL STUDY**  
**WATER QUALITY SURVEY**

**Technical Session for The Discussion on**  
**The Draft Water Quality Survey Report**

**Venue: Jurong Town Hall, Singapore**

**Time: 9.30 am - 12.00 noon**

**Date: 5 February 1982**

**Member Lists**

**Japanese Report Team**

**Mr Yoichi Suzuki - IPCAJ, Leader, Water Quality Survey Team**  
**Mr Kihachi Inagaki - IPCAJ, Co-ordinator**  
**Mr Kisaburo Nakata - HITI**  
**Mr Masaya Konno - HITI**

**Japanese Embassy**

**Mr Tokio Katayama - 1st Secretary, Commercial Attaché**

**Singapore Team**

**Mr Lim Sak Lan - Jurong Town Corporation**  
**Mr Tan Suan Yong - Jurong Town Corporation**  
**Mr Hee Ah Mui - Jurong Town Corporation**  
**Mr Ng Hwee Choon - Jurong Town Corporation**  
**Mr Chiang Kok Meng - Ministry of the Environment**  
**Mr Foong Chee Leong - Ministry of the Environment**  
**Mr Jasbir Singh - Port of Singapore Authority**  
**Mr Yang Keng Nua - Port of Singapore Authority**  
**Mr Wong Seng Chee - Port of Singapore Authority**  
**Mr Joseph Hui - Anti-Pollution Unit**  
**Dr Tay Joo Hwa - National University of Singapore**  
**Dr Ng Wan Jern - National University of Singapore**

**MINUTES OF MEETING**

**FOR**

**THE STUDY OF ENVIRONMENTAL EFFECTS**

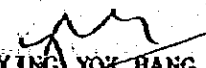
**OF COAL FIRING POWER STATIONS**

**AND**

**INTEGRATED STEEL MILL**

**23 JULY 1982**

**CONFIRMED BY**

  
**YING YOCK HANG**  
**PRINCIPAL DIRECTOR (TECHNICAL)**  
**JURONG TOWN CORPORATION**  
**ON BEHALF OF**  
**THE GOVERNMENT OF**  
**THE REPUBLIC OF SINGAPORE**

  
**KIHACHI INAGAKI**  
**TEAM LEADER**  
**JAPANESE SURVEY TEAM**  
**ON BEHALF OF**  
**JAPAN INTERNATIONAL COOPERATION AGENCY**

The Japanese Survey Team and the Singapore Counterpart had held discussions with the Relevant Authorities on future and present emission sources data for the purpose of setting up conditions and input data pertaining to the study on the environmental effects of coal firing power stations and integrated steel mill, and the following were mutually agreed upon -

- 1 For facilities commissioned before 1975, they are permitted to continue the use of the present quality of fuel; and  
For facilities commissioned after 1975, they are required to use fuel which contains less than 2% of sulphur, with the exception of PUB's Senoko Power Station.
- 2 Besides the present three existing power stations, the following power stations are expected to be in operation -

a Senoko Power Station Phase III

<u>Expected Date of Operation</u>	<u>Capacity</u>	<u>Sulphur Content of Fuel</u>	<u>Stack Diameter</u>
i June 1983	1 x 250 MW	2.8%	4.30m
ii Dec 1983	1 x 250 MW	2.8%	4.30m

b Seraya Power Station Phase I

<u>Expected Date</u> <u>of Operation</u>	<u>Capacity</u>	<u>Sulphur Content</u> <u>of Fuel</u>	<u>Stack</u> <u>Diameter</u>
i 1987	2 x 250 MW	2%	4.30m
ii 1988	1 x 250 MW	2%	4.30m

- 3 The projection of growth of industries will be based on information and data provided by EDB earlier, except that the petroleum refining industries will maintain the present level of production until 1990.

*[Handwritten signature]*

THE UNIVERSITY OF CHICAGO

PHYSICS DEPARTMENT  
5712 S. UNIVERSITY AVE.  
CHICAGO, ILL. 60637

PHYSICS 351  
LECTURE 10  
MAY 19, 1983



JICA