6-7 Utilities

6-7-1 Outline

The following comprise the utilities;

Natural gas, oxygen gas, nitrogen gas, argon gas, plant air, hydrogen gas, steam, raw water, potable water, circulation water, waste water, sewerage water, and fire hydrant

Outline of facilities are summarized as follows:

(1) Natural gas

Natural gas will be received at the battery point and will be supplied to each plant after filtering and metering the flow quantity by turbine meter.

(2) Oxygen gas, nitrogen gas and argon gas

Oxygen gas, nitrogen gas and argon gas will be received from the gas supply company through pipe line and the generation facilities will be completed by the end of 1998.

(3) Plant air

Plant air is generated by plant air compressors.

(4) Hydrogen gas

The required amount of hydrogen gas is rather small and hydrogen gas is produced by means of natural gas reforming and supplied to the plants.

(5) Steam

Steam is generated from plant boiler equipment.

(6) Raw water

Raw water will be received from municipal potable water system through a pipe line.

Raw water is treated (filtration and softening) and then supplied to each plant as make up water.

Alternatively raw water is filtered and chlorinated and supplied as potable water.

(7) Water treatment

In order to reduce raw water consumption, two counter measures are taken in the steel plant. These are;

1) Re-circulation system

Indirect cooling water (ICW) is not contaminated in the processes , so it is cooled down and treated chemically, then re-circulated.

Direct cooling water (DCW) is contaminated in the process, and scale and oils included in it.

DCW is treated by separation of contaminants by sedimentation, filtration, floatation and dehydration, etc. and is cooled for re-circulation.

Both the above systems are condense salinity due to re-circulation, so blow down of re-circulation water shall be required in order that water quality will meet with the requirements of the plant.

2) Cascade use system

Water quality required in each plant is different, for example, DCW of CCM can use low quality compared with DCW of HSMP. This means that blow down water from HSM can be supplied to CCM as make up water.

Therefore total water consumption can be reduced by this system.

(8) Waste water

Acid, alkali, chromate, and oil waste water are discharged from CSMP respectively.

These shall be treated in CSMP within target values as per latest proven technology in the world ,and the impurity values will be lesser than discharge limit in accordance with Law No.4/1994. Then after, treated water will be discharged to sea.

(9) Sewerage water

Live sewerage is gathered by the pumping station located in each office and plant and is treated in the sewerage water treatment station and will be discharged to sea.

(10) Fire hydrant

The fire hydrant supply system located in the raw water treatment station supply water to the outdoor fire hydrant system as per the requirements of NFPA.

(11) Yard piping system

Yard piping system is required to connect between supply systems, plants, re-circulation system and discharge systems.
The pipe line will generally be installed on the pipe rack for easy maintenance.
Fire water main is laid under ground as per NFPA.

6-7-2 Production plan (Annual supply plan)

Production plan (Annual supply plan) of utilities at the 1st stage is indicated in Table 6-7-1.

Table 6-7-1 Production Plan of Utilities

(Annual Supply Plan at 1st Stage)

Cost center		Natural gas	Steam	Plant air	Oxygen gas	Nitrogen gas	Argon gas	Hydrogen gas	ICW	DCW	Others	Make up water	Potable water
		1,000 Nm^3	ton	1,000 Nm^3	1,000 Nm^3	1,000 Nm^3	1,000 Nm^3	1,000 Nm^3	1,000 m^3	1,000 m^3	1,000 m^3	1,000 m^3	1,000 m^3
Production Section	DRP	285,000		17,250		6,075			3,750	18,750		1,500	
	EAF	800		13,000	30,000	4,000	200		19,344			800	
	LF								2,967				
	SMP Others								17,484				
	CC	3,200		29,000	2,000		500		11,755	8,332		1,000	
	HSM	27,777		38,021		0			7,486	63,040		2,069	
	LCP	4,000		2,200								1	
	Skinpass mill			18					18				
	Plate			10					10				
	As roll			0									
	PPL	678	5,782	2,390		32			355		162	162	
	CRM		3,232	16,160					960		64	64	
	CGL	1,420	2,130	1,420		1,420		142	1,420		71	71	
	BAF	4,674		0		3,690		369	2,214				
	TM			6,146					121				
	RCL			493					45				
	CRC												
	Total	327,549	11,144	126,107	32,000	15,217	700	511	67,928	90,122	297	5,666	0

Cost center		Natural gas	Steam	Plant air	Oxygen gas	Nitrogen gas	Argon gas	Hydrogen gas	ICW	DCW	Others	Make up water	Potable water
		1,000 Nm^3	ton	1,000 Nm^3	1,000 Nm^3	1,000 Nm^3	1,000 Nm^3	1,000 Nm^3	1,000 m^3	1,000 m^3	1,000 m^3	1,000 m^3	1,000 m^3
Support Section	Raw material handling												
	Industrial water												
	Plant air								1,752				
	Natural gas												
	Hydrogen generator	280	700						76			2	
	Electric power												
	Steam boiler	1,052										15	
	Analyzing												
	Maintenance shop												
	Product handling												
	Stock house												
	Head office												192
	Total	1,332	700	0	0	0	0	0	1,828	0	0	17	192
Grand total		328,881	11,844	126,107	32,000	15,217	700	511	69,756	90,122	297	5,683	192
To be purchased		328,881			32,000	15,217	700					5,683	192

6-7-3 Natural gas

(1) Design basis

Design basis of natural gas receiving station is as follows;

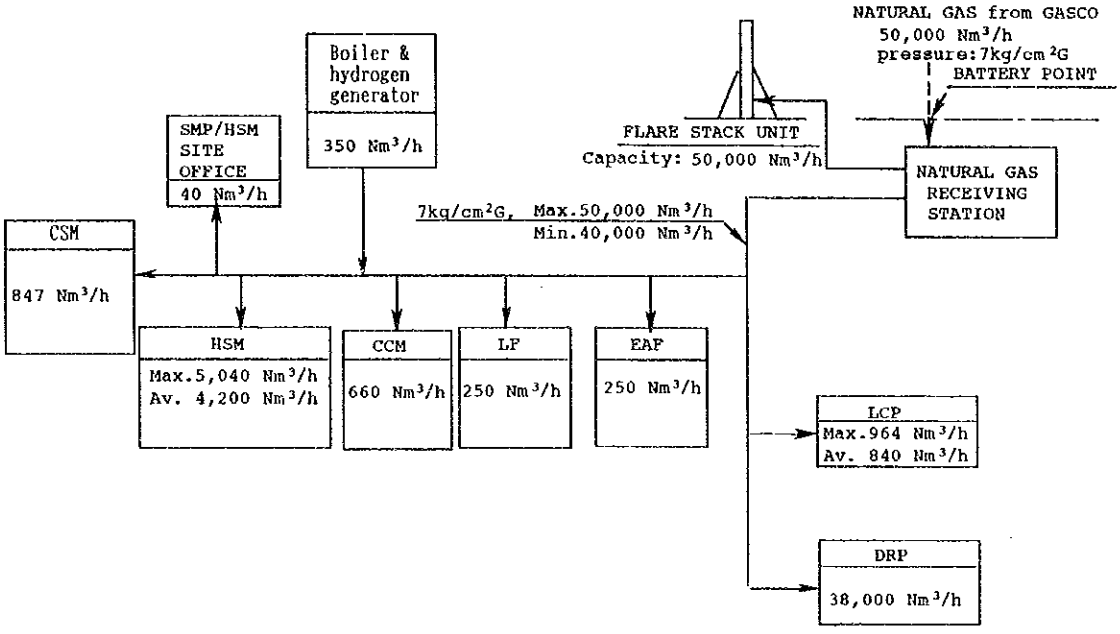
- Receiving quantity	: max. 50,000 Nm^3/hr, min. 40,000 Nm^3/hr
- Receiving pressure	: 7.0 + 0.1 kg/cm^2
- Impurity	: none
- G.C.V (BTU/FT)	: 1,183 ~ 1,077
- Supply pressure to plant	: 7.0 kgf/cm^2
- Pressure relieving and depressurizing system	: Safety relief valve and flare stack
- Application of standard	: API recommended practice 521,1990
- Instruments	: application of explosion proof.

(2) Description of process and equipment

Natural gas will be received at the battery point and will be supplied to each plant after metering the flow quantity by turbine meter (Refer to Figure 6-7-1).

The natural gas station shall be equipped with safety relief valves and flare stack for relieving and depressurizing if raised pressure in the line occurs.
Height of flare stack is 32 m and radius of safety area is 20 m as per API recommended practice 521, 1990.

Figure 6-7-1 Flow Sheet of Natural Gas



6-7-4 Gases supplied from gas supply company. (oxygen gas, nitrogen gas and argon gas)

Oxygen gas, nitrogen gas and argon gas will be received from gas company located adjacent to the plant site.

Design basis of oxygen gas, nitrogen gas and argon gas are as indicated in Table 6-7-2

Fluctuation of consumption shall be absorbed by the gas holder located in gas supply company. Flow meter of each gas is located at the battery limit of the plant and gases are supplied to each plant through a pipe line.

Table 6-7-2 Design Basis of Oxygen, Nitrogen and Argon Gas

Item	Oxygen gas	Nitrogen gas	Argon gas
Receiving quantity (max.) (Nm^3/hr)	8,100	3,600	150
Receiving quantity (Ave.) (Nm^3/hr)	4,300	1,550	95
Receiving pressure (kg/cm^2)	15.0	6.0	6.0
Supply pressure (kg/cm^2)	15.0	6.0	6.0
Purity (%)	99.5	99.99	99.9

6-7-5 Gases (plant air, hydrogen gas and steam)

Plant air, hydrogen gas and steam are generated in the plant and the design basis and process description for each gas is summarized as follows;

(1) Plant air

1) Design basis

Plant air is produced in plant facilities by installation of air compressors. Design basis of plant air is as follows;

- Atmospheric condition
  - Atmospheric pressure : 1,013 mm bar
  - Temperature(dry bulb) : 30.5 °C
  - Relative humidity : 70 % (at 30.5 °C)
- Total capacity of air compression : 18,000 Nm^3/hr
- Stand by unit : 1 unit
- Noise level : <95 dB(A) at 1 m distance from machine side.
- Supply pressure : max.7.7 kg/cm^2, nor.7.0 kg/cm^2
- Supply temperature : max. 40.0 °C
- Purity : Oil free

2) Description of process and equipment

Flow sheet of plant air is indicated in Figure 6-7-2.

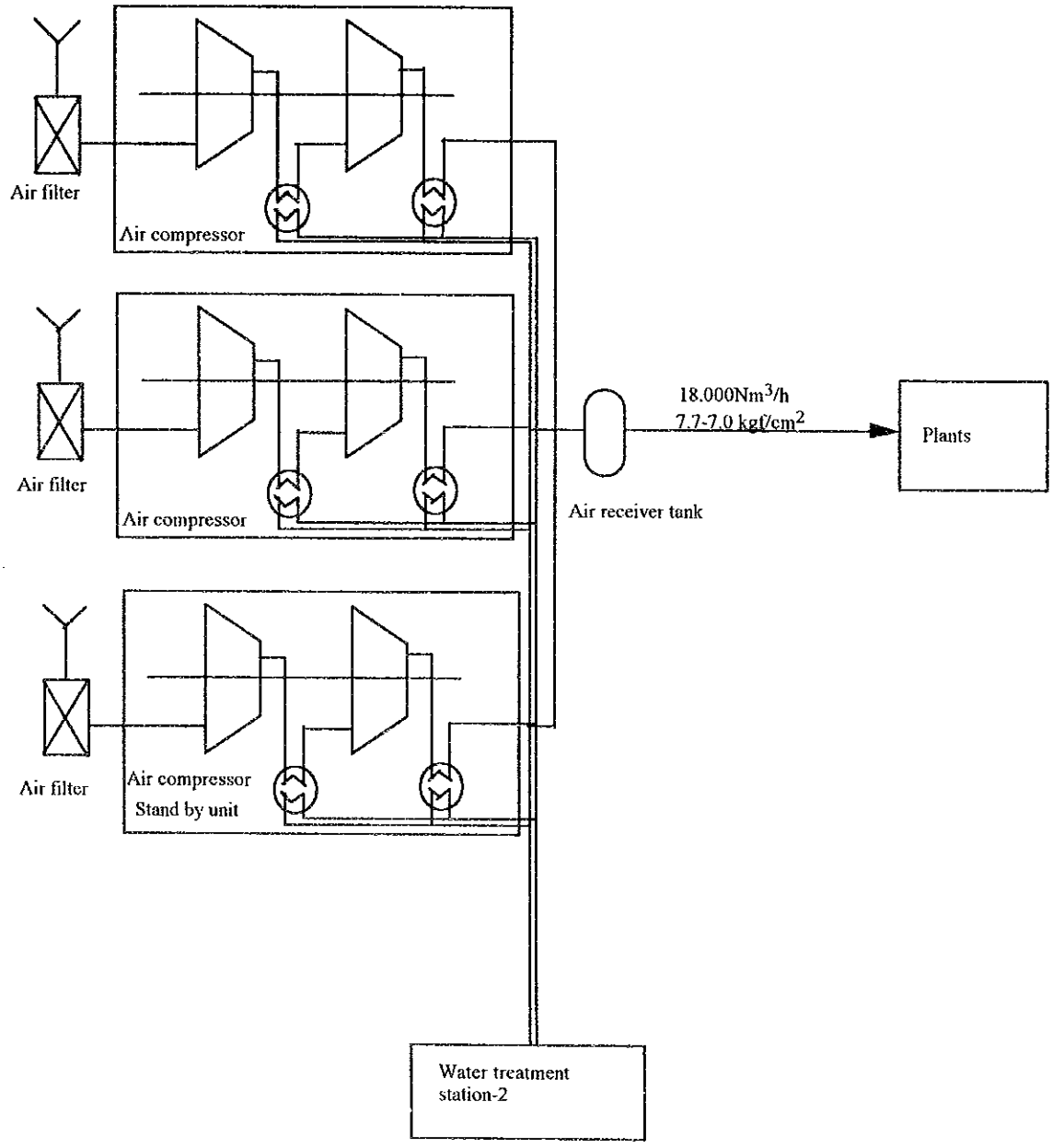
Air compressors of centrifugal type is selected from the three types as per Table 6-7-3.

Table 6-7-3 Comparison Table of Air Compressor

(Capasity:10,000 Nm^3/hr, pressure: 7.0 kg/cm2)

Type	Reciprocating	Centrifugal	Screw
Efficiency	Low	Higher	Normal
Capacity control with reduction of power consumption	Not easy. Unloader by suction valve open	Easier. By inlet guide vane	Not easy. By pass from intermediate stage
For huge capacity	Not applicable (Better for small capacity and high pressure)	Applicable	Not applicable
Rotation speed	Low	Highest	Normal
Equipment price	Expensive	Cheap	Cheap
Maintenance cycle and super visor	Every 6,000 hours. During maintenance, supervisor from manufacturer will not be required.	Every 1.5 – 2.0 years. During maintenance, supervisor from manufacturer shall be required.	Every 1.5 – 2.0 years. During maintenance, supervisor from manufacturer shall be required.

Figure 6-7-2 Flow Sheet of Plant Air



(2) Hydrogen gas

1) Design basis

Hydrogen gas is produced from natural gas in plant facilities by installation of hydrogen generators and then is supplied to annealing furnaces. Design basis of hydrogen gas is as follows;

- Generation capacity	: max. 80 Nm^3/h
- Supply pressure	: 6.0 kgf/cm^2
- Purity	: 99.999 %
- Supply temperature	: ambient temperature

2) Description of process and equipment

Hydrogen gas is generated from natural gas, methanol, ammonia and water as an industrial process.

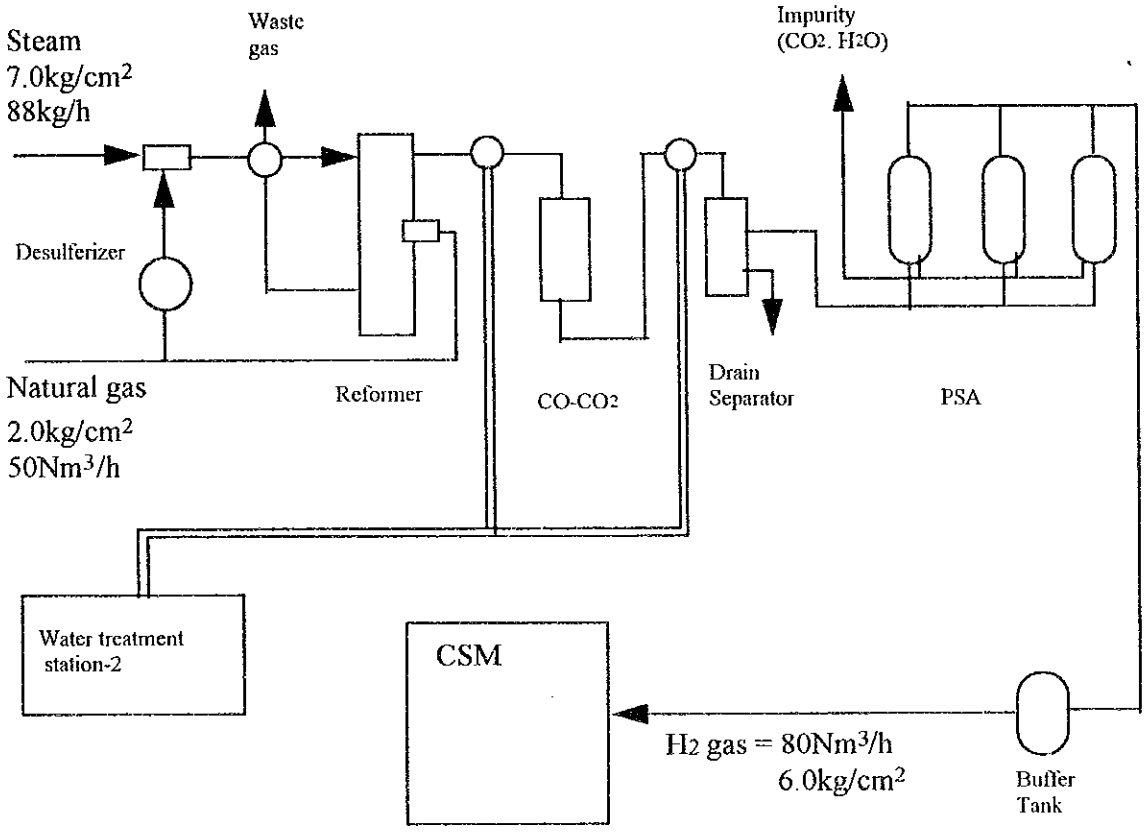
Reformer-PSA type uses natural gas and steam as raw material whereas electrolysis type uses water as raw material. Both types are evaluated and reformer-PSA type of hydrogen generator is selected as shown in Table 6-7-4 due to lower power consumption.

Process flow sheet is indicated in Figure 6-7-3.

Table 6-7-4 Comparison of Hydrogen Generator

Type	Electrolysis	Reformer-PSA
Raw material	Pure water	Natural gas, steam
Principle	Water will be electrolyzed and separated hydrogen and oxygen.	Natural gas with mixed steam will be reformed to H_2 and CO, then CO-CO_2, H_2 will be separated by PSA (pressure swing adsorber).
Purity of Hydrogen (%)	99.999	99.999
Required Utility	Water = 800 cc/Nm^3, Electric power = 6.0 kW/Nm^3	Steam = 1.1 kg/Nm^3 Natural gas = 0.6 Nm^3/Nm^3 Electric power = 0.38 kw/Nm^3
Equipment cost (Figure is no value)	100	100
Maintenance cycle	1 year	1 year: PSA valve and catalyst

Figure 6-7-3 Hydrogen Generator



(3) Steam

1) Design basis

Steam is generated in the plant facilities. Steam boiler requires de-mineralized water. Design basis of steam generation system is as follows;

- Steam generation capacity : 3,000 kg/hr
- Steam pressure : 8.0 kg/cm^2
- Steam temperature : saturated temperature
- Supply quality and capacity to boiler feed water
  - pH : 7.6 ~ 7.8
  - Total hardness : 0 mg/l as $CaCO_3$
  - Electric conductivity : 10 μS
  - Turbidity : < 2 NTU
  - Supply capacity : 5.0 m^3/hr
  - Supply pressure :10.0 kg/cm^2

2) Description of process and equipment

Process of steam as indicated in Figure 6-7-4.

Make up water is treated and generated as de-mineralized water.

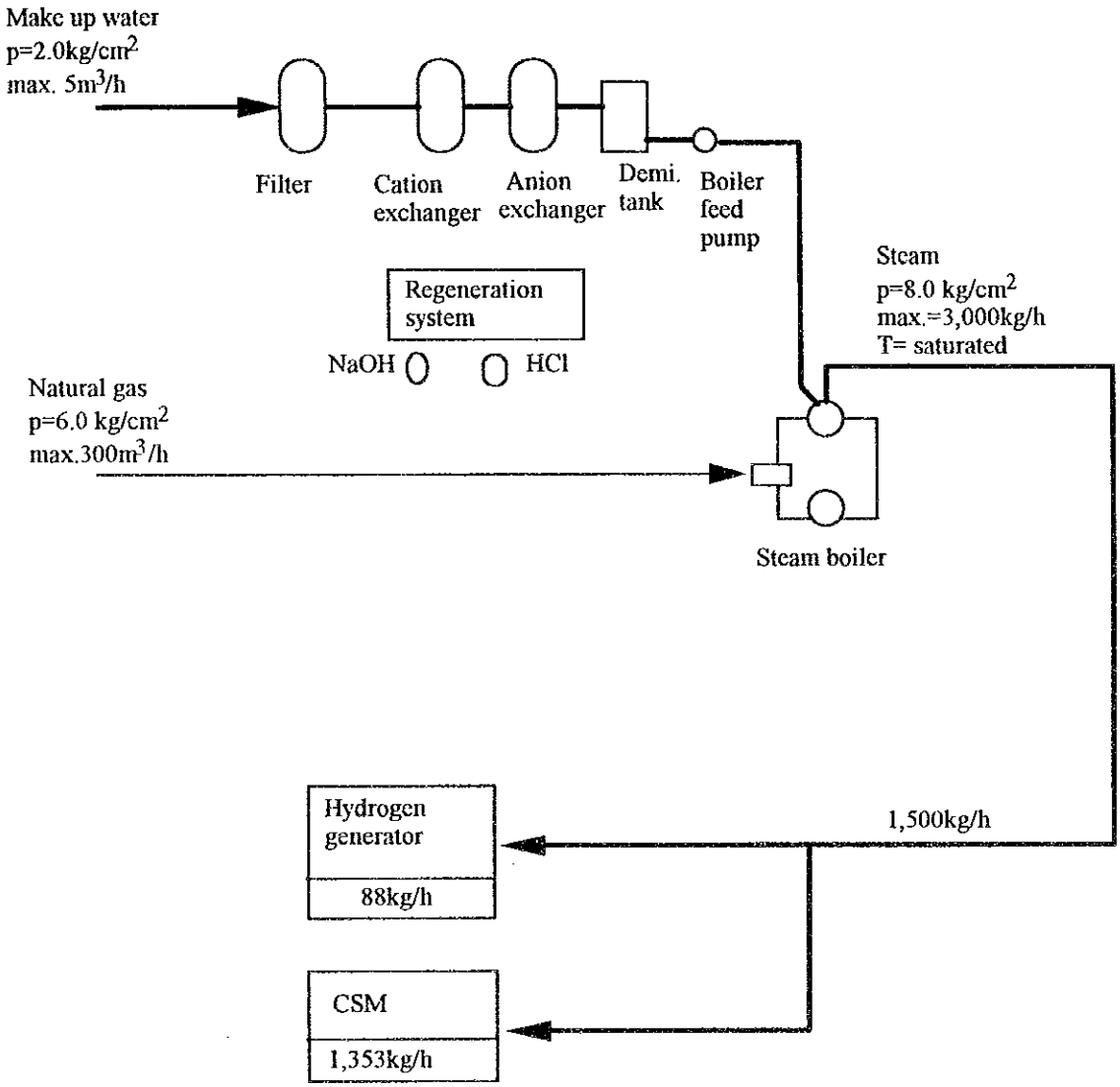
Capacity of 5 m^3/hr of de-mineralizer is installed at the boiler plant.

An ion exchange and 2B-2T type of de-mineralizer is selected so that water quality meets the requirement as boiler feed water.

Steam is generated from steam boiler and natural gas is used as fuel.

Steam is consumed at pickling line in cold rolling mill and hydrogen generator.

Figure 6-7-4 Flow Sheet of Steam



6-7-6 Water

(1) Raw water

1) Design basis

Raw water will be received at the battery point and is supplied to the plants after treatment in raw water treatment station. The design basis of raw water treatment station is as follows;

- Raw water quality : refer to chapter 4. Table 4-3-9
- Receiving quantity : max. 1,000 m^3/hr
- Storage capacity of raw water : 3.0 hours

Raw water is treated by the treatment station as make up water, and supplied to both circulation water system and rinsing water for the cold strip mill.

- Make up water quality and capacity to plant:

pH	: 7.6 - 7.8
Total hardness	: 80 mg/l as $CaCO_3$
Chloride ion	: 38 - 67 mg/l
Turbidity	: < 2 NTU
Supply capacity	: 980 m^3/hr
Supply pressure	: 3.0 kgf/cm^2

2) Description of process and equipment

Flow sheet of raw water treatment station is indicated in Figure 6-7-5.

As per the flow sheet, about half of the quantity of the raw water is stored, filtered and softened.

And the remaining raw water is mixed with softened water in make up water basin so that water quality of total hardness becomes 80 mg/l as $CaCO_3$.

Raw water basin has a capacity of 3,000 m^3 and this basin holds about 3 hours quantity during water shortage.

Gravity type filter is employed in order to protect from contamination of resin in softener.

Ion exchange type and sodium cycle water softener is selected and sodium chloride which is available in Egypt is used as the regeneration agent.

Treated water in the raw water treatment station is supplied to the plant as make up water.

(2) Circulation water

1) Design basis

Design base of ICW and DCW system are as follows;

(a) ICW system

ICW is used as cooling medium and requires such characteristics as anti-corrosion, non scaling and non slime growth so that system may be operated without trouble. Condensation ratio (N) of circulation water is decided taking into account of;

- Heat transfer rate and materials of the system
- Saturation index of calcium in circulation water
- Corrosion speed and bacteria growth rate

(N = circulation water quality / make up water quality)

a) Supply quality of ICW to plant(except mold and machine cooling in CCM) is as follows;

Condensation ratio (N) : 3.0	
pH	: 7.6 - 7.8
Total hardness	: max. 240 mg/l as $CaCO_3$
Chloride ion	: 100 - 150 mg/l
Turbidity	: < 2 NTU
Electric conductivity	: 1,700 μS
Supply capacity	: as per request by each plant
Supply pressure	: as per request by each plant

On the other hand, equipment which is exposed to the high thermal transfer rate, such as mold and machine cooling in CCM, requires more high quality water and closed cooling circuit is employed in this case.

b) Supply quality of ICW water to mold and machine in CCM plant is as follows;

Condensation ratio (N)	: 1.0 (closed circuit)
pH	: 7.6 - 7.8
Total hardness	: 1.0 < mg/l as $CaCO_3$
Chloride ion	: 38 - 67 mg/l
Turbidity	: < 2 NTU

Electric conductivity : 550 μS

(b) DCW system

a) SMP

As slab is semi product, supply quality of DCW water to slab CCM will be lower than that of HSM.

Condensation ratio (N) = 4.0 can be adopted.

pH	: 7.6 - 7.8
Total hardness	: 240 mg/l as $CaCO_3$
Chloride ion	: 80 - 200 mg/l
Turbidity	: < 5 NTU
Suspended solid	: < 10 mg/l
Oil	: < 5 mg/l
Supply capacity	: as per request by each plant
Supply pressure	: as per request by each plant

b) HSM plant

Hot rolled products are the final products and recirculation water quality shall be specified from production side and indicated as below;

pH	: 7.6 - 8.0
Total hardness	: 150 mg/l as $CaCO_3$
Chloride ion	: < 100 mg/l
Suspended solid	: < 20 mg/l

According to above required value, condensation ratio (N) of recirculation water shall be max.2.0.

(c) Estimation on the required make up water

Once condensation ratio for all circulation water system are decided, the required make up water can be estimated by calculating blow down water from evaporation loss.

Equation is as follows;

$N = 1 + E/B$

(where, B = blow down quantity,

E = evaporation quantity from cooling tower)

Water balance of raw water and circulation water are calculated as per above equation and indicated in Figure 6-7-6.

(d) Water recovery ratio

As an index to show the advanced situation for utilization of water, a water recovery ratio has been employed.

Water recovery ratio(WRR)
= {(recycled quantity - make up water quantity) /(recycled quantity)} x 100

Water recovery ratio (WRR) in this conceptual plan is calculated as per Figure 6-7-6 and result is as follows;

WRR = (22,807-907)/22,807 = 96.0 %

Some steelworks in Japan have maintained a WRR = 95 - 96 %.
In the case of ANSDK, WRR = 95.5 %
The conceptual plan will be reached to an advanced level.

2) Description of process and equipment

(a) ICW system

Five types of ICW system are mainly used in the steel industry and their features are indicated in Figure 6-7-7.

Type-2 and Type-4 of ICW system are used in operation around Egypt. Both types are compared in Table 6-7-5 and Type-2 of ICW system is selected in this study, because Type-2 has characteristically lower energy consumption and lower equipment cost than those of Type-4.

Table 6-7-5 Comparison between Type-2 and Type-4 of ICW

Type	Type-2	Type-4
Water consumption		
(m^3/hr)	0.028 x Q	0.001 x Q
(LE/hr)	(0.0285 x Q)	(0.001 x Q)
Power consumption		
(kwh)	0.075 x Q	10.2 x Q
(LE/hr)	(0.0051 x Q)	(0.69 x Q)
Equipment cost	-	Bigger than Type-2 Because sea water intake and pumping station is required. Heat exchanger is of titanium (high cost).

(Q: Water quantity of recirculation water, power = 0.068 LE/kWh, water = 1.02 LE/m^3)

ICW system in this conceptual plan is selected as indicated in Table 6-7-6.

Table 6-7-6 Selection of ICW System in this Conceptual Plan

Water treatment station	Plant name	Type of ICW system
Water treatment station-1	EAF,LF	Type-2
Water treatment station-2	Air compressor	Type-2
Water treatment station-3	CCM (Mold, machine cooling)	Type-3
Water treatment station-4	HSM	Type-2
Water treatment station-5	CSM	Type-2

As for Type-3, Softener is required for reducing hardness value of make up water.
Emergency water system during power shut down shall be required. Emergency water shall be supplied from head tank with gravity flow before the diesel driven pump is operated.

(b) Direct cooling system (DCW system)

DCW system is used in this conceptual plan for 2 plants (One is CCM and the other is HSM).
DCW is contaminated in plants during direct cooling by scale and oil.
DCW system is indicated in Figure 6-7-8.
Type-3 of DCW system and scale pit for pre-treatment system are selected because both system are commercially proven technology.

Brief explanation of system as follows(Refer to Figure 6-7-9);
DCW is discharged to the scale pit and coarse scale is separated by settling. Then water is transferred to sedimentation basin and scale and oil are separated here so that water can be fed to ultra high rate filter.
After filtration, DCW is cooled in cooling tower and recirculated.
On the other hand, settled scale in sedimentation basin and back washed water of ultra high rate filter are transferred to thickener and thickened, then, after being transferred to dehydrator and dehydrated about 30 % of water content so that sludge can be handled without scattering dirty water.
Oil is collected by oil skimmer and thickened by the oil-water separation tank and then after stored in oil tank.

Figure 6-7-5 Flow Sheet of Raw Water Treatment Station

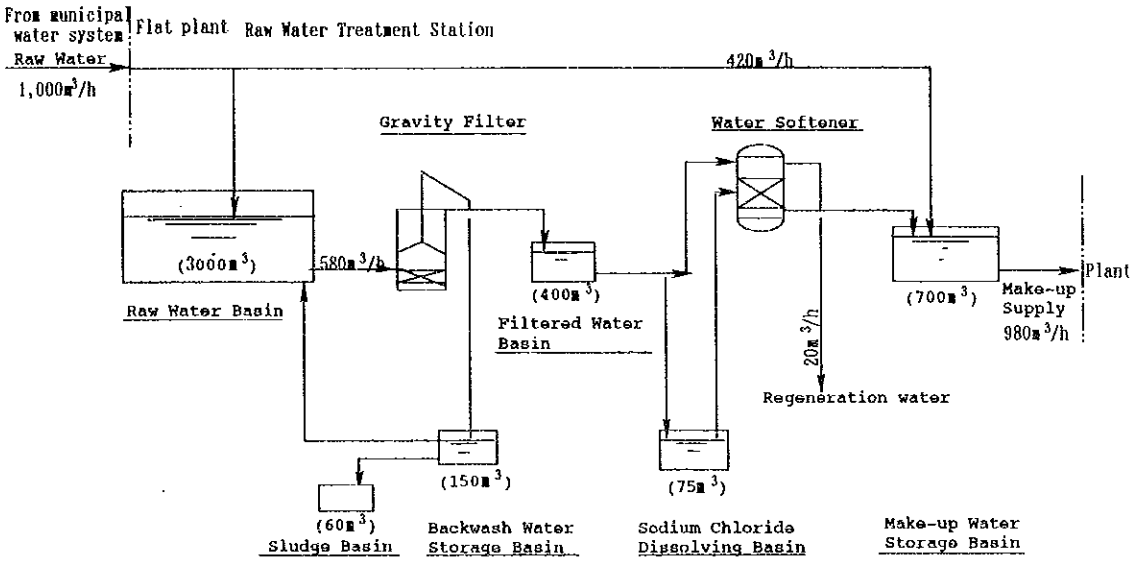


Figure 6-7-6 Water Balance

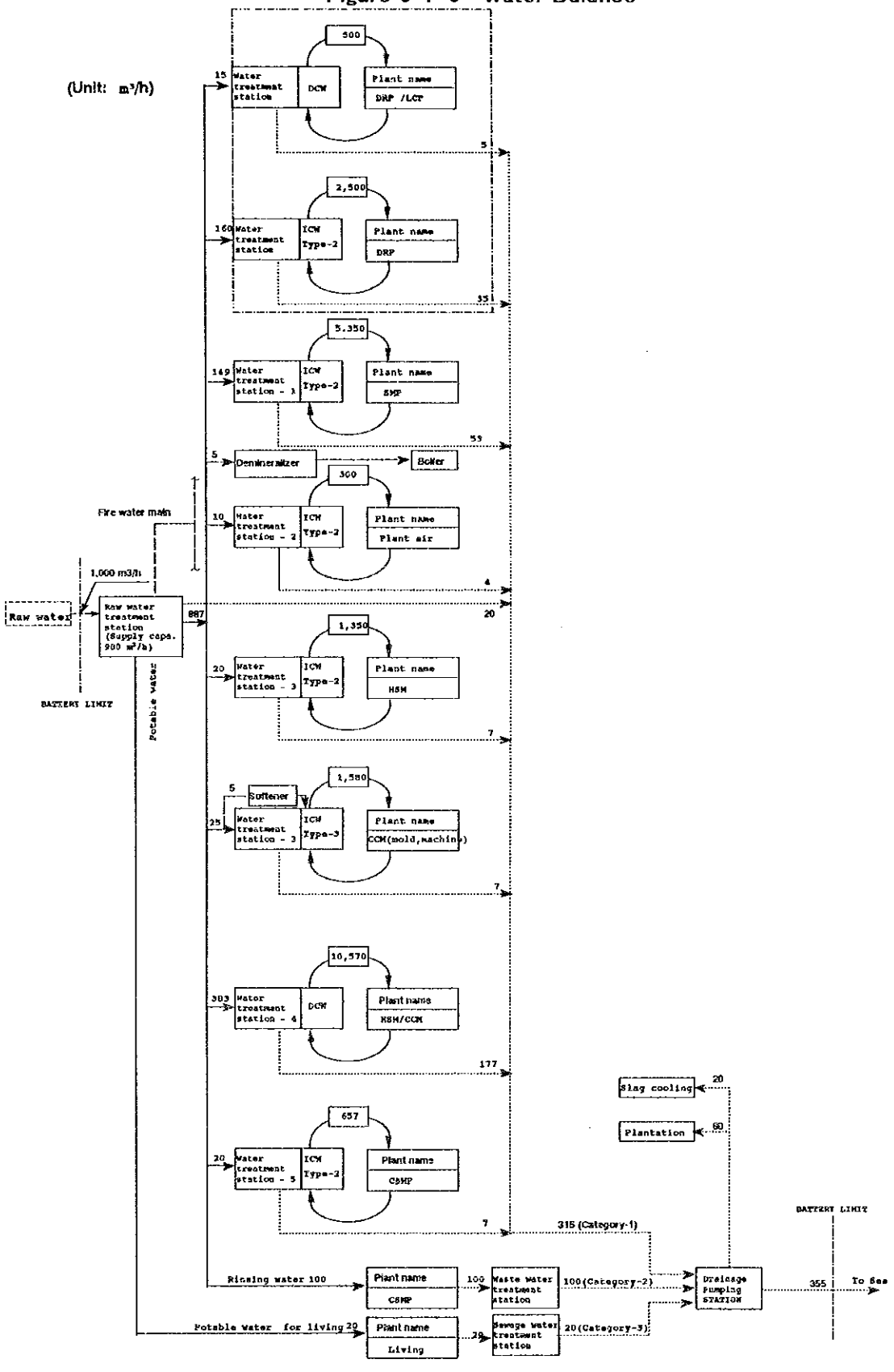


Figure 6-7-7 Indirect Cooling Water System

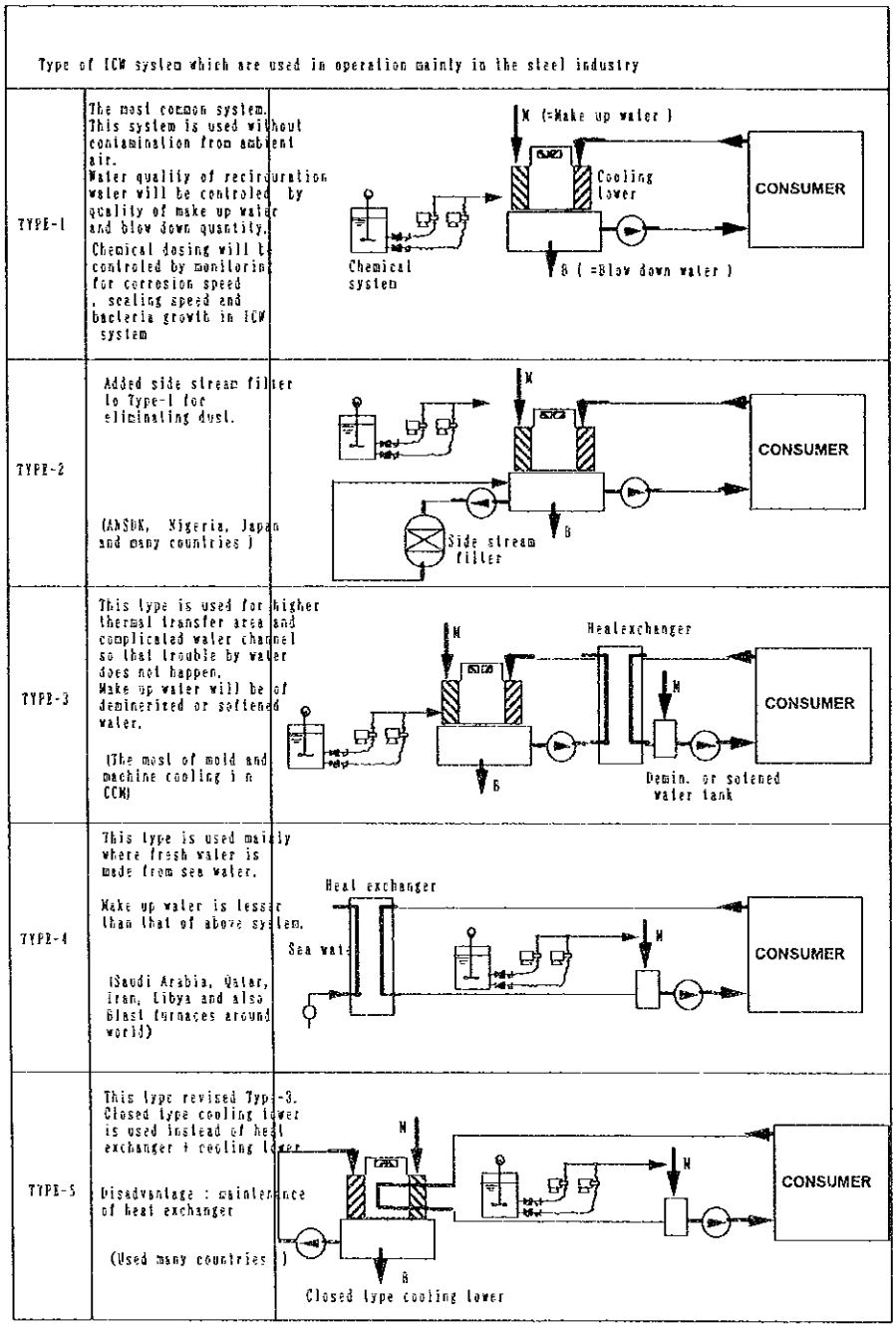


Figure 6-7-8 Direct Cooling System

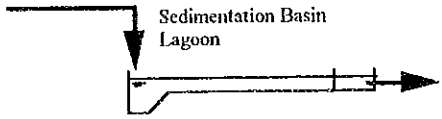
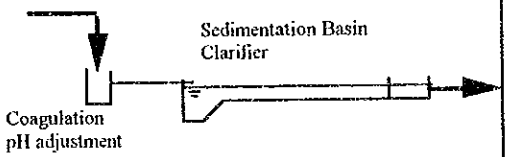
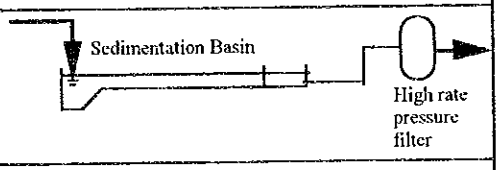
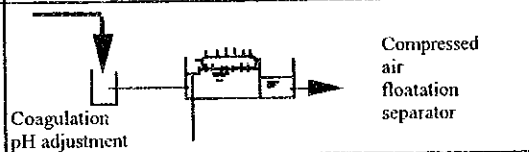
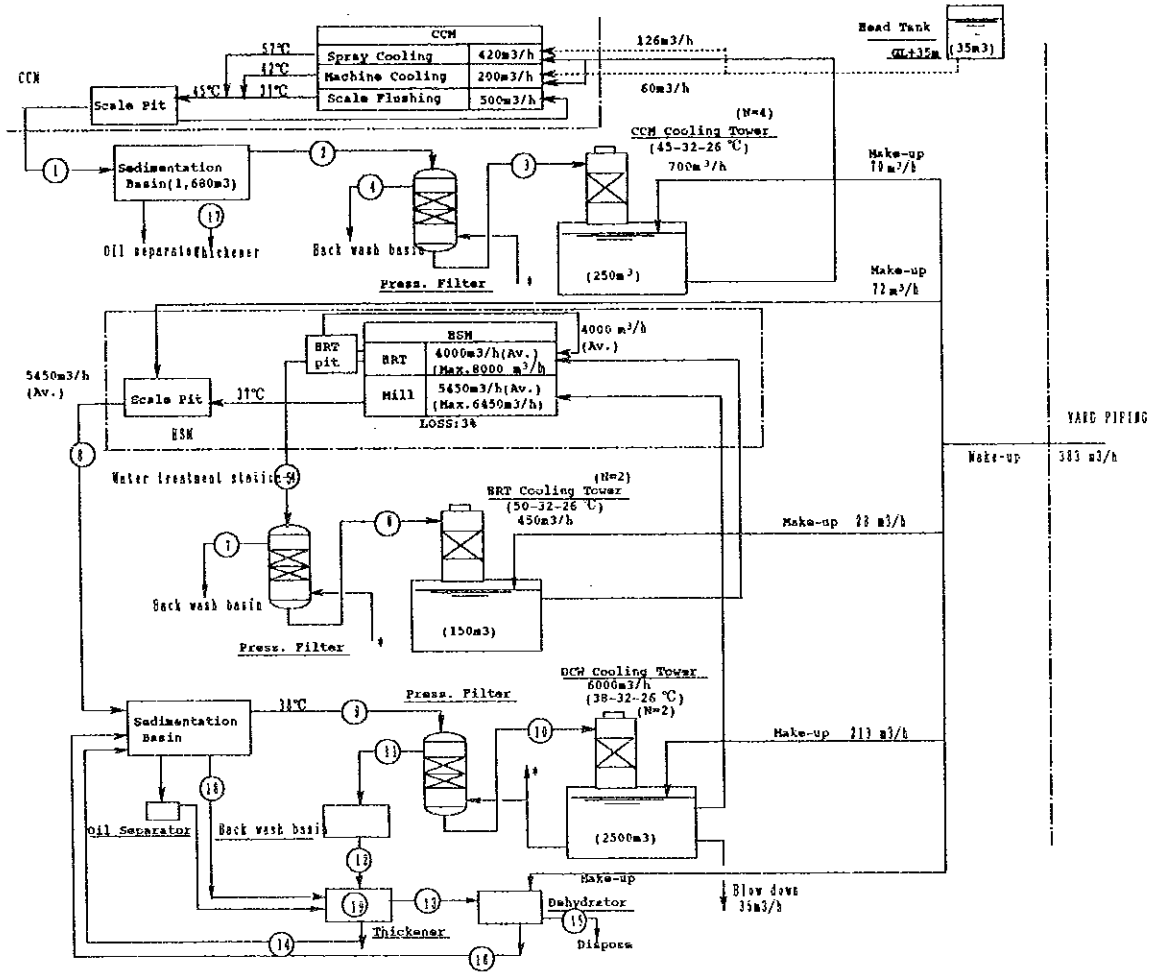
Function		Features and the applied plant	Treatment process
Separation of ss and oil	Type-1	Separation particle size : > 30 micron ss>50 ppm Bar /rod /section , rolling plant	
	Type-2	Type-1+ coagulation and/or flocculation Separation particle : >5 micron, ss=35-50 DR,Pellet,Sinter, BF, BOF, Rolling	
	Type-3	Type-1 + High rate pressure filter Filtration speed=40m/h ss <10ppm, oil<5ppm HSM, Rolling, CCM	
	Type-4	Coagulation + floatation Oil separation	
Pretreat-ment	S	Scale pit	Coarse scale settled easily. CCM, HSM, rolling
	C	Classifier	Large particles separated here. DRP. Pellet
	D	Desilter	Same as above
	B	Settling bed	Same as above.
Sludge Slurry Thickening		- a :Thickener	Thickener used for thickening of slurry and sludge in type-1,- type-4.
Dehydration Dehydrator		-b: Vacuum type	Drum type, belt type are available. Water contents in dehydrated cake higher than that of press filter.
		-c: press filter	Many types manufacturered, and in general, water content in dehydrated cake lower than that of Vacuum type
		-d: settling pond	2-settling ponds are installed, and used alternatively. Large area is required.

Figure 6-7-9 Flow sheet for DCW System



References			1	2	3	4	5	6	7	8	9	13	11	12	13	14	15	16	17	18	19	Total
ss & oil balance																						
Flow rate	m3/h		620	620	592	28.8	400	385.9	14.98	5450	5450	5253	197	209	10.50	348.9	1.46	8.904	30	90	359	
SS	ppm		206	50	10	1541	50	10	1136	206	80	8	1999	1861	1E+05	50	1E+05	8	2440	7261	3256	
	kg/h		124	43.6	5.92	43.4	20	3.859	16	1050	436	42	398	452	1162	17.44	1162	0	74.4	654	1180	
OIL	ppm		20		<5		0			20		<5										
	kg/h																					
CONAPE			5.5				5.5					5.5										
No. of filter		1+1					1+0					1+1										
Back wash	m3/cycle		338				338					335										
	m3/d		676				338					4737										5746 m3/day
																						239.4 m3/h

6-7-7 Waste water

(1) Design basis

1) Drainage quantity and the treated water quality of waste water

Waste water is divided into three categories and their details are as follows;

(a) Category-1: Blow down water from water treatment system.

Analysis of waste water is same as those of re-circulation water (Refer to Figure 6-7-6).

(b) Category-2: Waste water from cold strip mill.

Flow quantity,kind of impurities in waste water and treated water quality are summarized in Table 6-7-7.

Waste water from cold process is treated respectively for each kind of impurities as per latest proven technology in the world , and the impurities values shall be lesser than discharge limit specified as per Law No.4/1994.

Then after, treated water is transferred to drainage pumping station.

(c) Category-3: Live sewage.

Live sewage is gathered by the local pumping stations and is transferred to the sewage treatment station and then treated at the said station.

Then after, treated water is transferred to drainage pumping station.

Sewage treatment station shall be designed as indicated in Table 6-7-8.

Table 6-7-7 Waste water from CRMP

Process	Flow quantity (m^3/h)	Kind of impurities	Quality before treatment	Treated water quality
Pickling line	41.0	Acid	pH: 2 HCl: 8,000 mg/l Temperature: max.50 °C	PH:5.8~8.6 COD:<20mg/l BOD:<10mg/l Normal Hexane :<5mg/l T-Cr:<2mg/l Cr^{6+}:<0.05mg/l
Cold rolling mill	41.0	Oil	oil: 5 % Fe: 1,000 mg/l Cl: 100 mg/l pH: 4~7 BOD: 15 mg/l	
CGL	11.0	Alkali	NaOH: < 1.0 % pH: 12~13 Temperature: max.60 °C	
	7.0	Chromate	Cr^{+6}: 0.3 g/l pH = 2 Temperature: max. 50 °C	
Total	100.0			

Table 6-7-8 Design Basis of Live Sewage

Item	Before treatment	Treated water
Total flow rate (m^3/d) = 2,000 x 250 l/people-day	500	500
BOD_5(mg/l)	200	20
SS (mg/l)	250	50
Max. temperature(℃)	30	30
PH	6.5 ~ 7.5	5.8 ~ 8.6

(d) Total drainage water quantity

Total drainage water quantity from three categories are as follows;

Category-1 : 315 (m^3/hr)

Category-2 : 100 (m^3/hr)

Category-3	:	20 (m^3/hr)
Total		: 435 (m^3/hr)

Waste water is gathered to the drainage pumping station located in the flat steel plant.

2) Discharge of waste water

Waste water gathered to the drainage pumping station will be discharged according to the following priorities.

Priority-1: To slag yard for slag cooling in steel plant
(Quantity = 20 m^3/hr)

Priority-2: To plantation in steel plant
(Quantity = 60 m^3/hr)

Priority-3: To the sea through existing discharge pipe line in accordance with Law No.4/1994 and surplus capacity of existed discharge pipe line is 1,690 (m^3/h)
(Quantity = 355 m^3/h)

(2) Description of process and equipment

1) Waste water category-1.

Quality of this category is the same as those of re-circulation water and is better than discharge limit value as per Law No.4/1994.

Then waste water category-1 shall be discharged as blow down water without any treatment.

2) Waste water category-2.

(a) The treatment of waste water containing Cr^{+6}

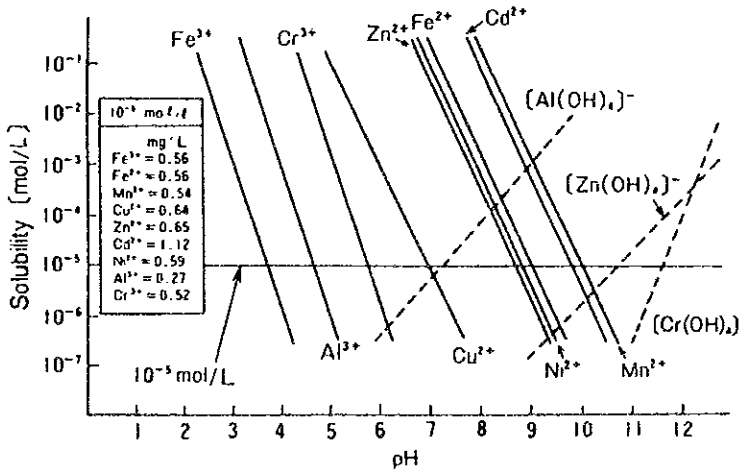
a) Principle of pH adjustment treatment

Some soluble substances become insoluble and precipitate upon pH changes. The most typical substances are some metal ions. For example, iron, aluminum, chromium, cadmium, etc., have the quality of becoming metallic hydroxides with low solubility within specific pH ranges, and as a result, will precipitate.

The relation between pH and the solubility of various metal ions is shown in Figure 6-7-10.

Chromium is present as Cr^{+6} and to remove chromium by sedimentation, it is necessary to reduce Cr^{+6} to Cr^{+3}, make the solution alkaline, and settle out chromium as $Cr(OH)_3$.

Figure 6-7-10 Relation Between pH and the Solubility of Various Metal Ion



(b) The treatment of waste water containing oil

The oil separator is based on the principle that oil is different in density from water. The floatation velocity of oil droplets in water can be calculated by the Stokes' formula.

The separation efficiency of oil varies with the condition of oil droplets in the waste water concerned. The results of a survey conducted at Japan's oil refineries indicate that the residual oil concentration in the treated water is approximately 10 to 20 mg/l as per gravity separation.

Coagulation and pressure floatation or coagulation, sedimentation, and sand filtration are required to reduce the residual oil concentration to a maximum of 5 mg/1.

Flow sheet of waste water treatment is indicated in Figure 6-7-11.

3) Waste water treatment category-3 (Live sewage)

Live sewage is treated by the activated sludge process as shown in Figure 6-7-12.

Waste water is removed of suspended solids, which are easy to separate by grit chamber and flow control basin and is introduced into the aeration basin.

The aeration basin is the heart of the activated sludge process.

The waste water is mixed with the activated sludge returned from the sedimentation basin and is aerated.

The waste water is separated into supernatant treated water and settled sludge in the sedimentation basin.

While some of the settled sludge is returned for reuse in the aeration basin, the excess sludge is discharged to the sludge storage basin and will be disposed.

Figure 6-7-11 Flow Sheet of Waste Water Treatment Station

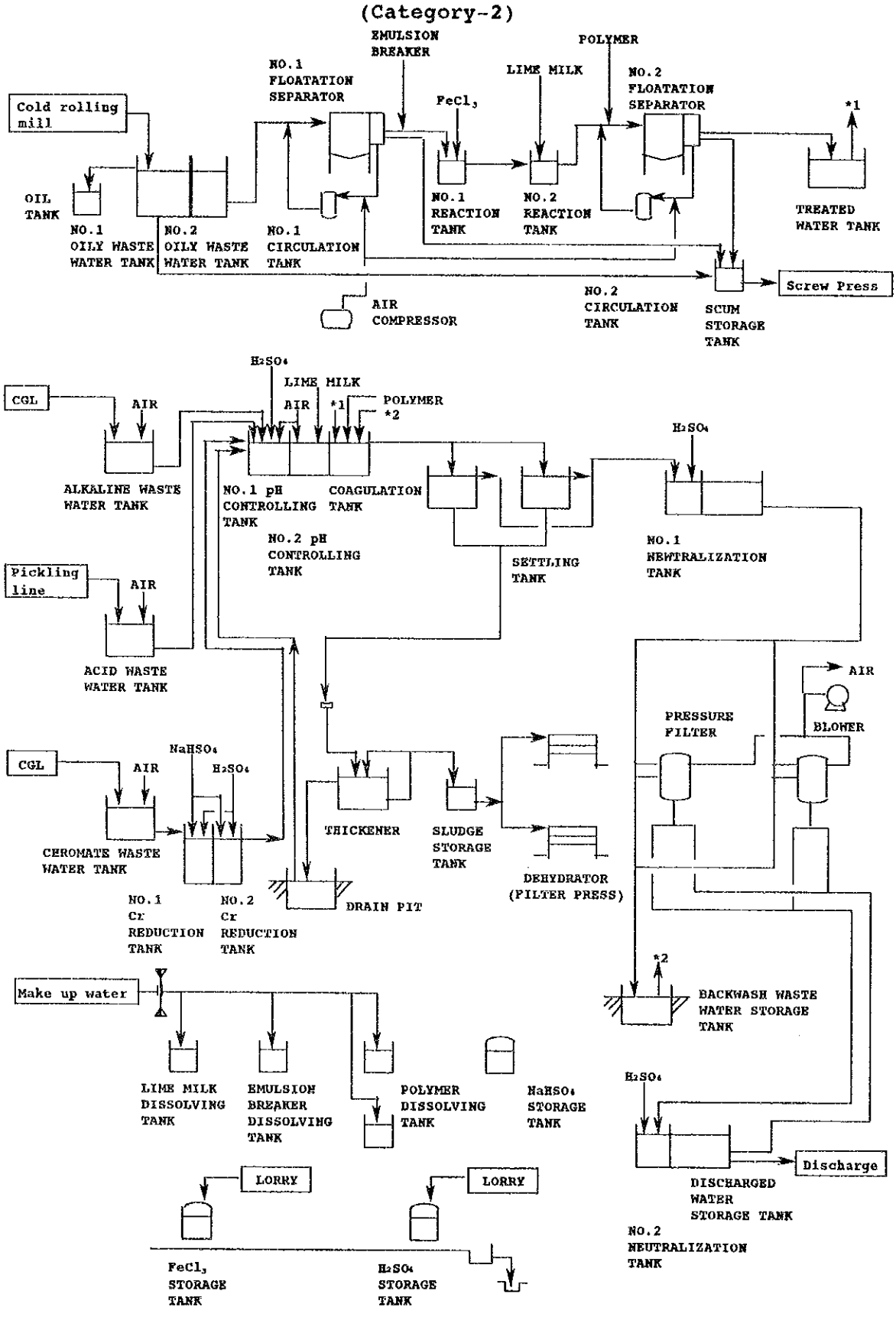
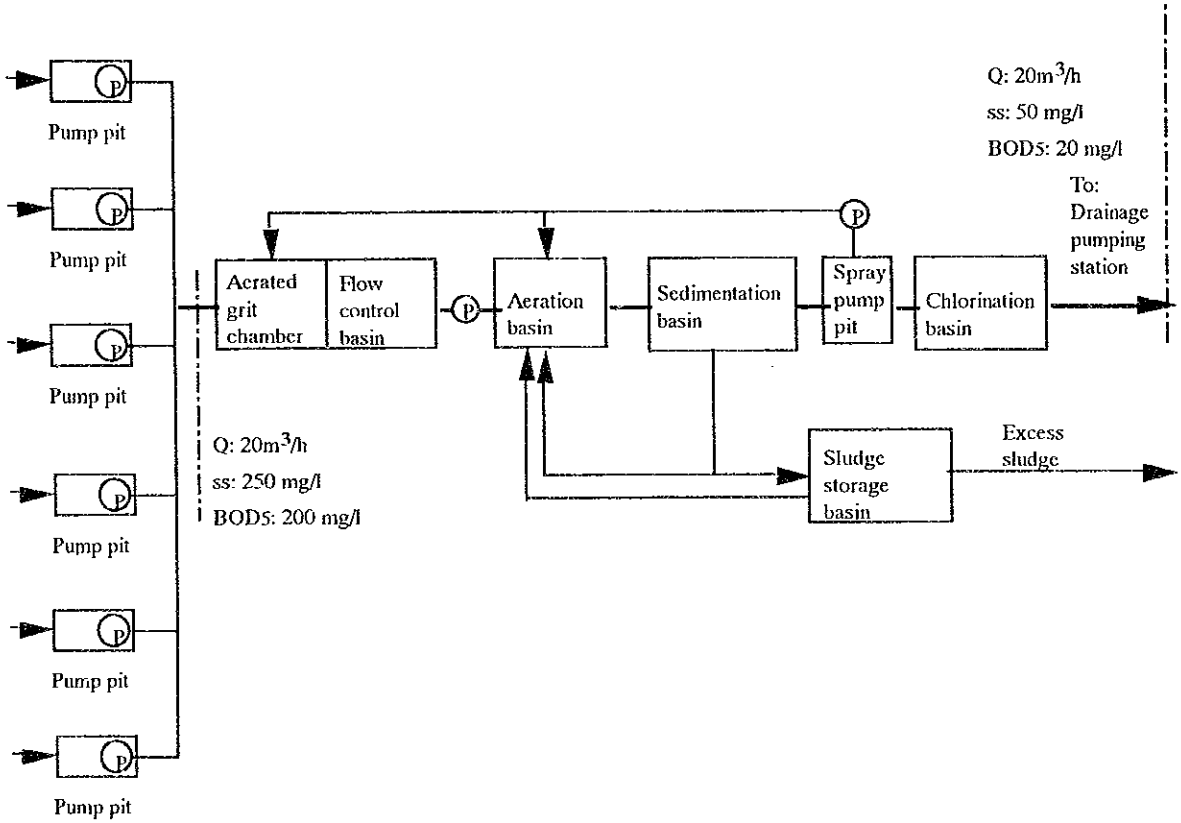


Figure 6-7-12 Flow Sheet of Sewage Water Treatment System

(Category-3)



6-7-8 Organization and personnel

Organization of utility section is one of the sections in maintenance and utilities department. Maintenance of utilities requires specific knowledge and understanding about systems as a whole and phenomenon of various gases and chemicals. So maintenance persons for daily maintenance are included in utility section.

The persons required for the utility facility are as follows ;

Table 6-7-9 Utility Facilities Organization and Personnel

Utility	SM	ASM	Eng	FO	AF	W
Operation (shift) (day)	1	2	2	2	4*4 2	18*4 4
Maintenance People	0	1	2	1	3	12
Total	1	3	4	3	21	88

6-7-9 Drawing and equipment list

(1) Equipment list

Refer to Appendix 6A-7-1

(2) Drawings

Refer to Appendix 6A-7-2

6-8 In-works Transportation Facilities

6-8-1 Outline

Transportation facilities in the steel works includes transporting and storing of scrap, limestone, additives, refractories, electrode, mill scale, slag, waste materials and others required for keeping production of 1,000,000 tons per year of flat products.

The facilities of in-works transportation cover the following:

1) Movable equipment such as crawler crane, crawler shovel, wheel shovel, forklift, etc. for unloading and loading.

2) Transportation equipment such as dump truck, flat deck truck, slag pot carrier, etc. for transportation.

3) Warehouse for brick, electrode, additives, and spare parts.

4) Open scrap yard for storage of scrap.

5) Limestone storage yard

6) Slag yard

7) Truck weighing equipment

6-8-2 Basic Design

Main routes of material transportation flow and amount of handling in the steel works are as shown in Table 6-8-1.

Table 6-8-1 Materials to be Transported in the Plant

Materials	Route	t/y
Charging scrap	OSY-SMP	155,000
SMP home scrap	SMP-OSY	18,700
Flat home scrap	RMP-OSY	57,000
Slag yard scrap	Slag yard-OSY	1,300
Limestone	Storage yard-LCP hopper	80,000
Additive	Warehouse/Storage yard-SMP	40,000
SMP refractories	Warehouse-SMP	15,000
Electrode	Warehouse-SMP	2,200
CCP mill scale	CCP-Disposal yard	4,000
Flat mill scale	RMP-Disposal yard	10,000
SMP slag	SMP-Slag yard-Disposal yard	150,000
Oxide fines	DRP-Stock yard-Disposal yard	52,000
Lime fines	LCP-Stock yard-Disposal yard	8,000
DRP cake	DRP-Disposal yard	22,000
SMP dust	SMP-Disposal yard	23,000
SMP waste brick	SMP-Disposal yard	9,000

6-8-3 Description of system and equipment

(1) In-works transportation facilities

Scrap will be loaded on dump trucks in open scrap yard by crawler cranes with lifting-magnet and transported by dump trucks to the steelmaking plant after weighing on the truck weighing scale and dumped into a scrap bucket in the SMP.

Returned home scrap from SMP, HSMP and CSMP will be transported to open scrap yard by dump trucks.

Hot slag poured into slag pots from the electric arc furnace or ladles in SMP will be self-loaded by hot slag pot carriers, transported to slag yard and self-dumped into the slag yard.

Limestone will be transported from the limestone storage yard to limestone receiving hopper by wheel shovels.

Additives for the SMP will be loaded on dump trucks by wheel shovels in additive warehouse, transported and dumped into receiving hopper in the SMP by dump trucks.

Refractories and electrode will be loaded on flat deck truck by forklift truck in the warehouse and transported to the SMP.

Major transportation equipment are as follows.

1) 35t crawler crane : 2
2) 2m^3 crawler shovel : 4
3) 1.5m^3 wheel shovel : 6
4) 1.5t forklift truck : 2
5) 14t dump truck : 16
6) 10t flat deck truck : 2
7) 60t slag pot carrier : 2

(2) Warehouse

Refractories, electrode, additives and spare parts for this project will be stored at warehouses in the plant.
Warehouses will be as follows:

1) Warehouse for brick and electrode : 40 m x 140 m x 1 bay
2) Warehouse for additive : 30 m x 80 m x 1 bay
3) Warehouse for spare parts : 30 m x 80 m x 1 bay

(3) Open scrap yard

(4) Limestone Storage yard

(5) Slag yard

(6) Truck weighing equipment

6-8-4 Organization and personnel

Manpower requirement will be determined in accordance with transportation equipment.

Operation of transportation of scrap and slag will be three shift. Other operation will be one shift.

Manpower for transportation will be as follows :

Charging scrap handling	:	3 x 4 =12
Hot slag handling	:	1 x 4 = 4
Other works	:	20 x 1 =20

6-9 Analysis and Inspection Facilities

6-9-1 Outline

Analysis and inspection facilities will be installed for the flat steel plant and be used for carrying out quality control work including routine analysis of DRI, molten steel, cast slabs, and finished products.

The analysis and inspection facilities will consist of two groups of equipment: one for analysis needed for steelmaking process and raw materials and the other for physical and metallurgical inspection of semi-finished and finished products. The first group of equipment will be installed in a building (called the analysis center) to be constructed beside the steelmaking plant. The other group of equipment will be installed in a building (called the material testing center) to be constructed beside the CRM building.

6-9-2 Basic plan

(1) Quick analysis needed for steelmaking process, an analysis of materials such as DRI, iron ore, ferroalloy, burnt lime, slag, natural gas, water, and refractories, and analysis of semi-finished and finished products will be conducted by the equipment installed in the analysis center.

(2) Physical and metallurgical inspection of semi-finished and finished products, DRI, iron ore, pellets, burnt lime, and refractories will be conducted in the material testing center.

(3) Physical inspection (yield point, tensile strength, elongation, etc.) of specimens to be taken from hot, cold and galvanized strip and/or sheet will be conducted by the equipment that incorporates automatic functions to maintain reliability of inspection and to save manpower.

(4) Gas cutting of cast slabs to provide the analysis and inspection facilities with specimens for sulphur print and macrostructure inspection will be conducted in the CCM shop.

(5) Sheets for specimens in designated dimensions and quantity will be provided from HSMP, CRMP, and CGL plants.

6-9-3 Facility plan

(1) Equipment for analysis

Vacuum emission spectrometer, fluorescent x-ray analyzer, carbon & sulphur and nitrogen & oxygen determinators, inductively coupled plasma analyzer, and equipment needed for preparation of specimens such as automatic sample preparation for lollipop samples and abrasive cut-off machine will be installed for analysis in the analysis center.

(2) Equipment for physical and metallurgical inspection

Equipment for physical and metallurgical tests and sample preparation equipment will be installed in the material testing center.

6-9-4 Description of system and equipment

(1) Description

The system and equipment will be installed to eliminate individual difference among operators and also to avoid complicated manual measuring as much as possible so that stable results of analysis and inspection will be obtained.

6-9-5 Organisation and personnel

The organisation and personnel are charted below.

Table 6-9-1 Organisation and Personnel for Analysis and Inspection

SM	ASM	Engineer	Foreman	A.Foreman	Worker	Remarks
1	Lab			1 x 4	3 x 4	OES & X-Ray
	1 x 1	2 x 1	2 x 1		1 x 4	Chemical analysis
					1 x 4	Sample preparation
				1 x 1	5 x 1	Chemical analysis
					1 x 1	Gas analysis
					7 x 1	Mechanical tests
				1 x 1	2 x 1	Physical tests
					5 x 1	Inventory & data control
1	1	2	2	6	40	Total 52

6-9-6 Equipment List

Refer to Apendix, 6A-9-1.

6-10 Maintenance Shop

6-10-1 Outline

Maintenance shop will be installed in the flat steel plant for keeping production of 1,000,000 tons per year of flat products.

Maintenance shop consists of machine shop, overhaul and assembly shop, fabrication shop, electrical repair shop and car repair shop.

6-10-2 Basic design

Work plan of maintenance shop will cover only the emergency works.

Machining and plating of moulds for slab caster and plating of rolls for cold rolling mill will be done by special suppliers. Special machines such as roll grinders and shot blast machine will be installed at roll shop in the hot strip mill and cold rolling mill.

6-10-3 Description of equipment

(1) Machine shop

Main equipment will be as follows:

1) Lathe 1 m	: 1
2) Lathe 2.5 m	: 1
3) Lathe 5 m	: 1
4) Milling machine	: 1
5) Slotting machine	: 1
6) Shaping machine	: 1
7) Boring machine	: 1
8) Radial drilling machine	: 1

(2) Overhaul and assembly shop

This shop will be provided with a 200 t horizontal press, assembly surface plate, etc.

(3) Fabrication shop

Bending roll, radial drilling machine and welding machine will be equipped.

(4) Electrical repair shop

Winding machine will be capable of repairing DC motor of about 100 kW and AC motor of 200 kW.

(5) Car repair shop

Repairing equipment will be capable of carrying out inspection and minor repair. Medium and major repair will be carried out by outside companies specialized in repair of cars.

6-10-4 Organization and personnel

Exclusively assigned personnel are 10. The maintenance shop will be operated by the worker of the maintenance group of shop maintenance.

6-11 Administrative Facilities

6-11-1 Outline

The construction and installation of such administrative facilities listed below shall be considered.

- Main office
- Canteen
- Clinic
- Guard office
- Fire fighting station
- Site offices for;
  DRP, LCP, SMP, HSMP, CSMP and Maintenance shop
- Parking lot
- Other

6-11-2 Basic design

The basic design and system of each facility shall be made in accordance with the "Egyptian codes of practice" or equivalent international codes, and requirements of local practice and regulation.

6-12 Civil and Building Work

6-12-1 Outline

Civil and building work will cover land preparation and all foundations and building items required for the construction and installation of such steel plant facilities including utilities, roads, drainage and administrative facilities as are specified in the facility plan of the flat steel product plant . The contents of the work is summarized as follows.

(1) Civil work

1) Land preparation
2) Foundations for buildings and structures
3) Foundations for equipment and machinery
4) Pits and culverts for piping and cable
5) Cellars
6) Slabs on grades
7) Yard preparation for scrap and slag storage, and waste disposal
8) Roads and paving
9) Drainage systems for rain water, waste water and sanitary sewage

(2) Building work

1) Provision, fabrication and erection of structural steel
2) Reinforced concrete structural building
3) Roofing and siding
4) Floor and wall finishing and ceiling
5) Doors and windows
6) Mechanical and electrical work for building, such as
   (a) Potable water supply system
   (b) Hot water supply system
   (c) Sanitation system
   (d) Fire fighting system
   (e) Heating, ventilation and air conditioning (HVAC)
   (f) Power distribution system
   (g) Lighting system
   (h) Fire alarm system
   (i) Lightning proofing system

(j) Internal communication system

6-12-2 Design basis for foundations and buildings

The design basis for foundations and buildings shall be established in accordance with the "Egyptian codes of practice for design and executing Reinforced Concrete Structure" and/or the relevant clause of the latest issue of international codes and standards and their equivalents.

6-12-3 Description of foundations and buildings

Items for foundation and building work for the following plant facilities shall be considered.

(1) Land preparation including gate and perimeter fence
(2) Direct reduction plant facility
(3) Lime calcining plant facility
(4) Steel making plant facility
(5) Hot strip mill plant facility
(6) Cold strip mill plant facility
(7) Power and distribution facility
(8) Utilities
1) Water treatment facility for SMP, HSMP
2) Waste water and water treatment facility for CSMP
3) Steam boiler and hydrogen generator unit
4) Natural gas receiving station
5) Raw water receiving and treatment station
6) Sewage treatment station
7) Drainage pumping station
(9) In-works transportation facility
(10) Analysis and inspection facility
(11) Maintenance shop facility
(12) Administrative facility
(13) Roads and paving
(14) Drainage systems for storm water, waste water and sanitary sewage

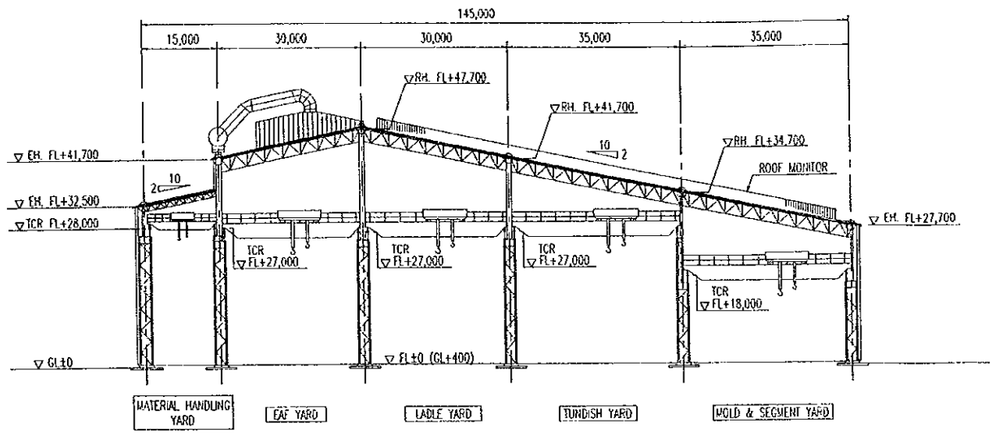
6-12-4 Foundation and building lists

(1) Foundation and building lists

The foundation and building for each plant facility and administrative facility shall be listed in Appendix 6A-12-1.

(2) Drawing

Refer to Figure 5-4-1 and Figure 6-12-1.



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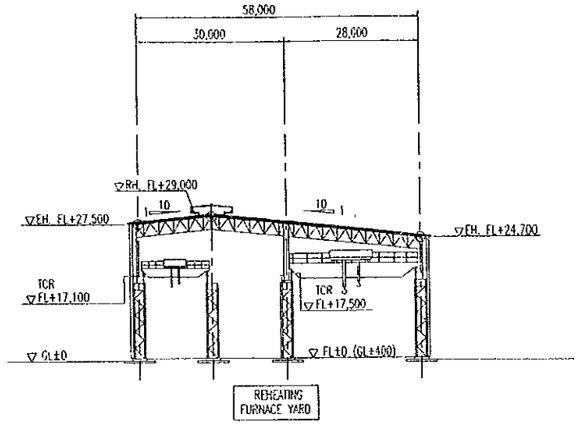

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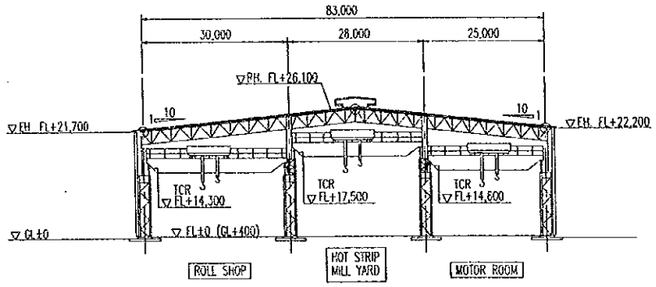

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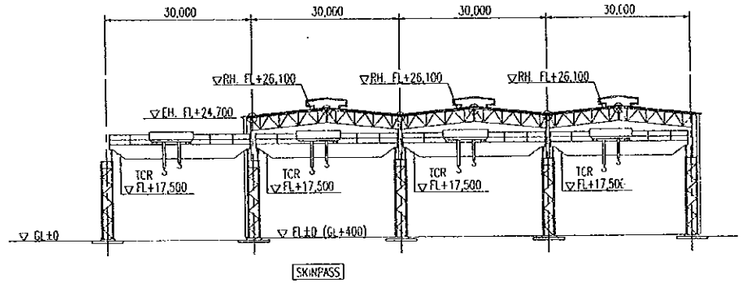

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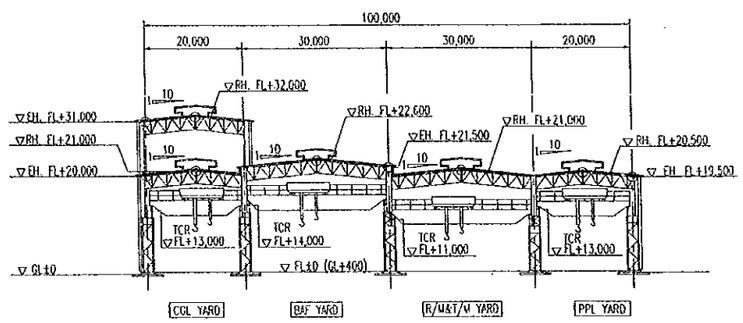

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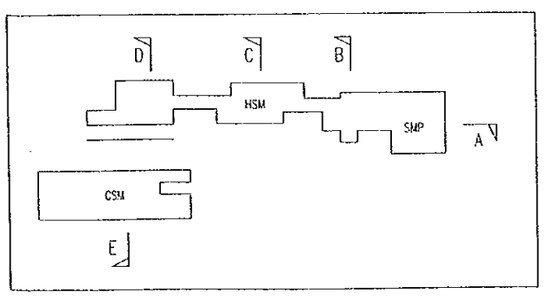


KEYPLAN

FIG.6-12-1.SMP,HSM & CSM SECTION.

FLAT PRODUCT PLAN OF EGYPT	
DWG NO. EFP-C/8-001	
TITLE SMP, HSM &CSM SECTION	
SCALE 1/600	DATE SEP.18.'97

Chapter 7

IMPLEMENTATION PLAN

Chapter 7. IMPLEMENTATION PLAN

7-1 General

Steel plant complex projects normally require a variety of technological methods, engineering skills and innovations. A huge amount of material and tremendous consumption of required resources, time ,money, manpower and talent is also required.

For instance, the construction period for this flat steel project is estimated at 30 to 36 months from the placement of supply contracts for equipment to start-up of the plants, and the total amount of investment will reach US$ 800 million or more. In spite of great and continuous efforts by the persons concerned, many issues such as cost overruns, schedule delays, failures in the performance guarantee tests, etc., will occur during the construction administration stage

Rather than focusing on post-failure analysis, the project owner is required to concentrate on ways to control performance of the project before failures take place.

The process of project implementation consists of three separate steps. These steps are closely related to each other. The first step is to conduct a basic engineering study. This study include development and refining of the scale of the project and design and definition of the conditions . Cost estimation and financial planning for the project are also implemented during this first step.

The second step is preparing the specifications and floating bids for the project and to award contracts to the successful bidders.

The final step is construction itself.

As far as these steps are properly and fairly applied to actual practices, the project will be successful and the interests of the investors can be preserved.
Before the project can be executed, legal approval should be obtained. It can be said for all projects in the world that the efficient and smooth execution of the project depends on timely obtaining of governmental, regional and/or other authorities' approval. In addition, these authorities' scope of work and time schedule shall be clearly defined.

7-2 Infrastructure

7-2-1 Natural gas supply

Required quantity of natural gas will be 50,000Nm^3/h and GASCO will supply facilities and the required quantity of natural gas at the battery limit of flat steel project.
It was confirmed that quality of natural gas meets requirement in DRP.

7-2-2 Raw water supply

The existing water supply pipe lines are of 700 mm and 1,000 mm diameter used for potable water and raw water.
Pipe line has a enough capacity for 1,000 m^3/h raw water.
Raw water will be received at the battery point through the municipal pipe line and will be supplied to the plants after treatment at the raw water treatment station.

7-2-3 Electric power supply

The electric power will be supplied by EEA through two 220 kV underground cables from El Dekhiela substation.

7-2-4 Ports and roads

(1) Port facilities

As the main raw material for the flat steel plant, iron ore is imported with 100,000 - 150,000 DWT vessels. Therefore, port facilities for these vessels, unloading, transportation and storage facilities for raw materials are necessitated.

Concerning port facilities for the flat steel project, existing port and transportation facilities at El Dekhiela could be utilized without any modification or additional equipment installation.

A mineral jetty as a raw materials unloading berth for both iron ore and coal was constructed at El Dekhiela port, in 1986 by the Industrial Mining Complex (IMC). The port is now under the control and administration of the Alexandria Port Authority, and the above facilities' operation and maintenance are conducted by ANSDK.

The mineral jetty has a 600m length and 14 m - 20 m depth at which 150,000 DWT vessels can be accommodated. As for off loading and transporting facilities, two 1,000 t/hr

unloading gantry cranes and two 2,000 t/hr belt conveyor lines are equipped.
The area of storage yard for iron and coal located at the south of the mineral jetty is 50,000 m^2. The handling capacity of the mineral jetty is about 5,500,000-6,000,000 tons per year. At present, about 1,250,000 tons per year of iron ore for ANSDK, which will be increased as 2,500,000 tons per year in 1999, and 1,250,000 tons per year of coal for EISCO are handled at the mineral jetty.

As described above, the existing mineral jetty at El Dekhiela, still has enough capacity for the flat product project of which raw materials to be unloaded at this port will be about 1,500,000 tons per year. The mineral jetty, therefore, could be utilized without any modification or additional equipment.
The port is now under the control and administration of the Alexandria Port Authority, and above facilities' operation and maintenance are conducted by ANSDK. Under such circumstances, detailed utilization and maintenance plan for the mineral jetty should be made in consultation with the Alexandria Port Authority and ANSDK.

(2) **Roads**

The existing roads which are able to be connected to the new flat product plant site are Dessert road and Alexandria Matrouh road. Both roads are well arranged and maintained to transport materials and products to/from the plant

New road construction work will not be required for the flat product plant.

7-2-5 Raw material yard

Iron ores (lump ore and oxide pellets) unloaded at the port are transferred by belt conveyors to a storage yard adjacent to the port. Storage capacity and storage area of iron ores required for the flat steel plant are estimated about 250,000 tons and 4.5 hectares, respectively.

In the area of El Dekhiela, the similar steel works which comprises DRP and EAF is operated by ANSDK making use of the port facilities and the storage facilities installed by IMC and administrated by the Alexandria Port Authority.

In order to make synergy effect on the facilities of this region, it is planned in this study that necessary facilities of the raw material yard for the flat steel plant would be placed in the authority's charge as same manner as ANSDK's case.
Detailed implementation plan shall be studied at an eventual project stage based on this

concept between the authority and an eventual enterprise.

7-3 Consultant Engineering

This flat product plant will be the first integrated project covering from DR / EAF to flat products rolling in Egypt. It is recommended that the project should retain an experienced foreign consultant. The consultant shall perform a basic engineering, procurement services and supervisory services for the smooth execution of the flat product project. Based on proprietary knowledge and experiences, the consultant shall participate in predetermination of the budget and schedule and closely coordinate with the parties concerned such as the owner of the project, authorities, equipment suppliers and construction contractors, etc.

The consultant shall be involved in the project according to the following scope of work:

- Consultation on project execution
- Decision of basic engineering policy
- Execution of procurement services
- Review of drawings and documents provided by suppliers
- Preparation of design drawings for civil work
- Supervisory services for construction work
- Supervisory services for commissioning

7-4 Procurement Method

7-4-1 General

Procurement policy and methods have significant effects on the overall budget, on the construction schedule and on the technical aspects of the project. Before proceeding to procurement practices, the following policies and decisions shall be considered and established.

(1) Pricing policy:

- Fixed prices or firm prices with escalation clauses for supply of equipment.
- In the case of the civil and structural steel contracts, fixed or firm rates against measured work.
- Advantages for use of local manufactures and contractors.

(2) **Contract policy:**

To define the total number of contract packages, scope of work and type of each contract;

- Design and supply of equipment and machinery with supervisory service for installation/installation for equipment and machinery /civil and building work.
- Turnkey contract including provision of civil foundations, building work and installation of equipment and machinery.
- Other types of contract.

(3) **Budget:**

- A break down of capital costs budget in accordance with the contract package.

7-4-2 Package classification

The policy and method of procurement depends on the source of funding, scope and magnitude of the work and construction period, etc. A sample matrix of a contract package is shown as follows.

(1) **Design, Manufacturing and supply of equipment with supervision of installation:**

-Direct reduction plant
-Lime calcining plant
-Steelmaking plant (EAF and SCC)
-Hot strip mill plant
-Cold strip mill plant
-Power and distribution facilities
-Utilities
-Auxiliary facilities

(2) **Installation of equipment and machinery:**

-The installation of equipment and machinery executed under supervision of suppliers.

(3) **Civil and building work:**

- Land preparation, fences and gates.

- Foundations and buildings for the plants
- Ancillary buildings, drainage and road construction and other civil work.

7-4-3 Procurement localization

In order to minimize the burden of the need for foreign currency, and to encourage and develop local industries, localization of procurement shall be considered and utilized as much as possible.

Construction material for civil and building work, steel structures, etc. can be procured from the local market. Delivery time and quality shall be assured and secured before entering into contracts.
Preference of local manufactures and contractors shall be defined in the bid documents.

7-5 Project Schedule

The overall implementation schedule for the flat steel project is shown in Figure 7-5-1.

Based on the marketing study of flat steel products, the start-up date of the hot strip mill and cold strip mill is scheduled to be January 1, 2005. The total construction period from basic engineering to start-up of the project is estimated at 55 months and the period of construction for major plants from CIF contract to start-up is set at 35 months. Other ancillary facilities shall be implemented with proper timing for start-up of the steel plant.

During construction, management's attention and control shall be required in the following three stages. Activities and events in each stage are stated below.

7-5-1 Preparation stage

At this stage, the basic engineering, which includes such work as review of the feasibility study, environmental impact assessment (E.I.A), overall implementation schedule, organization of management and the operating plan are conducted.
When construction of the new steel works has been decided and approved by the owner and relevant authorities, project organization shall be established and contractual strategies shall be made.

7-5-2 Bidding stage

The project is executed by contracts concluded between the project owner and contractors. The contracts for the project will be made through the international competitive bidding process for the supply of equipment, installation of equipment, and foundation and buildings work .

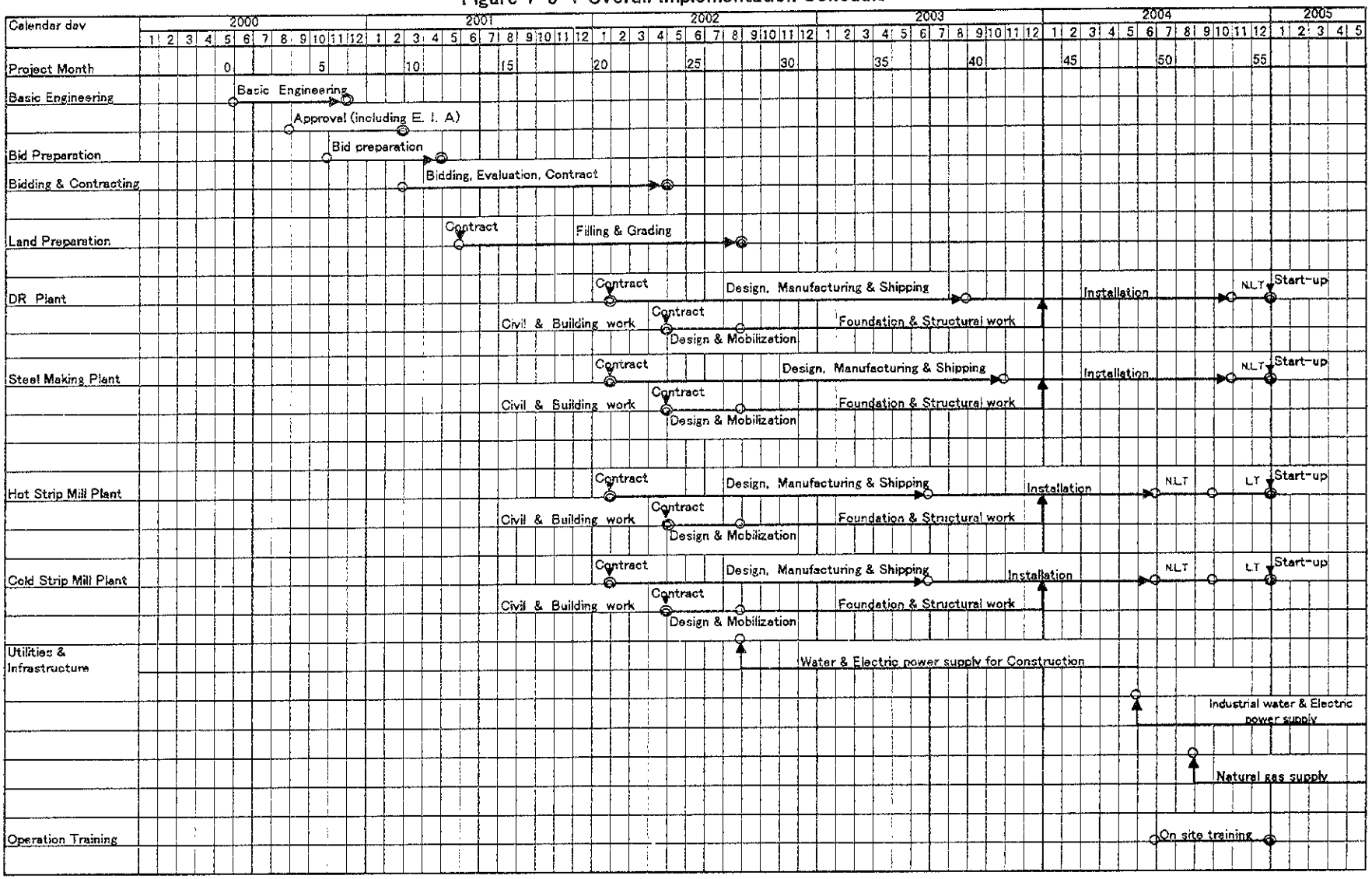
Inadequate content of the bidding and contract documents, inadequate bidder qualifications or bid management will cause serious damage to the following contract performance and administration.

7-5-3 Construction stage

Construction administration shall involve a correction of processes and schedule, a series of responses to events and control of the project. Progress payments, record keeping, claims and change orders are common to all contract administration.

Contract administration begins with the signing of contractual documents, continues throughout the performance period, and ends with the formal termination of the contractual relationship.

Figure 7-5-1 Overall Implementation Schedule



7-6 Construction and Transportation

Construction and transportation work shall be planned in consideration of the following.

7-6-1 Construction material and equipment

Such values as weight of equipment and structural steel, and concrete volumes for foundations, are estimated for the construction and installation work of each facility as follows.

Table 7-6-1 Work Volume for Construction

Facility	Equipment & Structural Steel(Ton)	Concrete Volume (m^3)
a. Direct reduction plant (DRP)	14,000	33,000
b. Lime calcining plant (LCP)	3,500	2,100
c. Steel making plant (SMP)	17,700	47,300
d. Hot strip mill plant (HSMP)	27,500	78,200
e. Cold strip mill plant (CSMP)	12,100	42,900
f. Power and distribution facility	2,500	12,000
g. Utility facilities	2,700	22,700
h. In works transportation facility	1,000	8,500
i. Analysis and inspection facility	-	300
j. Maintenance shop (MS)	700	5,700
k. Administrative facility	-	9,900

7-6-2 Personnel requirements

On the basis that the project will be implemented under such policies or formations as described in section 7-3 and 7-4, the numbers of personnel required for the construction and installation work (at peak) are estimated as follows.

Table 7-6-2 Number of Personnel for Construction

(person)

Category	Number
Management staff	180 – 230
Workers for;	
Civil construction	3,800 – 4,200
Equipment installation	2,000 – 2,200

7-6-3 Temporary facilities

During construction, such temporary facilities and areas for material and equipment storage as shown below will be required.

Facility for;
- contractor's offices
- commissary
- temporary power, water and fuel supply facility
- concrete mixing plant including laboratory and cement and aggregate stock yard
- warehouse, sheds and work shop

Area for;
- carpentry(for forms)
- stock and fabrication of re-bar and steel
- storage for fabricated steel and such bulk material as concrete products, pipes, cables, paint etc.
- temporary assembly
- motor pool
- disposal and borrow pit for earth work
- imported goods, material, and equipment storage(bonded area) etc.

7-6-4 Transportation of equipment and construction materials

For implementation of the project, to meet the construction schedule as specified in the project master plan, and to handle the huge amount of construction material and/or special oversize or overweight cargoes, consideration of the following measures is important.

(1) Customs clearance

To establish, authorize and implement effective planning and a cooperative relationship between the customs agency and the parties concerned for the administration of unloading of equipment and items for customs clearance at the site (by "direct delivery").

(2) Inland transportation

To establish, authorize and implement effective planning and a cooperative relationship between the city traffic agency and the parties concerned, especially for the transportation of the oversize and/or over weight cargoes.

(3) Storage area (bonded area) at site

At the designated and authorized bonded area at the site, to establish and implement effective planning for the administration and proper control of the stock and delivery of cargo. To manage and control the stock of such cargo as refractory and electrical equipment in the roofed warehouse, and oversize and/or heavy cargo to be separately stocked after customs clearance.

(4) Traffic regulations for construction vehicles

To establish and fulfill rules and regulations to provide a gate and/or to specify routes for exclusive use, so that expected traffic congestion due to an increase of various kinds of construction vehicles during the construction work can be minimized.

Chapter 8

ENVIRONMENTAL ASSESSMENT

Chapter 8. ENVIRONMENTAL ASSESSMENT

The planned process which will be adopted by the flat products project of this Study consists of direct reduction plant(DRP), electric arc furnace(EAF) and rolling mill.
Pollutant emissions from this process are less than the traditional integrated steel plant which consists of blast furnace, basic oxygen furnace, sintering plant, and coke oven.
Furthermore, by adopting advanced environmental control systems, the effects to the environment will be improved, therefore the conditions currently observed around existing steel plants in Egypt will not occur.

However, to judge the environmental conditions after the installation of the flat products plant, as the environmental assessment, the Study Team surveyed the present environmental situation at the proposed site, and then calculated the distribution of pollutants using a simulation based on surveyed data and predicted pollutant volume emitted from the new steel plant.

The results of the calculations were verified to be within the allowances accorded by Egyptian environmental laws and regulations.

8-1 Present Environmental Situation

The Study Team visited the Egyptian Environmental Affairs Agency, Suez Governorate, Alexandria Governorate, GOFI, Alexandria National Iron & Steel Co. S.A.E. and Egyptian Iron & Steel Co. to investigate environmental issues for this study.

8-1-1 Environmental Laws

(1) Laws and decrees

The basis of environmental protection is Law No.4 of 1994 and the Decree No.338 of 1995. This law covers air pollution, water pollution, waste material treatment and environmental assessment. Concerning control of water pollution, Law No.4 of 1994 stipulates only the requirements for discharge into the sea. There are other laws such as Law No.48 of 1982 and its implementation regulations regarding protection of the Nile and other waterways from pollution, and Law No.93 of 1962 and its regulations for discharge of waste water to sewage networks.

1) Air pollution

According to Decree No.338 of 1995, the maximum limits for outdoor air pollutants are shown in Table 8-1-1.

Table 8-1-1 Outdoor Air Pollutants Limits

unit : $\mu g/m^3$

Pollutant	Maximum limit	Exposure period
Sulfur Dioxide (SOx)	350	1 hr
	150	24 hr
	60	1 year
Carbon Monoxide (CO)	30 mg/m^3	1 hr
	10 mg/m^3	8 hr
Nitrogen Dioxide (NOx)	400	1 hr
	150	24 hr
Ozone	200	1 hr
	120	8 hr
Suspended Particulates	150	24 hr
(To be measured as black smoke)	60	1 year
Total Suspended Particulates	230	24 hr
(T.S.P.)	90	1 year
Thoracic particles (PM 10)	70	24 hr
Lead	1	1 year

Source: Decree No.338 of 1995

Also, the permissible limits of total particulate emissions for ferrous industries are shown in Table 8-1-2.

Table 8-1-2 Ferrous Industry Total Particulate Emission Limits

Activity	Maximum limit for emissions (mg/m^3 in exhaust)
Ferrous industries	200 existing
	100 new

Source: Decree No.338 of 1995

The maximum limits of gas and fume emissions from industrial establishments are shown in Table 8-1-3.

Table 8-1-3 Industrial Gas and Fume Emission Limits

Pollutant	Maximum limits for emission (mg/m^3 in exhaust)
Carbon Monoxide	500 existing 250 new
Sulfur Dioxide Burning Coke and Petroleum	4,000 existing 2,500 new
Non-ferrous Industries	3,000
Nitrogen Oxide Other Industries	300

Source: Decree No.338 of 1995

The maximum permissible limits for noise in different zones are shown in Table 8-1-4.

Table 8-1-4 Maximum Permissible Noise Limits by Zone

unit: dB

Type of zone	Permissible limits for noise (Intensity decibel(A))					
	Day		Evening		Night	
	from	to	from	to	From	to
Commercial, administrative and downtown areas	55	65	50	60	45	55
Residential areas including some workshops or commercial businesses or public roads	50	60	45	55	40	50
Residential areas in the city	45	55	40	50	35	45
Residential suburbs having low traffic flow	40	50	35	45	30	40
Rural residential areas (Hospitals and gardens)	35	45	30	40	25	35
Industrial areas (Heavy Industries)	60	70	55	65	50	60

Source: Decree No.338 of 1995

2) Water pollution

Standards and specifications for some elements whenever discharged into the sea in accordance with Law No.4 of 1994 are indicated in Table 8-1-5. But there is no standard or specification for sea water quality itself.

Waste water from this plant is planned to be discharged into the sea, therefore the standards and specifications of Law No.48 of 1982 regarding the protection of the Nile and other waterways and Law No.93 of 1962 regarding discharge of waste water to sewage networks are not described here.

Table 8-1-5 Standards and Specifications of Some Elements when Discharged into the Sea

Temperature	Not more than 10 °C over existing level	
PH	6-9	
Color	Free from	
BOD	60	mg/l
COD	100	mg/l
TDS	2,000	mg/l
Ash of dissolved solids	1,800	mg/l
SS	60	mg/l
Turbidity	50	NTU
Sulfides	1	mg/l
Oil & grease	15	mg/l
Hydrocarbon	0.5	mg/l
Phosphate	5	mg/l
Nitrate	40	mg/l
Phenols	1	mg/l
Fluoridates	1	mg/l
Aluminum	3	mg/l
Ammonia	3	mg/l
Mercury	0.005	mg/l
Lead	0.5	mg/l
Cadmium	0.05	mg/l
Arsenic	0.05	mg/l
Chrome	1	mg/l
Copper	1.5	mg/l
Nickel	0.1	mg/l
Iron	1.5	mg/l
Manganese	1	mg/l
Zinc	5	mg/l
Silver	0.1	mg/l
Barium	2	mg/l
Cobalt	2	mg/l
Pesticides	0.2	mg/l
Cyanides	0.1	mg/l
Probable Coliform count in 100 cc	5,000	mg/l

Source: Decree No.338 of 1995

(2) Environmental Impact Assessment (EIA)

According to the executive regulations on the environment from Law No.4 of 1994, industrial establishments are required to comply with the EIA procedure.

Before beginning a project, an EIA screening form should be submitted to, and approval obtained from the Egyptian Environmental Affairs Agency.

The environmental screening form consists of;

1) General information

Type of project, project phases and expected starting dates, technological systems, project location and site, and description of construction.

2) Description of input and output during construction and operation

Input : Raw materials and/or resources such as water, energy and manpower.

Output : End products, sulphur dioxide, particulate matter, smoke, odours, noise, sewage, industrial waste water, domestic waste, industrial waste, and hazardous waste.

3) Environmental description

General area description and important features

4) Preliminary impact analysis

- Potential effects on air quality around the site, neighboring areas, trans-boundary and such sensitive facilities as hospitals, schools, residential areas, etc. which exist nearby.
- Water quality and effects on fisheries, tourism, recreation and other activities.
- Soil quality
- Solid and hazardous waste

For the EIA procedure, there are three classifications: white, gray and black, depending on industry size. In the case of a steel plant, only two, namely, gray and black are applicable. Production capacity of 150 t/d and less is "gray", and over 150 t/d is "black".

8-1-2 Current situation

The problem of environmental pollution has become more serious in Egypt due to its developing economy and industry.

Environmental laws and regulations are being systematized, however, old laws and regulations have still remain partially in force. Amendment have been undertaken by the relative authorities.

Excepting few people and companies, interest in environmental pollution is generally very low, and existing plant facilities have not been modernized in terms of environmental controls. Consequently the problem of environmental pollution in some industrial areas seems to be very serious.

Accordingly, some rules which aim to strictlycontrol industries and industrial areas, especially for heavy industries, have been issued and/or considered by the government and governorates.

(1) Environmental conditions at Alexandria

Alexandria is the biggest industrial area in Egypt, and also environmental pollution has been generating serious problems. Therefore, strict controls on environmental pollution have been enacted and applied to industry, especially heavy industry, by the government and the governorate.

Considering the present situation of environmental pollution, it is very important to pay due attention to environmental protection in the case of steel plant installation.

Recent measured data is shown in Tables 8-1-6 and 8-1-7.

Table 8-1-6 Ambient Air Quality (SOx, Falling Dust and T.S.P.)

Measurement period		Jan.- Sep./1995			
Measurement point		Wadi El Kamer	El Mamel	Eshaf	Smoha
SOx	$\mu g/m^3$	10.4	12	13	7.75
Falling Dust	ton/mile^2/month	135	305	258	321
T.S.P.	$\mu g/m^3$	30.2	20.4	18.9	16.5

Source: Directorate for Health Affairs at Alexandria/Central Laboratory

Table 8-1-7 Ambient Air Quality (NOx and Sulphates)

Measurement period		1992
Measurement point		N.A.
NOx	$\mu g/m^3$	39.0
Sulphate	$\mu g/m^3$	20.4

Source: Assessment of Industrial Hazardous Wastes in Alexandria

Table 8-1-8 shows a comparison of this data with Egyptian environmental law No.4 of 1994 and the Decree No.338 of 1995, and data from Kawasaki City in Japan.

Table 8-1-8 Ambient Air Data Comparison

unit: $\mu g/m^3$

Pollutant	Alexandria	Egyptian law	Kawasaki City*
NOx	39.0	150	53/74
SOx	10.4	60	17/26
T.S.P.	30.2	90	46/73

* Residential area/industrial area

The present value of air quality in Alexandria is within Egyptian law and superior to that of Kawasaki City where is one of the most industrialized area and established most strict environmental regulations in Japan. Concerning falling dust, the value 135 - 321 ton/mile^2/month is higher than the value of 12 - 26 ton/mile^2/month which is generally measured in Kawasaki City. This higher value seems to be caused by the occurrence of dust and sand-rising in Egypt.

Monitored water pollution data in El Dekhiela port and Alexandria port are shown in Tables 8-1-9 and 8-1-10.

Table 8-1-9 Sea Water Quality

unit: mg/l

Measurement point	El Dekhiela Port	Alex. Eastern Harbor
COD	300	500

Source: Alexandria Governorate

Table 8-1-10 Alexandria Western Harbor Water Quality

Parameter		July 1996	March 1997
Temperature			
Air	°C	30(27.5 - 31.5)	23(21.7 - 24.2)
Sea water		29(27.2 - 31.1)	21(20.6 - 23.4)
Salinity	$^{0}/_{00}$	37.1(24.2 - 39.9)	37.2(26.1 - 39.6)
DO	%	57.0(n.d. - 95)	73.0(n.d. - 100)
H_2S			
Surface water	mg/l	(n.d. - 0.06)	(n.d. - 0.06)
Bottom water			(n.d. - 0.40)
PH		(6.8 - 8.1)	(7.2 - 9.1)
PO_4	mg/l	0.69(0.1 - 2.5)	0.43(0.1 - 1.5)
NO_3	mg/l	0.33(0.05 - 1.25)	0.32(0.05 - 1.10)
SPM	mg/l	270(10 - 1,180)	180(14 - 890)
Oil & grease	mg/l	45(14 - 175)	50(17 - 212)

Source: Alexandria Governorate

There are no Egyptian laws or regulations concerned with water quality in the sea, and no appropriate regulation to be referred for the study in the countries around the Mediterranean sea. Therefore, the COD parameter, a typical figure for water quality, is compared with data from Kawasaki City and Japanese law.

Table 8-1-11 Sea Water Quality Comparison

unit: mg/l

Parameter	El Dekhiela	Kawasaki City	Japanese law
COD	300	2.4 - 4.1	< 3 or < 8

From Table 8-1-11, the value of 300 mg/l at El Dekhiela port is extremely high. Because according to the JICA report of the Suez industrial area development plan (1993), the COD values by the permanganate method were between minimum 3.5 - maximum 7.3 mg/l and by dichrome method were between minimum 99 - maximum 277 mg/l. Therefore this value seems to have been derived by the dichrome method which is not suitable for sea water due to indications of extremely high values, because sea water contains chloride ions. In this case, the permanganate method should be adopted.

It is difficult to exchange these values by calculation. According to Appendix 8A-1, section 3, if this sample could be analyzed by the permanganate method, the estimated value is 4.3 mg/l.

The value 4.3 mg/l is higher than the bottom standard of Japanese law.

The total pollution load of the Alexandria area is shown in Table 8-1-12.

Table 8-1-12 Total Alexandria Pollution Load

No. of factories belonging to the Ministry of Industry		84
Total consumed water (million m^3/y)		110
Total discharged water (million m^3/y)		88
Total pollution load (ton/day)	BOD	91
	COD	186
	Oil & grease	45
	S.S	40
	Total S.S	246

Source: GOFI

(2) The situation at existing steel plants

As the result of visual observation at Egyptian Iron and Steel Co.(EISCO), air pollution, especially smoke and dust, are worse than anticipated. These conditions are rarely observed at modern steel plants.
For water treatment, from the glance taken during site observation , preliminary water treatment facilities seem to be very simple compared with current steel plants.

However, visual observations at Alexandria National Iron & Steel Co. S.A.E. (ANSDK) seem to indicate there is less (visual) air pollution. Also, ANSDK installed a new dust collection facility for the electric arc furnaces in order to improve dust collection efficiency, with the cost of US$ 17 million, even though existing facilities have sufficient capacity.

It can generally be concluded that the process planned in this feasibility study and also currently employed at ANSDK is less polluting than the traditional process which consists of blast furnace, sintering plant, and coke oven, and which does not have sufficient anti-pollution facilities and/or not proper maintenance services.

8-2 New Flat Products Project Environmental Control

To determine environmental conditions after installation of the flat products plant, as the environmental assessment, the Study Team calculated the distribution of pollutants using a simulation based on surveyed data and predicted pollutant volume emitted from the new steel plant.

8-2-1 Air pollution

The major factors which will affect air quality depend on the process and natural resources used in the flat product plant.

The planned process consists of a direct reduction plant(DRP), electric arc furnace(EAF) and rolling mill. And the main natural resources are iron ore and natural gas.

At each process, such pollutants as NOx, SOx, and dust are considered to be scarce in ambient air.

Generally at steel plants, the origins of the sulfur which is converted to sulfur dioxide(SO_2) are the oil and/or natural gas fuel, and the natural gas or coke reducting agent. This plant will use only natural gas as both fuel and reducting agent, not coke with its high sulfur content.

The sulfur content of natural gas is 0.5 ppm, very low. The sulfur content of the other resources, such as lump ore and pellet, is even less. Therefore, the total generated amount of SOx at this plant will be very small.

In steel plants, NOx is generated at the facilities where fuel burns. In this plant, NOx is generated mainly at the DRP reformer, EAF, reheating furnace of HSM and boiler. By using natural gas, total generated NOx will be low compared with traditional integrated steel plants.

Concerning dust, generation at the EAF is of rather high probability, but it is easy to prevent dust diffusion from the stack by installing a sufficient capacity dust collector.

(1) Estimated exhaust pollutants

Table 8-2-1 shows the estimated emission of air pollutants which will be generated from the planned plant, and Table 8-2-2 shows the facilities design for exhaust gas and gas characteristics.

Table 8-2-1 Estimated Air Pollutant Emissions

Process	Facility	NOx		SOx		Dust	
		mg/m^3	kg/hr	mg/m^3	kg/hr	mg/m^3	kg/hr
DRP	Reformer	69.0	38.64	2.4	1.34	2.1	1.18
	Shaft	–	–	–	–	7.9	–
SMP	EAF	71.9	1.44	22.9	0.46	0.5	0.38
HSM	Reheating furnace	184.8	9.90	1.4	0.13	–	–
Utility	Steam boiler	205 – 287	0.75	1.1	0.03	–	–
	Hydrogen generator	205 – 287	0.03	1.4	0.00	–	–
Permissible limits		< 300		< 2,500		< 100	

These pollutant emission levels are below the permissible limits shown in Tables 8-1-2 and 8-1-3.

Table 8-2-2 Exhaust Gas Facilities Design

Process	Facility	Stack		Exhaust gas	
		height (m)	diameter (m)	volume (Nm^3/hr)	temperature (°C)
DRP	Reformer	40	5.4	560,000	300
SMP	EAF	20	5.3	750,000	53
HSM	Reheating furnace	50	3.0	66,000	250
Utility	Steam boiler	10	–	3,000	–
	Hydrogen generator	10	–	100	–

The main facilities which generate noise are the DRP, EAF, rolling mills and air compressor. Estimated noise levels are shown in Table 8-2-3.

Table 8-2-3 Estimated Noise Levels

Parameter	Process	Facility	Value (dB)
Noise	DRP	Reformer	95 - 105
	SMP	EAF	105
	HSM	Mill	105
	Utility	Air Compressor	95

8-2-2 Waste water

Due to the increase of the water recycling ratio in the flat products plant, sufficient capacity water treatment will be installed also leading to clean discharge water.

(1) Estimated waste water quality

The estimated waste water quality to be discharged into the sea is shown in Table 8-2-4.

Table 8-2-4 Estimated Discharge Waste Water Quality

Parameter	Value	Quantity (kg/hr)	Limits
Water quantity	max. 295 m^3/hr	normal 150 m^3/hr	-
pH	7.73	-	6 - 9
T.H	213 mg/l	32.0	
Turbidity	< 2 NTU	-	< 50 NTU
Oil	< 3 mg/l	< 0.45	< 15 mg/l
SS	< 12 mg/l	< 1.80	< 60 mg/l
Cl^-	115 mg/l	17.25	
Temperature	31.7 °C	-	< 41 °C
COD	1.4 mg/l	0.21	< 100 mg/l
BOD	1.4 mg/l	0.21	< 60 mg/l

All parameters are within the standards and specifications shown in Table 8-1-5.

8-2-3 Solid waste

The basic concept for treating by-products and wastes is re-use (as far as possible) by both the flat products plant and outside users. Only that waste which cannot be re-used is discarded.

The methods of re-use are;

1) as raw materials for this steel plant
   - oxide fine for the pelletizing plant
   - scrap for the EAF

2) as raw materials for outside users
   - oxide fine, sludge and scale for cement companies which use them as sources of iron.
   - waste oil for oil companies which refine waste oil
   - slag for road bed material and reclamation work

To be discarded

- EAF slag, Lime fines, DRP cake, EAF dust, and SMP waste brick

The required area for discard EAF slag is about 80,000 m^2 for 10 years.

Kinds and quantities of waste generated from each plant and their treatment methods are shown in Table 8-2-5.

Table 8-2-5 Solid Waste Generation and Treatment

Material	Generated from	Treatment	Quantity (t/y)
Mill scale	CCM, HSM, CSM	Sell to cement companies	14,000
EAF slag	EAF	Discard	120,000
Oxide fines	DRP	Sell to cement companies, Pelletizing plant	62,000
Lime fines	LCP	Discard	8,000
DRP cake	DRP	Discard	26,000
EAF dust	EAF	Discard	20,000
SMP waste brick	EAF, CCM	Discard	5,000
Sludge	DRP, EAF, HSM, CRM	Sell to cement companies, and others	302,000

8-2-4 Environmental control organization

The environmental control section shall be under the general manager according to the philosophy of ISO 14000 (Refer to Figure 9-2-1). This section controls environmental matters in the plant and deals with external affairs.

Also, each department and section must be operated to conform with company environmental rules and laws.

8-3 Assessment

For the environmental assessment of this flat products plant, the Study Team estimated the effects to the surrounding area by simulation of typical parameters.

8-3-1 General

The general area around the site is shown in Figure 8-3-1.

The site is located on the north side of Lake Maryut, and about 2 km south of the Mediterrancan sea.

ANSDK is situated at the west side, a military camp to the north and a few houses on the southwestern side of this plant site.

There is no heavy industry except ANSDK.

Regarding temperature, the annual mean is 20.1 °C, maximum monthly mean, 24.2 °C, and minimum monthly mean, 16.3 °C.

Relative humidity is 68 %, and annual total rainfall is 168 mm.

Prevailing wind directions are NNW (22.8 %), N (20.5 %) and NNE (13.1 %). Mean scalar wind speed is 9.3 knots.

8-3-2 Simulation

Considering the characteristics of the flat products plant, the items to be simulated are as follow;

- Air pollution : NOx, SOx, Dust, Noise
- Water pollution(sea discharge) : COD

(1) Ambient Environmental Data

From the data in section 8-1-2, the basic ambient environmental data is shown in Table 8-3-1 for air, Table 8-3-2 for noise and Table 8-3-3 for sea water.

Table 8-3-1 Air Quality Data for Simulation

	Data ($\mu g/m^3$)	Measurement point	Measurement period
NOx *1	39.0	N.A.	1992
SOx *2	10.4	Wadi El Kamer	Jan.- Sep. /1995
T.S.P. *2	30.2		

Source: *1 Assessment of industrial hazardous wastes in Alexandria

*2 Directorate for Health Affairs in Alexandria/Central Laboratory

The point "Wadi El Kamer" is an industrial area in El Dekhiela and the nearest to the site. So the data at Wadi El Kamer will be adopted for the simulation.

Figure 8-3-1 Study Area

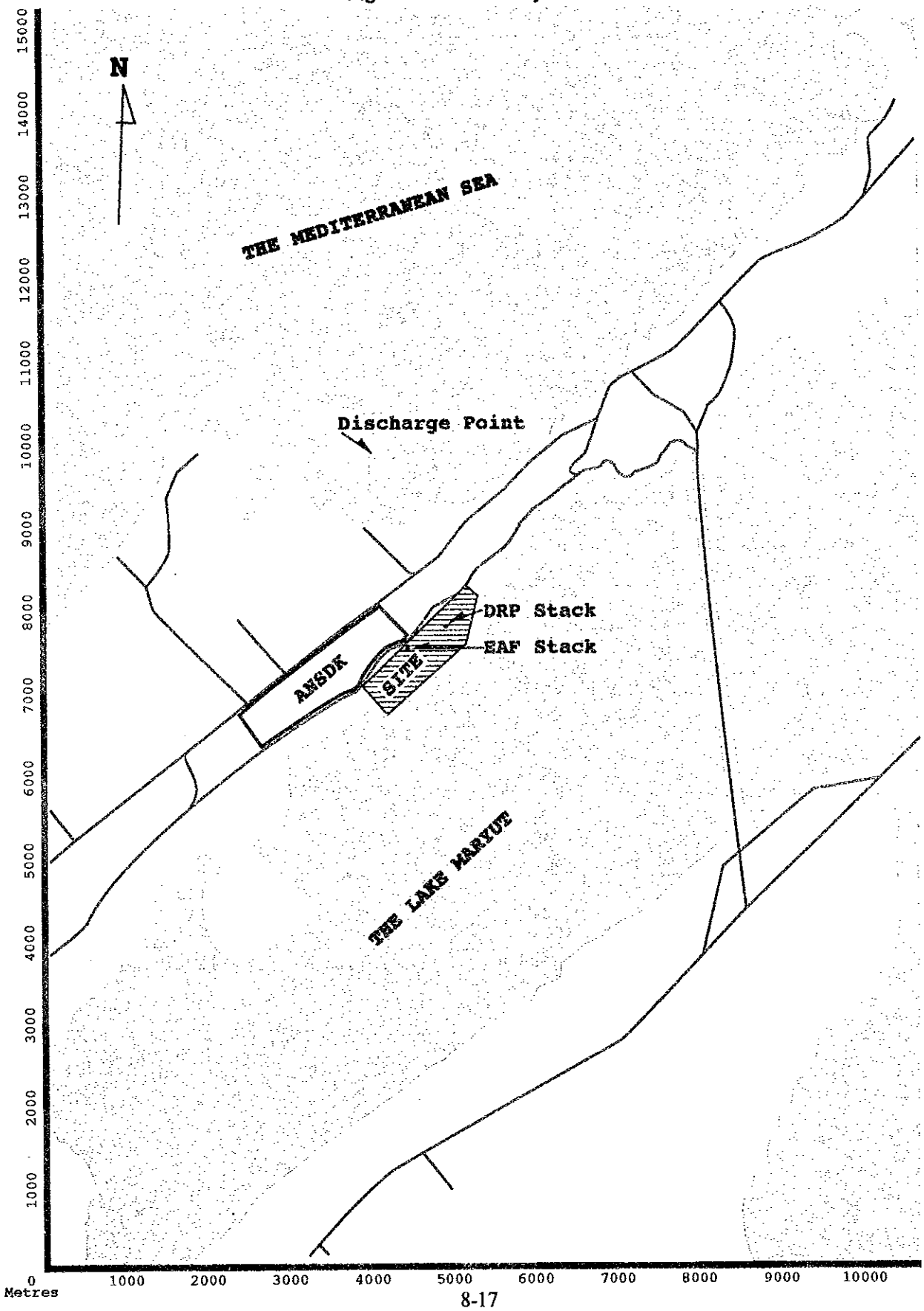


Table 8-3-2 Noise Data for Simulation

Measurement period	Feb. – Mar. /1995
Measurement point	South gate at ANSDK
Noise	64.8 Db

Source: ANSDK

The Measurement point is the south gate of ANSDK near the northwestern corner of the project site.

Monitored water pollution data in El Dekhiela port is shown in Table 8-3-3.

Table 8-3-3 Water Pollution Data for Simulation

Parameter	Analysis method	Value (mg/l)	Source
COD(Cr)	dichrome method	300	Alexandria Governorate
COD(Mn)	permanganate method	4.3	by estimation

As already mentioned in section 8-1-2, the original value of 300 mg/l at El Dekhiela port is extremely high. This value COD(Cr) was replaced with 4.3 mg/l based on the permanganate method.

Therefore, the Study Team applied the value 4.3 mg/l to this simulation.

(2) Estimated emission data for simulation

From section 8-2, the data shown in Table 8-3-4 was used for the simulation of air quality, the data shown in Table 8-3-5 for simulation of noise, and the data shown in Table 8-3-6 for simulation of sea water quality.

Table 8-3-4 Air Emission Data for Simulation

Element		NOx	SOx	Dust	
Plant		DRP			SMP
Facility		Reformer			EAF
Emission value	(mg/m^3)	69.0	2.4	2.1	0.5
Exhaust gas					
volume	(Nm^3/hr)	560,000			750,000
temperature	(°C)	300			53
Stack					
height	(m)	40			20
diameter	(m)	5.4			5.3

Concerning NOx and SOx, the emission value of the DRP reformer was applied because the contribution ratio of this facility's emissions are high.
Concerning dust, the major emitting facilities are the DRP reformer and EAF.

Table 8-3-5 Estimated Noise Level for Simulation

Plant	Generating facility	Noise level (dB)
DRP	Reformer	100
SMP	EAF	105
HSM	entire mill	105
Utility	Air compressor	95

Table 8-3-6 Estimated Discharge Water COD

Parameter	Value
COD	1.4 mg/l
Water quantity	150 Nm^3/hr

Details of the method of simulation are described in Appendix 8A-1.

8-3-3 Simulation results

(1) Ambient air quality

1) NOx

The distribution of NOx during operation is shown in Figure 8-3-2.

NOx emissions from the new plant will contribute 99.5 $\mu g/m^3$ (annual mean) to ambient air quality (present value 39.0 $\mu g/m^3$). A total NOx level of 138.5 $\mu g/m^3$ is within limits (max. 150 $\mu g/m^3$). Estimated daily mean value will be 110.1 $\mu g/m^3$ instead of 99.5 $\mu g/m^3$ (annual mean).

2) SOx

The distribution of SOx during operation is shown in Figure 8-3-3.

SOx emissions from the new plant will contribute 6.12 $\mu g/m^3$ to ambient air quality (present value 10.4 $\mu g/m^3$) and therefore have little effect. A total SOx level of 16.52 $\mu g/m^3$ is within limits (max. 60 $\mu g/m^3$).

3) T.S.P.(Dust)

The distribution of T.S.P. during operation is shown in Figure 8-3-4.

Dust emissions from the new plant will contribute 13.0 $\mu g/m^3$ to ambient air quality (present value 30.2 $\mu g/m^3$ T.S.P.) and therefore have little effect. A total T.S.P. level of 43.2 $\mu g/m^3$ is within limits (max. 90 $\mu g/m^3$).

Figure 8-3-2 Predicted NOx Concentration Distribution Pattern

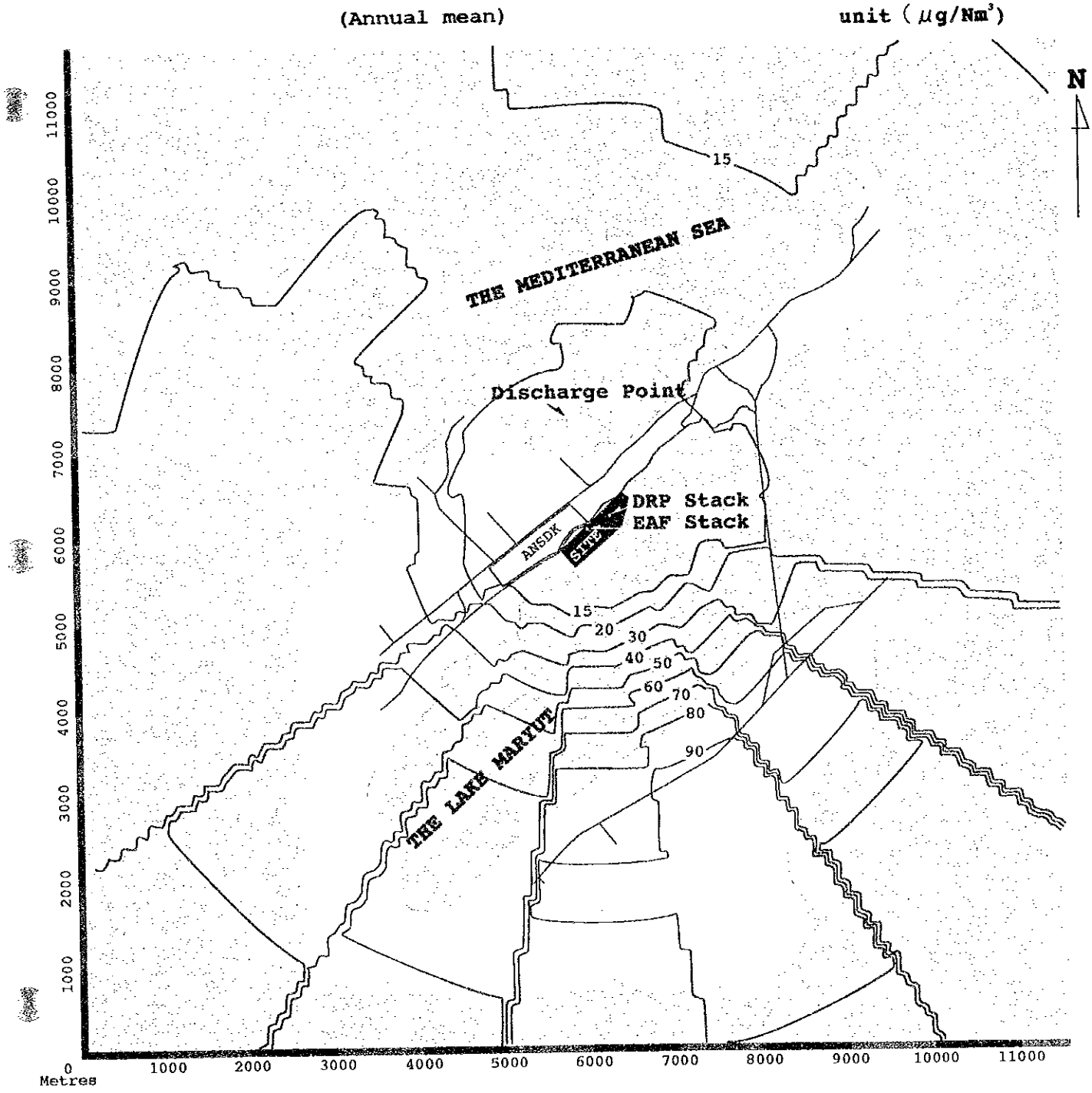


Figure 8-3-3 Predicted S0x Concentration Distribution Pattern
(Annual mean)

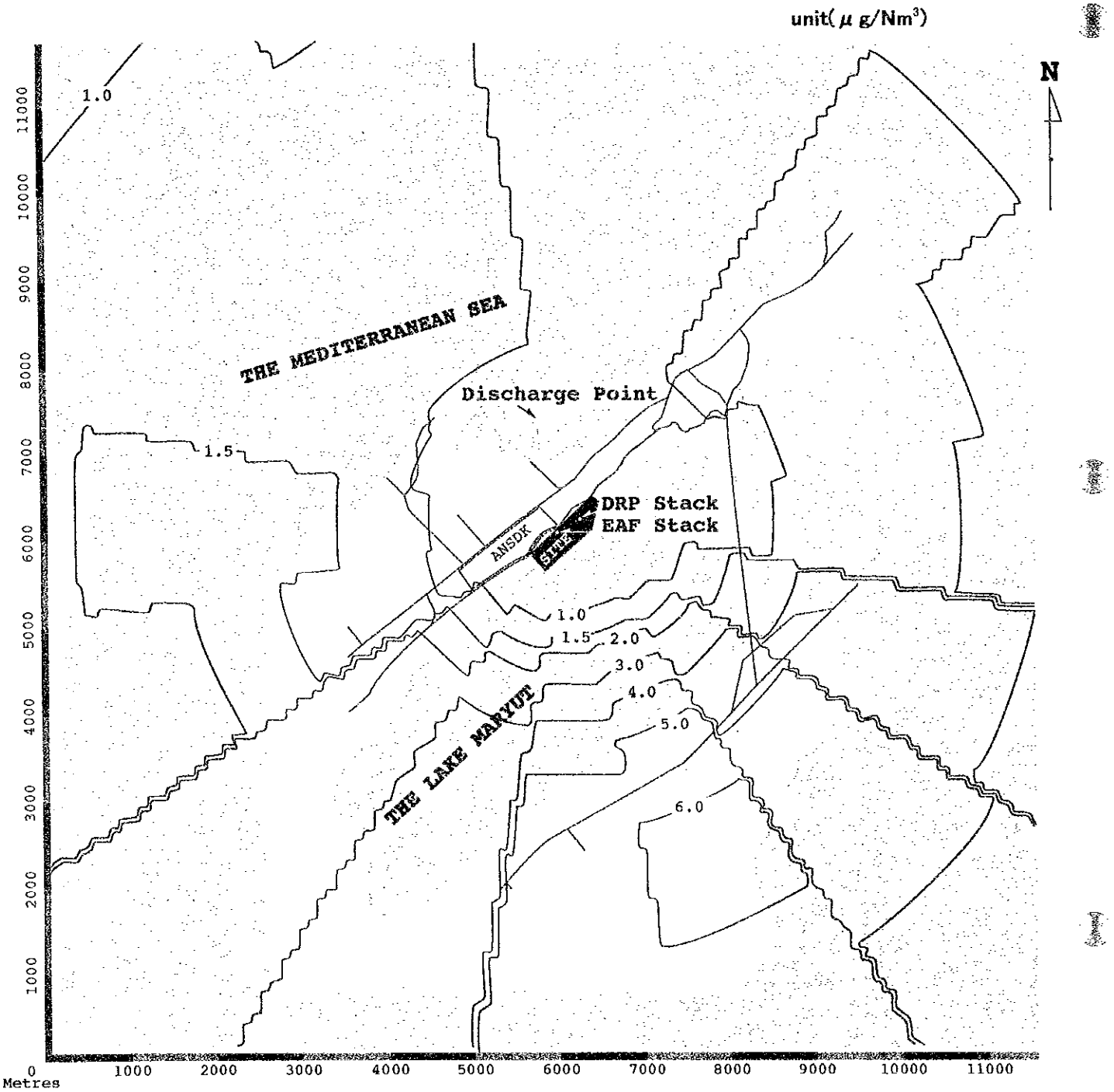
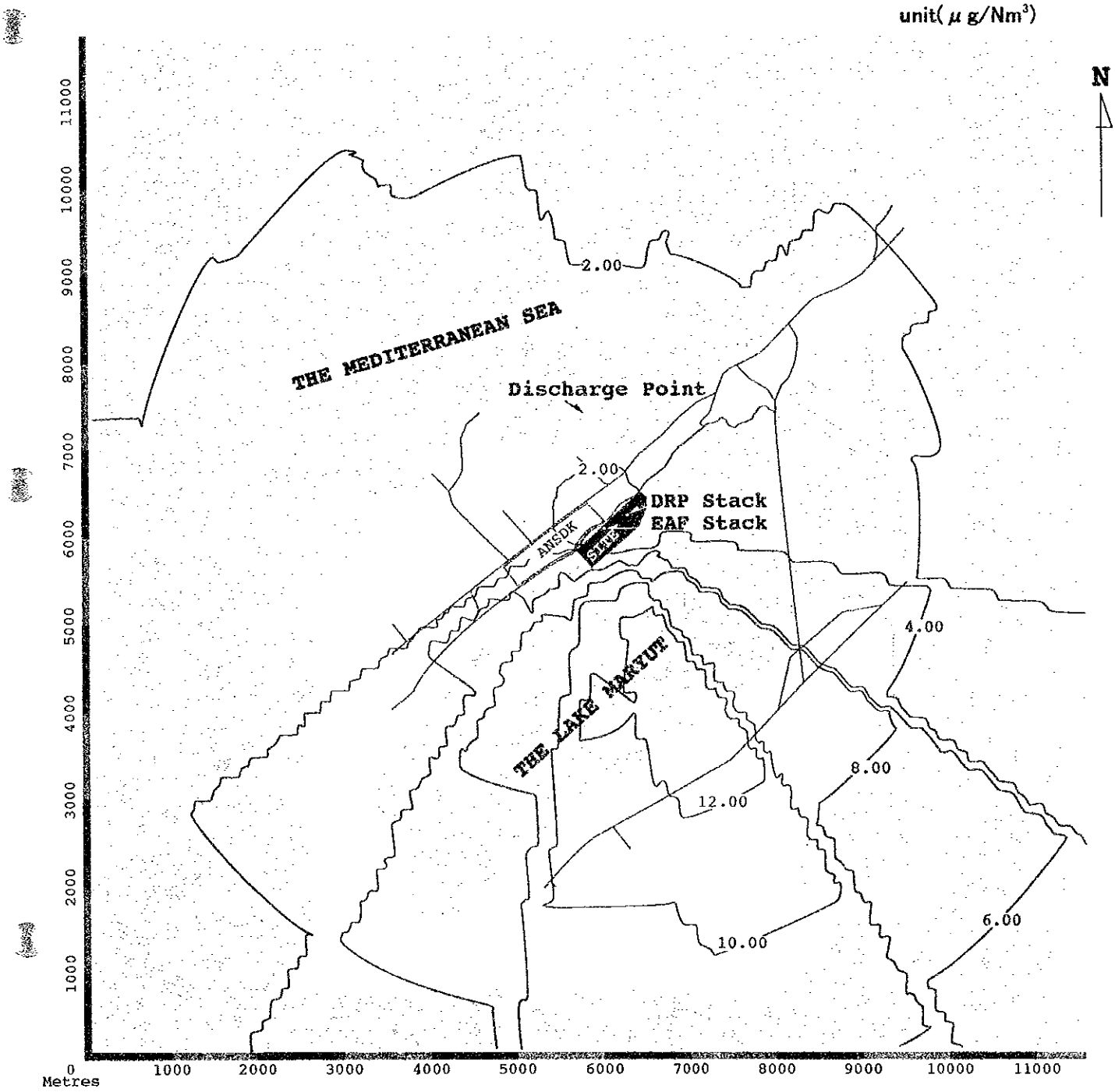


Figure 8-3-4 Predicted T.S.P. Concentration Distribution Pattern
(Annual mean)



(2) Noise

The distribution of noise levels during operation is shown in Figure 8-3-5.

Noise levels at the plant boundary are shown in Table 8-3-7.

The noise levels at all points are under 59 dB, within limits (max. 60 dB at night).

Table 8-3-7 Plant Boundary Noise Levels

unit: dB

Point	Plant and facility				Entire plant Operation
	DRP Reformer	SMP EAF	HSM Rolling mill	Utility Air compressor	
A	< 30	< 30	43	< 30	43
B	< 30	46	56	< 30	56
C	30	59	44	< 30	59
D	40	51	< 30	32	51
E	34	59	41	41	58
F	< 30	49	46	38	51

(3) Sea water quality

The COD distribution during operation is shown in Figures 8-3-6 and 8-3-7. The contribution of the new plant to sea water quality (present value 4.3 mg/l) is 0.001 mg/l and will therefore have little effect.

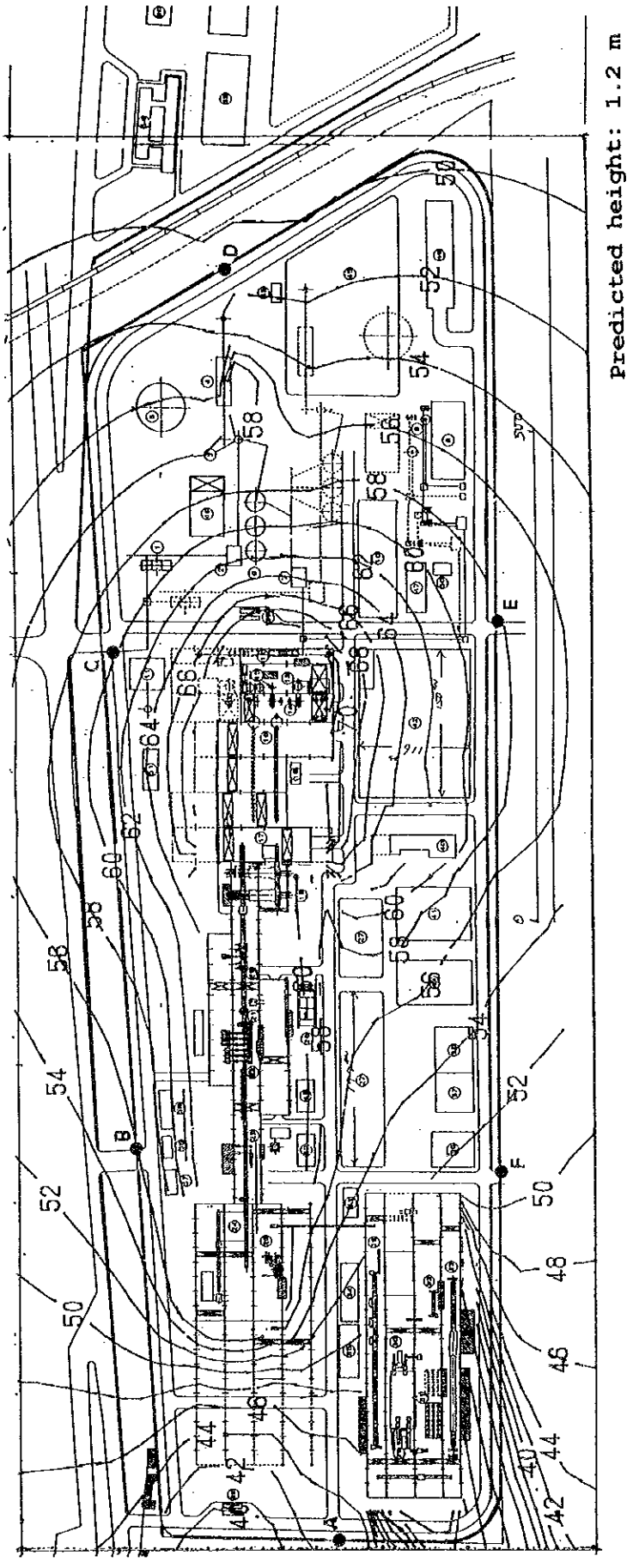
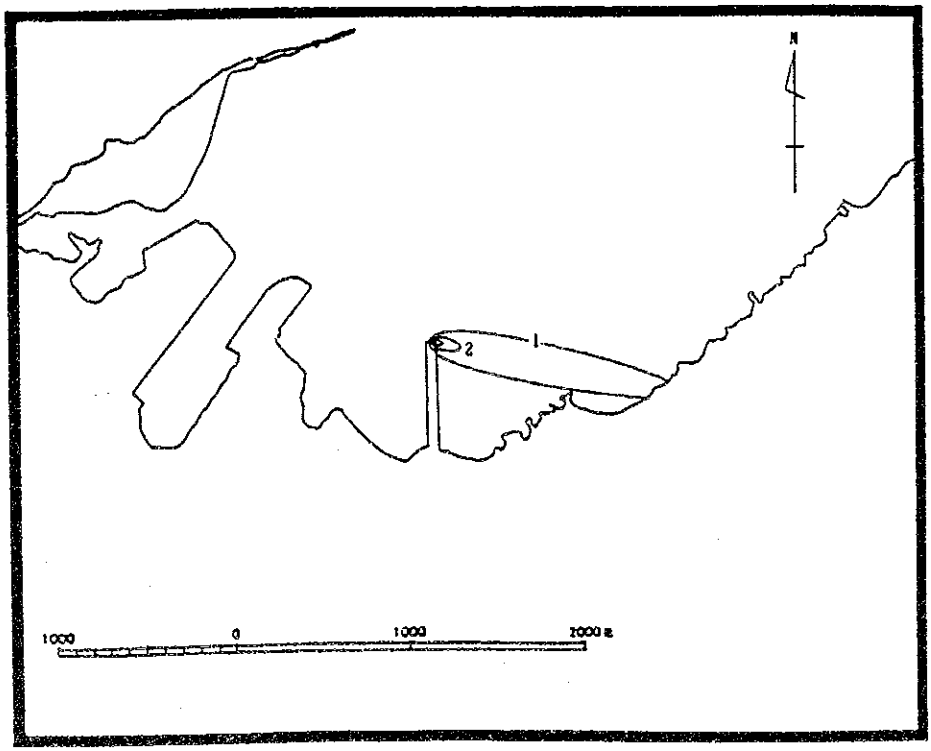


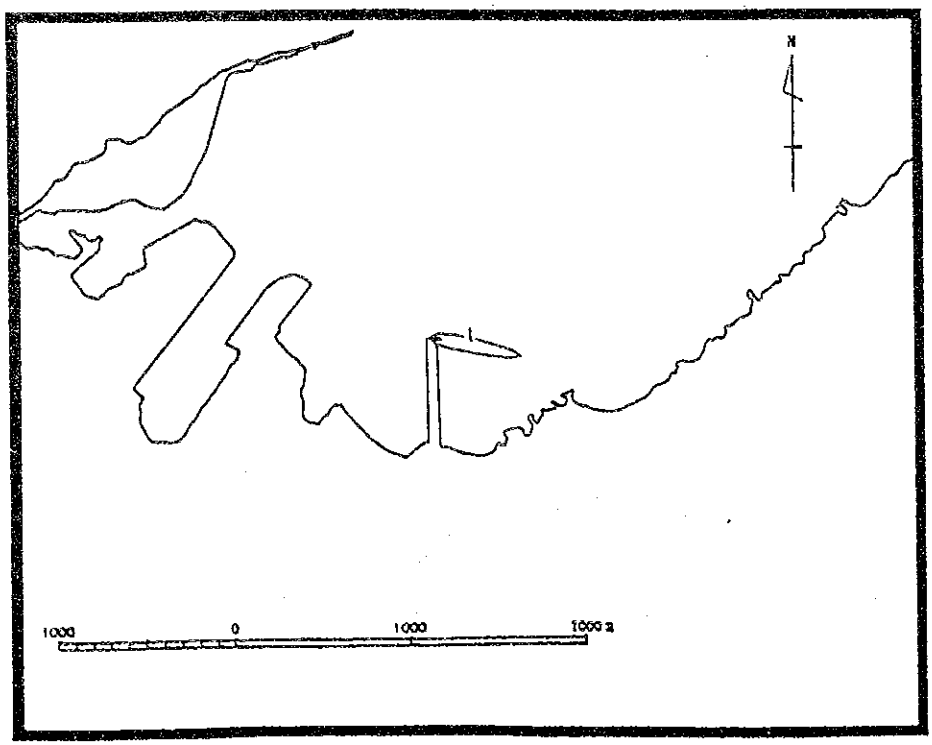
Figure 8-3-5 Predicted Noise Level Distribution Pattern

Figure 8-3-6 Predicted COD Concentration Distribution Patterns (1)

unit: 10^{-4} mg/l



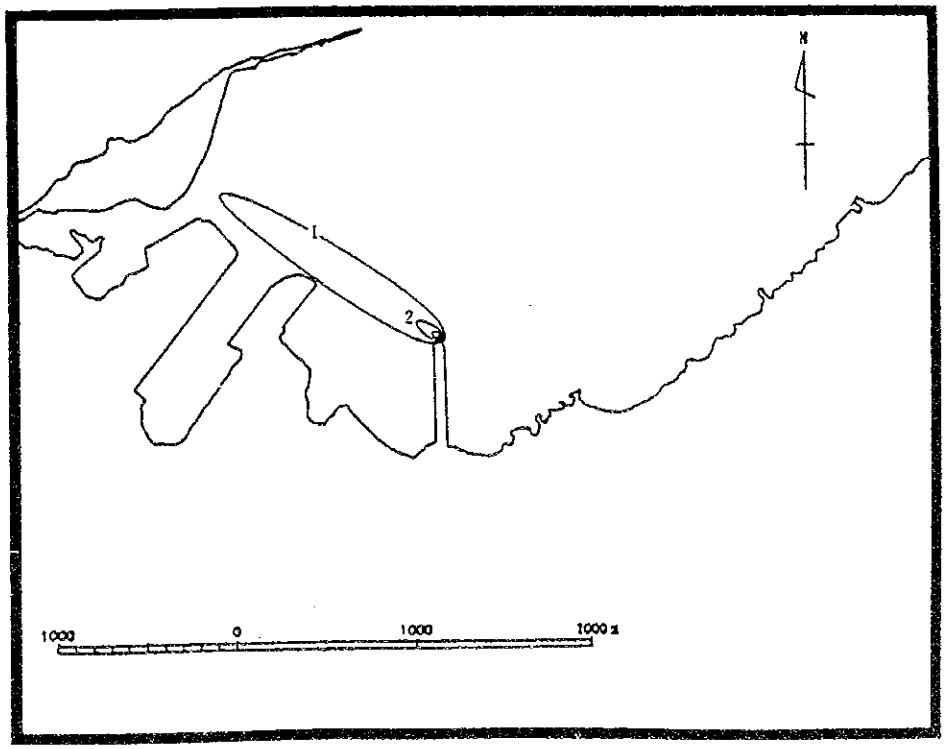
Tidal Current Direction: E + 11.5, Velocity: 0.08 m/s



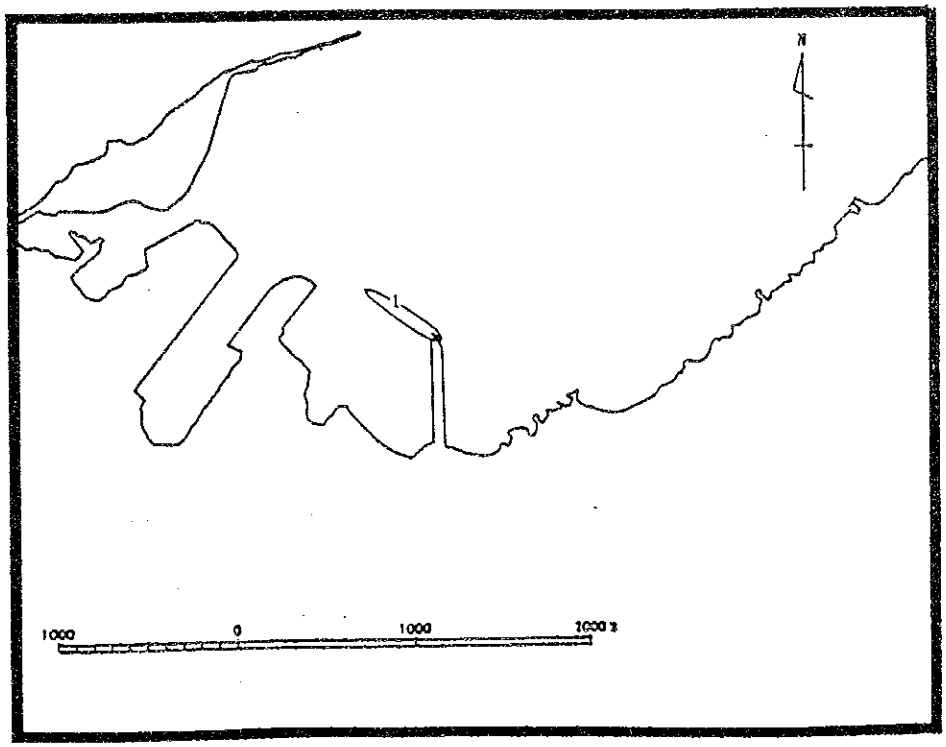
Tidal Current Direction: E + 11.5, Velocity: 0.23 m/s

Figure 8-3-7 Predicted COD Concentration Distribution Pattern (2)

unit: 10^{-4} mg/l



Tidal Current Direction: NW + 11.5, Velocity: 0.08 m/s



Tidal Current Direction: NW + 11.5, Velocity: 0.23 m/s

(4) Evaluation

The results mentioned above are summarized in Table 8-3-8.

Table 8-3-8 Evaluation

Parameter		Contribution*	Background	Total	Limit
Air quality ($\mu g/m^3$)	NOx	A.m. 99.5	-	-	-
		D.m. 110.1	39.0	149.1	150
	SOx	6.1	10.4	16.5	60
	T.S.P.	13.0	30.2	43.2	90
Noise (dB)		43/59	64.8	-	D 60/70 N 50/60
Sea water (mg/l)	COD	0.001	4.3	4.3	-

Note: * Maximum value (in the case of air quality, at ground level)

A.m.: Annual mean, D.m.: Daily mean

D: Day time N: Night time

Almost all predicted parameters are within limits.

8-3-4 Environmental impact assessment

An environmental impact assessment was conducted on the principle pollutants NOx, SOx and dust as well as noise and effluent COD which are supposed to be emitted from the flat steel plant with reference to the following standards.

- Emissions limit

  Comparison of the predicted emissions with Egyptian standards

- Environmental standards

  Comparison of the pollution levels, calculated by simulation using data from the site and the predicted emissions levels from the flat product plant, with Egyptian standards

Not only the parameters mentioned above but also other parameters are within the limits of the emissions standards.

As a result of the assessment, the emissions value from the plant and environmental pollution near the site will be within the limits of Egyptian environmental standards.

Therefore, it can be said that pollution will be kept within the limits of Egyptian standards provided the flat product plant is constructed equipped with the environmental control systems described in this report.

Chapter 9

CORPORATIVE IMPLEMENTION PLAN

Chapter 9. CORPORATIVE IMPLEMENTATION PLAN

This chapter describes briefly about an entity, which will execute this flat product project, and indispensable management matters which this entity shall organize prior to start-up and during the operation of flat product plant.

9-1 General

In recent years in Egypt, the government has been strongly promoting the privatization of industry. Under the privatization policy, this flat product project will be carried out as an enterprise of the private sector. It will make a corporative implementation plan; obtain various governmental approvals for this project; and manage the construction and operation of the plant.

The project cost is assumed to be US$ 1,108 million. 30% of the total investment is privately financed by equity, and 70% of that is by debt or loan. Debt finance solely depends on long-term loans for construction cost of the production facilities, incorporation expenses and interest payments during construction. Working capital is financed by short-term loans.

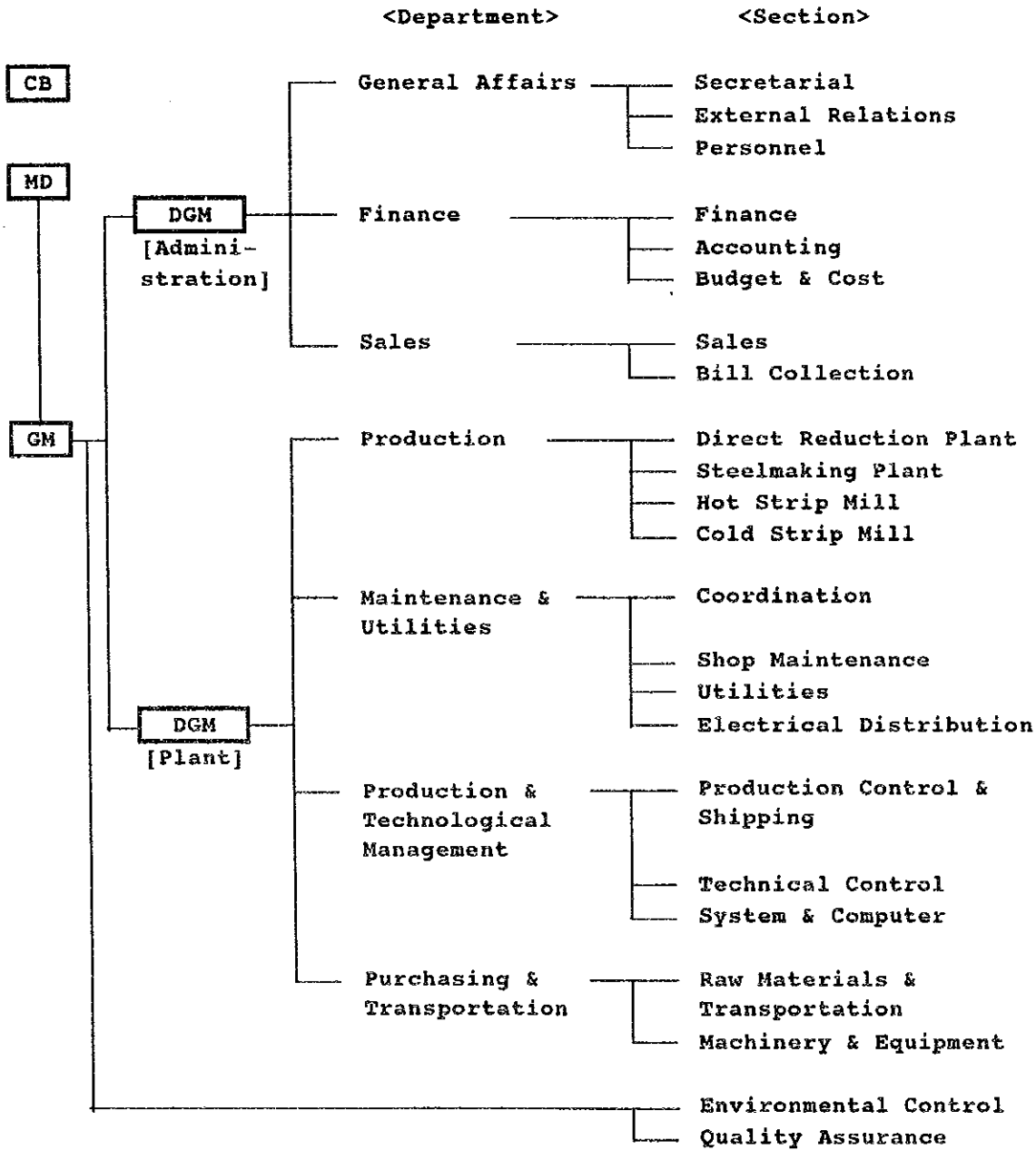
This flat steel plant shall produce annually one million tons of products with manpower of 1,550. Most of the flat products shall be delivered to domestic customers and basically they will not be exported.

9-2 Organization and Personnel Plan

9-2-1 Organization plan

The organization of this project is charted in Figure 9-2-1.
This organization is made under the following consideration based on broad experiences of flat steel operation in an advanced country:

Figure 9-2-1 Organization Chart



Note: CB/ Chairman of Board, MD/ Managing Director
GM/ General Manager, DGM/ Deputy General Manager

- The administration division is kept small in order to reduce administrative expenses and maintain international competitiveness.
- The four departments in the plant division are independent so that the responsibility and authority of each is clearly defined.
- The technical control section in the production & technological management department is organized in order to satisfy the high quality requirements for flat products.

This project as an incorporated company is organized by two divisions, seven departments and twenty-three sections.

There are three departments in the administration division, the general affairs, finance and sales department and four departments in the plant division, i.e. the production, maintenance and utilities, production and technological management, and purchasing and transportation department. The deputy general manager (DGM) is in the administration and plant division respectively and the general manager (GM) controls them. The general manager, under the trust of the managing director (MD), controls all production, sales and finance. The managing director discharges management responsibility of the company. The chairman of the board (CB) controls the board as a representative of the board of directors and decides management matters.

The general affairs department in the administration division has three sections; secretarial, external relations and personnel. Especially, the function of the personnel section are personnel, recruitment, labor control, welfare, safety, education and training. The finance department has three sections; finance, accounting, and budget and cost. The sales department has two sections of sales and bill collection, including a special function that covers the Cairo area where a large scale demand is expected.

The production department in the plant division has four sections; the direct reduction plant, steelmaking plant, hot strip mill plant and cold strip mill plant.

The maintenance and utilities department has four sections; coordination, shop maintenance, utilities and electrical distribution.

The production and technological management department has three sections; production control and shipping, technical control, and system and computer. The production control and shipping section controls the production schedules from receipt of the raw material to shipment of the products. The technical control section controls operational technology, development technology, quality control and analysis including technical services to consumers.

The purchasing and transportation department has two sections; raw materials and

transportation, and machinery and equipment.

In addition, two sections consisting of environmental control and quality assurance shall be organized and directly controlled by the general manager in regard to environment matters and customer's needs.

9-2-2 Personnel plan

Required manpower is shown in Table 9-2-1. The administration division has 152 persons including one general manager, one deputy general manager and three department managers. The plant division has 1,398 persons including one deputy general manager and four department managers. The required manpower is 1,550 persons in total.

Taking account of sustaining international competitiveness, the number of manpower is squeezed as much as possible. Especially the administration division shall be kept as small as possible.

9-2-3 Recruitment and training plan

(1) Recruitment

In Egypt excellent manpower may be easily employed for these ten years because of an excessive labor market. That is, it is easy for the flat product plant to employ skilled workers and potential university graduates, due to serious restructuring of companies in the public sector and restrained recruitment of the authorities concerned. (Refer to "Social Conditions" in Chapter 4.)

The recruitment of key personnel for plant operation such as managers, engineers and foremen, shall be started at least two to three years prior to the start-up of production, and that of ordinary personnel in principle shall be started at least six to twelve months prior to the start-up of production.

As for the stage of plant construction, managers and engineers concerned shall be employed at least five years before the scheduled date of start-up of operation along with Figure 7-5-1.

Table 9-2-1 Personnel Plan

	Department	Section	Section Manager	Assistant Section Manager	Engineer or Clerk	Worker	Sub-total
Admini-Stration	General Affairs	Secretarial	1	1	1	0	3
		External Relations	1	1	1	2	5
		Personnel	5	8	26	23	62
	Finance	Finance	1	1	5	0	7
		Accounting	1	2	12	0	15
		Budget and Cost	1	2	9	0	12
	Sales	Sales	1	4	24	0	29
		Bill Collection	1	1	4	0	6
Plant	Production	Direct Reduction Plant	1	1	8	64	74
		Steelmaking Plant	1	3	4	252	260
		Hot Strip Mill	1	2	2	153	158
		Cold Strip Mill	1	2	4	193	200
	Maintenance and Utilities	Coordination	1	3	15	0	19
		Shop Maintenance	1	6	22	202	231
		Utilities	1	3	4	112	120
		Electrical Distribution	1	1	3	12	17
	Production & Technological Management	Production Control & Shipping	1	4	8	78	91
		Technical Control System & Computer	2	3	9	96	110
			1	2	12	0	15
	Purchasing & Transportation	Raw Materials & Transportation	1	2	10	60	73
		Machinery & Equipment	1	3	17	4	25
		Environmental Control	1	1	2	0	4
		Quality Assurance	1	1	2	0	4
		Total	28	57	204	1,251	1,540

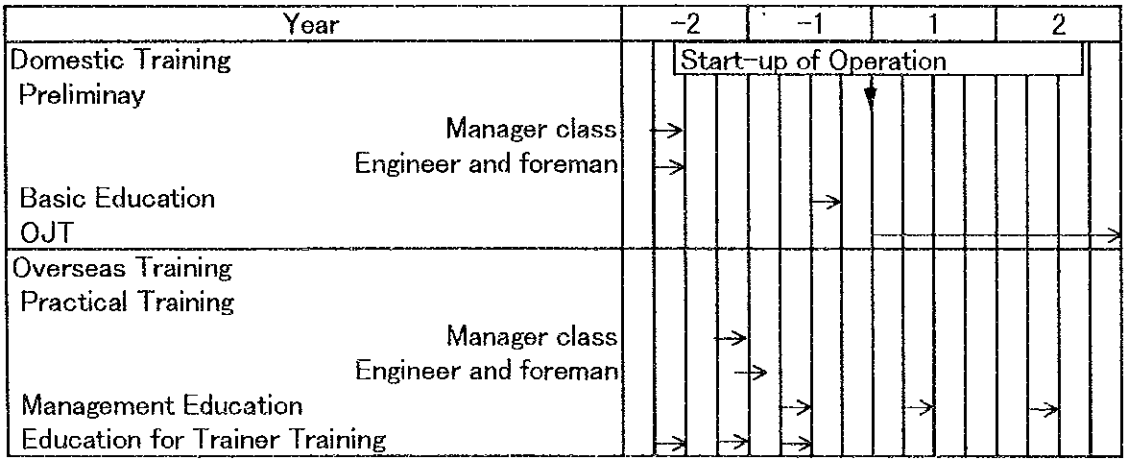
Note : GM(General Manager) = 1 DGM(Deputy General Manager) = 2

DM(Department Manager) = 7 Gross Total = 1,550

(2) Training plan

The purpose of training is that new employees can acquire enough ability to execute administration and operation in the works as soon as possible. The training plan is shown in Figure 9-2-2. It shall be prepared as follows.

Figure 9-2-2 Training plan



1) Domestic preliminary training

Preliminary training is carried out through lectures for both management staffs of personnel, finance, accounting, purchasing and sales, and for key personnel of main shops about two years before the start-up of operation. Separated classes are held for managers and other supervisors (engineer, foreman, etc.) ranging from two to three months.

2) Overseas training

The personnel, who will qualify for overseas training, are selected during the course of domestic preliminary training. The overseas training will be carried out by some groups. The estimated number of overseas trainees is shown in Table 9-2-2.

Table 9-2-2 Estimated number of overseas trainees

Facility	Number of trainees
Direct reduction plant	15
Steelmaking plant	40
Hot strip mill	25
Cold strip mill	30
Utilities / Electrical	15
Maintenance	20
Technical control / Quality assurance	15
Production control	5
Others	20
Total	185

a) Practical training

In practical overseas training, flat steel plant suitable to this project is to be selected by the consultant. The term is for about three months.

b) Management education

Department manager-class personnel will have to take management courses about company management and production control. They should study real management under a market economy in developed countries for about one month.

c) Education for trainer training

In-company training has to be continued originally after start-up of production. Original training trainers are required to execute it. The candidates for trainers are selected from the personnel who had undergone overseas training.

3) Basic education at site

Basic education for employees who will occupy higher positions than engineer and assistant foreman class are lectured at site according to each job task. The lectures are to include explanation of plant outline, operation standard, quality control, cost control, safety plan, etc. in their lecture plan, and are commenced six months before the start-up of operation. These courses are for about two months.

4) OJT (On - the - Job Training)

Once production starts up, OJT for operators is conducted by the consultant at first. Then training is transferred to original in-company trainer from consultant.

5) The training subject

The main subjects which must be carried out during the training before and after the start-up of operation are described as follows;

a) Direct reduction plant

- Raw material receiving, stocking and supplying
- Technical control of raw material preparation
- Operation of main equipment and its technical standards control
- Safety control

b) Steelmaking

- DRI receiving and supplying
- Technical control of steelmaking Sub-materials, scrap, etc.
- Operation of electric arc furnace, continuous casting machine and its technical standards
- Safety control

c) Hot strip mill and Cold strip mill

- Slabs & coils receiving and supplying
- Operation of main equipment such as rolling mill, etc. and its technical standards
- Control of auxiliary equipment such as crane
- Safety control

d) Utilities

- Mechanism of supply of power, water, gas, oxygen, compressed air, etc.
- Operation of main equipment and its technical standards
- Safety control

e) Maintenance

- Organization and control system
- Standards of repair works
- Control of parts and components
- Safety control
- Operation of main equipment

f) Others

- Planning of management policy
- Organization of integrated steel plant
- Budget control system
- Control of production planning system
- Quality control system
- Cost control system
- Accounting system
- Personnel management and labor relations such as salary, employee benefits, etc.
- Transportation system
- Marketing, price system, etc.

(3) Support of foreign consultant

Support of the foreign experienced consultant is indispensable for the establishments of plant management and techniques by Egyptian in the early stage. In order to make sure these technical skills, especially for flat steel products, the assistance of the consultant is very important. The term of the consultant is for five years, that is, two years for preparation before the start-up of operation and three years for plant operation after the start-up of operation. The personnel requirement for foreign technical assistance is shown in Table 9-2-3.

Table 9-2-3 Personnel Requirement for Technical Assistance

Area	Year after start-up				
	-2	-1	1	2	3
Administration	4	4	4	4	4
Operation technology Production and technological Control	1	1	1	1	1
Production					
DR plant	1	5	8	5	5
Steel making plant	1	8	14	8	8
Hot strip mill plant	1	11	20	11	11
Cold strip mill plant	1	11	20	11	11
Utilities	1	10	17	10	10
Maintenance	1	7	12	7	7
Total	11	57	96	57	57

9-3 Operation Management Plan

9-3-1 Production control plan

The production control should take such characteristics of flat products as order production in principle, various strict specifications, many varieties of products sizes and diversified quality requirements, etc. into consideration. The production control should be data oriented or supported by data control system, and should have check function. Data for the production plan should be prepared in such four terms as monthly, quarterly, six months and one year term.

(1) Raw material control plan

It is important to control the supply and demand of the large volume of raw materials in the plant. Most of the main raw materials and sub-materials are imported in Egypt with few materials supplied domestically. If imported materials are not supplied on schedule, production will stop and the production schedule will not be achieved. Therefore, management should concentrate on controlling vessel assignment and purchasing of materials by means of long-term contract in close cooperation with the purchasing & transportation department.

(2) Whole production plan

According to sales plan, production plans are made up in such four terms as one year, six months, quarterly and monthly. Volume of production plan is more precisely decided, depending upon the fact that the terms become shorter and shorter. Plan of production, that contains operation plan of main equipment, flows of raw material, semi-products and finished products, shall be established efficiently by balancing each of the process.

(3) Rolling plan

In order to meet with the contract delivery time for consumers, a rolling plan and delivery plan will be made. Shipment of spot orders shall be made under appropriate inventory control.

9-3-2 Quality control plan

The objects of quality control are to satisfy consumers and ensure their confidence. Quality control is not only to control quality of steel products in accordance with own standards and customers' requirements, but also to control cost of production, delivery schedule to consumers. The products quality of this flat steel plant should be as the same as that of

international level.

Quality control action is to grasp precisely what consumers require, and establish concrete quality standard or quality specifications. And then, it is to make products most economically , and to keep the delivery time as required. As a result, consumers can use satisfactorily these products. It is quality control that a series of these tasks are efficiently carried out.

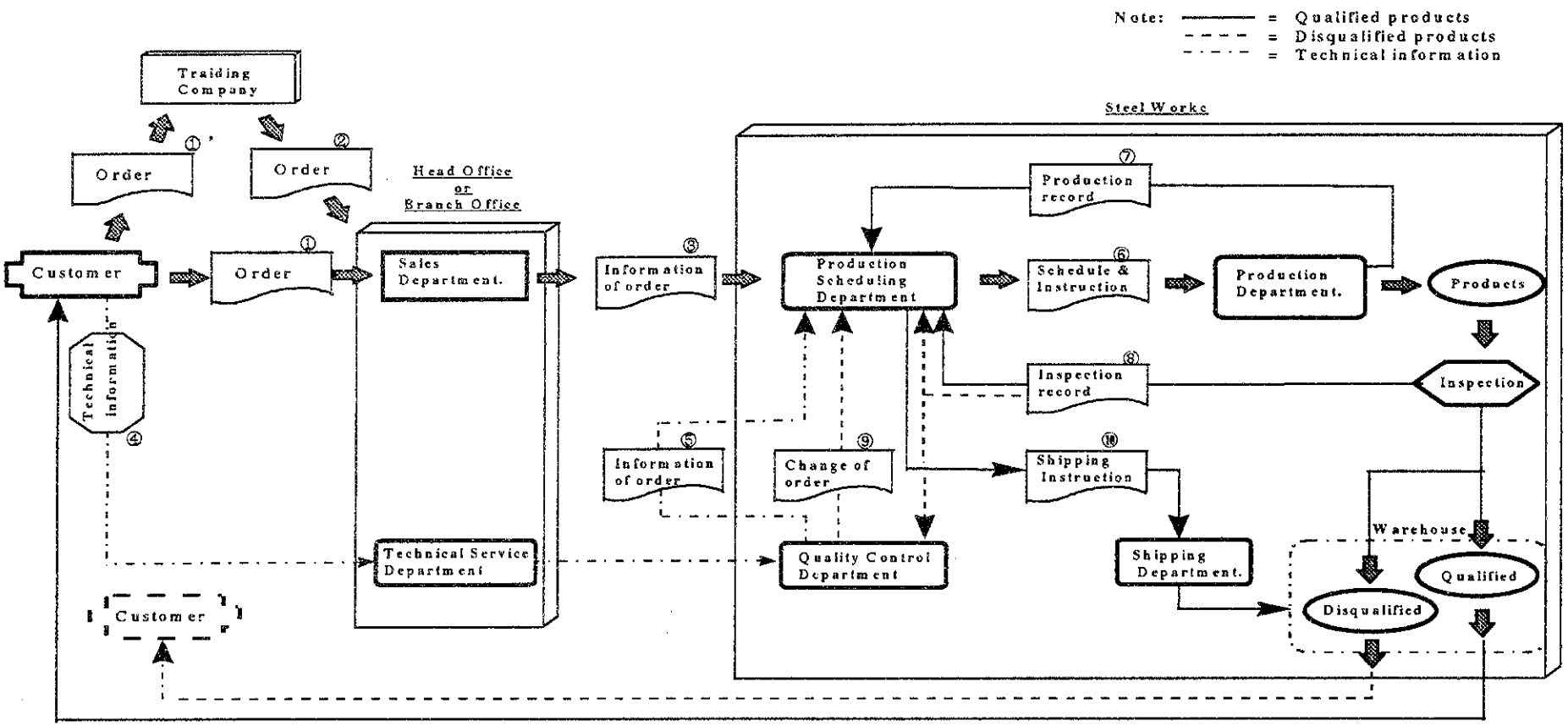
A quality control plan should be, therefore, established as illustrated in the Figure 9-3-1.

Through the contact with consumers, sales department and technical service section grasp precisely quality requirements and delivery time, and present production division with these. Based on this order information, the production division will try to incorporate its own standard, process capability and quality requirements into specifications from consumers. And in order to produce the ordered products most economically, quality plan and process plan are established, and products are manufactured in accordance with those plans.

It is important to have a clear description about the organization and function on quality control, that is to say, responsibility and authority on it. In this project, the production control & shipping section in the production department takes leadership with respect to quality control, and every section of the production department, which relates to quality control, and sales department shall follow that.

Thus, quality control action is important and indispensable one to ensure confidence of consumers and to sustain continuous operation of the company through consumption of its own products by consumers and its services for them.

Figure 9-3-1 Example of Quality Control System



9-4 Sales Plan

As opposed to bar, or long products, which are generally demanded by construction companies on project basis, the consumers of flat products are mainly manufacturers. The fact shows that a flat steel plant is ensured a stable demand for flat products, because the demand is constantly expected as far as these manufacturers operate.

Sales activities should be strongly executed setting a target in such areas where a big demand is expected.
It is important for the sales section to take consumer's requirements such as quality and delivery into their consideration of the sales activities, and cooperate with the technical service section in consideration of cost performance.

The Sales plan is shown in Table 9-4-1. To acquire fixed customer, who is expected to place a basic order with the flat product plant, especially in 2005 and 2006 at the time of production start, every effort for sales should be concentrated on penetration into the domestic market by winning market share against imports through the following measures :

- Customer-oriented technical services
- Quality of products
- Quick delivery time
- Pricing policy
- Quality assurance

Table 9-4-1 Sales Plan

(Unit: 1,000 t/y)

Year	HRC	Plate	CRC	GI	Total
2005	312	56	128	40	536
2006	532	95	220	70	917
2010	541	97	224	71	933
2015	541	97	224	71	933
2020	541	97	224	71	933

In Egypt the consumption of flat products will increase consistent with the development of the market economy and the progress of privatization in the next ten years, and the number of coil service centers will be also increased in the distribution of flat products as described in the paragraph 5-1-4.

The sales base shall be established in Cairo, where it is easier for the sales personnel to get information on market than other cities in Egypt, because there are a lot of headquarters of consumers, separated from the flat product plant in Alexandria.

9-5 Research and Development Plan

9-5-1 Research and development

Judging from the Egyptian flat product market, a large demand for high grade products can not be expected. Most of the product will be of commercial grade. Therefore, it is recommended to introduce operating technology from an outside steel company as occasion demands without organizing a large scale research and development center.
This may be organized when requirements for high grade products increase due to changes in the market in future.

9-5-2 Development plan of new products

The following products will be newly developed in the future.

Hot Rolled Products to be developed are the following :

a) High strength steel for line pipe use
b) Hot rolled high strength steel with high stretch flangeability for automobile use
c) Corrosion resistant steel for automobiles
d) Improvement of wide size thin gauge rolling technology

Cold Rolled Products to be developed are the following :

a) High quality products of pickled coil (Replacement of cold rolled coil)
b) Ultra low carbon steel for extra drawing quality
c) Super-formable steel with tensile strength of 390 - 440 N/mm2
d) Bake hardenable cold steel for automobile use
e) Ultra high strength steel

9-6 Future Expansion Plan

9-6-1 Flat product market growth

As described in Section 5-1, demand for flat products in Egypt is not supposed to grow enough to support production of two million tons per year by the flat steel plant before 2015.

On the other hand, in order to realize high cost performance for the plant, production capacity of the DR plant and steelmaking plant are assumed to be one million tons per year per unit respectively. On the other hand, production capacity of the plant will be one million tons per year in the 1st stage and two million tons per year in the 2nd stage. Consequently, execution of the expansion plan shall be suspended till market size justifies the expansion of production capacity to two million tons per year. If the growth of demand continues following the medium growth rate shown in the Phase-1 report, there will be the possibility to expand production capacity by 2018.

Although this feasibility study does not cover dates beyond 2015, the basic plan for the expansion of the plant is shown as followings.

9-6-2 Basic plan for the future expansion

(1) Material flow

Production capacity for the 2nd stage shall be two million tons per year. The kinds of products will be increased and steel grade is assumed to be higher than that of the 1st stage. The material flow of the 2nd stage is shown in Figure 9-6-1.

(2) Facility plan

In addition to the facilities of the 1st stage, the facilities shown in Table 9-6-1 shall be installed for the expansion of production capacity of flat products from one million to two million tons per year.

In the cases of the DR plant and steelmaking plants, almost the same size facilities as the 1st stage shall be required. On the other hand, only one reheating furnace and one coiler shall be required for the expansion of the hot strip mill.
Regarding the cold strip mill, one combination mill, additional annealing furnaces and one recoiling line shall be installed.

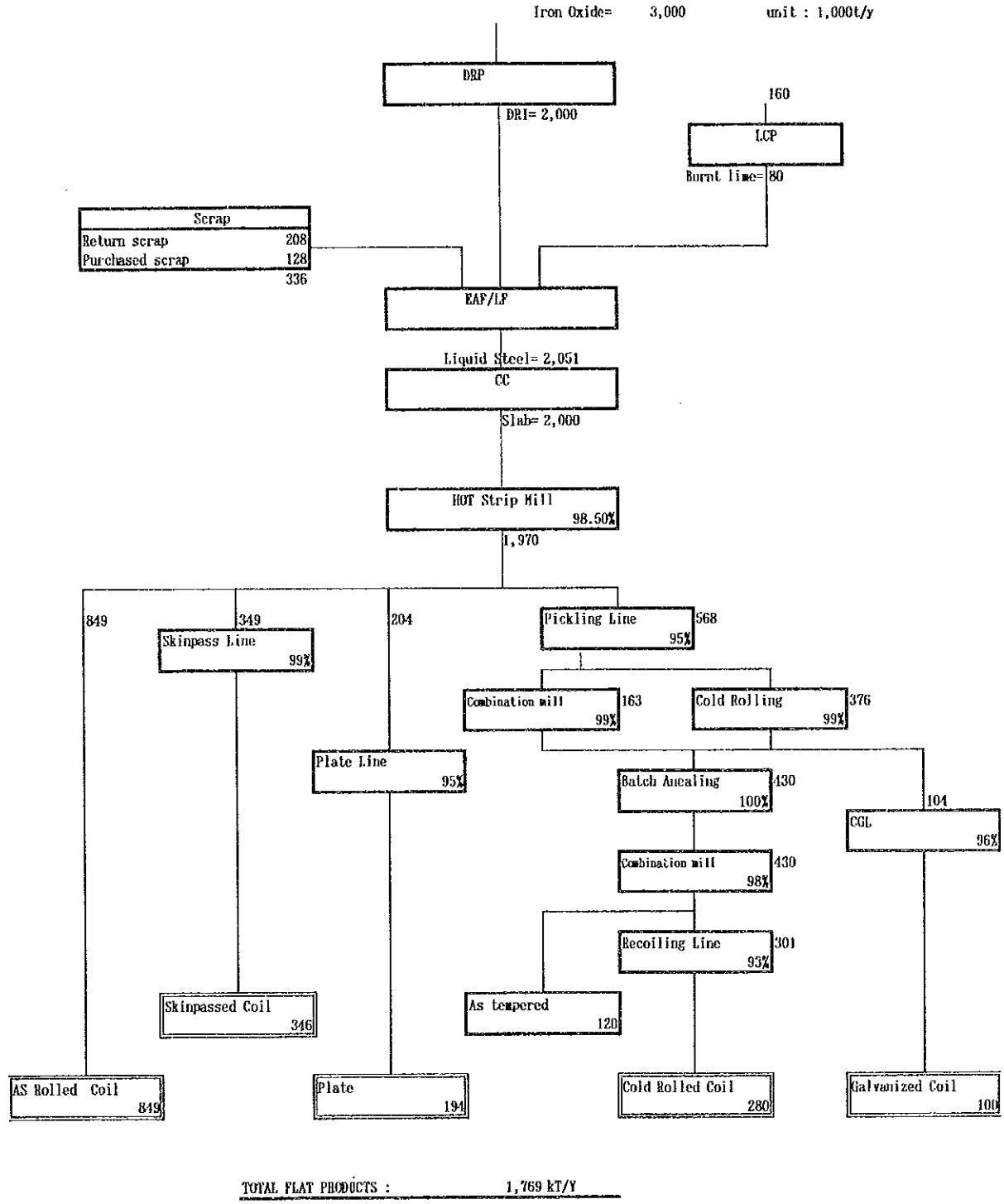
(3) Construction cost

Although the production capacity will be double that of the 1st stage, the 2nd expansion will

not require so large amount of construction cost as the 1st stage. It will not be necessary to pay for land acquisition, land preparation, construction of the hot rolling mill and administrative facilities. Consequently, if high market demand is expected, a rather high return of investment can be expected from the 2nd expansion compared to the 1st stage.

Figure 9-6-1 2nd Stage Material Flow

(Production capacity : two million tons per year)



TOTAL FLAT PRODUCTS : 1,769 kT/Y

Table 9-6-1 Facilities for 2nd Stage Construction

Plant	1st stage (Initial stage)	2nd stage (Additional equipment)		Remarks
	Main facilities	Main facilities	Ancillary equipment	
DR plant [Capacity] - DR plant	[1 million ton/y] - Megamod x1 plant	[1 million ton/y] - Megamod x 1 plant		
Steelmaking plant [Capacity] - FAF - LF - Slab caster	[1 million ton/y] - 160 t/heat x1 - 160 t/heat x1 - 1 machine/1 strand	[1 million ton/y] - 160 t/heat x1 - 160 t/heat x1 - 1 strand/1 strand	- Crane & lifting equipment - Water treatment system	Expansion of buildings
Hot strip mill [Capacity] - Slab reheating furnace - Rolling mill Rougher Coil box Finisher Coiler - Skinpass mill - Plate line	[1 million ton/y] - 250 t/h x1 - 1 stand - 1 machine - 5 stands - 1 machine - 1 mill - 1 line	[1 million ton/y] - 250 t/h x1 - - - - 1 machine - -	- Roll grinders - Crane & lifting equipment - Water treatment system - Crane & lifting equipment	Expansion of buildings

Plant	1st stage (Initial stage)	2nd stage (After expansion)		Remarks
	Main facilities	Main facilities	Ancillary equipment	
Cold strip mill [Capacity] - Pickling line - Reversing mill - Combination mill - Annealing furnace - Temper mill - Recoiling line - Galvanizing line	[0.35 million ton/y] - 1 line (with 3 tanks) - 1 mill - 1 mill - 21 bases/ 10 furnaces - 1 mill - 1 line - 1 line	[0.20 million ton/y] - (Additional 3 tanks) - - - 13 bases/6 furnaces - - -	- Roll grinders - Crane & lifting equipment - Water treatment system	Expansion of buildings
Auxiliary facilities - Lime calcining plant - Sub-station - Maintenance shop	- 1 plant - 1 set - 1 shop	- 1 plant - 1 set -		

Chapter 10

ESTIMATION OF CAPITAL INVESTMENT COST

Chapter 10. ESTIMATION OF CAPITAL INVESTMENT COST

10-1 Contents of Capital Investment Cost

This chapter estimates the direct capital investment cost and the accompanying indirect cost required for construction of the flat product plant.

The direct capital investment cost includes the following costs expressed in foreign currencies for imports at CIF prices and in local currency for domestic procurements and inland transportation.

- Equipment to be purchased: Import
- Site work: Domestic, including land and reclamation
- Construction material: Import, except for ballast, sand, and red bricks, which can be procured domestically

The indirect cost includes engineering fees and contingency costs.

Other initial investment cost includes preproduction costs, interest to be paid during construction period, and working capital before start-up of production, all covered in Chapter 12.

10-2 Calculation of Capital Investment Cost

10-2-1 Estimation basis

(1) Price level

The capital investment cost is estimated based on international price levels as of June 1997 and the following data and information.

- Information/data collected during the site survey for field work and local supply
- Estimation by NKK and Kobe Steel for foreign supply
- Information/data quoted for field work
- Information/data collected at the international bidding at the similar project for foreign supply
- Information/data collected at the engineering work of similar project for supply and field work

The capital investment cost is expressed in U.S. dollars for international procurements. For domestic purchases, Egyptian pounds are converted to U.S. dollars at the following rate:

- 1 US$ = 3.39 LE

(2) Taxes, duties, and exemptions

Under the assumption that Investment Law No. 8 of 1997 is applicable to the flat product plant project, all imports necessary for the establishment of the plant are subject to a unified customs duty of 5 %.

A sales tax of 10 % is levied on the value of all procurements. In regard to imports, a sales tax of 10% is to be levied on the total value of procurements, including customs duties.

10-2-2 Cost of equipment

The cost of equipment - all of which is calculated on CIF Alexandria port basis - consists of equipment; auxiliary facilities; materials such as steel frames, bricks, cables and piping, and spare parts required for a normal one-year operation; consumables for six-month start-up operation; and supervision for installation work. The inland transportation cost is included.

10-2-3 Installation cost

The installation cost applies to equipment installation work and machinery testing and related support.

10-2-4 Cost of site work

The cost of site work applies to civil engineering and building construction.

10-2-5 Others

(1) Engineering fees

The cost of engineering services applies to such expenses as those for man-day fees for the following services:

- Procurement
- Preparation of design drawing for civil engineering and building structures
- Consultancy for construction work

Engineering fees is assumed to be 3 % of direct construction cost.

(2) **Contingencies**

To complement the accuracy of construction costs, an appropriate amount of funds is provided to cover contingencies, based on the construction practices of steel plants in Egypt.

Contingencies is assumed to be 5 % of direct construction cost.

10-3 Estimated Capital Investment Cost

The capital investment cost estimated on the above preconditions is shown in Table 10-3-1.

Table 10-3-1 Summary of Estimated Capital Investment Cost

Unit: 1,000 US$

	Equipment			Installation			Civil & Building			Total		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
Direct Reduction Plant	164,992	2,999	167,991	0	16,740	16,740	0	15,873	15,873	164,992	35,612	200,604
Lime Calcining Plant	8,025	1,633	9,658	0	1,786	1,786	0	2,024	2,024	8,025	5,442	13,467
Steelmaking Plant	108,100	8,900	117,000	0	11,800	11,800	8,900	28,622	37,522	117,000	49,322	166,322
Hot Strip Mill Plant	123,570	22,410	145,980	0	17,100	17,100	5,550	51,182	56,732	129,120	90,692	219,812
Cold Strip Mill Plant	63,252	12,915	76,167	0	9,360	9,360	920	21,621	22,541	64,172	43,896	108,068
Hot-dip galvanizing Line	20,538	4,302	24,840	0	4,995	4,995	80	6,466	6,546	20,618	15,763	36,381
Electric Power	26,711	189	26,900	0	6,030	6,030	0	5,080	5,080	26,711	11,299	38,010
Utilities	27,457	5,947	33,404	0	5,044	5,044	0	10,794	10,794	27,457	21,784	49,242
In-works Transportation	4,230	4,950	9,180	0	90	90	0	6,023	6,023	4,230	11,063	15,293
Analysis & Inspection	5,001	68	5,069	0	464	464	0	145	145	5,001	677	5,678
Maintenance Shop	558	189	747	100	18	118	0	3,752	3,752	658	3,959	4,617
Administration Office	0	0	0	0	0	0	0	4,194	4,194	0	4,194	4,194
Sub-total	552,435	64,501	616,936	100	73,427	73,527	15,450	155,776	171,226	567,985	293,704	861,689
Land & Reclamation										0	39,822	39,822
Engineering Fee										27,045	0	27,045
Contingency										28,399	16,676	45,076
Total										623,430	350,202	973,632
Customs Duty										0	28,394	28,394
Sales Tax										0	59,628	59,628
Grand Total										623,430	438,224	1,061,654