JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY OF PUBLIC ENTERPRISES (MOPE)
EGYPTIAN ENVIRONMENTAL AFFAIRS AGENCY (EEAA)

STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT

EGYPTIAN FERRO-ALLOYS CO.
DESIGN PACKAGE

DECEMBER 2000

CHIYODA-DAMES & MOORE CO., LTD.
CHIYODA CORPORATION

Document Title **CONCEPTUAL DESIGN REPORT**

Company Name **EGYPTIAN FERROALLOYS CO.**

Document No. EF - CD - 00 - 01 REV. 0

Project Name THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT

Client JAPAN INTERNATIONAL COOPERATION AGENCY
INDUSTRIAL DEVELOPMENT STUDY DIVISION

Consultant CHIYODA DAMES AND MOORE CO.
CHIYODA CORPORATION

ISSUED DATE 1999. 11. 12

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CONSULTANT

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SIGN			
DATE	Nov. 1 '99	Nov. 1 '99	Nov 11 '99

THE EGYPTIAN FERROALLOYS CO.

1. General Outline

1.1 General

(1) Address:

Edfe Aswan

(east bank of Nile River, 3km north of the city EDFU)

(2) Capital:

100 million L.E.

(3) Total Sales(Revenue):

130 million L.E./Year

(4) Number of Employees:

1,570

(5) Area:

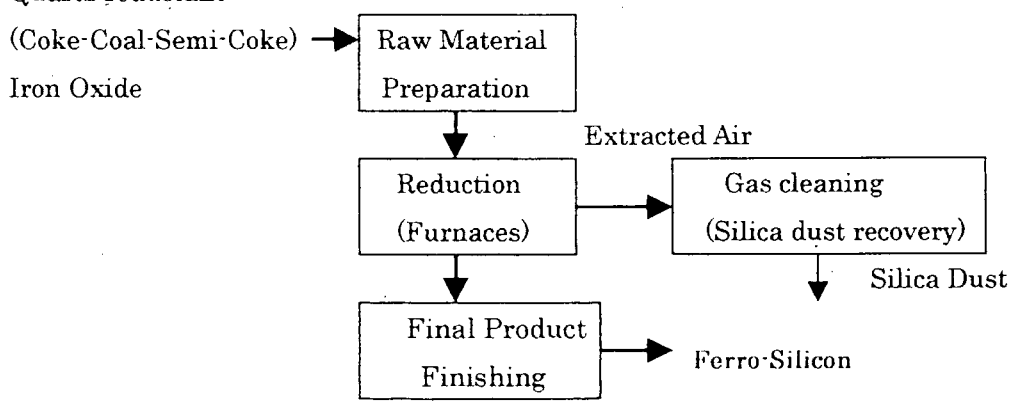
- Factory 148,896m²
- Structure 45,000m²(approx.30%)

(6) Operation Hours:

24hs x 365days by 3 shifts (8,760hs/Y)

1.2 Production Process

(1) Production Process



(2) Annual Production(1996/1997)

1)Ferro-Silicon Alloys (Alloys 75%)	33,302	ton/Y
(Alloys 65%)	7,866	ton/Y
(Alloys 45%)	1,253	ton/Y

2)Slag 4,730 ton/Y

3)Silica Dust 18,255 ton/Y

(3) Future Plan

to change the production of one furnace from Fesi tosimetal.

1.3 Others

(1) Privatization Plan: under study

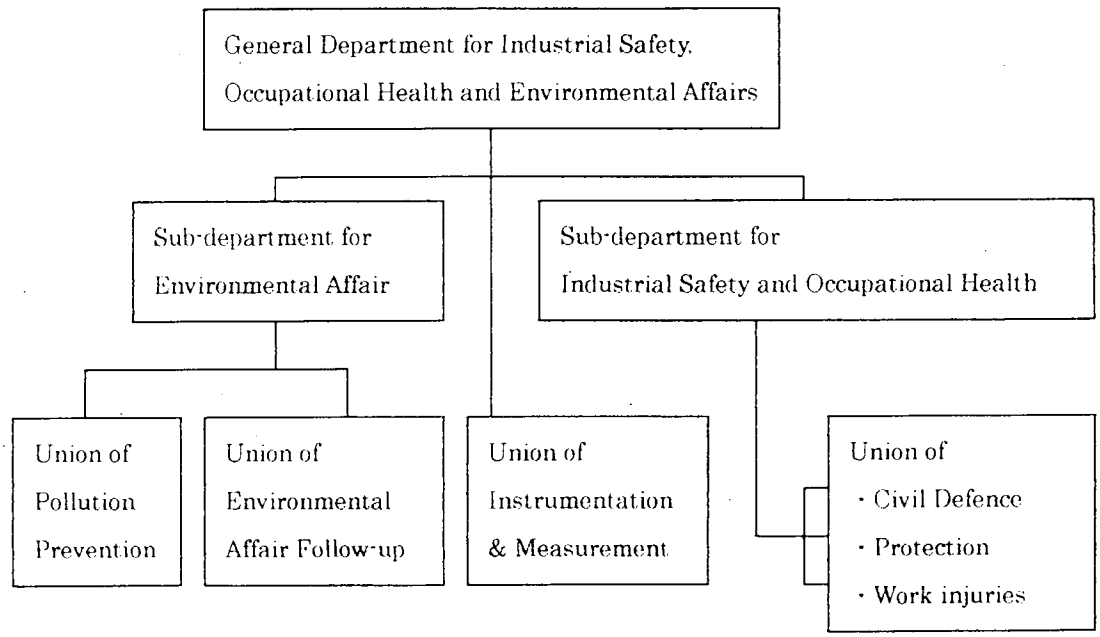
(2) Intention to share the cost of Demo-Plant: depend on the cost

(3) Environmental Management System

1) The environmental management organization is established.

2) Environmental working group is established to develop Environmental Management System (EMS) and to conduct Environmental Compliance Action Plan (CAP).

(4) Organization Structure for Environment



2. Waste Water Survey

2.1 Field Survey

(1) Date Sep.20– Sep.23, 1999.
(Sampling & Flow Measurement: Sep.21,22)

(2) Person in charge

1) JICA Study Team I. Nagahama (WWT Engineer, Team Leader)
Y. Hiraiwa (Process Engineer)
Mazen Adib (Civil Engineer)

2) The Egyptian Ferroalloys Co.
Eng. Ahmed Mohamed Ebrahim (Director of Factory Section)
Eng. Asem Ibrahim (Technical Director)

3) TIMS Dr. Mohamed Radwan
Samir Hamad

2.2 Questionnaire

The answer sheets of questionnaire sent before visit was received at site survey.

2.3 Existing Waste Water Sewer System

Refer to DWG. NO. EF-CD-15-01.

(1) 750m³/h water from Nile River is used for industrial water and potable water. 4 filters are provided for industrial water use and own potable water treatment unit is provided in the Factory.

(2) Cooling water for No.3 and No.4 furnaces is recycled through the collection pit. But, cooling water for No.1 and No.2 furnaces is discharged to Nile River, that is one-through cooling. And, washing water of quartz crush, cooling water of transformer, air station are returned to the collection pit to reuse.

(3) Sanitary and domestic waste waters are discharged to the seepage pit.

(4) The criteria of discharge water quality is applied to Nile River Regulation Law No.48 of 1982.

(5) At the outfall of the factory , discharge waste water flow rate is monitored continuously, and oil & grease contents, water temperature are measured monthly.

(6) Quartz crush washing water contaminated much suspended solids was not discharged due to plant stoppage during our survey. Therefore, it is promised that 2-samples of Quartz crush wastewater will be sent to TIMS by EFC later.

(7) Water Consumption

Water consumption cited the Report is shown on Table-1 as reference.

Table-1 Water Consumption (1996/97)

	Consumption[m^3/h]
1. Cooling Process	
(1) Furnaces	1,450
(2) Air Pumping Station	70
(3) Research furnace & Building	70
(4) Production workshops	30
(5) Vehicles workshop	20
(6) Main substation	60
Sub-Total	1,700
2. Quartz Washing	200
3. Potable Water	72
Total	1,972

2.4 Waste Water Sampling, Flow Measurement and Analysis

(1) Based on the results of discussion to the Factory and sewer survey at site, 9 sampling points were selected. And, sampling/flow measurement method were agreed mutually.

(2)Composite sampling (6hs-period x 4times) , flow rate and water qualities (pH, Turbidity, Electric conductivity, Dissolved Oxygen, Salinity, Water temperature) were measured at field every sampling time. The results of field measurement is shown on Table 2-1～2-4.

(3)Sampling Point: 9 Points (Refer to DWG. NO. EF-CD-15-01)
But, No.9 sample of quartz crush washing wastewater could not be taken because of plant stoppage during our survey.

(4)Detail water qualities were analyzed at TIMS laboratory. The result is shown on Table 3.

Table 2-1 Flow rate/Water Quality measured at Site (Sep. 21 1999)

	① Transformer cooling water					② Strainer outlet				
Sampling Time	6:15	12:05	17:53	24:00	Av.	7:50	12:40	18:40	1:05	Av.
Flowrate[m^3/h]										
pH [−]	7.6	7.5	5.5?	7.75	7.09	7.4	7.4	7.4	7.7	7.48
Turbidity [unit]	0	0	0	1	0.3	0	0	0	0	0
EC [μS/cm]	310	300	300	300	303	310	300	290	300	300
DO [mg/L]	7.1	7.4	6.9	7.2	7.2	5.7	5.5	5.1	5.8	5.5
Salinity [%]	0	0	0	0	0	0	0	0	0	0
COD_{Mn}(P)[mg/L]	>100	>100	>30	>80	>100	50	50	50	50	50
W. Temp [℃]	35.0	33	33	35	34	25	25	24	26	25

Note 1: COD_{Mn}(P) is the analysis data by Pack Test.

Table 2-2 Flow rate/Water Quality measured at Site (Sep. 21/22 1999)

	③Cooling Water No.384 Furnace					④Cooling Water No.182 Furnace				
Sampling Time	6:00	12:00	18:15	0:30	Av.	7:10	12:20	18:25	0:30	Av.
Flowrate[m^3/h]										
pH [−]	7.9	7.9	7.9	7.8	7.88	7.9	7.8	7.8	7.7	7.8
Turbidity [unit]	0	0	0	0	0	10	0	90	0	25
EC [μS/cm]	320	300	300	310	308	328	300	290	300	305
DO [mg/L]	5.0	5.5	5.1	4.5	5.0	8.1	6.2	7.2	4.8	6.6
Salinity [%]	0	0	0	0	0	0	0	0	0	0
COD_{Mn}(P)[mg/L]	20	20	10	---	17	20	20	10	---	17
W. Temp [℃]	37	35	30	31	33.3	36	33	33	35	34.3

Table 2-3 Flow rate/Water Quality measured at Site (Sep.21/22 1999)

	⑤Outlet No.3 & No.4 Furnace					⑥Intake after Feed Pump				
Sampling Time	6:45	12:05	18:10	0:20	Av.	7:50	12:40	18:40	1:05	Av.
Flowrate[m^3/h]										
pH [−]	7.6	7.7	7.9	7.7	7.73	7.4	7.4	7.4	7.7	7.48
Turbidity [unit]	0	0	0	0	0	0	0	0	0	0
EC [μS/cm]	300	300	300	310	303	310	300	290	300	300
DO [mg/L]	6.4	6.3	5.1	6.0	6.0	5.7	5.5	5.1	5.8	5.5
Salinity [%]	0	0	0	0	0	0	0	0	0	0
COD_{Mn}(P)[mg/L]	20	10	50	---	27	50	50	50	---	50
W. Temp [℃]	31	29	29	36	31.3	25	25	24	26	25

Table 2-4 Flow rate/Water Quality measured at Site (Sep.21/22 1999)

	⑦ Before Strainer					⑧Drinking Water after Treatment				
Sampling Time	7:50	12:50	18:50	1:10	Av.	6:00	12:00	19:00	1:20	Av.
Flowrate[m^3/h]										
pH [−]	7.8	7.7	7.8	7.7	7.75	7.7	7.5	7.7	7.7	7.65
Turbidity [unit]	0	0	90	0	23	0	0	0	0	0
EC [μS/cm]	310	300	300	300	303	300	300	290	310	300
DO [mg/L]	5.5	5.8	7.5	4.9	5.9	4.5	6.2	5.0	4.9	5.2
Salinity [%]	0	0	0	0	0	0	0	0	0	0
COD_{Mn}(P)[mg/L]	20	20	50	---	30	20	20	20	---	20
W. Temp [℃]	30.0	28	28	30	29	27	26	23	37?	28.3

Note 1: COD_{Mn}(P) shows the analysis data by Pack Test.

Table 3 Waste Water Qualities [TIMS Lab. Data]

Point / Item	①Transformer	② Strainer Out	③C.W. No. 384	④C.W Furnace	⑤Outlet F3&F4
pH [-]	7.09	7.80	7.83	7.88	7.75
SS [mg/L]	--	--	13	30	60
TDS [mg/L]		Nil	90	110	70
BOD [mg/L]	--	--	3.6	9	--
COD [mg/L]	114	--	19.3	24	14.5
Oil&Grease[mg/L]	Nil	Nil	Nil	Nil	--
SiO_2 [mg/L]			6.88	6.47	6.62
W.Temp [℃]	34	31	33	34	30
Point / Item	⑥ Intake After Pump	⑦ Before Strainer	⑧ D.W. after Treat	⑨Quartz Washing W	
pH [-]	7.48	7.78	7.70		
SS [mg/L]	10	--	6		
TDS [mg/L]	70	---	214		
BOD [mg/L]	3.6	Nil	Nil		
COD [mg/L]	14.4	4.8	4.8		
Oil&Grease[mg/L]	Nil	Nil	--		
SiO_2 [mg/L]			7.06		
W.Temp [℃]	25	29	28		

3. Conceptual Design

3.1 Philosophy of Conceptual design

(1)Conceptual design 1

Conceptual design 1 (CD-1) shows the recommendable wastewater treating system to all wastewater in the Factory to meet the wastewater disposal regulation to Nile River (Law No.4 1994) and water saving point of view.

But, the drawings prepared Schematic Flow Diagram for wastewater treating sewer system and plants (EF-CD-15-05/06) only.

Concerning to treated water, Filter unit to polish treated water of Clarifier is not always necessary to operate, because clarified water quality will meet sufficiently Nile River Regulation so long as normal operation.

(2)Conceptual design 2

Conceptual design 2 (CD-2) shows the study of waste water treating system, in case that the demonstration plant will be applied in the factory by JICA.

Therefore, wastewater for conceptual design were selected the following points of view:

- Quality: Wastewater should be treated by the treating system consisting of various treating unit processes.
- Quantity: Flow rate(plant capacity) to be treated within limited JICA budget, and wastewater are discharged continuously as possible.
- The plants of wastewater source are operated constantly as possible.

3.2 Conceptual Design 1

Recommendable wastewater treating system for Egyptian Ferroalloys Co. consists of 2 treating systems shown on DWG. No. EF-CD-15-05/06.

(1)Wastewater treatment

Wastewater containing suspended solids and a slice of oil should be removed easily by chemical (coagulation), physical(filtration) treatment.

The wastewater treating system is basically as same as CD-2.

(2)Cooling water system

In order to save intake/discharge water, energy, thermal load to Nile River and water cost, all cooling water for furnaces(4) is recycled using Cooling Towers. Cooling water reduces as evaporation loss, drip loss at a cooling tower.

In order to keep water quantity and quality, make-up water (fresh water) should be fed to cooling tower basin continuously. Also, chemicals should be

injected into the water as inhibitor, pH and slime controller to maintain suitable water quality.

As a result, intake water quantity from Nile River is reduced extremely.

3.3 Conceptual Design 2

(1)Design Basis

1) Wastewater

The following wastewater were selected for conceptual design:

(a) Washing water of Quartz Crush(RW-1)

To remove suspended solids

(b)Cooling water of Transformer(RW-2)

To remove a slice of oil

RW-1 has not been discharged during our survey because of plant stoppage, but RW-1 was selected as results of the discussion and Pre-survey Report on May 1999.

2) Flow Rate

- RW-1 200m³/h
- RW-2 60m³/h

Total 260m³/h

Flow rate of RW-1 was given by the Factory, and RW-2 was assumed based on the result of flow measurement at field.

3) Water quality

Table 4 Water Quality

	Raw Water Clarifier Inlet	Treated Water Filtered Water	Nile Regulation Law of No.4
pH [-]	6.5~8.0	7.0~8.0	6~9
COD [mg/L]	10~30	<30	30
SS [mg/L]	30~550	10	30
Oil & Grease [mg/L]	<5	1	5
SiO_2 [mg/L]	25		None

(a)Inlet Water Quality of Clarifier is assumed based on the results of Pre-survey in the end of May 1999, because the sample of Quartz washing waste water could not take during our survey in September, 1999.

(b) Water qualities of treated water shall meet the discharge waste water regulation to Nile River (Law No.48 of 1982) .

(2) Wastewater Treating System

Refer to DWG. NO. EF-CD-15-03/04.

Wastewater treating system is designed mainly to remove suspended solids contaminated in washing wastewater of quartz crush plant.

1) Pre-treatment

(a)Collection pit (for RW-1)

A collection pit of concrete is provided to receive RW-1 near by Quartz crush plant, and wastewater is fed to Equalization Tank.

(b)Oil sump pit (for RW-2)

Oil sump pit is provided to remove a slice of oil from transformers near by the sub-station .

(c)Equalization Tank

Equalization tank of carbon steel with epoxy coating is provided to equalize by air bubbling quantity and quality of wastewater RW-1, RW-2.

2) Primary treatment

[Clarifier Unit]

- Clarifier 260m^3/h x conventional type 1 set
  carbon steel/epoxy coating
- Chemical dosing unit (drums, mixers, pumps)
- Clarified water pit
  concrete basin, Filter feed pumps

(a))In Clarifier, alum (aluminum sulfate) as coagulant, lime as alkali and polymer as coagulant aid will be injected. Suspended solids, turbidity, slice of oil in wastewater are removed as sludge in Clarifier basin.

(b) Supernatant quality of Clarifier will meet to Nile River Regulation sufficiently so long as normal operation.

(c) Sludge settled on the bottom of Clarifier is discharged to Dewatering unit automatically, periodically.

3) Advanced Treatment

[Filter Unit]

- Sand Filter
  90m^3/h x 4sets (1 spare)
  Filter media: Anthracite + Sand/Gravel
- Filtered water pit(concrete)
- Backwashing pumps, Blowers

(a)To remove micro flocs in the clarified water, Sand filters are used.

(b)Filtered water can be reused as cooling water.

(c)Filters are backwashed with air and filtered water automatically, periodically.

(d)Backwash wastewater is returned to Equalization Tank to treat again.

4) Sludge Dewatering Unit

(a)Sludge Thickener

With bottom sludge collecting rake,

Made of carbon steel with epoxy coating

(a) Centrifuge

Horizontal, stainless steel

i)Solid content of Clarifier bottom sludge is around 1%wt(10g-SS/L). Therefore, it is thickened in Sludge Thickener by gravity, then dewatered by Centrifuge.

ii)To thicken and dewater effectively, polymers as coagulant are injected to sludge, respectively.

iii)Supernatant of Thickener and separated wastewater by Centrifuge are returned to Equalization Tank to treat again.

5) Local Control Room

(a)The control room (Approx. 6m x 12m, ground floor only) is built at the demonstration plant area.

(b)The room consists of a control panel room and an electricity distribution panel room , rest room for operators, toilet, sink locker, etc..

(c)Chemical storage room is also provided.

6)Electricity

(a) Electricity (380V AC x 3 phase x 50HZ) is received from Main sub-station at the northeast corner of Factory through underground buried cable along the road. Cable length is approx. 600m.

(b) Approx. 200kVA electricity is used for power, lighting, control for instrument for wastewater treating unit, and air conditioning in the control room.

(3)Disposal of sludge

Pollutants in wastewater are removed, dewatered cake generates finally at the wastewater treatment plant. Wastewater in the Factory may not contain any harmful materials such as heavy metals and organic chloro compounds, therefore, dewatered cake can be dumped to the specified place near desert

(b)Filtered water can be reused as cooling water.

(c)Filters are backwashed with air and filtered water automatically, periodically.

(d)Backwash wastewater is returned to Equalization Tank to treat again.

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(3)Disposal of sludge

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under management.

(4) Location of Demonstration Plant

Location of Demonstration Plant to be constructed was selected preliminarily a west part of Quartz Ore Storage and Preparation Yard by JICA Study Team and the Company (Refer to EF-CD-12-01).

(5) Budgetary Cost Estimation

1) Conditions of Estimation

(a)Major mechanical equipment, electrical equipment, instrument, and valves are purchased out of Egypt (Japan or Europe).

(b)Bulk materials such as pipe and fittings, re-bar, cable are purchased in Egypt.

(c) Large vessels (larger than 3.0m) and tanks is erected at site.
Sand filters made of carbon steel and filter media are purchased from Japan.

(d) Large basins are constructed of reinforced concrete.

(e) Field works are conducted by Egyptian contractors under supervising by Japanese consultants.

(f) Construction at site is proceeded as the standard schedule.

2)Cost Estimation

Table 5 Budgetary Cost Estimation

	Yen Portion	LE Portion	
	[x10³ Yen]	[LE]	[x10³ Yen]
1. Equipment & Materials (1) Mechanical Equipment	105,300		
(2)Elec./Instrument	57,100		
(3)Transportation	22.400		
Sub-Total(1)	184,800		
2. Construction Cost (with Local materials) (1)Civil/Architecture		1,607,800	
(2)Installation/Piping		1,134,200	
(3)Elec./Instrument		536,400	
(4)Commissioning		6,000	
Sub-Total(2)		3,284,400	111,670
3. Indirect Cost (1)Contractor Expenses		821,100	27,920
(2)Supervision Expenses			10,000
Sub Total(3)		821,100	37,920
Total Cost	334,390 [x10³ Yen]		

Note: 1) Exchange Rate 1 LE = 34 Yen

2) Indirect cost = Direct cost (Field Portion) x 0.25

3) Excluded Supervision Fee by Japanese consultant.

4)Demarcation of Scope of Work between Egyptian and Japanese Sides has not been decided yet.

(6)Standard Schedule

Standard schedule is shown on Table 3, but it is not so easy schedule.

It is scheduled so as to be passed Egypt custom without any delay.

Table 6 Standard Construction Schedule

Item \ Month	1	3	5	7	9	11	13
Detail Design	*						
1) Procurement		**********					
2) Transportation			**********				
3)Civil Work			**********				
4)Instal./Piping				**********			
5)Elec./Instrument					********		
6)Control Room			*******				
7)Commissioning						**	
Demonstration Operation							*

4. Recommendations of Feasible Improvement for Waste Water Treatment

(1) Segregation Oil and water

It is suggested that a cause of oil leakage in transformer cooling water should be confirmed and countermeasures should be taken urgently.

*The problem has been pointed out at Pre-survey by JICA in May 1999

Oil should be segregated from water before dilution at the transformer yard.

(2) Installation of cooling tower

It is recommended that cooling towers for furnaces should be installed to reduce intake and discharge water quantity. It will save not only water resource, energy, but also the cost of waste water discharging to Nile River.

5. Process Survey

(1).General

The main product of this factory is Ferro-Silicon used for steel making process, and supplemental product is silicon dust used for cement industries. Originally process technology has been introduced from Bulgaria in 1989 and equipment has been introduced from various country.

Annual production of Ferro-Silicon is 50,000 ton and its 80% is exported (75%-Fe-Si).

On the process 15,000 ton/Y of Silicon Dust can be collected from the furnace fume and sold as the supplemental product.

Current production and market of Ferro Silicon in Egypt are as follows;

(ton/year)

Egyptian Ferro Alloys Co. : 50,000		Kema Co. : 5,000
Export : 40,000	Domestic : 10,000	Domestic : 5,000
Export : 40,000	Domestic use: 15,000	

So, this company is the major manufacturer of Ferro Silicon in Egypt.100,000 ton/Y of silicon quartz is transferred from their own mine located 90 km eastern side from the factory. Quartz has 99.8 - 99.9% of purification, so, their operation is slug less process, but actually 30 -50 kg/ton of slug is generated.

Silicon quartz is crushed and classified into 20 - 80 mm size range to get better reduction, so under 20 mm size of quartz is wasted. Dusty water is generated by quartz washing and discharged into the water route.

2,000 m^3/hr of water is in-taken from Nile River and major consumption is for indirect cooling for furnaces. There is no water cooling tower in this factory, so 50 % of water is wasted due to the temperature raise(about 10 ℃ raise) and remaining 50 % of cooling water is recycled. Namely, return cooling water from Furnace-#1 and #2 is wasted and cooling water from Furnace-#3 and #4 is recycled.

Except quartz wash water and some oil leakage from pump station and substation, almost of water is not so polluted as it is used for indirect cooling medium.

To reduce the amount of in-take and discharge water, installation of cooling tower is reasonable solution.

(2).Operation and Process;

Condition of operation is as follows;

- Silicon quartz crush and wash ; 1 shift/day
  (looks very few operation)
- Reduction Furnace ; 3 shift/day
- Silicon Dust Collection Unit ; 3 shift/day

Every production system and equipment are relatively new and sophisticated. System of reduction furnace and dust collection unit are fully computerized, so, operation is done automatically except material charging.

But sometimes temperature of exhaust gas will be raised by operational cause and this brings direct discharge of exhaust fume into the air without purification treatment. Such action is by the protection program on dust collection unit but this invites heavy air pollution.

Under the normal operation, dust content in the gas is as follows;

- Before Bag Filter ; 2,000 mg/Nm^3
- After 〃 ; 20 -30mg/Nm^3
- Regulation ; under 20 mg/Nm^3

So, sometimes air pollution regulation is not satisfied.

This factory has the laboratory for development and quality control. Development for new production is executed in this laboratory and now they are implementing the modification program on one reducing furnace to produce silicon metal. This will be completed at the end of 1999. By this modification their sales is expected to be more beneficial, but no additional discharge material is generated because process is similar as current.

(3). Equipment;

Maintenance condition for equipment looks fairly good but some oil leakage is occurred in the pump station . To prevent water pollution, installation of oil gathering pit is recommendable.

Regarding silicon fume leakage, implementation of precision investigation and study on furnace operation and equipment capability by specialists will be desirable.

(4). Environmental;

Except some local problem, there is less problem on water pollution, and to reduce the amount of water consumption and discharge, installation of cooling tower is reasonable solution.

On the other hand, air pollution by silicon dust due to by pass operation of fume

purification unit is more serious problem. To find the reasonable solution, precision diagnosis by specialists is recommendable

(5) Conclusion:

This factory is located at the beautiful scenery area and convenient for material transportation. Technology and equipment adopted on the production process are fairly good.

In addition, they are implementing the development to get better quality and new products. So, we can say that this company can be operated under competitive and beneficial constitution. Return on sales is 7.7 % in 1998.

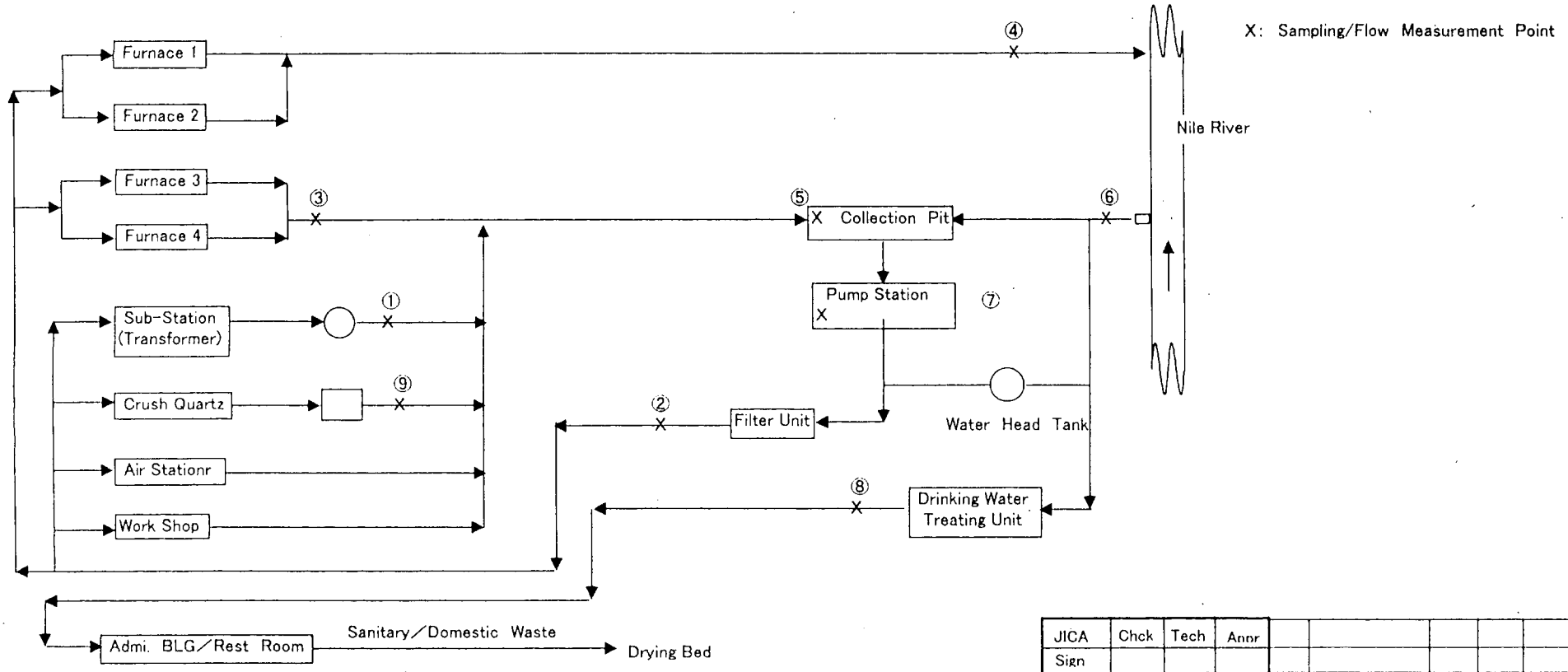
Now, this company is proceeding on the privatization program.

DRAWING LIST OF CONCEPTUAL DESIGN

[THE EGYPTIAN FERROALLOYS CO.]

NO	DRAWING NAME	DWG. NO.	REV.	DATE	NOTE
1	FLOW SHEET				
1)	SCHEMATIC DIAGRAM FOR WASTE WATER FLOW	EF-CD-15-01	0	1999.11.08	
2)	SCHEMATIC FLOW DIAGRAM FOR				
	W.W.T. DEMONSTRATION PLANT	EF-CD-15-02	0	1999.11.08	
3)	BLOCK FLOW DIAGRAM FOR				
	W.W.T DEMONSTRATION PLANT	EF-CD-15-03	0	1999.11.08	
4)	SCHEMATIC FLOW DIAGRAM FOR				
	W.W.T DEMONSTRATION PLANT	EF-CD-15-04	0	1999.11.08	
5)	BLOCK FLOW DIAGRAM FOR				
	RECOMENDABLE WASTE WATER TREATING SYSTEI	EF-CD-15-05	0	1999.11.08	
6)	SCHEMATIC FLOW DIAGRAM FOR				
	RECOMENDABLE WASTE WATER TREATING PLANT	EF-CD-15-06	0	1999.11.08	
2	PLOT PLAN				
1)	LOCATION OF W.W.T. DEMONSTRATION PLANT	EF-CD-12-01	0	1999.11.08	
2)	PLOT PLAN FOR CONCEPTUAL DESIGN OF				
	W.W.T. DEMONSTRATION PLANT	EF-CD-12-02	0	1999.11.08	

NOTE:



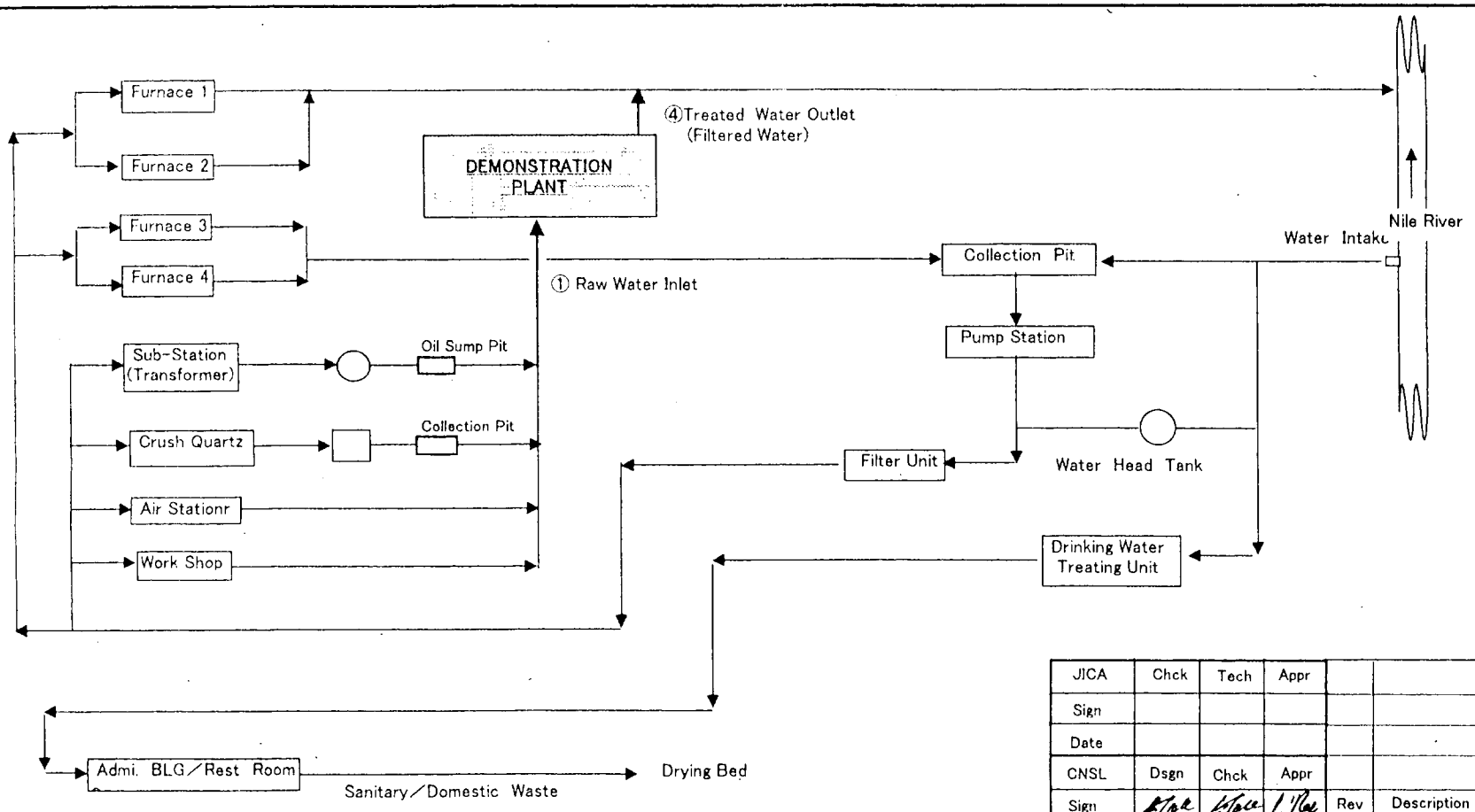
Sampling Point / Analytical Item	Unit	①	②	③	④	⑤	⑥	⑦	⑧	⑨1	⑨2
Flow Rate	m^3/h	60	1,900	725	725	790	1,200	~	72	(stop)	
pH	—	7.1	7.7	7.93	7.8	7.7	7.48	7.75	7.65		
Conductivity	μS/cm	303	303	310	305	303	295	303	300		
Turbidity	NTU	0	0	0	10~90	0	0	0~90	0		
Water Temp.	℃	34	31.3	33.3	34.3	30	25	29	30		
Salinity	%	0	0	0	0	0	0	0	0		
COD_{Mn}	mg/L	20-100	10~20	10~20	10~20	5~50	50	20~50	20		

* : Field Measurement(Average)

JICA	Chck	Tech	Annr
Sign			
Date			
CNSL	Dsgn	Chck	Appr
Sign			
Date			

Rev	Description	Dsgn	Chc	Appr	Date
REVISION					

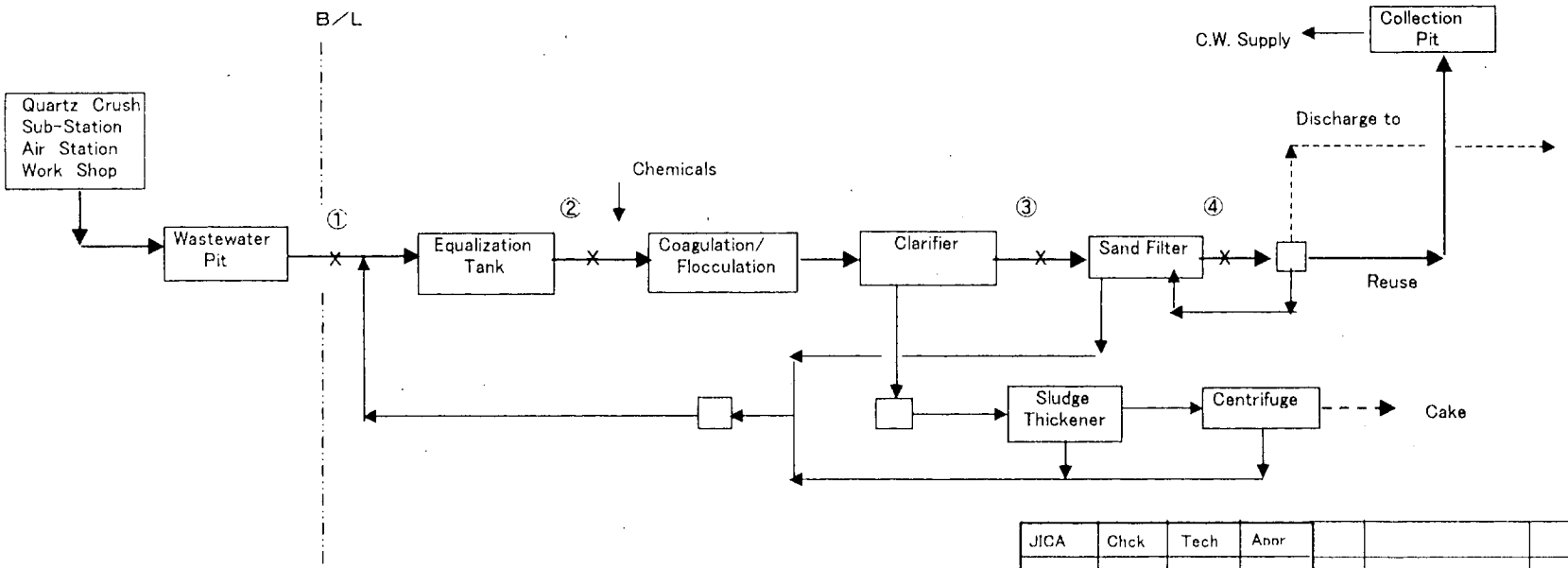
CLIEN	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN FERROALLOYS SCHEMATIC DIAGRAM FOR WASTE WATER FLOW
ISSUED	1998. 11. 12
SCALE	None
DWG	EF-CD-15-01
REV.	0



Analytical Item \ Stream		① Raw Water Inlet	② Clarifier Feed Water	③ Clarified Water	④ Filtered Water		Nile River W.W. Disposal Regulation
Flow Rate Max	m³/h	260	260	260	260		
Ave	m³/h						
pH	--	6.5～8.0	6.5～8.0	7.0～8.0	7.0～8.0		6～9
S S	mg/L	30～700	550	30	10		30
B O D	mg/L	5	<5	5<	<5		20
C O D	mg/L	3～30	3～30	<30	<30		30
Oil&Grease	mg/L	0～20	<5	2	<2		5
SiO2	mg/L	30	30	<10	<10		None
Water Temp.	℃	20～35	20～35	20～35	20～35		<35

JICA	Chck	Tech	Appr						
Sign									
Date									
CNSL	Dsgn	Chck	Appr						
Sign				Rev	Description	Dsgn	Chck	Appr	Date
Date					REVISIO				

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY		
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION		
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT		
TITLE	FOR EGYPTIAN FERROALLOYS CO. SCHEMATIC FLOW DIAGRAM FOR W. W. T. DEMONSTRATION PLANT		
ISSUED DATE	1999. 11. 12	SCALE	None
DWG NO	EF-CD-15-02	REV	0

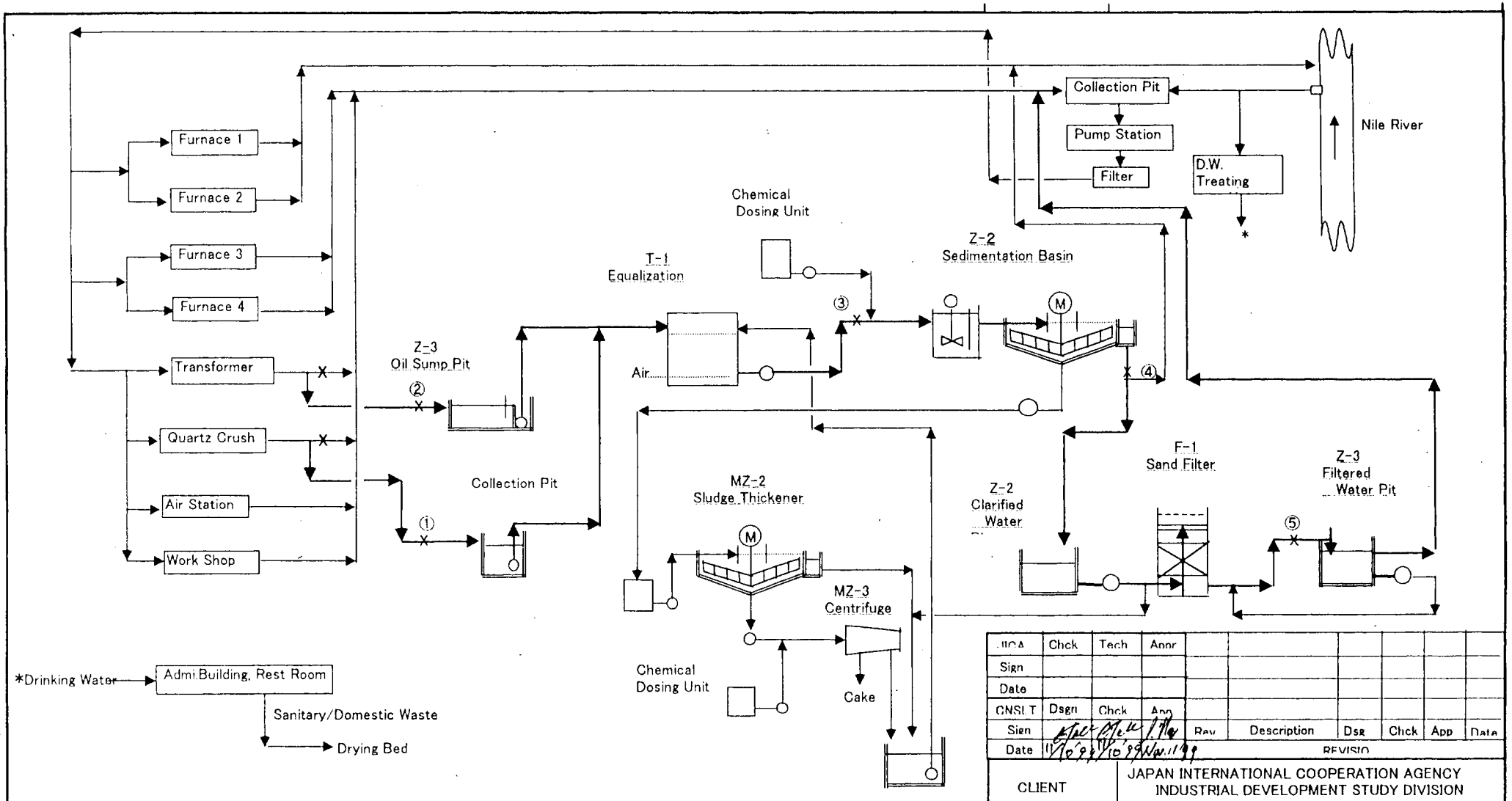


Analytical Item \ Stream		① Raw Water	② Clarifier Feed Water	③ Clarifier Treated W.	④ Filtered Water	⑤	⑥	Nile Branch Disposal Regulation
Flow Rate Max	m³/h	260	260	260	260			
Ave	m³/h							
pH	—	6.5~8.0	6.5~8.0	7.0~8.0	7.0~8.0			6~9
SS	mg/L	30~700	550	30	10			30
BOD	mg/L	<5	<5	<5	<5			20
COD	mg/L	3~30	3~30	<30	<30			30
Oil&Grease	mg/L	0~20	<5	2	<2			5
SiO2	mg/L	30	30	<10	<10			None
Water Temp.	℃	20~35	20~35	20~35	20~35			<35

JICA	Chck	Tech	Appr
Sign			
Date			
CNSLT	Dsgn	Chck	Appr
Sign			
Date	11/11'99	11/11'99	

Rev	Description	Dsgn	Chck	Appr	Date
	REVISION				

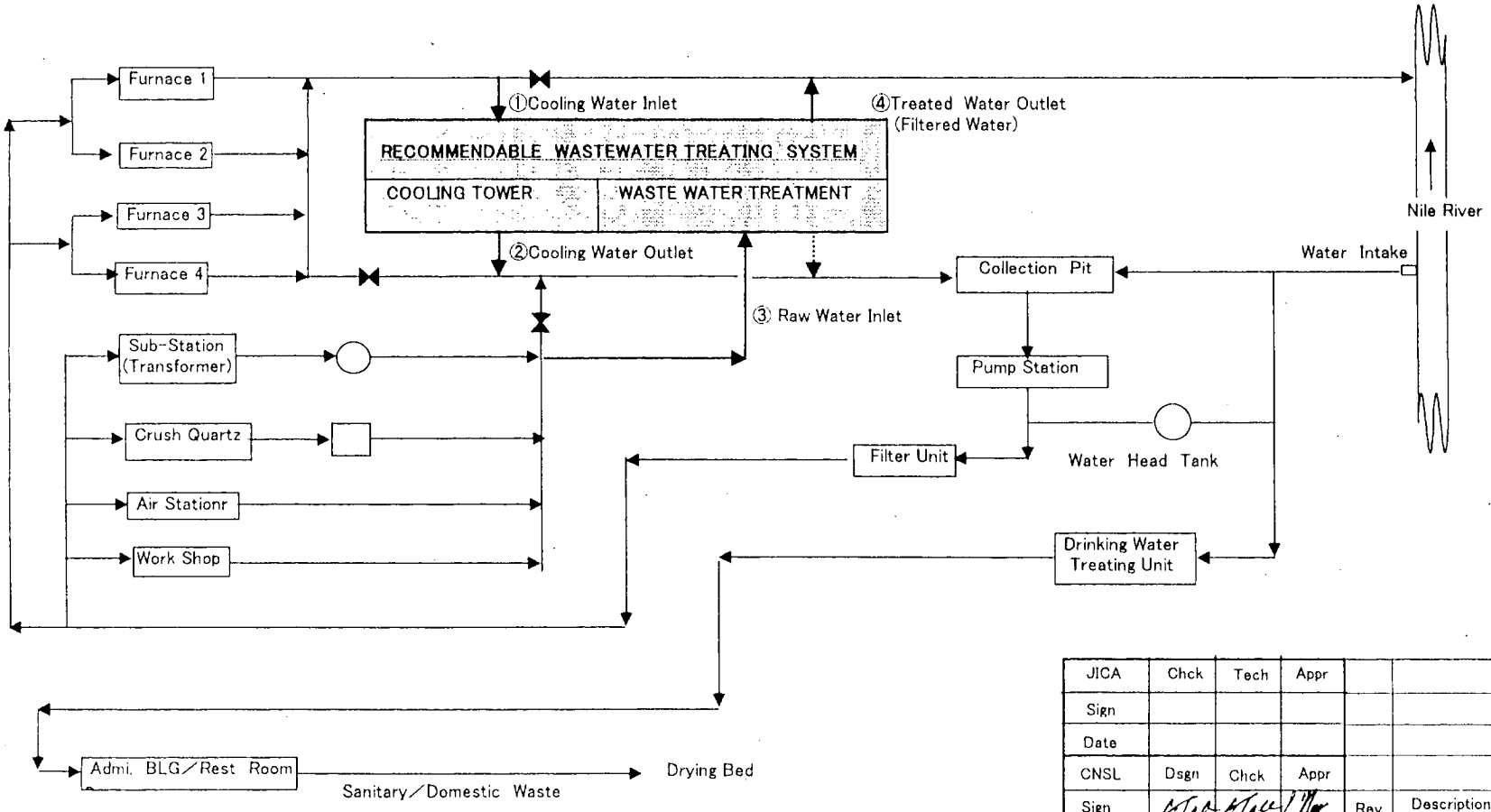
CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION		
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION		
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT		
TITLE	FOR EGYPTIAN FERROALLOYS CO. BLOCK FLOW DIAGRAM FOR W. W. T. DEMONSTRATION PLANT		
ISSUED DATE	1999. 11. 12	SCALE	None
DWG NO	EF-CD-15-03	REV.	0



Sampling Point / Analytical Item	Unit	①	②	③	④	⑤	⑥	Nile River Regulation
Flow Rate Max	m^3/h	60	200	260	260	260		
Ave	m^3/h							
pH	—	6.5-8.0	6.5-8.0	6.5-8.0	7.0-8.0	7.0-8.0		6~9
SS	mg/L	~700	20	~550	30	10		30
BOD	mg/L	5	5	5	<5	<5		20
CODcr	mg/L	10~30	10~30	10~30	<30	<30		30
Oil & Grease	mg/L	<5	10	5	2	<2		5
SiO_2	mg/L	50	20	50	10	<10		None
Water Temp.	°C	20~35	25~35	25~35	25~35	25~35		<35

JICA	Chck	Tech	Appr							
Sign										
Date										
CNSLT	Dsgn	Chck	App							
Sign				Rev.	Description	Dsg	Chck	App	Date	
Date	11/6/98	10/29/98	11/9/98		REVISIO					

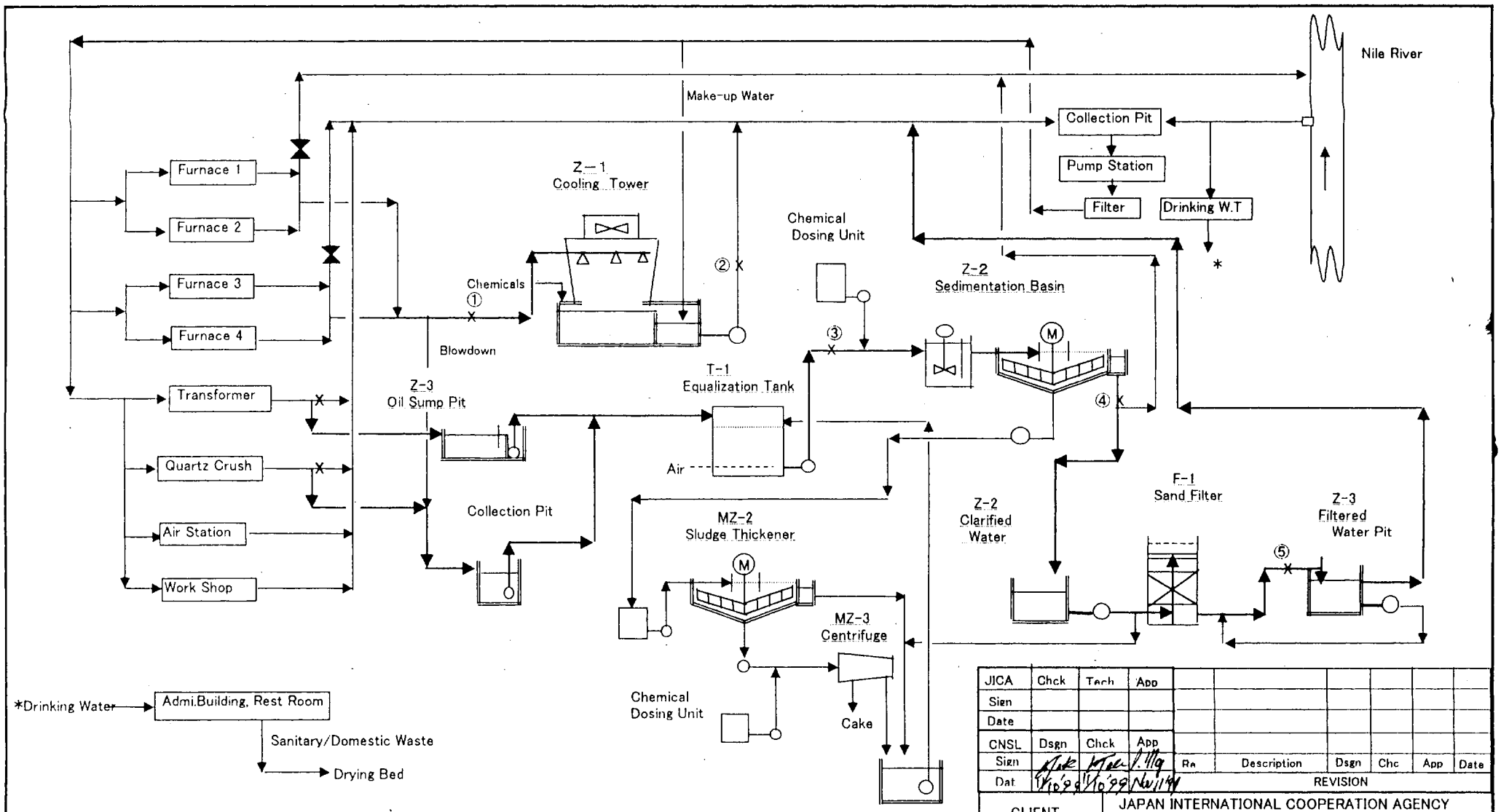
CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN FERROALLOYS SCHEMATIC FLOW DIAGRAM FOR W. W. T. DEMONSTRATION PLANT
ISSUED	1999. 11. 12 — SCALE: None
DWG NO	EF-CD-15-04 — REV.: 0



Analytical Item \ Stream		① Cooling W. Inlet	② Cooling W. Outlet	③ Raw Water Inlet	④ Filtered Water		Nile River W.W. Disposal Regulation
Flow Rate Max	m^3/h	2000	2000	260	260		
Ave	m^3/h						
pH	—	6.5～8.0	6.5～8.0	6.5～8.0	7.0～8.0		6～9
SS	mg/L	100	100	30～700	10		30
BOD	mg/L	5	<5	5	<5		20
COD	mg/L	3～30	3～30	3～30	<30		30
Oil&Grease	mg/L	<5	<5	0～20	<2		5
SiO2	mg/L	50	50	30	<10		None
Water Temp.	℃	30～40	<30	20～35	20～35		<35

JICA	Chck	Tech	Appr							
Sign										
Date										
CNSL	Dsgn	Chck	Appr							
Sign				Rev	Description	Dsgn	Chck	App	Date	
Date	11/10'99	11/10'99	Nov.11'99	REVISION						

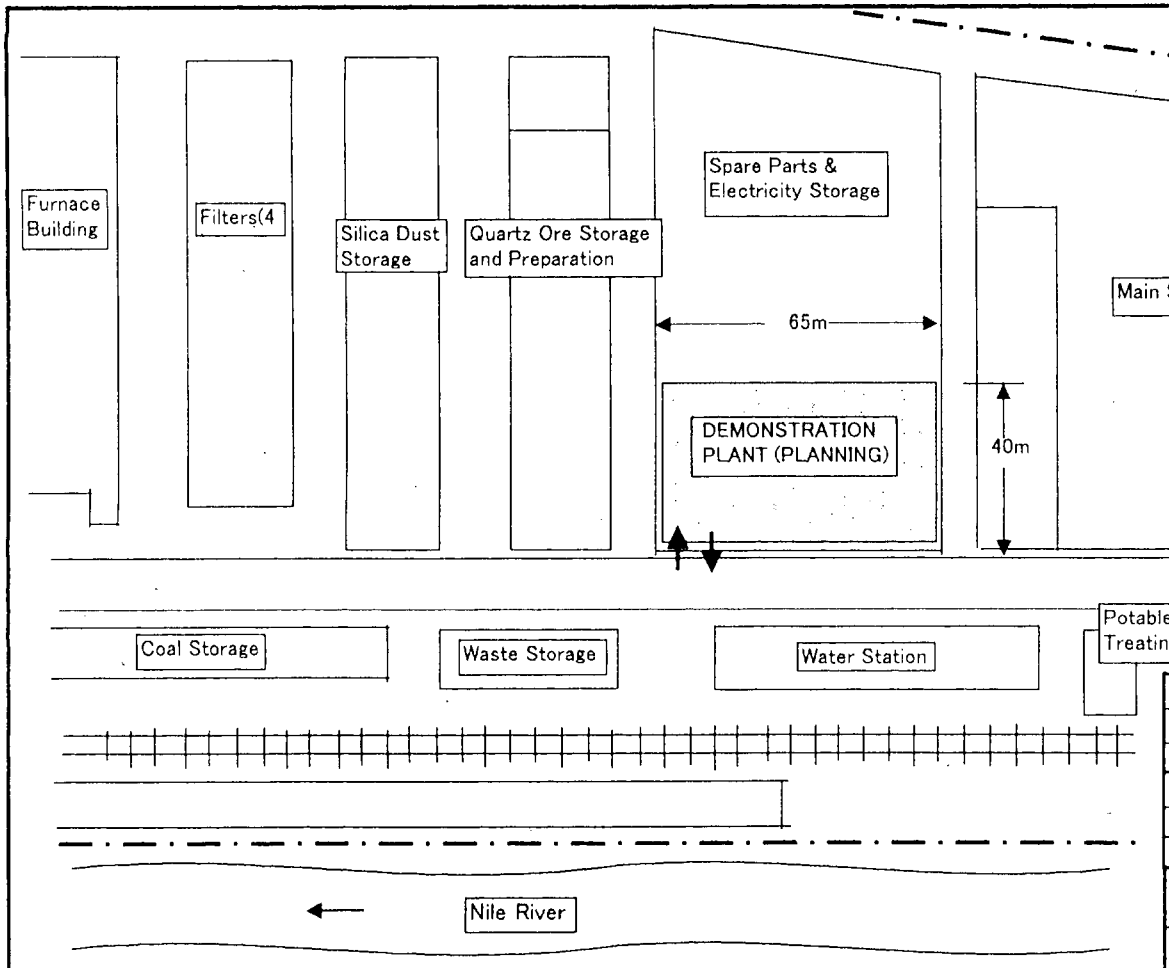
CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY		
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION		
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT		
TITLE	FOR EGYPTIAN FERROALLOYS CO. BLOCK FLOW DIAGRAM FOR RECOMMENDABLE WASTEWATER TREATING SYSTEM		
ISSUED DATE	1999. 11. 12	SCALE	None
DWG NO	EF-CD-15-05	REV	C



Analytical Item	Unit	Sampling Point ①	②	③	④	⑤	⑥	Nile River Regulatio
Flow Rate Max	m^3/h	2,000	2,000	260	260	260		
Ave	m^3/h							
pH	—	7.0-8.0	7.0-8.0	6.5-8.0	7.0-8.0	7.0-8.0		6~9
SS	mg/L	90	90	550	30	10		30
BOD	mg/L	60	60	5	<5	<5		20
CODcr	mg/L	90	90	10~30	<30	<30		30
Oil & Grease	mg/L	10	10	5	2	<2		5
SiO2	mg/L	75	75	25	<10	<10		None
Water Temp	°C	25-40	20-35	20-35	20-35	20-35		<35

JICA	Chck	Tech	App							
Sign										
Date										
CNSL	Dsgn	Chck	App							
Sign				Re	Description	Dsgn	Chc	App	Date	
Dat	11/10'99	11/10'99	Nov/14	REVISION						

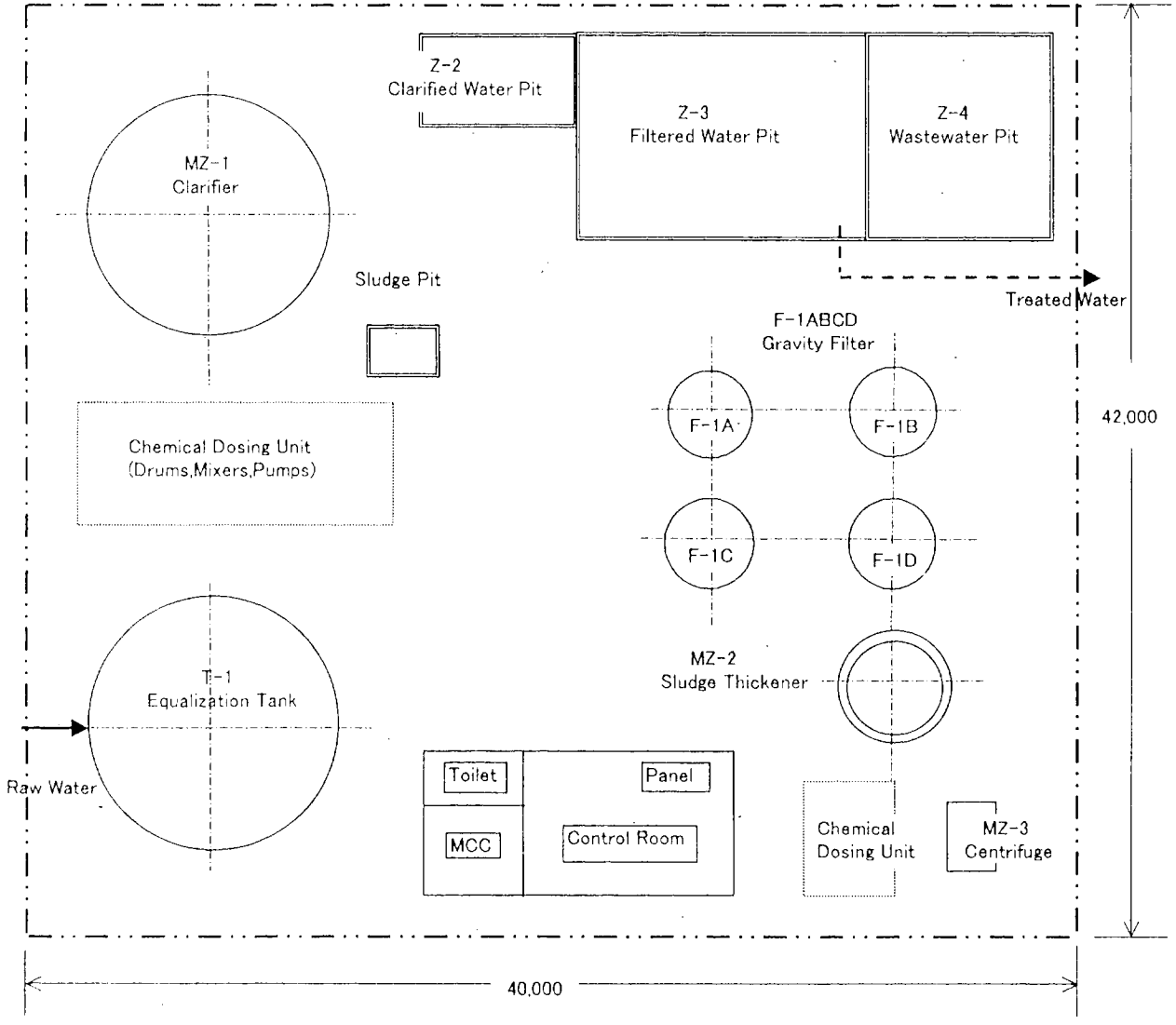
CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT
TITLE	FOR EGYPTIAN FERROALLOYS CO. SCHEMATIC FLOW DIAGRAM FOR RECOMMENDABLE WASTE WATER TREATING SYSTEM
ISSUED	1999. 11. 12
SCALE	Non
DWG NO	EF-CD-15-06
REV.	0



JICA	Chck	Tech	App
Sign			
Date			
CNSL	Dsgn	Chck	App
Sign			
Date	10'99	10'99	

Rev	Description	Dsgn	Chck	App	Date
	REVISION				

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION		
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION		
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT		
TITLE	FOR EGYPTIAN FERROALLOYS CO. LOCATION (PLANNING) OF W. W. T. DEMONSTRATION PLANT		
ISSUED	1999. 11. 12	SCALE	None
DWG	EF-CD-12-01	REV	0



Major Equipment:

T-1	Equalization Tank	10,200ID x 7,600H
Z-2	Clarified Water Pit	4,000W x 6,000L x 3,000H
Z-3	Filtered Water Pit	8,000W x 13,000L x 3,000H
Z-4	Wastewater Pit	7,000W x 8,000L x 3,000H
MZ-1	Clarifier	9,800ID x 3,500H
MZ-2	Sludge Thickener	3,700ID x 2,400H
F-1ABCD	Gravity Filter	3,700ID x 4,500H
Control Room Building		6,000W x 12,000L

JICA	Chck	Tech	Appr						
Sign									
Date									
CNSLT	Dsgn	Chck	Appr						
Sign				Rev	Description	Dsgn	Chck	Appr	Date
Date	11/10/99	11/10/99	11/11/99	REVISION					

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY INDUSTRIAL DEVELOPMENT STUDY DIVISION		
CONSULTANT	CHIYODA DAMES & MOORE CO. CHIYODA CORPORATION		
PROJECT	THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT		
TITLE	FOR EGYPTIAN FERROALLOYS CO. PLOT PLAN FOR CONCEPTUAL DESIGN OF W. W. T. DEMONSTRATION PLANT		
ISSUED	1999. 11. 12	SCALE	None
DWG NO	EF-CD-12-02	REV.	0

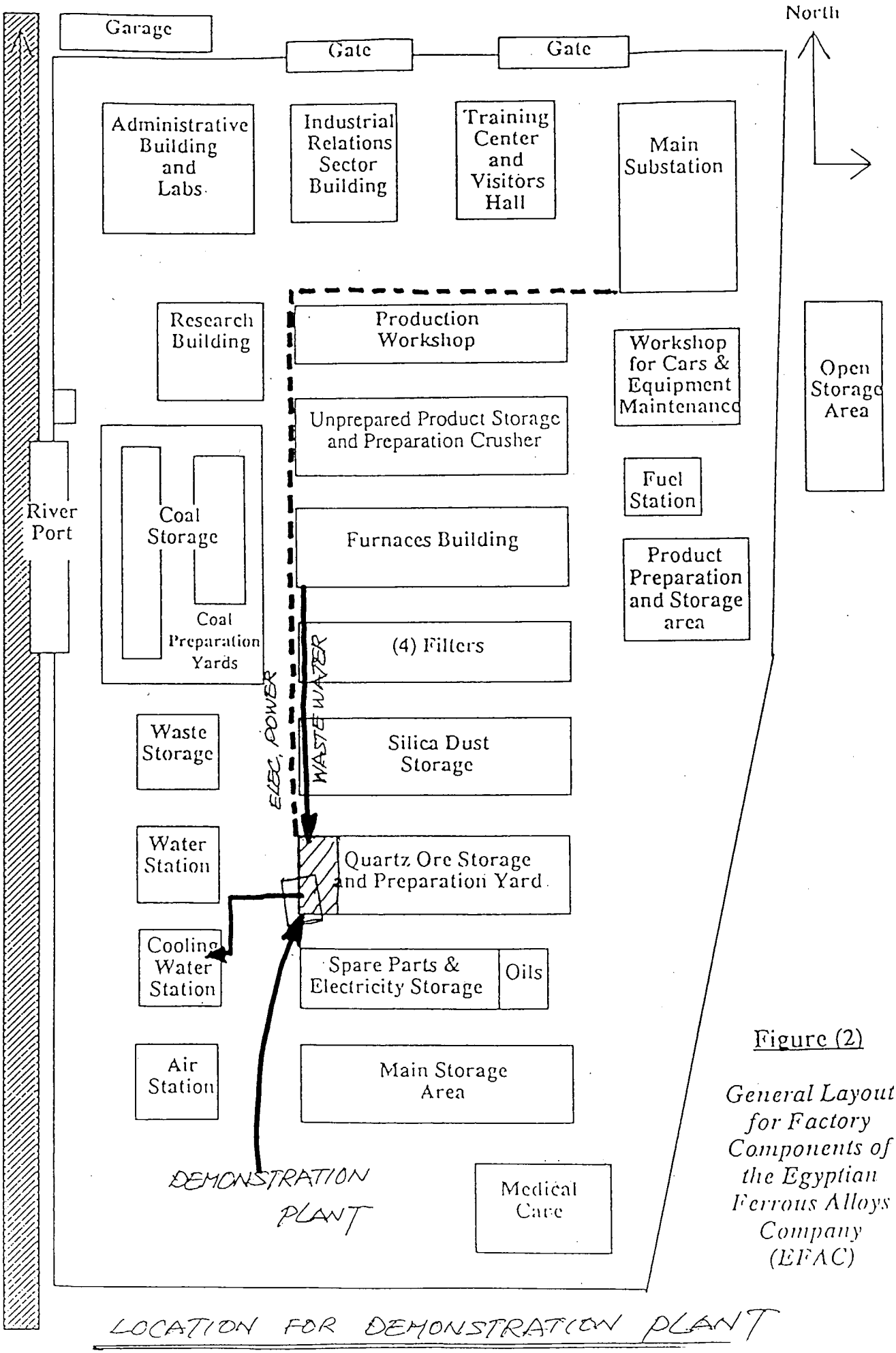


Figure (2)

General Layout for Factory Components of the Egyptian Ferrous Alloys Company (EFAC)

LOCATION FOR DEMONSTRATION PLANT

Table-1 EQUIPMENT LIST for EGYPTIAN FERROALLOYS CO.

CLIENT :Japan International Cooperation Agency

PROJECT :The Study on Industrial Waste Water P.

PLANT :W.W.T. DEMONSTRATION PLANT

WASTE W. Cooling Water/Washing Waste Water
e

REV	1	2	3	MADE	
BY				CHKD	
APVE				APVE	
DATE				DATE	1999.10.08

Equipment NO.	Service	No. Req'd	Type of Equipment	Remarks
T-1	Equalization Tank	1	600m^3, 10,200ID x 7,500H	Air Bubbling Device
			Open Top Tank, C.S./Epoxy coat.	
Z-1	Collection Pit	1	130m^3, Concrete	(out of Battery)
			6,500Wx8,000Lx3,000H	
Z-2	Clarified water Pit	1	65 m^3, 4,000W x 6,500Lx3,000H	
			Concrete Basin	
Z-3	Filtered Water Pit	1	260m^3, 8,000Wx13,000Lx3,000H	Backwashing Pump
			Concrete	Blower
Z-4	Wastewater Pit	1	140m^3, 7,000Wx8,000Lx3,000H	Backwash Waste Pump
			Concrete	
Z-5	Oil Sump Pit	1	60 m^3/h, 1,500W x 5,000L	(Out of Battery)
			Concrete Basin	
MZ-1	Clarifier	1	260 m^3/h 9,800IDx3,500H	
			Conventional Type, C.S./Epoxy	
	Coagulation/Flocculation Unit	1	Mechanical Mixing	Chemical Dosing Unit
MZ-2	Sludge Thickener	1	8m^3/h, 3,700ID x 2,400H,	chemical Dosing Unit
			C.S./Epoxy	
Mz-3	Centrifuge	1	2m^3/h, Hoizontal,	Chemical Dosing Unit
			Stainless Steel	
F-1ABC	Sand Filter	3+1S	90m^3/h, 3,700IDx4,500H	Anthracite+Sand,Gravel
			Carbon Steel, Circular	

Table-2 INSTRUMENT LIST for EGYPTIAN FERROALLOYS CO.

CLIENT :Japan International Cooperation Ager
PROJECT:The Study on Industrial Waste Water
PLANT :W.W.DEMONSTRATION PLANT
WASTE W:Cooling Water/Washing Waste Water

REV	1	2	3	MADE	
BY				CHKD	
APVE				APVE	
DATE				DATE	1999.09.26

Equipment NO.	Service	No. Req'd	Type of Instrument	Remarks
FI-1	Flow Indicator	1	0-300m^3/h	
			Clarifier Feeding Pump Outlet	
FR-2A-D	Flow Recorder	4	0-300m^3/h	
			Filter Feeding Pump Outlet	
FI-3	Flow Indicator	1	0-800m^3/h	
			Backwashing Pump Outlet	
FI-4	Flow Indicator	1	0-100m^3/h	
			Backwash Waste Pump Outlet	
FI-5	Flow Indicator	1	0-400Nm^3/h	
			Blower Outlet	
ApH-1	pH Recorder	1	pH4-10	
			Rapid Mixing Tank	
SQ-1	Sequence Timer	1	Backwashing Sequence	
PI	Pressure Indicator		Pump Outlet	
SQ-1	Blowdown SQ. Timer	1	Clarifier	Local Box
SQ-2	Filter SQ. Timer	1	Filter Unit	Loca Panel

Note:

DOCUMENT TYTLE: **STANDARD SKETCH DRAWINGS OF**

W.W.T. MAJOR EQUIPMENT

DOCUMENT NO. STD - CD - 20/50-01 REV. 0

PROJECT: THE STUDY ON INDUSTRIAL WASTE WATER

POLLUTION CONTROL IN

THE ARAB REPUBLIC OF EGYPT

CLIENT: JAPAN INTERNATIONAL COOPERATION AGENCY

INDUSTRIAL DEVELOPMENT STUDY DIVISION

CONSULTANT: CHIYODA DAMES AND MOORE CO.

CHIYODA CORPORATION

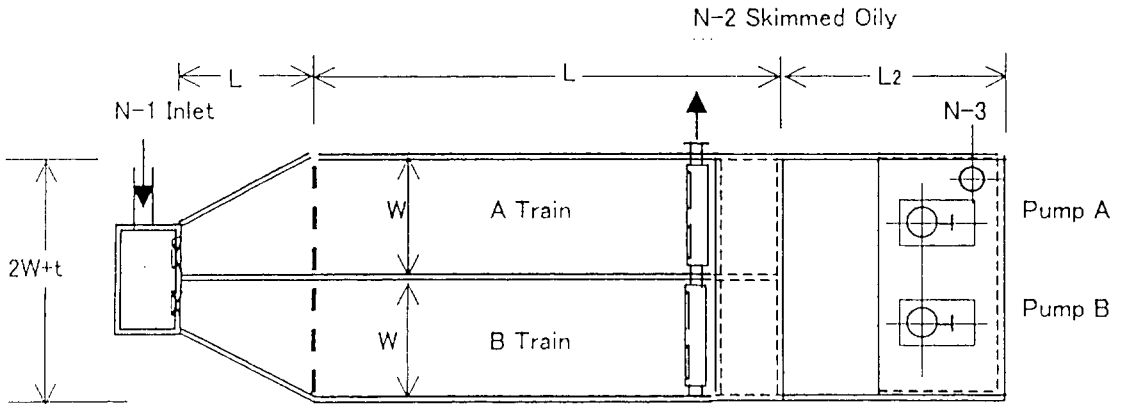
ISSUDED DATE: 1999. 10. 18

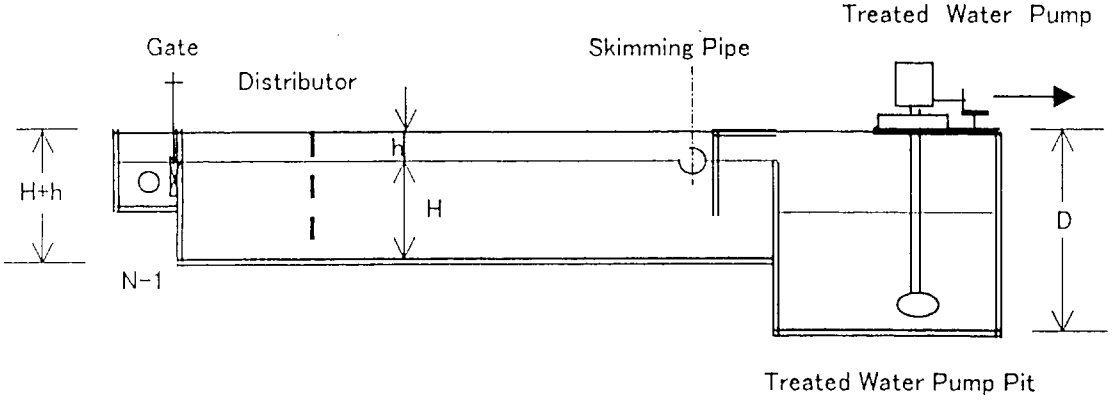
JICA

	CHCK'D	TECH.	APPR'D
SIGN			
DATE			

CONSULTANT

	DSGN	CHCK'D	APPR'D
SIGN			
DATE	Oct.18.'99	Oct.18.'99	Nov.11.'99

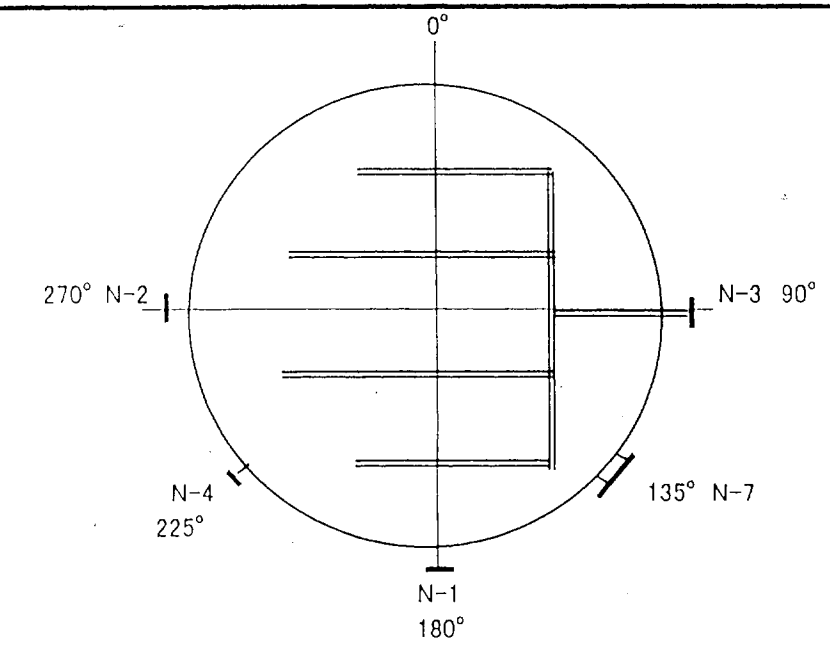


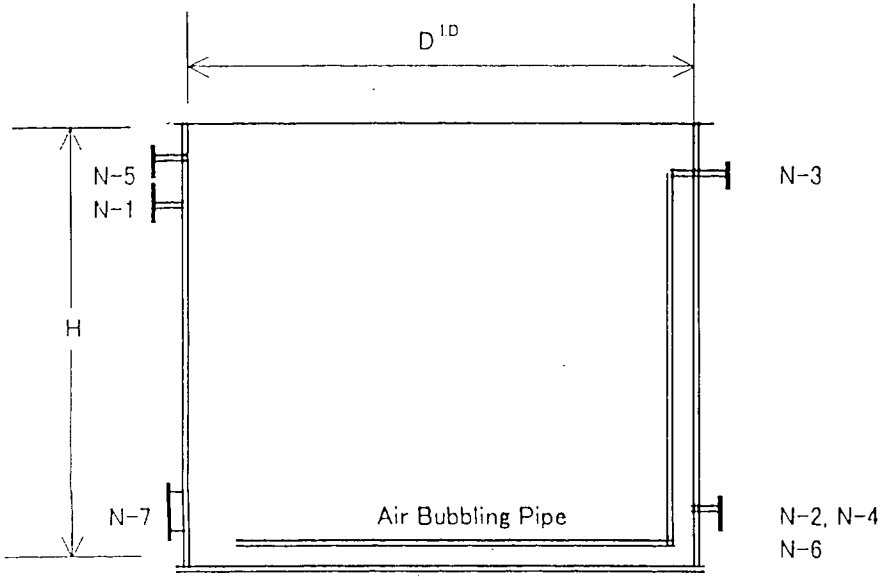


Material: Reinforced Concrete
Accessories: Skimming Pipe
Hand rail, Inside Ladder
Option: Flight Scraper (Surface, Bottom)

Nozzle No	Name	Size	No	Note
N-3	Level Instrument		1	
N-2	Skimmed Oily		1	
	Water Outlet			
N-1	Raw Water inlet		1	

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY
TYTLE	FOR: WASTE WATER TREATMENT UNIT STANDARD DRAWING OF _____m^3/h API OIL SEPARATOR (Z-1)
DWG. NO.	STD - CD - 50 - SK01 REV.0

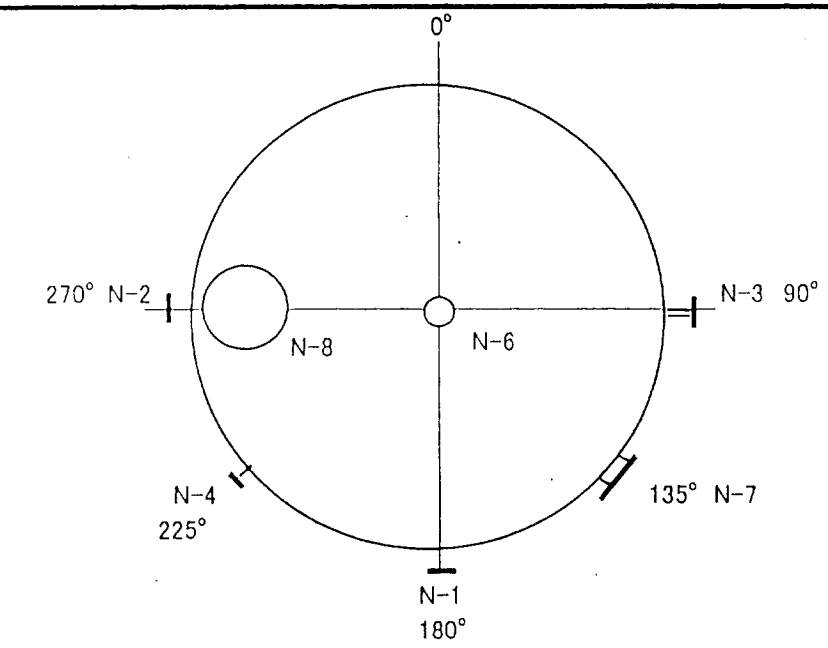




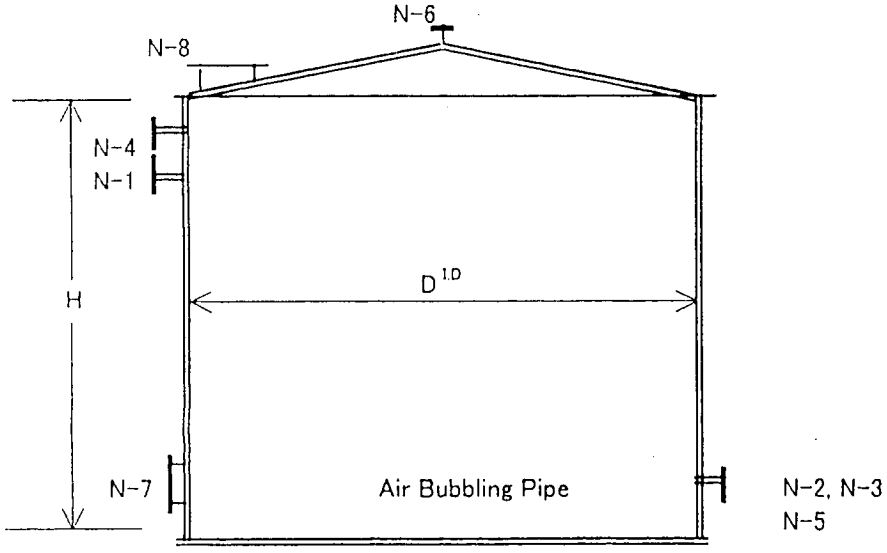
1)Type: Cylindrical Tank
(Open Top Tank)
2)Materials: Carbon Steel
inside Epoxy Coating
3)Accessories: Stairway

Nozzle No	Name	Size	No	Note
N-7	Manhole	500A	1	
N-6	Level Instrument		1	
N-5	Over Flow		1	
N-4	Drain		1	
N-3	Bubbling Air Inlet		1	
N-2	Raw Water Outlet		1	
N-1	Raw Water inlet		1	

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY
TYTLE	FOR: WASTE WATER TREATMENT UNIT STANDARD DRAWING OF _____m^3 EQUALIZATION TANK (T-1)
DWG. NO.	STD - CD - 22 - SK01 REV.0

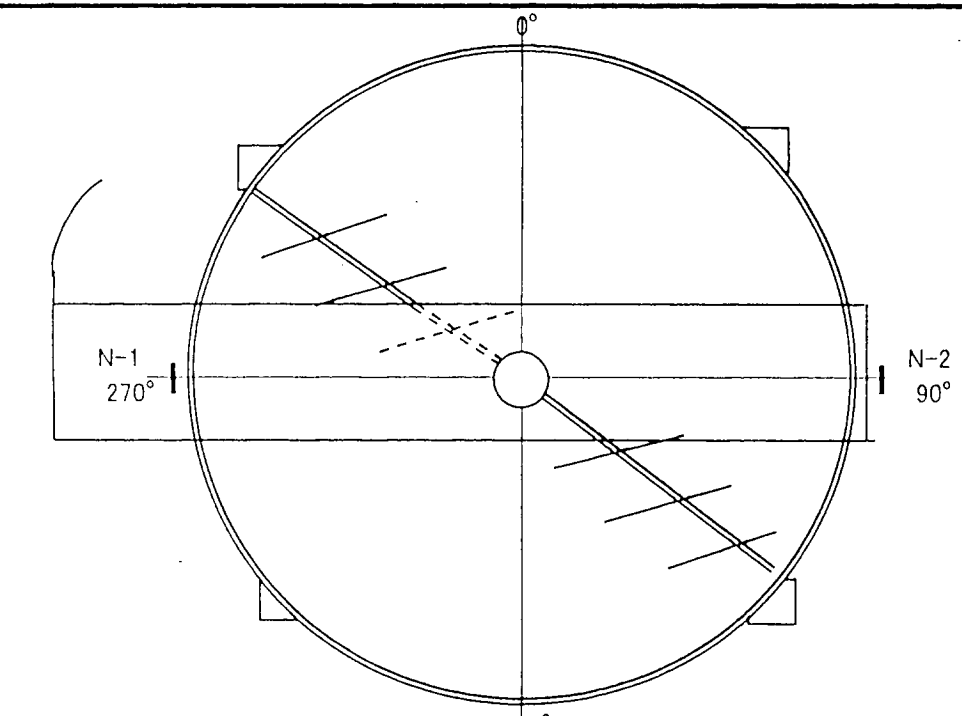


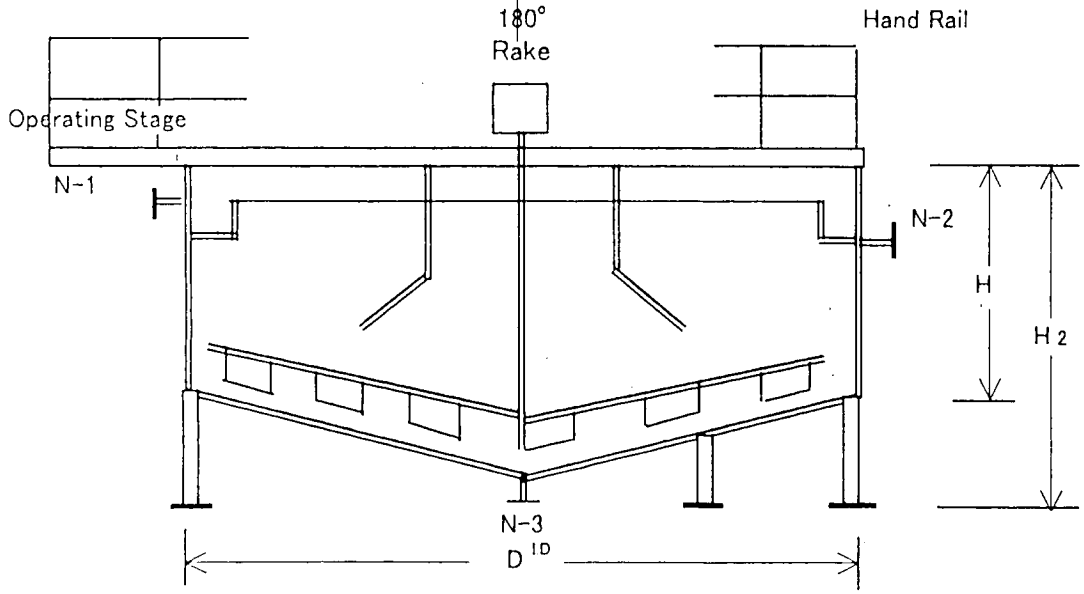
1)Type: Cylindrical Tank
(Cone Roof Tank)
2)Materials: Carbon Steel
inside Epoxy Coating
3)Accessories: Stairway



Nozzle No	Name	Size	No	Note
N-8	Roof Manhole	450A	1	
N-7	Manhole	500A	1	
N-6	Air Vent		1	
N-5	Level Instrument		1	
N-4	Over Flow		1	
N-3	Drain		1	
N-2	Raw Water Outlet		1	
N-1	Raw Water inlet		1	

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY
TYTLE	FOR: WASTE WATER TREATMENT UNIT STANDARD DRAWING OF _____m^3 STORAGE TANK (T-2)
DWG. NO.	STD - CD - 22 - SK02 REV.0

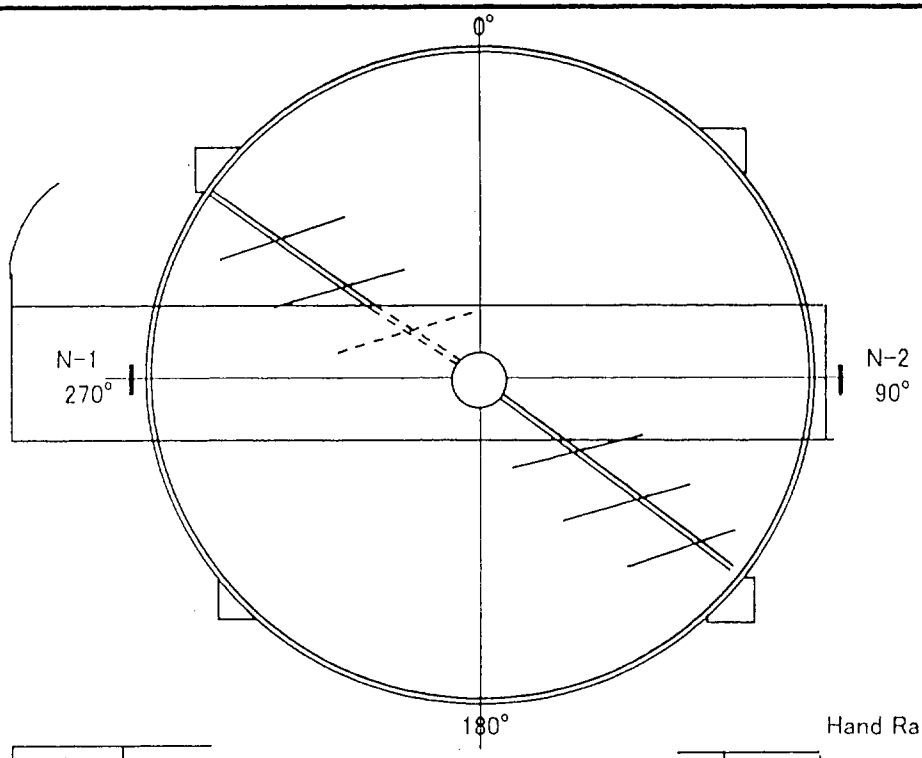


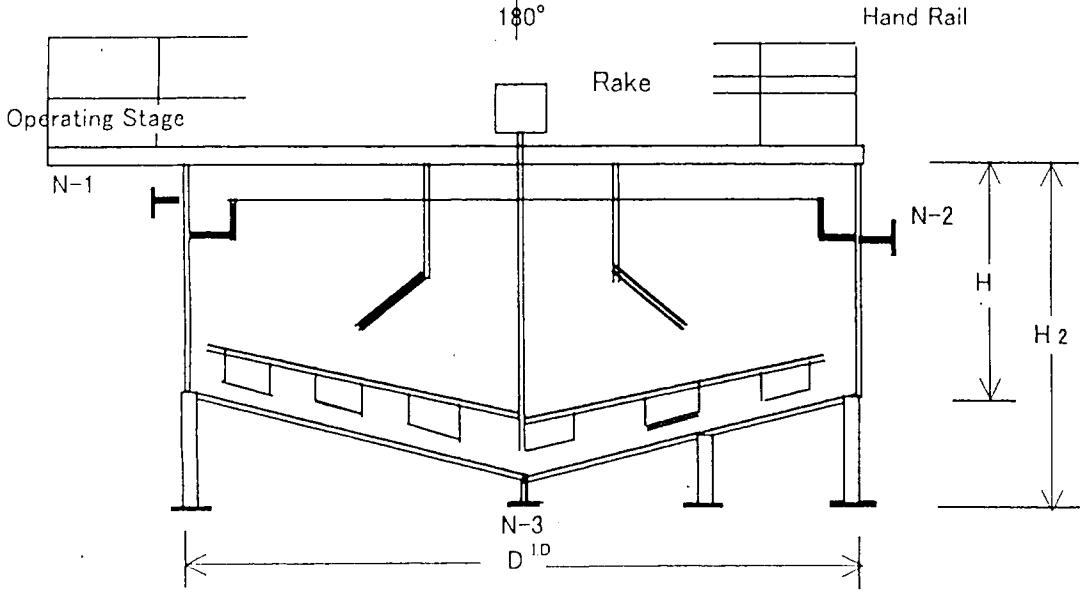


Materials: Carbon Steel/Epoxy coating
Accessories: Sludge Collection Rake
Operating Stage
Stairway

Nozzle No	Name	Size	No	Note
N-1	Raw Water inlet		1	
N-2	Treated Water Outlet		1	
N-3	Sludge Outlet		1	
N-4				

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY
TYTLE	FOR: WASTE WATER TREATMENT UNIT STANDARD DRAWING OF _____m^3/h CLARIFIER (MZ-1)
DWG. NO.	STD - CD - 29 - SK01 REV.0

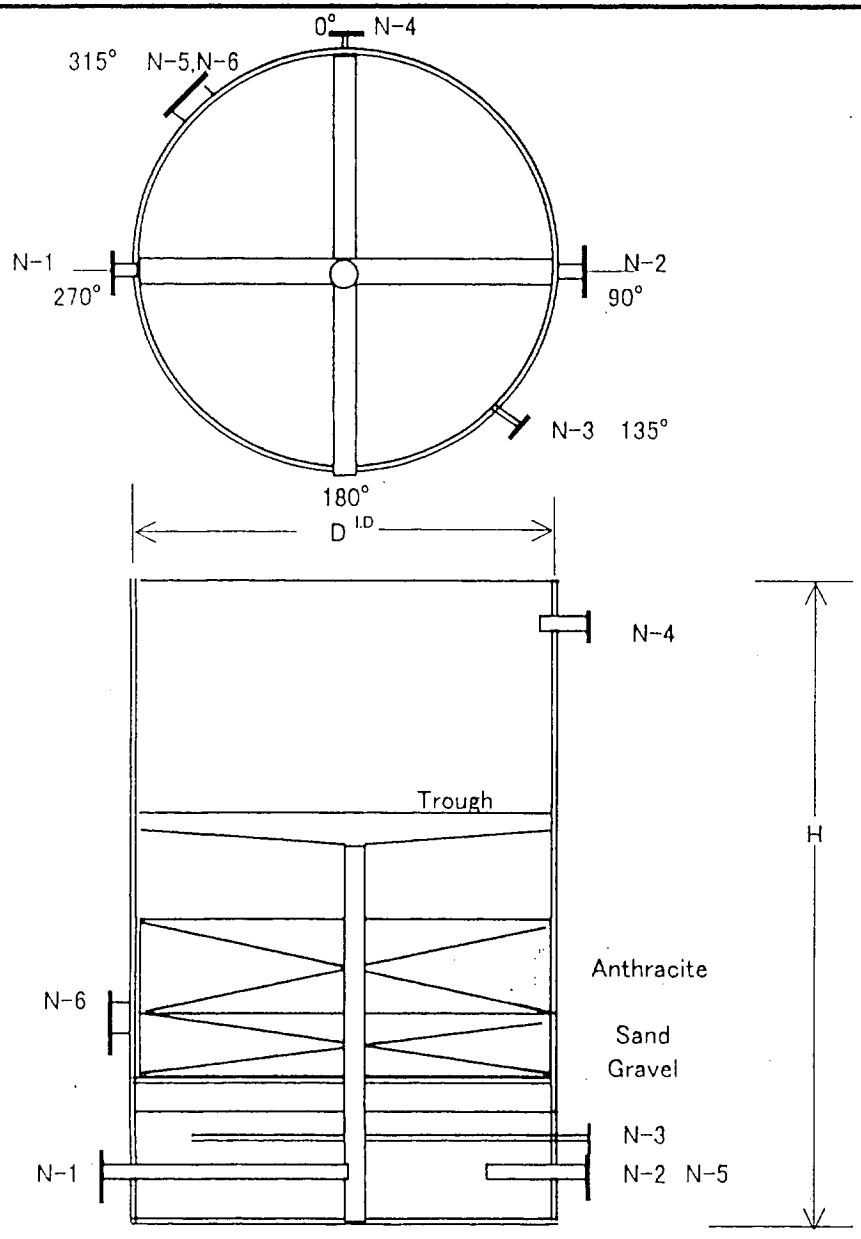




Materials: Carbon Steel/Epoxy coating
Accessories: Sludge Collection Rake
Operating Stage
Stairway

Nozzle No	Name	Size	No	Note
N-4				
N-3	Sludge Outlet		1	
N-2	Treated Water Outlet		1	
N-1	Raw Water inlet		1	

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY
TYTLE	FOR: WASTE WATER TREATMENT UNIT STANDARD DRAWING OF _____m^3/h SLUDGE THICKENER (MZ-3)
DWG. NO.	STD - CD - 29 - SK03 REV.0



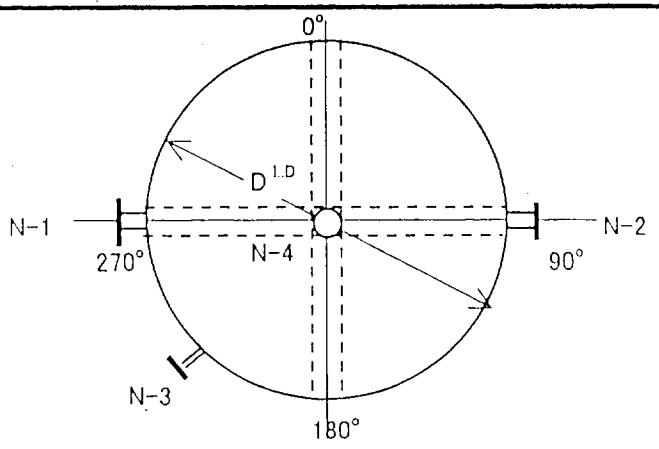
Material: Carbon steel/Epoxy Coating

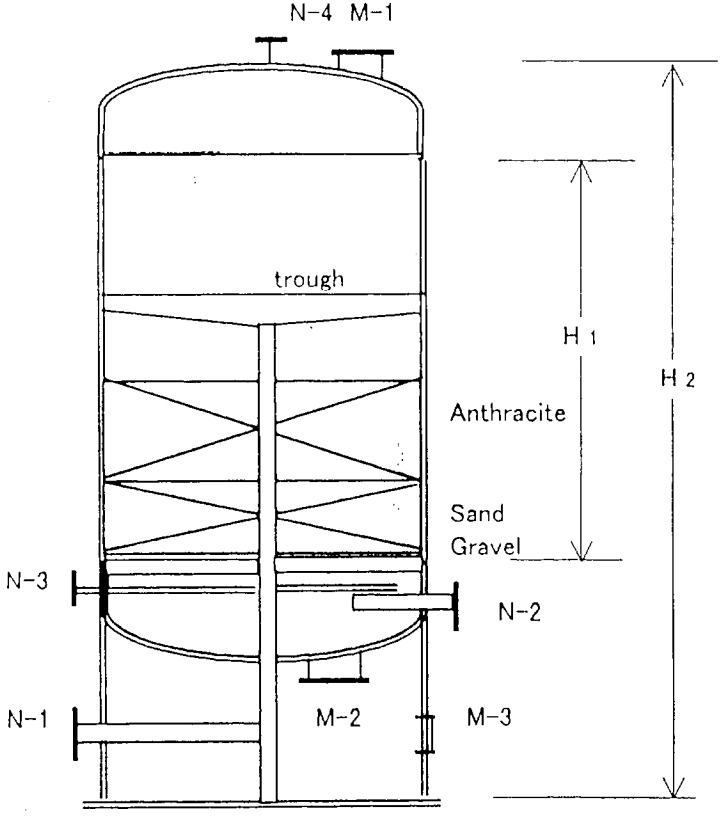
Filter Media: Anthracite + Sand/Gravel

Accessories: Operating Stage
Ladder

Nozzle No	Name	Size	No	Note
N-6	Handhole	200A	1	
N-5	Manhole	500A	1	
N-4	Over Flow		1	
N-3	Air Inlet		1	
N-2	Filtered Water Outlet/ Backwash Water Inlet		1	
N-1	Clarified W.ater inlet/ Backwash Waste Ouktlet		1	

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY
TYTLE	FOR: WASTE WATER TREATMENT UNIT STANDARD DRAWING OF _____ m^3/h SAND FILTER (F-1) (GRAVITY TYPE)
DWG. NO.	STD - CD - 29 - SK03 REV.0





Materials: Carbon Steel/Epoxy Coating

Filter Media: Anthracite + Sand/Gravel

Accesary: Operating Stage
Ladder

Nozzle No	Name	Size	No	Note
M-3	Manhole	500A	1	
M-2	Manhole	500A	1	
M-1	Manhole	500A	1	
N-4	Auto Air Vent		1	
N-3	Air Inlet		1	
N-2	Filtered Water Outlet/		1	
	Backwash Water Inlet		1	
N-1	Clarified W.ater inlet/		1	
	Backwash Waste Ouktlet		1	

CLIENT	JAPAN INTERNATIONAL COOPERATION AGENCY
TYTLE	FOR: WASTE WATER TREATMENT UNIT STANDARD DRAWING OF _____m^3/h SAND FILTER (F-1) (PRESSURE TYPE)
DWG. NO.	STD - CD - 29 - SK04 REV.0

Client: JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Project Name: THE STUDY ON INDUSTRIAL WASTE WATER POLLUTION CONTROL IN THE ARAB REPUBLIC OF EGYPT

Factory Name: EGYPTIAN FERROALLOYS CO.

CONCEPTUAL DESIGN

Document Title:

CALCULATION SHEET

FOR

W.W.T. DEMONSTRATION PLANT

Issued Date: September 2000

Consultant: JICA STUDY TEAM

CHIYODA DAMES AND MOORE CO.

CHIYODA CORPORATION

Calculation Sheet for W.W.T. in EGYPTIAN FERROALLOYS CO.

1. Purpose

This calculation sheet is prepared to the conceptual design of W.W.T. demonstration plant in Egyptian Ferroalloys Co.

2. Wastewater to be treated

(1) RW 1 : Quartz Crush Washing Wastewater

(2) RW 2 : Cooling Water for transformer

3. Premised Conditions

(1) The quartz plant should always be operated in normal.

(2) A oil sump should be provided at the transformer yard to remove leakage oil in cooling water for the transformers.

4. Wastewater Treating Units

(1) Primary Treatment: Chemical Clarifier

(2) Secondary Treatment: Rapid Sand Filter

5. Design Conditions

5.1 Flowrate and quality of Influent Wastewater

Shown on Table-1.

5.2 Flowrate and quality of Treated Water

(1) Target of Treated Water Quality

Law 48/82 Discharge into Nile River Branches /Canals

(2) Sampling point of treated water is at the outlet of the sand filters.

Table-1 Flowrate and Quality of Inlet/outlet of W.W.T

	RW 1	RW 2	Inlet of Clarifier	Treated Water	Law48/82
Flow [m^3/h]	200	60	260	260	
pH [-]	7 ~8	7 ~8	7 ~8	6.5 ~8.5	6 ~9
SS [mg/L]	700	30	550	20	30
BOD [mg/L]	20	5	17	20	20
COD [mg/L]	40	10	33	40	30
Oil [mg/L]	0	20	5	1	5
SiO_2 [mg/L]	10	5	9	5	—
水温 [℃]	20 ~35	20 ~35	20 ~35	20 ~35	< 35

6. Conceptual Design

The sizes of major equipment is calculated to design the layout of equipment and to estimate construction cost of plant roughly.

6.1 Equalization Basin / Wastewater Receiving Basin

(1) Purpose

To store and equalize RW1 and RW2 in quantity and quality.

(2) Design Condition

1) Flowrate : RW 1+RW 2

260 m^3/h = 6240 m^3/day

2) Water Quality: Same as Table-1.

3) Sharp, Materials, Quantity:

Square, Semi-underground, Reinforced Concrete, 1 set

4) Retention Time: 0.5 hour

5) Calculation

(a) Volume of Tank: 130 m^3

(b) Effective Height : 2.5 m^2

(c) Cross Area: 52 m^2

(d) Length x Width: L= 8 m W= 6.5 m

6.2 Chemical Clarifier

(1) Purpose

To remove suspended solids(SS), color, slice of oil, some metals

(2) Design Conditions

1) Wastewater to be Treated: Wastewater received in the Equalization Basin

2) Flowrate: 260 m^3

3) Influent water quality: Inlet of clarifier shown on Table-1.

4) Effluent water quality: Shown on Table-2.

Table-2 Effluent water quality of Clarifier

pH [-]	7	Oil [mg/L]	3
SS [mg/L]	30	SiO_2 [mg/L]	5
BOD [mg/l]	10		
COD [mg/L]	30	Temp. [℃]	20 ~35

5) Chemicals

(a) Coagulant: Inorganic chemicals such as Alum

(b) pH Controller: Alkali such as $Ca(OH)_2$

(c) Coagulant Aid: Polymer (Cation or Anion)

(3) Calculation

(3-1) Coagulation/Flocculation Tank

1) Retention Time (Rapid & Slow) Tfl= 30 min

2) Volume of Coag./Floc. Tank Vfl= 130 m^3

3) Shape, Materials, Quantity:

Sqquare, Vertical, Steel with Epoxy coating, 1 set

4) Height Hfl= 3 m (take) Cross Area Afl= 43.33 m^2

W= 5 m L= 8.667 m→ 8.7 m

(3-2) Sedimentation Tank of Clarifier

1) Surface Load: Ls= 3.5 $m^3/m^2/h$(take)

2) Surface Area As= 74.29 m^2

3) Shape, Materials, Quantity

Circular, Vertical, Steel with epoxy coating, 1 set

4) Diameter: Ds= 9.728 m→ 9.8 m→ Actual As= 75.39 m^2

5) Retention Time: 1 hour (0.5-1)hour

6) Height: Hs= 3.449 m→ 3.5 m

(3-3) Sludge production

1) Production Rate: 2 % of Treated Water → 5.2 m^3/h

2) SS contents in Sludge: 26 kg/m^3

6.3 Rapid Sand Filter

(1) Purpose

To polish treated water by removing a little SS in the clarified water

To reuse treated water as cooling water

(2) Design Conditions

1) Wastewater to be treated: Effluent water from Clarifier

2) Flowrate: 260 m^3/h

3) Water Quality of Influent: Shown on Table-2.

4) Water Quality of Filtrate: Shown on Table-3.

Table-3 Water Quality of Filtrate

pH	[-]	7 ~8	Oil	[mg/L]	1
SS	[mg/L]	10	SiO_2	[mg/L]	< 5
BOD	[mg/L]	15			
COD	[mg/L]	25	温度	[℃]	20 ~35

5) Shape, Materials, Quantity

Circular, Vertical, Gravity-type, Steel with epoxy coating, 3 sets + 1spare

6) Unit Flowrate: 86.67 m^3/h x 4 sets (including 1 spare)

7) Filter media: Anthracite + Sand & Graavel

8) Washing by: Air (Blower) + Water (Pump)

(3) Calculation

(3-1) Filter

1) Filtration Velocity: Vf= 180 m/day = 7.5 m/h(take)

2) Filtration Area: Af= 10.51 m^2 Df = 3.659 m → 3.7 m

3) Height:

	Upper Trough	0.5 m
<Linear part>	Trough~Top of Anthracite	1 m
	Anthracite	1.3 m
	Sand + Gravel	0.7 m
	Filtrate Chamber	0.7 m
	Allowance	0.3 m
	Total Height of Filter	4.5 m

(3-2) Filtered Water Basin

1) Volume: 1 hour (take) = 260 m^3

2) Depth: 2.5 m (take) Surface Area = 104 m^2

3) Width: 8 m (take) Length = 13 m

(3-3) Backwashing Pump

1) Backwashing Velocity: 50 $m^3/m^2/h$ (take)

2) Pump Capacity: 525.4 m^3/h 540 m^3/h

(3-4) Backwashed Wastewater Pit

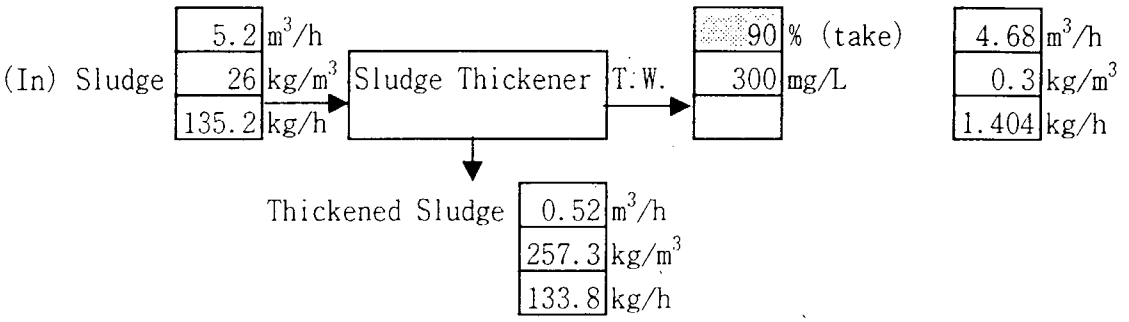
1) Volume: 10 min (take) → 90 m^3

2) Depth: 2.5 m (take) Surface Area = 36 m^2

3) Width: 5 m (take) Length = 7.2 m^2 → 7.5 m

6.4 Sludge Thickener

(1) Flowrate and SS Balance



(2) Surface Load = 12 $m^3/m^2/d$ (take) Surface Area = 10.4 m^2

(3) Diameter = 3.64 m

(4) Retention Time = 3 h Volume = 15.6 m^3 Height = 1.5 m

(5) Sludge Ret. Time 18 h Volume = 9.36 m^3 Height = 0.9 m

Total Height = 2.4 m