

Appendix 6A-7 UTILITIES FACILITIES

Appendix 6A-7-1 UTILITIES EQUIPMENT LIST

Appendix 6A-7-2 UTILITIES DRAWINGS

Figure 6-7-13 Layout Drawing of Natural Gas Receiving Station

Figure 6-7-14 Layout Drawing of Hydrogen Gas Generator and Steam Generation Station

Figure 6-7-15 Layout Drawing of Raw Water Receiving Station

Figure 6-7-16 Layout Drawing of ICW Treatment Station and Air Compression Station

Figure 6-7-17 Layout Drawing of DCW Treatment Station

Figure 6-7-18 Layout Drawing of Waste Water Treatment Station(Category-2)

Figure 6-7-19 Layout Drawing of Sewage Water Treatment System(Category-3)

Appendix 6A-7-1 Utilities Equipment List

No.	Equipment	Q'ty	Specification
UT-0100	Natural Gas Receiving Station		Capa. : 50,000 Nm ³ /h
UT-0101	Filter Separator	2	Material: CS Type : Horizontal Capa. : 50,000 Nm ³ /h, Design Press.:10 kgf/cm ² G, Size Particles Removed : 10micron and Over
UT-0102	Pressure Regulation Unit	2	
UT-0103	Flare Stack with Ignitor, Control Panel, Flare Burner, Pilot & Dry Seal	1	Material: CS/SS Type : Guy Wire smokeless Capa. : 50,000 Nm ³ /h
UT-0104	Instrument Nitrogen Receiving Tank	1	Material: CS Type : Vertical Capa. : 2.3m ³
UT-0105	Flow Meter	1	Type : Turbine Capa. : 60,000Nm ³ /h Accuracy: 71%
UT-0106	Electrical Equipment and Instruments	1 lot	-Lighting System -Local Instrument Panel -Local Mount Instruments
UT-0107	Piping	1 lot	
UT-0108	Wiring Materials	1 lot	
UT-02	Air Compression Station		
UT-0201	Air Compressor with Suction Air Filter	3	Type : Centrifugal Capa. : 9,000Nm ³ /h, 7 kgf/cm ² G
UT-0202	Air Receiving Tank	1	Material: CS Type : Vertical Capa. : 30 m ³
UT-0203	Hoist Crane	1	Material: CS Type : Electric Overhead Crane Capa. : 5 tons, Lift 10 m Span 12 m
UT-0204	Piping	1 lot	
UT-0205	Electrical Equipment	1 lot	
UT-0206	Instruments	1 lot	
UT-0207	Wiring Materials	1 lot	

No.	Equipment	Q'ty	Specification
UT-03	Hydrogen Generator		
UT-0301	Hydrogen generator	1 set	Type : Reformer-PSA Capa. : 80 Nm ³ /h Purity : 99.999 % Pressure: 7.0 kg/cm ²
UT-0302	Buffer tank	1	Material: CS Type : Vertical, cylindrical Capa. : 10 m ³
UT-0303	Piping with Necessary Accessories	1 lot	
UT-0304	Analysis Apparatus	1 lot	
UT-0305	Electrical Equipment	1 lot	
UT-0306	Instruments	1 lot	
UT-0307	Wiring Materials	1 lot	
UT-04	Steam boiler		
UT-0401	Demineralizer	1 lot	Type : 2B-2T ion exchanger Capa. : 5 m ³ /h TREATED WATER : <10 micro.S
	With		
	Caustic Soda Tank	2	
	Caustic Soda Agitator	2	
	Caustic Soda Injection Pump	2	
	Acid Tank	1	
	Acid Injection Pump	3	
	Demineralized Water tank	1	
	Demineralized Water Pump	2	
UT-0402	Feed water pump	2	Type : Turbine Capa. : 5 m ³ /h x 10m
UT-0403	Steam boiler with deaerator	1	Type : Packaged / ACC control Capa. : 3,000 kg/h Pressure: 8 kg/cm ² Fuel : Natural gas
UT-0404	Stack	1	Type : CS/Self standing Height : 10 m
UT-0405	Piping with Necessary Accessories	1 lot	
UT-0406	Analysis Apparatus	1 lot	
UT-0407	Electrical Equipment	1 lot	
UT-0408	Instruments	1 lot	
UT-0409	Wiring Materials	1 lot	

No.	Equipment	Q'ty	Specification
UT-1100	Raw Water Treatment Station		
UT-1101	Raw Water Basin	1	Material: RC Type : Rectangular Capa. : 3,000m ³
UT-1102	Filter Feed Pump	2	Material: CI/CS Type : Centrifugal Capa. : 520m ³ /h x 15 m
UT-1103	Gravity Filter	3	Material: CS/Tar Epoxy Type : Gravity Siphon Filter Capa. : 160m ³ /h/unit
UT-1104	Backwash Water Storage Basin	1	Material: RC Type : Rectangular Capa. : 150m ³
UT-1105	Sludge Basin	1	Material: RC Type : Rectangular Capa. : 60m ³
UT-1106	Filtered Water Basin	1	Material: RC Type : Rectangular Capa. : 300m ³
UT-1107	Sodium Chloride Dissolving Basin	1	Material: RC Type : Rectangular Capa. : 45m ³
UT-1108	Make-up Water Storage Basin	1	Material: RC Type : Rectangular Capa. : 450m ³
UT-1109	Surface Water Drain-off Pump	2	Material: CI/CS Type : Centrifugal Capa. : 24m ³ /h x 10 m
UT-1110	Portable Sludge Pump	1	Material: CI/Gr-CI Type : Submersible Capa. : 50m ³ /h x 15 m
UT-1111	Water Softener Feed Pump	4	Material: CI/CS Type : Centrifugal Capa. : 200m ³ /h x 25 m
UT-1112	Water Softener	3	Material: CS/Epoxy Coating Type : Vertical Capa. : 160m ³ /h
UT-1113	Make-up Water Supply Pump	3	Material: CI/CS Type : Centrifugal Capa. : 500m ³ /h x 40 m

No.	Equipment	Q'ty	Specification
UT-1114	Sodium Chloride Feed Pump	2	Material: CI-R.L Type : Centrifugal Capa. : 20m ³ /h x 20 m
UT-1115	FAC Storage Tank with Agitator	1	Material: PE Type : Vertical,Cylindrical Capa. : 200 l
UT-1116	Vacuum Pump for Gravity Filter	2	Material: CI Type : Water Ring Capa. : 15m ³ /h x 500 mm Aq.
UT-1117	Hypochlorite Storage	1	Material: PE Type : Vertical,Cylindrical Capa. : 200 l
UT-1118	Hypochlorite Injection	2	Material: PVC Type : Diaphragm Capa. : 3.6l/h x 100m
UT-1119	Potable Water Storage	1	Material: RC Type : Rectangular Capa. : 490m ³
UT-1120	Potable Water Supply Unit With Pressure Tank 2m ³	1 Set	Material: FC Type : Centrifugal Capa. : 50m ³ /h x 40m
UT-1121	Piping with Necessary Accessories	1 lot	
UT-1122	Analysis Apparatus	1 lot	
UT-1200	Water Treatment Station - 1		
UT-1201	ICW Cooling Tower for EAF,LF and SMP	1	Material: RC/FRP Type : Counter Flow Film type Capa. : 6,000m ³ /h (42-32-26°C)
UT-1202	Hot Well	1	Material: RC Type : Rectangular Capa. : 800m ³
UT-1203	Cold Well	1	Material: RC Type : Rectangular Capa. : 2,500m ³
UT-1204	ICW Supply Pump for EAF,LF and SMP	5	Material: CI/CS Type : Centrifugal Capa. : 1,475m ³ /h x 55 m
UT-1205	Hot Water Transfer Pump	5	Material: CI/CS Type : Centrifugal Capa. : 1,475m ³ /h x 20 m

No.	Equipment	Q'ty	Specification
UT-1206	Diesel Pump for EAF,LF	1	Material: CI/CS Type : Centrifugal Capa. : 825m ³ /h x 50 m Diesel Enclosure Type Engine : Automatic Electrical Starting System
UT-1207	Side Stream Filter	2	Material: CS Type : Vertical Capa. : 150m ³ /h
UT-1208	Head Tank	1	Material: RC Type : Cylindrical Capa. : 130m ³ , 35m High
UT-1209	Chemical Injection facilities	1 lot	
UT-1210	Piping with Necessary Accessories	1 lot	
UT-1300	Water Treatment Station - 2		
UT-1301	Cooling Tower for Air compression station	1	Material: RC/PVC Type : Counter Flow Film Type Capa. : 300m ³ /h(42-32-26°C)
UT-1302	Cold Well	1	Material: RC Type : Rectangular Capa. : 150m ³
UT-1303	Side Stream Filter	1	Material: CS Type : Vertical Capa. : 20m ³ /h
UT-1304	ICW Supply Pump for Air Compressor	2	Material: CI/CS Type : Centrifugal Capa. : 400m ³ /h x 35m
UT-1305	Chemical Injection facilities	1 lot	
UT-1306	Piping with Necessary Accessories	1 lot	
UT-1400	Water Treatment Station - 3		
UT-1401	ICW Cooling Tower for CC and HSM	1	Material: RC/FRP Type : Counter Flow Film Type Capa. : 3,000m ³ /h (42-32-26°C)
UT-1402	Cold Well	1	Material: RC Type : Rectangular Capa. : 1,000m ³

No.	Equipment	Q'ty	Specification
UT-1403	ICW Supply Pump for Cooling Tower	3	Material: CI/CS Type : Centrifugal Capa. : 870m ³ /h x 30 m
UT-1404	Heat Exchanger for CC	5	Material: SS Type : Plate Type Capa. : Hot : 435m ³ /h(48-35°C) Cold: 435m ³ /h(32-45°C)
UT-1405	ICW Supply Pump for CC	3	Material: CI/CS Type : Centrifugal Capa. : 870m ³ /h x 90 m
UT-1406	ICW Supply Pump for HSM	3	Material: CI/CS Type : Centrifugal Capa. : 500m ³ /h x 50 m
UT-1407	Diesel Pump for HSM, CC	2	Material: CI/CS Type : Centrifugal Capa. : 840m ³ /h x 50 m Diesel Enclosure Type Engine : Automatically Electrical Starting System
UT-1408	Softener	2	Material: FRP Type : Vertical Capa. : 10m ³ /h
UT-1409	Softened Water Tank	1	Material: RC Type : Rectangular Capa. : 500m ³
UT-1410	Head Tank	1	Material: RC Type : Cylindrical Capa. : 250m ³ , 45m High
UT-1411	Chemical Injection facilities	1 lot	
UT-1413	Piping with Necessary Accessories	1 lot	
UT-1500	Water Treatment Station - 4		
UT-1501	DCW Cooling Tower for HSM	1	Material: RC/FRP Type : Counter Flow, Splash Capa. : 6,000m ³ /h (38-32-26°C)
UT-1502	DCW Cooling Tower for HRT in HSM	1	Material: RC/FRP Type : Counter Flow, Splash Capa. : 450m ³ /h (50-32-26°C)

No.	Equipment	Q'ty	Specification
UT-1503	DCW Cooling Tower for CC	1	Material: RC/FRP Type : Counter Flow, Splash Capa. : 700m ³ /h/cell x1 cells (45-32-26°C)
UT-1504	Cold Well for HSM	1	Material: RC Type : Rectangular Capa. : 2,500m ³
UT-1505	Cold Well for HRT	1	Material: RC Type : Rectangular Capa. : 150m ³
UT-1506	Cold Well for CC	1	Material: RC Type : Rectangular Capa. : 250m ³
UT-1507	DCW Supply Pump for CC Spray and Mach. Cooling	2	Material: CI/CS Type : Centrifugal Capa. : 680m ³ /h x 105 m
UT-1508	DCW Supply Pump for HSM, HRT	2	Material: CI/CS Type : Centrifugal Capa. : 450m ³ /h x 45 m
UT-1509	DCW Supply Pump for HSM	5	Material: CI/CS Type : Centrifugal Capa. : 1,775m ³ /h x 105m
UT-1510	Diesel Engine Pump for DCW CC	1	Material: CI/CS Type : Centrifugal Capa. : 200m ³ /h x 55 m Diesel : Enclosure Type Engine : Automatic Electrical Starting System
UT-1511	Head Tank for DCW	1	Material: RC Type : Cylindrical Capa. : 35m ³ , 35m High
UT-1512	Sedimentation Basin	1	Material: RC Type : Rectangular Capa. : 6,720m ³
UT-1513	Sludge Remover for Sedimentation Basin	2	Material: CS Type : Gantry Crane with Grab Bucket

No.	Equipment	Q'ty	Specification
UT-1514	Sludge Pump	4	Material: CI/Cr-CI Type : Submersible Capa. : 30m ³ /h x 15 m
UT-1515	Oil Skimmer	4	Material: CS Type : Mop Skimmer Capa. : 10m ³ /h
UT-1516	Floating Pump	4	Material: CI Type : Scum Skimmer Capa. : 12m ³ /h x 2 m
UT-1517	Sedimentation Treated Water Basin for HSM	1	Material: RC Type : Rectangular Capa. : 1,920m ³
UT-1518	Sedimentation Treated Water Basin for CC	1	Material: RC Type : Rectangular Capa. : 640m ³
UT-1519	Filter Feed Pump for HSM	3	Material: CI/CS Type : Centrifugal Capa. : 3,000m ³ /h x 25m
UT-1520	Filter Feed Pump for CC	2	Material: CI/CS Type : Centrifugal Capa. : 700m ³ /h x 25m
UT-1521	Pressure Filter	11	Material: CS, Anthracite/Sand Type : Vertical Capa. : 860m ³ /h
UT-1522	Backwash Blower	3	Material: CI/CS Type : Rotary Capa. : 1,450m ³ /h x 7000mmAq.
UT-1523	Lub. Oil Pump for Blower	3	Material: CI/CS Type : Gear / Lub. Oil Cooler Capa. : 0.5m ³ /h x 3 kgf/cm ²
UT-1524	Backwash Pump	3	Material: CI/CS Type : Centrifugal Capa. : 950m ³ /h x 25m
UT-1525	Backwash Water Storage Basin	1	Material: RC Type : Rectangular Capa. : 700m ³
UT-1526	Backwash Water Transfer Pump	2	Material: CI/Cr-CI Type : Centrifugal Capa. : 400m ³ /h x 20m

No.	Equipment	Q'ty	Specification
UT-1527	Sedimentation Sludge Pit	2	Material: RC Type : Rectangular Capa. : 15m ³
UT-1528	Sludge Pit Pump	4	Material: CI/Cr-CI Type : Submersible Capa. : 60m ³ /h x 15m
UT-1529	Separated Oil Pit	2	Material: RC Type : Rectangular Capa. : 9m ³
UT-1530	Coagulation Tank with Agitator	1	Material: RC/SS Type : Rectangular Capa. : 20m ³
UT-1531	Thickener	1	Material: RC, OS/Tar Epoxy Type : Rectangular Center Shaft Sludge Scraper with Electrical Lifting Device
UT-1532	Thickener Sludge Pump	2	Material: CI/Cr-CI Type : Centrifugal Capa. : 18m ³ /h x 15m
UT-1533	Slurry Constant Head Box	1	Material: OS Type : Rectangular Capa. : 250 l
UT-1534	Sludge Storage Basin with Agitator	1	Material: RC/SS Type : Rectangular Capa. : 100m ³
UT-1535	Sludge Feed Pump	4	Material: Cr-CI Type : Centrifugal Capa. : 45m ³ /h x 50m
UT-1536	Dehydrator	3	Material: OS Type : Filter Press with Oil Pressure Unit Capa. : 2,500kg-Ds/h
UT-1537	Flushing Pump	3	Material: CI/SS Type : Plunger Capa. : 6m ³ /h x 400m
UT-1538	Air Compressor for Blower	2	Material: CI Type : Recipro Capa. : 250Nm ³ /h x 7 kg/cm ²
UT-1539	Air Receiving Tank	1	Material: OS Type : Vertical Capa. : 2m ³
UT-1540	Flushing Water Tank	1	Material: OS Type : Vertical Capa. : 1.5m ³

No.	Equipment	Q'ty	Specification
UT-1541	Waste Water Pit	1	Material: RC Type : Rectangular Capa. : 1.5m ³
UT-1542	Waste Water Pump	2	Material: Cl/Cr-Cl Type : Submergible Capa. : 20m ³ /h x 20m
UT-1543	Gate Hopper	3	Material: CS/Tar Epoxy Type : Box Open Gate with Air Cylinder Capa. : 20m ³
UT-1544	Chemical Injection facilities	1 lot	
UT-1545	Piping with Necessary Accessories	1 lot	
UT-1600	Water Treatment Station - 5		
UT-1601	ICW Cooling Tower for CRM	1	Material: RG/FRP Type : Counter Flow Film type Capa. : 660m ³ /h/cell x 1 cells (42-32-26°C)
UT-1602	Cold Well	1	Material: RC Type : Rectangular Capa. : 200m ³
UT-1603	ICW Supply Pump for CRM	3	Material: Cl/CS Type : Centrifugal Capa. : 660m ³ /h x 40 m
UT-1604	Side Stream Filter	1	Material: CS Type : Vertical Capa. : 35m ³ /h
UT-1605	Chemical Injection facilities	1 lot	
UT-1606	Deminerlizer Unit	1	Type: Mixed bed Ion Exchanger Production a)Capacity: 5m ³ /h b) Quality of Treated Water E. Conductivity: Max.5 microS
-1	Mixed bed Ion Exchanger	1	
-2	Caustic Soda Tank	2	
-3	Caustic Soda Agitator	2	
-4	Caustic Soda Injection Pump	2	
-5	Acid Tank	1	
-6	Acid Injection Pump	3	
-7	Mixing Blower	2	
-8	Deminerlized Water tank	1	
-9	Deminerlized Water Pump	2	

No.	Equipment	Q'ty	Specification
UT-1607	Piping with Necessary Accessories	1 lot	
UT-1608	Alkaline Raw Water Tank	1	Type : FRP Lining Capa. : 30 m ³
UT-1609	Acid Raw Water Tank	1	Type : FRP Lining Capa. : 120 m ³
UT-1610	Chromate Raw Water Tank	1	Type : FRP Lining Capa. : 20 m ³
UT-1611	Oily Raw Water Tank	2	Type : RC Capa. : 100 m ³
UT-1612	Cr Reduction Tank	2	Type : FRP Lining Capa. : 2 m ³
UT-1613	pH Control Tank	2	Type : FRP Lining Capa. : 30 m ³
UT-1614	Coagulation Tank	1	Type : RC Capa. : 10 m ³
UT-1615	Settling Tank	2	Type : RC Capa. : 350 m ³
UT-1616	Neutralization Tank	2	Type : RC Capa. : 20 m ³
UT-1617	Filter Feed Tank	1	Type : RC Capa. : 50 m ³
UT-1618	Pressure Filter	2	Type : Double Media Pressure Filter 3200d x 2400h
UT-1619	Discharged Water Storage Tank	1	Type : RC Capa. : 100 m ³
UT-1620	Back Wash Water Storage Tank	1	Type : RC Capa. : 100 m ³
UT-1621	Thickener	1	Type : Center Shaft Sludge Scraper Capa. : 64 m ³
UT-1622	Dehydrator	2	Type : Screw Press Capa. : 100kg-ss/d
UT-1623	Dehydrator	2	Type : Filter Press Capa. : 2100kg-ss/d
UT-1624	Sludge Storage Pit	1	Capa. : 60 m ³
UT-1625	Scum Storage Tank	1	Capa. : 30 m ³
UT-1626	Lime Milk Dissolving Tank	1	Capa. : 50 m ³
UT-1627	Analysis Apparatus	1 lot	

No.	Equipment	Q'ty	Specification
UT-1700	Pumping Station		
UT-1701	Pump Pit	7	Material: RC Type : Rectangular Capa. : 4m ³
UT-1702	Rough Screen	7	Material: CS Type : Bar Screen, Pitch : 30 mm
UT-1703	Basket	7	Material: SS Type : 5 Mesh, Rectangular Capa. : 20 l
UT-1704	Sewage Pump	14	Material: CI Type : Submersible with Quick Discharge Connector Capa. : 7.5m ³ /h x 15m
UT-1705	Pump Lifting Hanger	7	Material: CS Type : Selfstanding
UT-1706	Piping with Necessary Accessories	1 lot	

No.	Equipment	Q'ty	Specification
UT-1800	Sewage Treatment Station		Capa. : 500m ³ /day BOD5 : Outlet 20ppm
UT-1801	Rough Screen	1	Material: CS Type : Bar Screen
UT-1802	Basket	1	Material: SS Type : 5 Mesh
UT-1803	Diffuser for Aerated Grid Chamber	1 lot	Material: ABS Type : Disc Capa. : 0.25 m ³ /min. x 5 m
UT-1804	Spray Nozzle for Aerated Grit Chamber	1 lot	Material: ABS Capa. : 0.25 m ³ /min. x 5 m
UT-1805	Gate	1 lot	Material: PVC Type : Slide Gate
UT-1806	Grit Pump	1	Material: PVC Type : Air Lift Capa. : 6 m ³ /h x 5 m
UT-1807	Grid Separator	1	Material: RC Type : Rectangular
UT-1808	Aerated Grid Chamber with Baffle Board	1	Material: RC, CS/Tar Epoxy Type : Rectangular Capa. : 6 m ³
UT-1809	Comminutor	1	Material: CI/SCS Type : Control Type Capa. : 630 m ³ /day-3,150 m ³ /day
UT-1810	Flow Control Basin	1	Material: RC Type : Rectangular Capa. : 200 m ³
UT-1811	Feed Pump	2	Material: CI Type : Submersible Capa. : 24 m ³ /h x 5 m
UT-1812	Diffuser for Flow Control Basin	1 lot	Material: ABS Type : Disc Capa. : 0.25 m ³ /min.
UT-1813	Constant Head Box	1	Material: CS Type : V-Notch Weir Capa. : 21 m ³ /h
UT-1814	Sludge Storage Basin	1	Material: RC Type : Rectangular Capa. : 36 m ³

No.	Equipment	Q'ty	Specification
UT-1815	Aeration Basin	2	Material: RC Type : Rectangular Capa. : 250 m ³
UT-1816	Diffuser for Aeration Basin	1 lot	Material: ABS Type : Disc Capa. : 0.25 m ³ /min.
UT-1817	Sludge Measuring Box	1	Material: CS/Tar Epoxy Type : V-Notch Weir Capa. : 20 m ³ /h-60 m ³ /h
UT-1818	Sedimentation Basin	1	Material: RC Type : Cylindrical Capa. : 20.8 m ³ /h
UT-1819	Sludge Return Pump	1	Material: PVC Type : Air Lift Capa. : 0.35 m ³ /min. x 1.5 mAq
UT-1820	Sludge Collector	1	Material: CS/Tar Epoxy Type : Center Shaft With Drive Unit
UT-1821	Spray Pump Pit	1	Material: RC Type : Rectangular Capa. : 2 m ³
UT-1822	Chlorination Basin	1	Material: RC Type : Rectangular Capa. : 5.2 m ³
UT-1823	Spray Pump	1	Material: CI Type : Submersible with Quick Discharge Connector Capa. : 12 m ³ /h x 15 m
UT-1824	Blower for Aeration	2	Material: CI Type : Rotary Type / Silencer Capa. : 17.5 m ³ /min. x 4,000 mmAq
UT-1825	Hoist	1	Material: CS Type : Electrical Lifting & Travelling Capa. : 0.5 ton
UT-1826	Hypochlorite Tank with Agitator	1	Material: PE, CS/RL Type : Cylindrical Capa. : 1 m ³
UT-1827	Hypochlorite Pump	2	Material: PVC Type : Diaphragm Capa. : 3.6 l/h x 10 kgf/cm ²

No.	Equipment	Q'ty	Specification
UT-1828	Surface Water Drain-off Pump	2	Material: CI Type : Submersible Capa. : 0.2 m ³ /min. x 4 m
UT-1829	Hoist for Chemical Storage Room	1	Material: CS Type : Electrical Lifting & Travelling Capa. : 0.5 ton
UT-1830	Piping with Necessary Accessories	1 lot	
UT-1831	Analysis Apparatus	1 lot	
UT-1832	Electrical Equipment for Water Treatment Station	1 lot	
UT-1833	Instruments for Water Treatment Station	1 lot	
UT-1835	Wiring Materials for Water Treatment Station	1 lot	
UT-2000	Fire Hydrant System		
UT-2001	Fire pump	2	Material: CI/OS Type : Centrifugal Capa. : 250m ³ /h x 85 m
UT-2002	Jockey Pump	2	Material: CI/OS Type : Centrifugal Capa. : 20m ³ /h x 50 m
UT-2003	Fire Diesel Pump	1	Material: CI/OS Type : Centrifugal Capa. : 250m ³ /h x 85 m Diesel : Enclosure Type Engine : Automatic Electrical Starting System
UT-2004	Pressure Tank	1	Material: OS Type : Cylindrical Capa. : 10m ³
UT-2005	Hydrant With Hose Box	1 lot	
UT-2006	Piping with Necessary Accessories	1 lot	
UT-2007	Analysis Apparatus	1 lot	
UT-2008	Electrical Equipment for Water Treatment Station	1 lot	
UT-2009	Instruments for Water Treatment Station	1 lot	
UT-2010	Wiring Materials for Water Treatment Station	1 lot	
UT-3000	Yard piping		
UT-3001	Piping with Necessary Accessories	1 lot	

No.	Equipment	Q'ty	Specification
UT-3002	Pipe rack and stanchion	1 lot	
UT-3003	Electrical equipment	1 lot	
UT-3004	Instrumentation	1 lot	
UT-3005	Auxiliary equipment	1 lot	
UT-9800	Initial fill Quantity shall be of 6 Months Operation	1 lot	
UT-9900	Spare Parts Quantity shall be of 2 years operation	1 lot	

Figure 6-7-13 Layout Drawing of Natural Gas Receiving Station

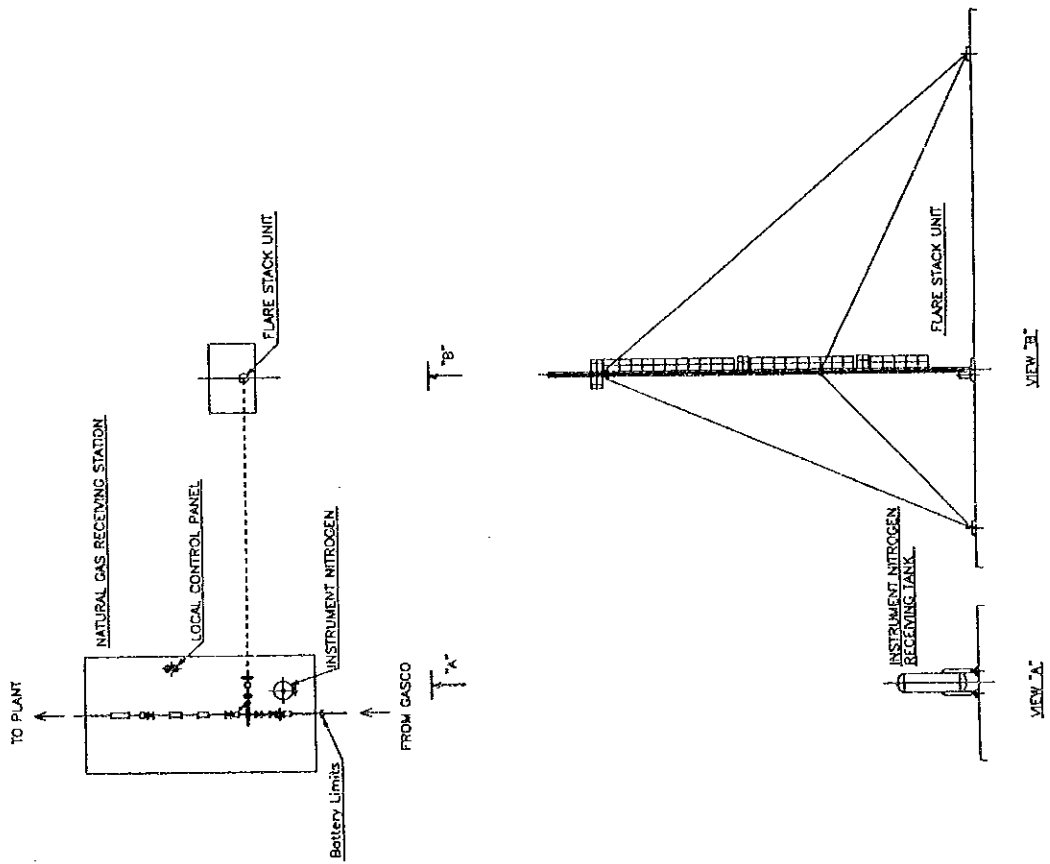
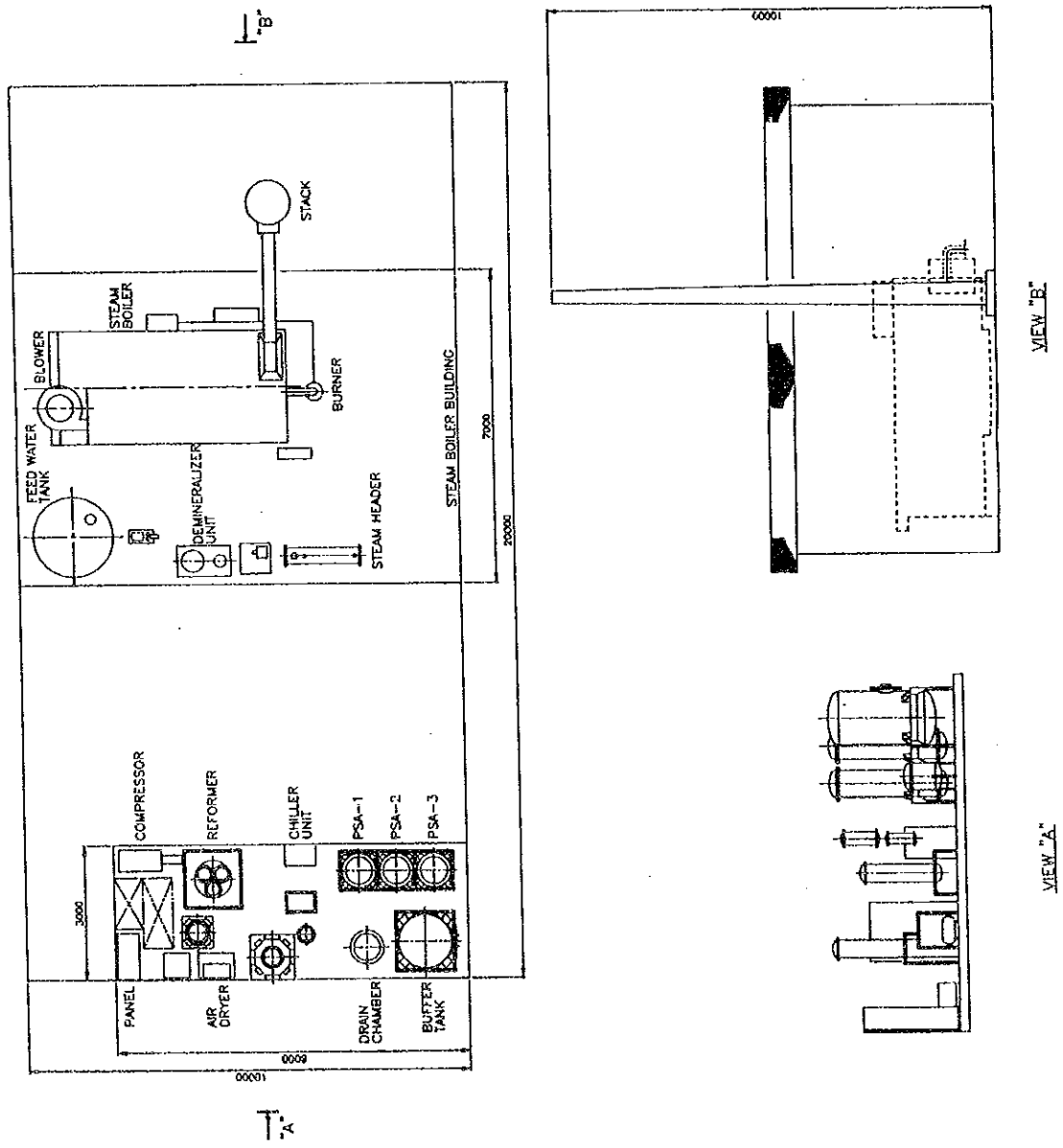


Figure 6-7-14 Layout Drawing of Hydrogen Gas Generator and Steam Generation Station



64790

Figure 6-7-15 Layout Drawing of Raw Water Receiving Station

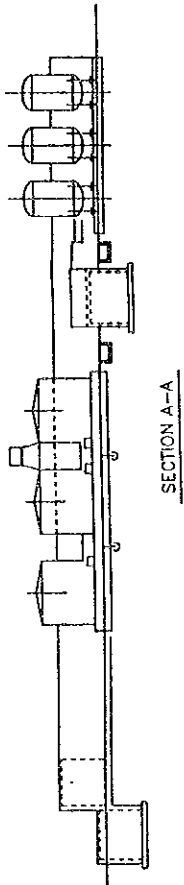
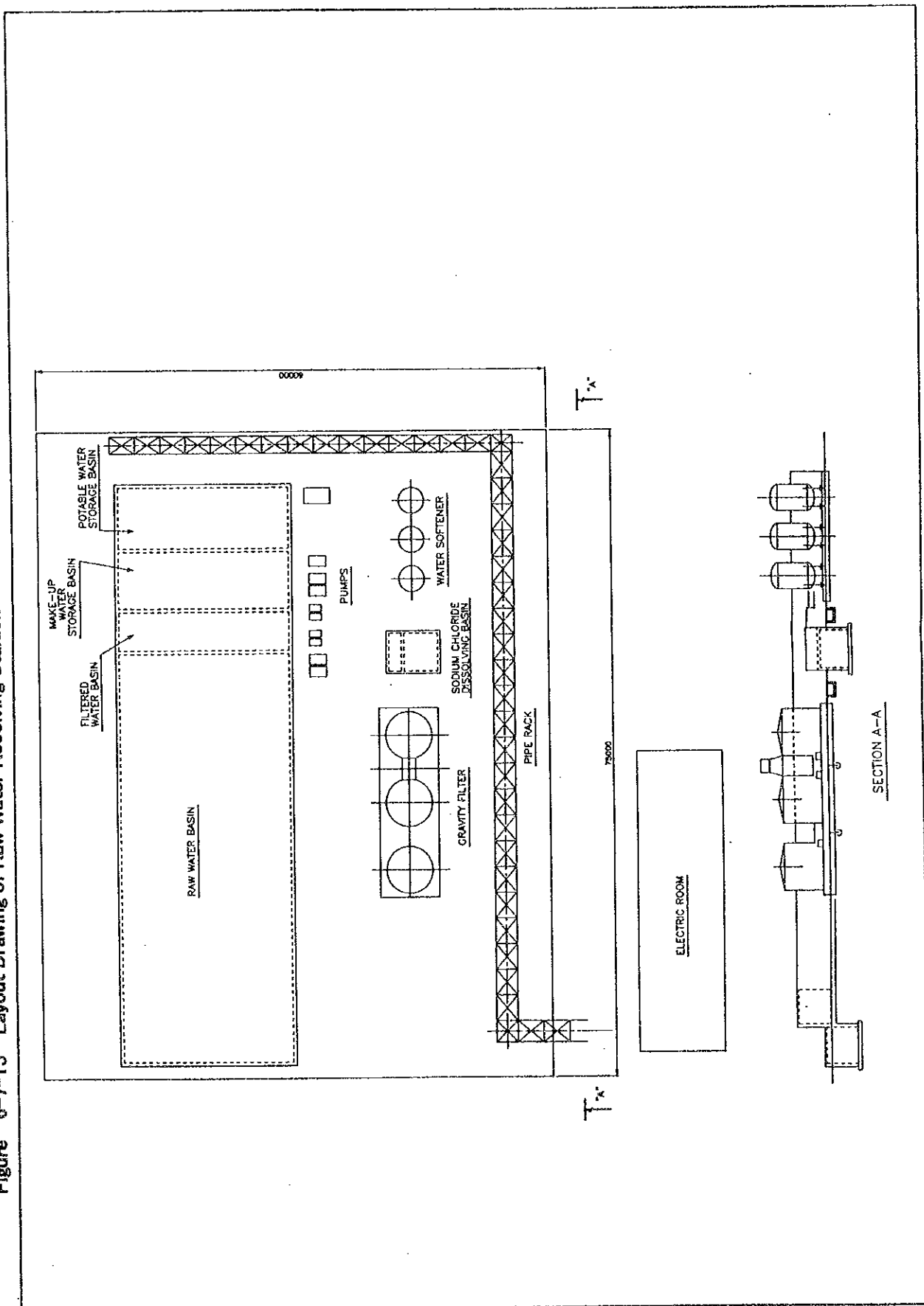


Figure 6-7-16 Layout Drawing of ICW Treatment Station and Air Compression Station

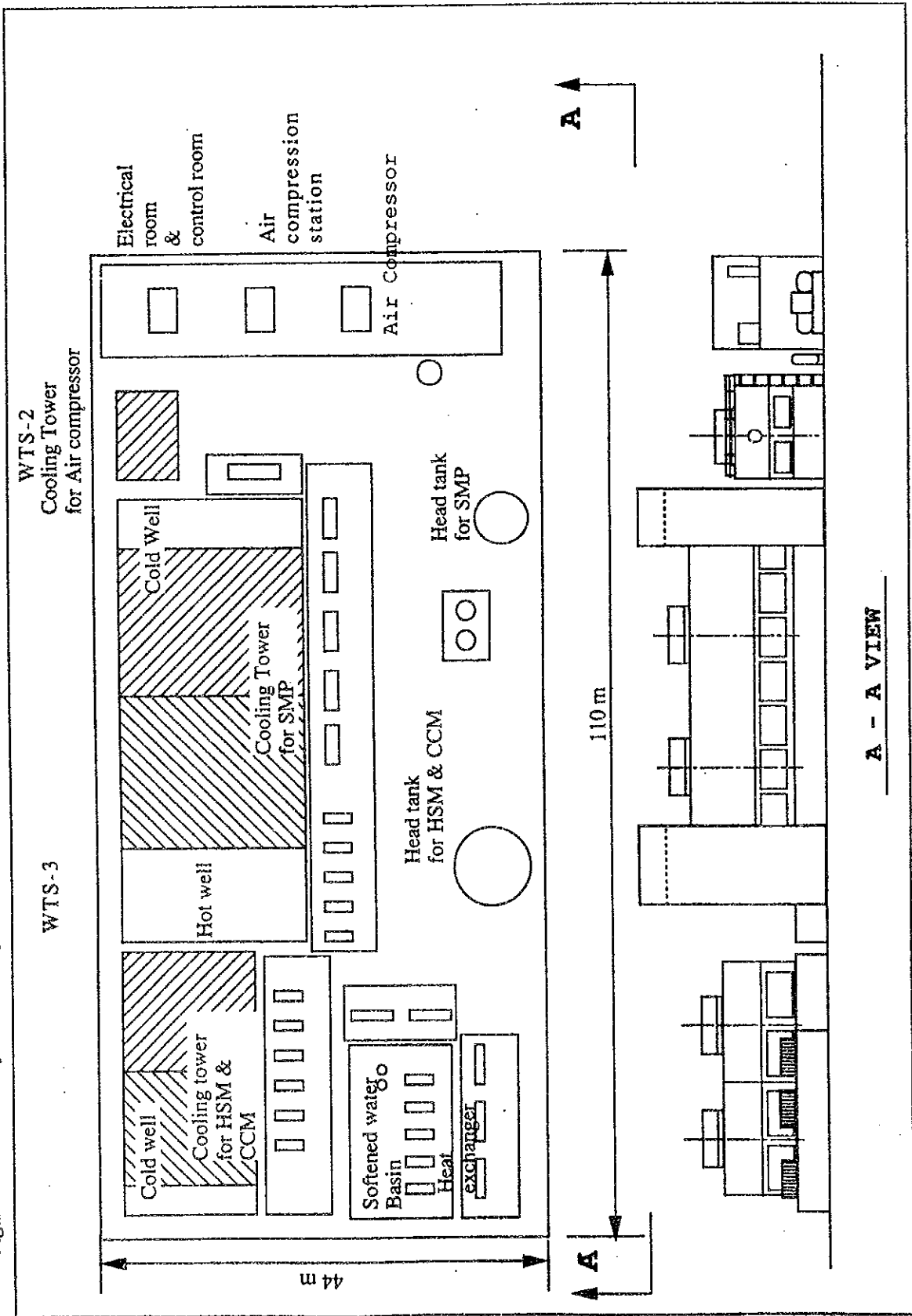


Figure 6-7-17 Layout Drawing of DCW Treatment Station

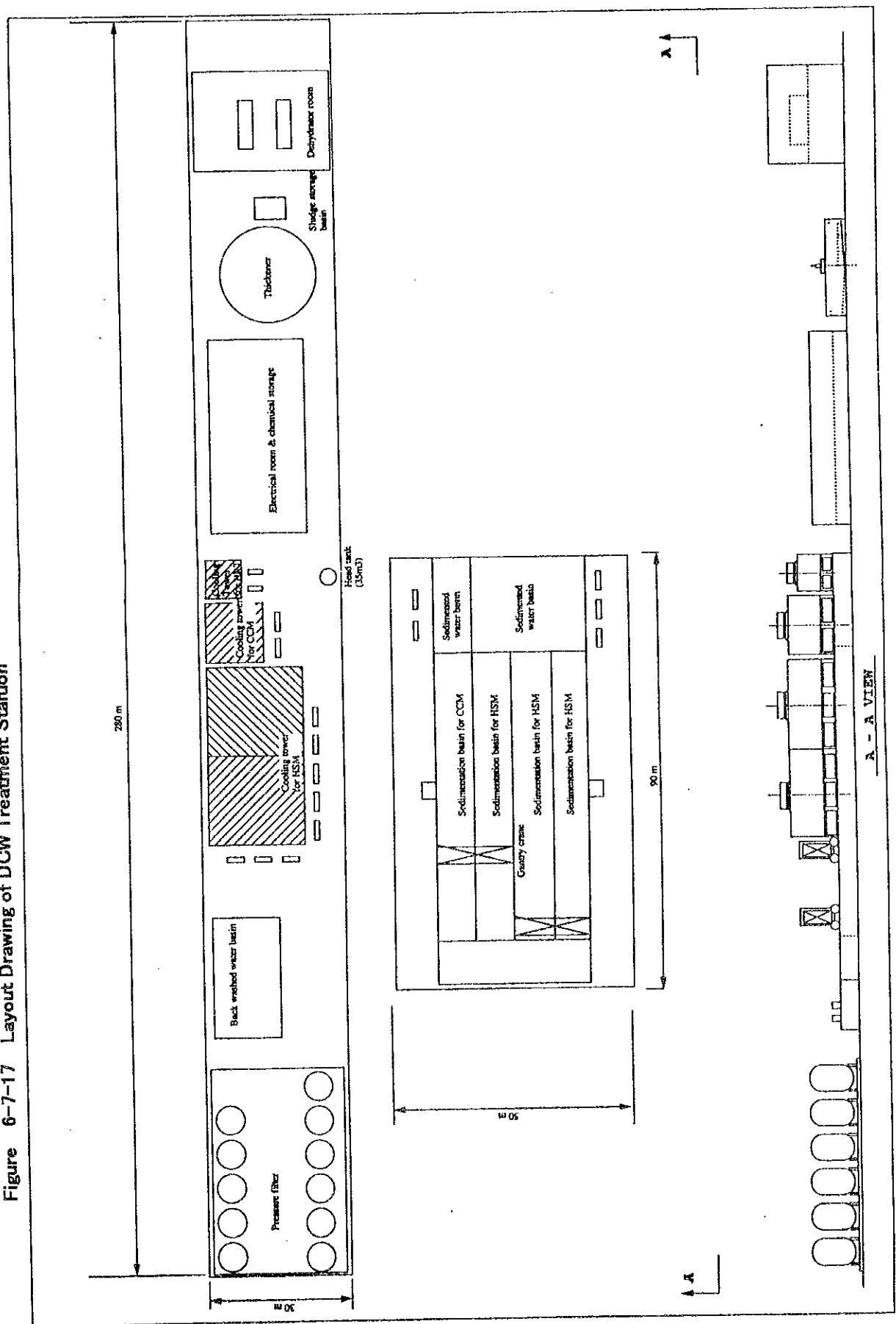
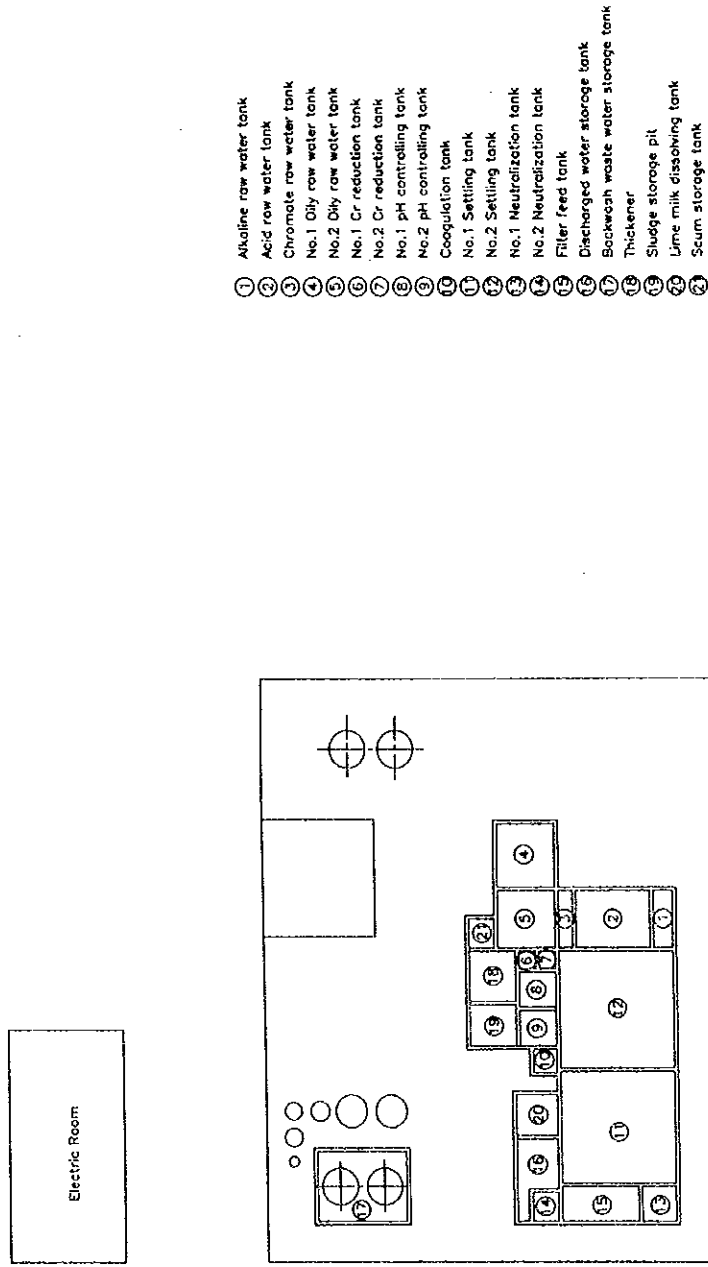
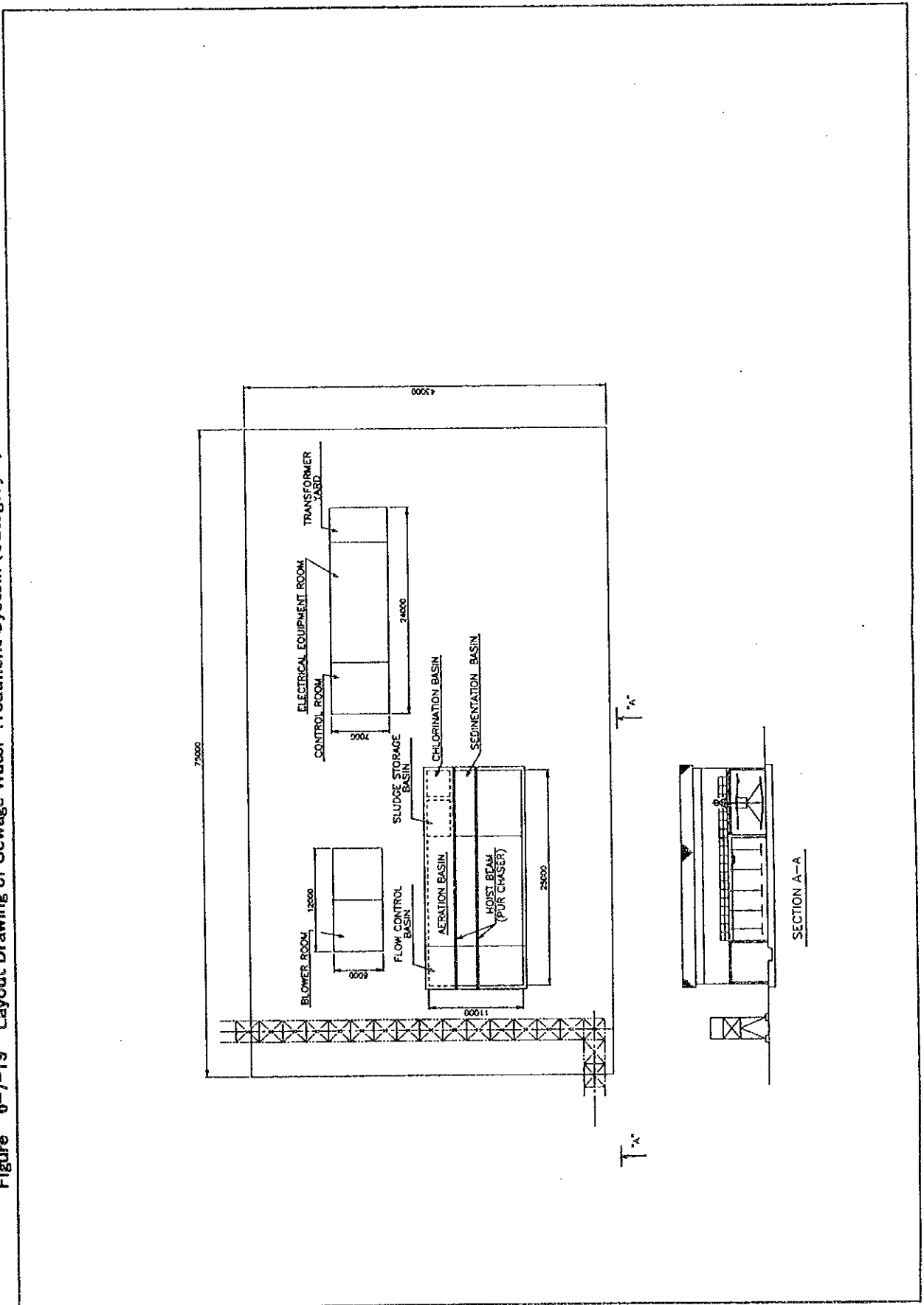


Figure 6-7-18 Layout Drawing of Waste Water Treatment Station (Category 2)



- ① Alkaline raw water tank
- ② Acid raw water tank
- ③ Chromate raw water tank
- ④ No.1 Oily raw water tank
- ⑤ No.2 Oily raw water tank
- ⑥ No.1 Cr reduction tank
- ⑦ No.2 Cr reduction tank
- ⑧ No.1 pH controlling tank
- ⑨ No.2 pH controlling tank
- ⑩ Coagulation tank
- ⑪ No.1 Settling tank
- ⑫ No.2 Settling tank
- ⑬ No.1 Neutralization tank
- ⑭ No.2 Neutralization tank
- ⑮ Filter feed tank
- ⑯ Discharged water storage tank
- ⑰ Backwash waste water storage tank
- ⑱ Thickener
- ⑲ Sludge storage pit
- ⑳ Lime milk dissolving tank
- ㉑ Scum storage tank

Figure 6-7-19 Layout Drawing of Sewage Water Treatment System (Category 3)



Appendix 6A-8 IN-WORKS TRANSPORTATION FACILITIES

**Appendix 6A-8-1 EQUIPMENT LIST OF IN-WORKS
TRANSPORTATION FACILITIES**

Appendix 6A-8-1 In-works Transportation Equipment List

No.	Equipment	Q'ty	Specification
TR01	Material handling		
HS011	Handling of slage and waste		
0111	Crawler crane	2	35 ton
0112	Crawler shovel	4	2 m ³
0113	Wheel shovel	6	1.5 m ³
HS012	Handling of scrap and waste		
0121	Forklift truck	2	1.5 ton
0122	Dump truck	16	14 ton
0123	Flat deck truck	2	10 ton
0124	Slag pot carrier	2	60 ton

Appendix 6A-9 ANALYSIS AND INSEPECTION FACILITIES

**Appendix 6A-9-1 EQUIPMENT LIST OF ANALYSIS AND
INSPECTION FACILITIES**

Appendix 6A-9-1 Equipment List of Analysis and Inspection Facilities

NO.	Equipment	Q'ty	Specification
AI01	Analysis Center		
0101	Abrasive Cut-off Machine	1	Wet cutting type
0102	Automatic Sample Preparation for Lollipop Samples	1	
0103	Double Head Pedestal Grinding Machine	1	
0104	Double Head Pedestal Belt Grinder	1	
0105	Disk Vibrating Mill	1	Batch type
0106	Dust Collector for Grindstone	1	
0107	Vacuum Emission Spectrometer	1	with data processing unit
0108	Fluorescent X-Ray Analyzer	1	with data processing unit and x-ray protection
0109	Carbon and Sulphur Determinator	1	
0110	Nitrogen and Oxygen Determinator	1	
0111	Inductively Coupled Plasma Analyzer	1	
0112	Gas Chromatograph	1	
0113	Orsat Gas Analysis Apparatus	1	
0114	Calorimeter	1	Junker's type
0115	Direct Reading Balance	3	Capacity: 200g Readability: 0.1mg
0116	Electronic Reading Balance	3	Weighing capa: 2800g x 2 sets, 500g x 1 set
0117	Shakers of Separated Funnel	2	
0118	Water Bath	2	Propeller stirring type
0119	Sand Bath (Hot Plate)	2	
0120	Drying Oven	3	Temp. range: 40 to 300°C
0121	Muffle Furnace	2	Electrically heated type Temp.: Max. 1200°C
0122	Annular Electric Furnace	2	
0123	Magnetic Stirrer	2	Reverse & one -way revolution drive
0124	Pure Water Making Apparatus	2	Distillation capa: 1.8 l/h
0125	Ion Regenerator	1	Normal flow rate: 50 l/h
0126	Draft Chamber	3	

NO.	Equipment	Q'ty	Specification
0127	Refrigerator	1	
0128	PH Meter	2	
0129	Moisture Tester	1	
0130	Water Testing Meter	1	
0131	Oil Content Analyzer	1	
0132	Water Bath for Viscosimeter	1	
0133	Centrifuge	1	
0134	Interfacial Tensionmeter for oil	1	
0135	Cloud and Pour Point Apparatus	1	
0136	Dropping Point Tester	1	
0137	Sample Transportation System for EAF, CC, LF	1	One-way reversible compressed air carrier type
0138	Waste Water Treatment Installation	1	
0139	Glass and Polyethylene Wares	1 lot	
0140	Laboratory Furniture	1 lot	
0141	Automatic Voltage Regulator	1	
0142	Miscellaneous	1 lot	
AI02	Material Testing Center		
0201	Polishing Machine	1	
0202	Horizontal Band Saw	1	
0203	Shearing Machines	2	
0204	Milling Machine for Tensile Test Piece	1	
0205	Refrigerator	1	
0206	Ultrasonic Flaw Detector	1	Portable type
0207	Tensile Tester for YP, TS, and Elongation	1	Capacity: Max. 50 tons Full automatic type
0208	Universal Testing Machine	1	Vertical, hydraulic loading type Capacity: Max. 30 tons
0209	Shore Hardness Tester	1	Dial gauge type
0210	Brinell Hardness Tester	1	
0211	Rockwell Hardness Tester	1	
0212	Deep Drawing Tester for Erichsen Test, CCV Test	1	Punching power: 12 tons
0213	Surface Roughness Tester	1	

NO.	Equipment	Q'ty	Specification
0214	Charpy Impact Tester	1	Capacity: 50 kgf-m
0215	V-Bend Press Machine (Powdering test)	1	
0216	Impact press Machine	1	
0217	Lock Forming Tester	1	
0218	Salt Spray Test Apparatus	1	
0219	Fluorescent X-ray Spectrometer for Coating Mass Test of Zn	1	X-ray generator capa.: Max. 3kw Measurement range: 20-400g/m ²
0220	Sampling Puncher for Coating Mass Test	1	Punching diameter: 64.5mm
0221	Universal Projector	1	Vertical optical axis type
0222	Optical Metallographic Microscope	1	
0223	Dark Room Equipment	1	
0224	Pickling Equipment	1	
0225	Jaw Crusher	1	
0226	Rotary Grind Divider	1	Cone type
0227	Disk Vibration Mill	1	
0228	Siever Shaker	1	Square sieve type
0229	Increment Reduction Instrument	1	
0230	Briquette Press	1	Max. load: 50 tons
0231	Specimen Mounting Press	1	Capacity: Max. 5000 Kg
0232	Sample Mixer	1	
0233	Refractory Cutting Machine	1	
0234	Refractory Drilling Machine	1	
0235	Refractory Grinding Machine	1	
0236	ISO Type Drum Testing Machine	1	Tumbler tester
0237	Furnace for Refractoriness Test	1	
0238	Compression Testing Equipment	1	
0239	Refractoriness Tester under Load	1	
0240	Thermal Conductivity Tester	1	
0241	Thermal Expansion Tester	1	
0242	Permeability Apparatus	1	
0243	Optical Pyrometer	1	
0244	Laboratory Furniture	1 lot	
0245	Miscellaneous	1 lot	

Appendix 6A-10 MAINTENANCE SHOP

Appendix 6A-10-1 EQUIPMENT LIST OF MAINTENENCE SHOP

Appendix 6A-10-1 Maintenance Shop Equipment List

No.	Equipment	Q'ty	Specification
MT01	Maintenance shop		
MT011	Mechanical repair		
0111	Lathe	1	1 m
0112	Lathe	1	2.5 m
0113	Lathe	1	5 m
0114	Milling machine	1	
0115	Slotting machine	1	
0116	shaping machine	1	
0117	Boring machine	1	
0118	Radial drilling machine	1	
MT012	Overhaul and assembly shop		Disassembling and assembling
0121	Horizontal press	1	200 ton press
0122	Assembly surface plate		
MT013	Fabrication shop		
0131	Bending roll	1	
0132	Radial drilling machine	1	
0133	Welding machine	1	
MT014	Electrical repair shop		
0141	Winding machine for DC	1	up to 100 kW motor
0142	Winding machine for AC	1	up to 200 kW motor
MT015	Car repair shop		Tool for inspection

Appendix 6A-12 FOUNDATION AND BUILDINGS

Appendix 6A-12-1 FOUNDATION AND BUILDING LIST

1. SUMMARY	Table 6-12-1
2. FOUNDATION LISTS	Table 6-12-2 through Table 6-12-11
3. BUILDING LISTS	Table 6-12-12 through Table 6-12-22
4. LAND PREPARATION	Table 6-12-23

Table 6-12-1 Foundation and Building List (Summary)

Facility	Foundation			Building				
	Type	Concrete(*) (m ³)	Pile (No)	Main Building		Ancillary Building		SS (Ton)
				Type	Area (m ²)	Type	Area (m ²)	
a. Direct Reduction Plant (DRP)	(S),P	33,000	2,800	RC(SS)	2,300	-	-	120
b. Lime Calcining Plant (LCP)	(S),P	2,100	200	-	-	RC	200	240
c. Steel Making Plant (SMP)	P,(D)	47,300	2,500	SS	13,900	RC(SS)	4,000	6,800
d. Hot Strip Mill (HSMP)	(S),P,D	78,200	5,500	SS	42,700	SS(RC)	8,200	7,500
e. Cold Strip Mill (CSMP)	S,P,D	42,900	3,300	SS(RC)	31,200	SS(RC)	3,600	3,900
f. Power & Distribution Facilities	S,(P)	12,000	200	RC	2,000	RC	4,000	-
g. Utility Facilities	S,P	22,700	1,500	RC	3,100	RC	1,300	-
h. In Works Transportation Facilities	(S),P	8,500	500	SS	10,400	RC(SS)	100	1,040
i. Analysis & Inspection Facilities	S	300	-	-	-	RC	300	-
j. Maintenance Shop (MS)	S,P	5,700	300	SS	6,400	SS(RC)	300	660
k. Administrative Facilities	S	9,900	-	RC	6,100	RC(SS)	5,400	40
Total	-	262,600	16,800	-	118,100	-	27,400	20,300
i. Land Preparation	See Table 6-12-23							

Concrete(*) includes that of RC type building.

Remarks

S: Spread Foundation
P: Pile Foundation
D: Deep Foundation

SS: Steel Structure
RC: Reinforced Concrete Structure

Abbreviation

Table 6-12-2 Direct Reduction Plant (DRP)

(Foundation List)

Item	Description	Type of Foundation	Remarks
1. Foundations for building & structure	<ul style="list-style-type: none"> a. Gas analyzer room b. Control building 	<ul style="list-style-type: none"> P P 	<ul style="list-style-type: none"> A= 50 m² A=1,250 m²
2. Foundations for equipment & machinery	<ul style="list-style-type: none"> a. Oxide pellet storage bin b. Oxide pellet screen c. Reduction shaft furnace & elevator d. Process & cooling gas compressor e. Air blower f. Reformer, heat recovery system & stack etc. 	<ul style="list-style-type: none"> P P P S & P P P 	
3. Roads & paving	<ul style="list-style-type: none"> g. Clarifier & thickener h. DRI storage bin i. DRI screen j. Conveyor k. Dust collector l. Settling pond m. Cooling tower with pump n. Pipe rack, junction tower etc. 	<ul style="list-style-type: none"> P P P P P S P S & P 	<ul style="list-style-type: none"> A=28,000 m²
4. Drainage system	<ul style="list-style-type: none"> a. Asphalt paving(t=50 mm) a. Drainage pipe for storm water (RC pipe) b. Sanitary sewage pipe (PVC pipe) 	<ul style="list-style-type: none"> - - - 	
5. Other	<ul style="list-style-type: none"> a. Miscellaneous 	<ul style="list-style-type: none"> - 	

Abbreviation

S: Spread foundation P: Pile foundation D: Deep foundation

Table 6-12-3 Lime Calcining Plant (LCP)

Item	Description	Type of Foundation	Remarks
1. Foundations for building & structure	a. Control building	P	A= 200 m ²
2. Foundations for equipment & machinery	a. Receiving hopper	P	
	b. Limestone storage bin	P	
	c. Lime calcining kiln	P	
	d. Product bin	P	
	e. Conveyor	S & P	
	f. Rejected material pile	S	
3. Yard preparation	a. Lime stone storage yard	S	
4. Roads & paving	a. Asphalt paving(t=50 mm)	-	A=9,000 m ²
5. Drainage system	a. Drainage pipe for storm water (RC pipe)	-	
	b. Sanitary sewage pipe (PVC pipe)	-	
6. Other	a. Miscellaneous	-	

S: Spread foundation P: Pile foundation D: Deep foundation

Abbreviation

Table 6-12-4 Steel Making Plant (SMP)

Item	Description	Type of Foundation	Remarks
1. Foundations for building & structure	<ul style="list-style-type: none"> a. Main building b. Ancillary building 	<ul style="list-style-type: none"> P P 	<ul style="list-style-type: none"> A=13,900 m² A= 2,100 m²
2. Foundations for equipment & machinery	<ul style="list-style-type: none"> a. Electric arc furnace (EAF) b. Material handling system c. Ladle furnace (LF) d. Transfer car for EAF & LF e. Dust collector and duct support f. Slab caster (including ladle turret and runoff table) 	<ul style="list-style-type: none"> P P P P P P 	
3. Pits & culverts	<ul style="list-style-type: none"> g. Scale sluice & scale pit h. Segment transfer car a. Scrap pit b. Cable & piping culvert 	<ul style="list-style-type: none"> D & P P P P 	<ul style="list-style-type: none"> Sheeting or diaphragm wall
4. Slab on grades	<ul style="list-style-type: none"> a. Ground floor slab for scrap bucket, ladle & relining, dryer, preparation, digout, slag pot, roof stand & tundish yard, mould & segment yard 	<ul style="list-style-type: none"> P 	
5. Yard preparation	<ul style="list-style-type: none"> a. Scrap yard & slag yard 	<ul style="list-style-type: none"> - 	
6. Roads & paving	<ul style="list-style-type: none"> a. Asphalt paving(t=50 mm) 	<ul style="list-style-type: none"> - 	<ul style="list-style-type: none"> A=10,000 m²
7. Drainage system	<ul style="list-style-type: none"> a. Drainage pipe for storm water (RC pipe) b. Sanitary sewage pipe (PVC pipe) 	<ul style="list-style-type: none"> - - 	
8. Other	<ul style="list-style-type: none"> a. Miscellaneous 	<ul style="list-style-type: none"> - 	

Abbreviation S: Spread foundation P: Pile foundation D: Deep foundation

Table 6-12-5 Hot Strip Mill (HSMP)

Item	Description	Type of Foundation	Remarks
1. Foundations for building & structure	<ul style="list-style-type: none"> a. Main building b. Ancillary building 	(D) & P (D) & P & S	<ul style="list-style-type: none"> A=42,700 m² A= 4,900 m²
2. Foundations for equipment & machinery	<ul style="list-style-type: none"> a. Slab conveyor b. Reheating furnace(charger/extractor) c. Mill (including Hydraulic scale breaker, Roughing mill,Coil box,Crop shear,Finish Mill, Runout cooling. Down coiler, Coil inspection etc.) d. Roll shop(including roll transfer car) e. Plate line f. Skippass mill g. Transfer car for plate & coil h. Coil conveyor i. Mill scale pit j. Runout scale pit & stabilizer 	<ul style="list-style-type: none"> P & S P P P P D & P P 	<ul style="list-style-type: none"> Sheeting or diaphragm wall , do do do
3.Pits & culverts	<ul style="list-style-type: none"> a. Cable/piping pits & culverts 	S	do
4.Cellar	<ul style="list-style-type: none"> a. Motor room 	D & P	do
5.Slab on grades	<ul style="list-style-type: none"> a. Slab yard b. Transformer yard 	P	
6.Roads & paving	<ul style="list-style-type: none"> c. Plate cooling & gas cutting yard d. Coil cooling yard 	P	
7.Drainage system	<ul style="list-style-type: none"> a. Asphalt paving(t=50 mm) a. Drainage pipe for storm water (RG pipe) b. Sanitary sewage pipe (PVC pipe) 	P & S	A=30,000 m ²
8.Other	<ul style="list-style-type: none"> a. Miscellaneous 	-	

S:Spread foundation P:Pile foundation D:Deep foundation

Abbreviation

Table 6-12-6 Cold Strip Mill (CSMP)

Item	Description	Type of Foundation	Remarks
1. Foundations for building & structure	a. Main building b. Ancillary building	P S & P	A=31,200 m ² A= 2,700 m ²
2. Foundations for equipment & machinery	a. Pickling line b. Reversing mill c. Temper mill d. Batch annealing furnace e. Recoiling line f. Hot dip galvanizing line g. Roll shop h. Coil transfer car i. Acid generation plant	D & P (D) & P D & P P P (D) & P P S & P S & P	Sheeting or diaphragm wall do do do
3. Pits & culverts	a. Cable pits & culverts	S & P	do
4. Cellars	a. Mill cellar	D & P	do
5. Slab on grades	a. Coil storage yard	P	do
6. Roads & paving	a. Asphalt paving (t=50 mm)	-	A=16,000 m ²
7. Drainage system	a. Drainage pipe for storm water (RC pipe) b. Sanitary sewage pipe (PVC pipe)	-	
8. Other	a. Miscellaneous	-	

Abbreviation

S: Spread foundation P: Pile foundation

D: Deep foundation

Table 6-12-7 Power & Distribution Facilities

(Foundation List)

Item	Description	Type of Foundation	Remarks
1. Foundations for building & structure	<ul style="list-style-type: none"> a. Main substation b. Local substation 	P P	<ul style="list-style-type: none"> A=2,000 m² A=1,700 m²
2. Foundations for equipment & machinery	<ul style="list-style-type: none"> a. Transformer b. Pressurized tank c. Cooling tower d. Air filter e. Dummy tank f. Fuel oil tank g. Flicker yard 	P S S S S S S	
3. Pits & culverts	<ul style="list-style-type: none"> a. Cable culverts 	S	A=6,000 m ²
4. Roads & paving	<ul style="list-style-type: none"> a. Asphalt paving(t=50 mm) 	-	
5. Drainage system	<ul style="list-style-type: none"> a. Drainage pipe for storm water (RC pipe) b. Sanitary sewage pipe (PVC pipe) 	- -	
6. Other	<ul style="list-style-type: none"> a. Perimeter fence b. Miscellaneous 	- -	L=450 m

Abbreviation S: Spread foundation P: Pile foundation D: Deep foundation

(Foundation List)

Table 6-12-8 Utility Facilities

Item	Description	Type of Foundation	Remarks
1. Foundations for building & structure	<ul style="list-style-type: none"> a. Electrical and control room b. Other buildings 	P	A= 1,900 m ²
2. Foundations for equipment, vessel and basin etc.	<ul style="list-style-type: none"> a. Natural gas receiving station b. Hydrogen gas and steam generation station c. Raw water receiving station d. ICW treatment station <ul style="list-style-type: none"> -Cold well & cooling tower for CCM & HSM -Hot/cold well & cooling tower for SMP -Cooling tower for air compressor -Softened water basin -Heat exchanger e. DCW treatment station <ul style="list-style-type: none"> -Head tank for SMP & CCM/HSM -Pressure filter -Back washed water basin -Cooling tower for CCM/HSM/HRT -Head tank -Thickener -Sludge storage basin -Sedimentation basin for CCM/HSM f. Waste water treatment station g. Sewage water treatment station h. Drainage pumping station i. Pipe rack <ul style="list-style-type: none"> a. Asphalt paving(t=50 mm) a. Drainage pipe for storm water (RC pipe) b. Sanitary sewage pipe (PVC pipe) 	<ul style="list-style-type: none"> S & P S & P S & P S & P 	A= 700 m ²
3. Roads & paving		S & P	
4. Drainage system		-	
5. Other		-	A=12,000 m ²

Abbreviation

S: Spread foundation P: Pile foundation D: Deep foundation

Table 6-12-9 In-Works Transportation Facilities

(Foundation List)

Item	Description	Type of Foundation	Remarks
1. Foundations for building & structure	a. Refractory warehouse building and other	P	A=10,500 m ²
2. Foundations for equipment & machinery	a. Truck scale	P	
3. Slab on grades	a. Ground floor of warehouse	S & P	
4. Roads & paving	a. Asphalt paving(t=50 mm)	-	A=4,000 m ²
5. Drainage system	a. Drainage pipe for storm water (RC pipe)	-	
6. Other	b. Sanitary sewage pipe (PVC pipe)	-	
	a. Miscellaneous		

S: Spread foundation

P: pile foundation

D: Deep foundation

Abbreviation

Table 6-12-10 Analysis & Inspection Facilities

Item	Description	Type of Foundation	Remarks
1. Foundations for building & structure	a. Laboratory building	S	A= 300 m ²
2. Roads & paving	a. Asphalt paving(t=50 mm)	-	
3. Drainage system	a. Drainage pipe for storm water (RC pipe)	-	
	b. Sanitary sewage pipe (PVC pipe)	-	
4. Other	a. Miscellaneous	-	

Abbreviation S: Spread foundation P: Pile foundation D: Deep foundation

Table 6-12-11 Maintenance Shop (MS)

Item	Description	Type of Foundation	Remarks
1. Foundations for building & structure	<ul style="list-style-type: none"> a. Main building b. Ancillary building 	P S & P	A=6,400 m ² A= 300 m ²
2. Foundations for equipment & machinery	<ul style="list-style-type: none"> a. Lathe b. Milling & grinding machine c. Press machine 	P P P	
3. Slab on grades	<ul style="list-style-type: none"> a. Ground floor slab of maintenance shop b. Ground floor slab of car repair shop 	S S	
4. Roads & paving	<ul style="list-style-type: none"> a. Asphalt paving (t=50 mm) 	-	A=1,000 m ²
5. Drainage system	<ul style="list-style-type: none"> a. Drainage pipe for storm water (RC pipe) b. Sanitary sewage pipe (PVC pipe) 	- -	
6. Other	<ul style="list-style-type: none"> a. Miscellaneous 	-	

S: Spread foundation

P: Pile foundation

D: Deep foundation

Abbreviation

(Building List) Table 6-12-12 Direct Reduction Plant (DRP)

Item Name of Building	No of Building	No of Story	Dimension W(m)xL(m)	Building Area(m ²)	Total F.Area(m ²)	Eaves Height(m)	Structure/Finish		
							Structure	Roofing Siding	
1.Gas analyzer room	1	1	5x10	50	50	5	SS	MS	MS
2.Control building	1	2	25x50	1,250	2,250	11	RC	RCS	MB

Abbreviation

SS:Steel Structure
RC:Reinforced Concrete
MB:Masonry Brick

MS: Metal Sheet
RCS:Reinforced Concrete Slab

Table 6-12-13 Lime Calcining Plant (LCP)

Item Name of Building	No of Building	No of Story	Dimension W(m)xL(m)	Building Area(m ²)	Total F.Area(m ²)	Eaves Height(m)	Structure/Finish	
							Structure	Roofing Siding
1.Control building	1	1	10x20	200	200	5	RC	RCS MB

Abbreviation

SS:Steel Structure
RC:Reinforced Concrete
MB:Masonry Brick

MS :Metal Sheet
RCS:Reinforced Concrete Slab

Table 6-12-14 Steel Making Plant (SMP)

Item Name of Building	No of Building	No of Story	Dimension W(m)xL(m)	Building Area(m ²)	Total F.Area(m ²)	Eaves Height(m)	Structure/Finish		
							Structure	Roofing	Siding
(Main Building)									
1.Material handling yard	1	1	15x 96	1,440	1,440	32	SS	MS	MS
2.EAF yard	1	1	30x 96	2,880	2,880	42	SS	MS	MS
3.Ladle yard	1	1	30x 96	2,880	2,880	42	SS	MS	MS
4.Casting yard	1	1	35x120	4,200	4,200	35	SS	MS	MS
5.Mould & Segment preparation yard	1	1	35x 72	2,520	2,520	28	SS	MS	MS
(Ancillary Building)									
1.EAF electric & control room	1	2		400	800	18	RC	RCS	RC
2.LF electric & control room	1	3		200	500	15	RC	RCS	RC
3.COM electric & control room	1	2		450	900	9	RC	RCS	RC
4.Emergency generator room	1	1		160	160	8	RC	MS	MB
5.Pulpits	1	3		90	270	18	SS	RCS	RC
6.Dehydration room	1	2		600	1,200	18	RC	RCS	MB
7.Laboratory	1	1		100	100	4	RC	MS	MB
8.Amenity (rest) room	3	1		20	60	4	RC	MS	MB

Abbreviation

SS:Steel Structure
RC:Reinforced Concrete
MB:Masonry Brick

MS :Metal Sheet
RCS:Reinforced Concrete Slab

Table 6-12-15 Hot Strip Mill (HSMP)

Item Name of Building	No of Building	No of Story	Dimension W(m)xL(m)	Building Area(m ²)	Total F.Area(m ²)	Eaves Height(m)	Structure/Finish	
							Structure	Roofing Siding
(Main Building)								
1.Slab Yard	1	1	35x72	2,520	2,520	25	SS	MS MS
	1	1	35x96	3,360	3,360	25	SS	MS MS
2.Reheat.furnace Yard	1	1	30x45	1,350	1,350	25-28	SS	MS MS
	1	1	28x45	1,260	1,260	25-28	SS	MS MS
3.Mill yard	1	1	28x300	8,400	8,400	25	SS	MS MS
4.Roll shop	1	1	30x135	4,050	4,050	22	SS	MS MS
5.Motor room	1	1	25x150	3,750	3,750	22	SS	MS MS
6.Flat storage Yard	1	1	30x120	3,600	3,600	25	SS	MS MS
7.Level & cut Yard	1	1	30x120	3,600	3,600	25	SS	MS MS
8.Skinpass Mill Yard	1	1	30x180	5,400	5,400	25	SS	MS MS
9.Coil storage Yard	1	1	30x180	5,400	5,400	-	SS	-
(Ancillary Building)								
1.Electric & control room for RF,FM,FM,DC,RS and SM	6	2		700	6,600	10	SS	MS MS
2.Pulpits	4	1		70	280	4	RC	MS MB
3.Grease station	1	1		50	50	10	SS	MS MS
4.Fan and air condition room	2	1		450	900	5	RC	RCS MB
5.Laboratory	1	1		70	70	4	RC	MS MB
6.Rest room	5	1		60	300	4	RC	MS MB

Abbreviation

SS:Steel Structure
RC:Reinforced Concrete
MB:Masonry Brick

MS :Metal Sheet
RCS:Reinforced Concrete Slab

Table 6-12-16 Cold Strip Mill (CSMP)

Item Name of Building	No of Building	No of Story	Dimension W(m)xL(m)	Building Area(m ²)	Total F. Area(m ²)	Eaves Height(m)	Structure/Finish	
							Structure	Roofing / Siding
(Main Building)								
1.PPL yard	1	1	20x315	6,300	6,300	20	SS	MS SS
2.Rolling yard for RM, TM & RS	1	1	30x255	7,650	7,650	20	SS	MS SS
3.BAF & RCL yard	1	1	30x315	9,450	9,450	20-22	SS	MS SS
4.CGL yard	1	1	20x315	6,300	6,300	20-31	SS	MS SS
5.Motor room	1	1	25 x60	1,500	1,500	8	RC	RCS RC
(Ancillary Building)								
1.Electric & control room for								
-PPL	1	2		450	900	12	SS	MS SS
-BAF	1	1		225	225	5	RC	RCS MB
-RCL	1	1		225	225	5	RC	RCS MB
-CGL	1	2		450	900	12	SS	MS SS
2.Maintenance shop for CGL	1	1		450	450	9	SS	MS SS
3.Pulpits	12	1		50	600	4	RC	RCS MB
4.Rest room	6	1		50	300	4	RC	RCS MB

Abbreviation

SS:Steel Structure
RC:Reinforced Concrete
MB:Masonry Brick

MS :Metal Sheet
RCS:Reinforced Concrete Slab

Table 6-12-17 Power & Distribution Facilities

Item Name of Building	No of Building	No of Story	Dimension W(m)xL(m)	Building Area(m ²)	Total F.Area(m ²)	Eaves Height(m)	Structure/Finish	
							Structure	Roofing / Siding
(Main substation)								
1.220kv GIS room	1	1	10x50	500	500	10	RC	RCS MB
2.33kv MCS room	1	1	13x60	780	780	5	RC	RCS MB
3.Control room	1	1	6x30	180	180	5	RC	RCS MB
4.AC generator and D/E room	1	1	13x15	195	195	5	RC	RCS MB
			15x20	300	300	5	RC	RCS MB
(Local substation)								
1.EAF substation	1	4		300	1,200	10	RC	RCS MB
-Switchgear room								
-Panel room								
-Wiring room								
2.HSM substation	1	2		1,400	2,800	10	RC	RCS RC
-Switchgear room								
-Panel room								
-Wiring room								

Abbreviation

SS:Steel Structure
 RC:Reinforced Concrete
 MB:Masonry Brick
 MS: Metal Sheet
 RCS:Reinforced Concrete Slab

Table 6-12-18 Utility Facilities

Item Name of Building	No of Building	No of Story	Dimension W(m)xL(m)	Building Area(m ²)	Total F.Area(m ²)	Eaves Height(m)	Structure/Finish	
							Structure	Roofing Siding
(Electric & control room)								
1.Raw water receiving station	1	1	10x35	350	350	4	RC	MS MB
2.ICW treatment station	1	2	10x45	450	900	12	RC	RCS MB
3.DCW treatment station	1	2	20x40	800	1,600	9	RC	MS MB
4.Waste water treatment station	1	1	150	150	150	4	RC	RCS MB
5.Sewage water treatment station	1	1	7x20	140	140	4	RC	RCS MB
(Other building)								
1.Steam boiler building	1	1		70	70	5	RC	MS MB
2.Dehydrator room for DCW treatment station	1	2	20x30	600	1,200	15	RC	RCS MB
3.Blower room for sewage water treatment station	1	1		70	70	4	RC	RCS MB

Abbreviation
 MS: Metal Sheet
 RCS: Reinforced Concrete Slab
 SS: Steel Structure
 RC: Reinforced Concrete
 MB: Masonry Brick

Table 6-12-19 In-Works Transportation Facilities

Item Name of Building	No of Building	No of Story	Dimension W(m)xL(m)	Building Area(m ²)	Total F.Area(m ²)	Eaves Height(m)	Structure/Finish	
							Structure	Roofing / Siding
(Main building)								
1.Warehouse for brick & electrode	1	1	40X140	5,600	5,600	12	SS	MS MB
2.Warehouse for additive	1	1	30x80	2,400	2,400	12	SS	MS MB
3.Warehouse for spare parts	1	1	30x80	2,400	2,400	12	SS	MS MB
(Ancillary building)								
1.Weighing station	2	1		15	30	4	SS	MS
2.Warehouse office	1	1		50	50	4	RC	RCS MB

Abbreviation

SS:Steel Structure
RC:Reinforced Concrete
MB:Masonry Brick

MS: Metal Sheet
RCS:Reinforced Concrete Slab

(Building List)

Table 6-12-20 Analysis & Inspection Facilities

Item Name of Building	No of Building	No of Story	Dimension W(m)xL(m)	Building Area(m2)	Total F.Area(m2)	Eaves Height(m)	Structure/Finish		
							Structure	Roofing Siding	
1.Laboratory	1	1	15x20	300	300	5	RC	RCS	MB

Abbreviation

SS:Steel Structure
RC:Reinforced Concrete
MB:Masonry Brick

MS :Metal Sheet
RCS:Reinforced Concrete Slab

Table 6-12-21 Maintenance Shop (MS)

Item Name of Building	No of Building	No of Story	Dimension W(m)xL(m)	Building Area(m ²)	Total F.Area(m ²)	Eaves Height(m)	Structure/Finish		
							Structure	Roofing	Siding
(Main Building)									
1.Machine shop & electric repair shop	1	1	20x90	1,800	1,800	12	SS	MS	MS
2.Assembly shop	1	1	20x90	1,800	1,800	12	SS	MS	MS
3.Fabrication shop	1	1	20x90	1,800	1,800	12	SS	MS	MS
4.Car repair shop	1	1	20x50	1,000	1,000	9	SS	MS	MS
(Ancillary Building)									
1.Transformers room	1	1		30	30	4	SS	MS	MS
2.Tool storage room	3	1		50	150	4	SS	MS	MS
3.Rest room	2	1		50	100	4	RC	RCS	MB

Abbreviation
 MS: Metal Sheet
 RCS: Reinforced Concrete Slab
 SS: Steel Structure
 RC: Reinforced Concrete
 MB: Masonry Brick

Table 6-12-22 Administrative Facilities

Item Name of Building	No of Building	No of Story	Dimension W(m)xL(m)	Building Area(m ²)	Total F.Area(m ²)	Eaves Height(m)	Structure/Finish	
							Structure	Roofing / Siding
1.Main office	1	3	12x170	2,040	6,120	12	RC	RCS RC
2.Canteen	1	1	25x30	750	750	4	RC	RCS MB
3.Clinic	1	1	10x25	250	250	4	RC	RCS MB
4.Guard office	1	1	10x20	200	200	4	RC	RCS MB
5.Fire fighting station	1	1	10x30	300	300	5	SS	MS
6.Site office for								
-SMP	1	2	15x40	600	1,200	8	RC	RCS MB
-HSMP	1	2	20x30	600	1,200	8	RC	RCS MB
-CSMP	1	2	15x30	450	900	8	RC	RCS MB
-Maintenance shop	1	1	20x30	600	600	4	RC	RCS MB
7.Parking lot					LS			
8.Sprinkler system					LS			
9.Landscaping					LS			

Abbreviation

SS:Steel Structure
RC:Reinforced Concrete
MB:Masonry Brick

MS :Metal Sheet
RCS:Reinforced Concrete Slab

Table 6-12-23 Land Preparation

Item	Description	Requirement	Remarks
1.Land acquisition		600x10 ³ m ²	
2.Preparation Work	a. Survey & subsoil Exploration	LS	
3.Earth Work	a. Embankment & filling	2,700x10 ³ m ³	Finishing E.L.= +4.5 m
	b. Improvement of subsoil	LS	
4.Road & Drainage	c. Slope protection	21x10 ³ m ²	i=1/1-1/1.5
5.Demolition & Relocation Work	a. Temporary road & drainage	LS	
6.Other	a. Gates	7 units	
	b. Perimeter fence(Brick wall H=3m)	6x10 ³ m	

Appendix 8A-1 ENVIRONMENTAL SIMULATION FOR ASSESSMENT

Appendix 8A-1 ENVIRONMENTAL SIMULATION FOR ASSESSMENT

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

1. Basic Data

1-1 Climate and Sea Conditions

1-1-1 Climate

1) Ambient temperature (°C)

Annual mean	: 20.1
max.	: 24.2
min.	: 16.3

2) Barometric Pressure (mbar)

Annual mean	: 1,014.6
max.	: 1,020.2
min.	: 1,009.2

3) Relative Humidity (%)

Annual mean	: 68
max.	: 73
min.	: 64

4) Rainfall (mm)

Annual mean	: 168.0
-------------	---------

5) No. of days with rain (≥ 1.0 mm): Annual total 23.4

6) Wind

Prevailing direction:	Spring	NNW to NNE
	Summer	N to NNW
	Autumn	N to NNE
	Winter	WSW to NNE

Mean scalar wind : Annual mean 9.3 knots speed

Detailed wind data is shown in Tables 8A-1-1 and 8A-1-2.

1-1-2 Sea conditions

1) Tide levels

High water level	: + 0.52 m
Mean water level	: + 0.33 m
Low water level	: + 0.11 m

2) Tidal current

Velocity (m/s)	: 0.08 - 0.23
Direction	: E/ESE and NW/NNW

3) Wave height

Height (m)	: 0.2 - 0.5 and 1.0 - 1.4
Period (s)	: 8.5 - 9.2

Table 8A-1-1 Surface Wind Direction at El Dekhela

Month	Mean scalar wind speed (knots)	Frequency percentage by direction																Variable	Calm
		345° / 014°	015° / 044°	045° / 074°	075° / 104°	105° / 134°	135° / 164°	165° / 194°	195° / 224°	225° / 254°	255° / 284°	285° / 314°	315° / 344°						
		Jan	10.2	5.8	2.9	1.9	2.5	4.2	5.1	4.6	10.2	18.6	11.5	16.2	14.4	0.1	2.0		
Feb	9.1	14.7	13.1	5.3	7.7	5.4	5.8	4.2	4.8	3.8	4.6	10.0	18.9	0.1	1.7				
Mar	10.5	13.0	7.2	6.4	5.9	7.7	7.6	4.7	4.2	3.7	5.5	10.6	20.6	0.4	2.5				
Apr	9.8	15.1	14.4	10.3	9.5	10.4	5.2	3.2	1.8	0.9	2.5	6.9	18.1	0.3	1.4				
May	9.0	22.2	22.7	9.0	4.6	4.1	3.9	1.6	0.9	0.7	2.3	5.7	20.4	0.1	1.8				
Jun	9.8	33.5	15.3	3.1	1.2	1.2	1.4	0.7	0.6	0.8	1.0	7.8	31.0	0.1	2.2				
Jul	9.4	28.8	7.3	0.8	0.5	0.1	0.7	0.1	0.4	0.5	2.5	12.9	43.8	0.1	1.5				
Aug	10.2	32.0	5.8	1.2	0.0	0.0	0.0	0.0	0.5	0.6	1.0	9.3	49.3	0.0	0.3				
Sep	9.0	38.4	18.8	2.6	0.6	0.5	1.5	1.9	1.2	0.7	0.7	4.2	27.1	0.2	0.6				
Oct	8.0	21.2	21.6	11.8	6.6	5.1	6.2	3.0	3.2	2.6	1.7	3.3	12.5	0.1	1.1				
Nov	8.0	12.5	17.6	13.6	11.7	5.5	2.8	3.8	4.8	3.4	3.2	6.6	11.1	0.1	3.3				
Dec	8.2	9.2	10.3	9.1	10.9	7.9	5.9	7.2	8.3	13.6	5.8	2.7	6.0	0.4	2.7				
Annual mean	9.3	20.5	13.1	6.2	5.1	4.3	3.9	2.9	3.4	4.2	3.5	8.0	22.8	0.2	1.9				

Table 8A-1-2 Surface Wind Speed at El Dekhiela

Month	Frequency percentage by speed									
	1 - 3 knots	4 - 6	7 - 10	11 - 16	17 - 21	22 - 27	28 - 33	> 33		
Jan	11.5	17.8	25.8	27.7	10.1	4.5	0.6	0.0		
Feb	13.7	22.1	29.3	25.6	5.3	1.6	0.7	0.0		
Mar	9.1	13.8	29.2	32.7	10.4	2.2	0.1	0.0		
Apr	9.1	15.9	36.4	32.7	3.9	0.6	0.0	0.0		
May	11.2	18.3	37.8	29.8	1.1	0.0	0.0	0.0		
Jun	7.7	14.0	39.4	33.9	2.8	0.0	0.0	0.0		
Jul	8.9	16.3	38.3	33.1	1.9	0.0	0.0	0.0		
Aug	7.0	11.8	36.0	40.6	4.3	0.0	0.0	0.0		
Sep	10.0	14.0	36.6	36.1	1.7	0.0	0.0	0.0		
Oct	14.8	19.7	35.8	27.5	1.1	0.0	0.0	0.0		
Nov	17.2	21.3	30.4	23.9	3.4	0.5	0.0	0.0		
Dec	20.3	25.4	28.3	18.8	2.5	1.7	0.3	0.0		
Annual mean	11.7	17.5	33.5	30.4	4.0	0.9	0.1	0.0		

1-2 Ambient Conditions

1-2-1 Air Quality

Table 8A-1-3 Air Quality Data (NOx, SOx, and T.S.P.)

unit: $\mu\text{g}/\text{m}^3$

Pollutant	Data
NOx	39.0
SOx	10.4
T.S.P.	30.2

1-2-2 Noise levels

Table 8A-1-4 Noise Data

Measurement period	Feb. - Mar. /1995
Measurement point	south gate at ANSDK
Noise	64.8 dB

1-2-3 Sea water quality

Table 8A-1-5 Sea Water Quality Data

unit: mg/l

Parameter	Analysis method	Value
COD(Mn)	Permanganate method	4.3

1-3 Estimated Exhaust Pollutants

1-3-1 Air

Table 8A-1-6 Estimated Air Pollutant Emissions

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

1-3-2 Noise

Table 8A-1-7 Estimated Noise Levels

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

1-3-3 Waste Water Quality

Estimated waste water quality to be discharged into the sea is shown in Table 8A-1-6.

Table 8A-1-8 Estimated Waste Water Quality

Parameter	Unit	Value
Quantity	m ³ /hr	150
Temp	°C	31.7
COD	mg/l	1.4

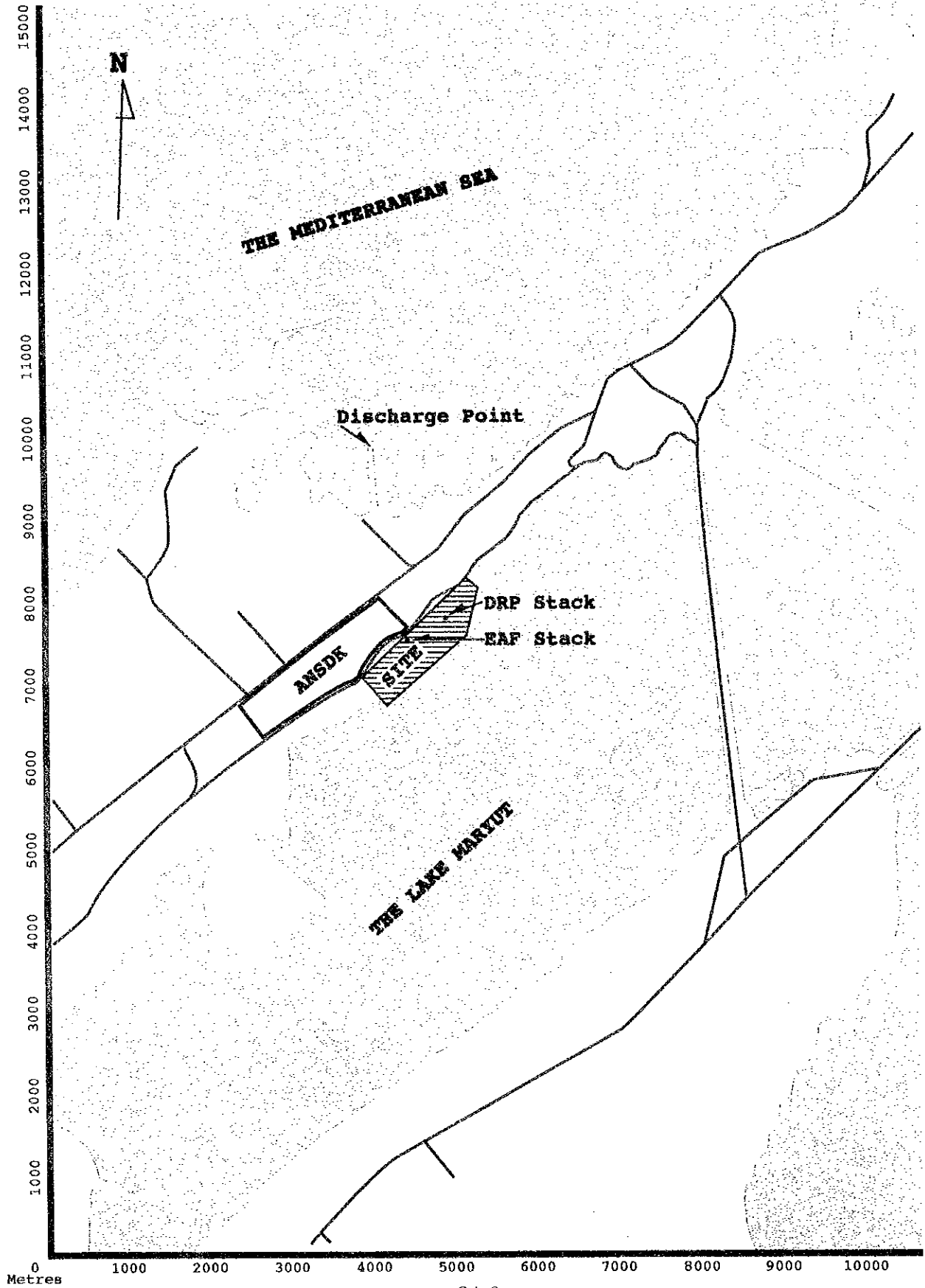
2. Impact Prediction

2-1 Study Area

Pollutant emissions and discharge points are shown in Figure 8A-2-1.

Figure 8A-2-1

Figure 8A-2-1 Study Area



2-2 Air Quality

To estimate the effect on ambient air quality after operation of the new plant, daily mean NO_x, and annual mean SO_x and T.S.P. were predicted.

2-2-1 Methodology

(1) Model

A Plume equation was adopted for windy conditions and a Puff equation for dead calm and weak wind conditions.

1) Point Source Plume Equation

$$C(x, y, z) = \frac{Q_p}{2\pi\sigma_y\sigma_z u} \cdot \exp\left(-\frac{y^2}{2\sigma_y^2}\right) \cdot \left[\exp\left\{-\frac{(z - H_e)^2}{2\sigma_z^2}\right\} + \exp\left\{-\frac{(z + H_e)^2}{2\sigma_z^2}\right\} \right]$$

But, the wind direction is divided to 16 bearings for calculation, and the concentration in a direction is assumed to be uniform for long period, therefore following equation was adopted.

$$C(R, z) = \sqrt{\frac{1}{2\pi}} \cdot \frac{Q_p}{\frac{\pi}{8} R \sigma_z u} \cdot \left[\exp\left\{-\frac{(z - H_e)^2}{2\sigma_z^2}\right\} + \exp\left\{-\frac{(z + H_e)^2}{2\sigma_z^2}\right\} \right]$$

Where,

$C(R, z)$: pollutant concentration at point(R, z)
R	: downwind distance from source
z	: height of point from ground where concentration is calculated
Q_p	: pollutant emission rate ($\mu\text{g/s}$)
u	: wind speed (m/s)
H_e	: effective stack height (m)
σ_z	: vertical diffusion parameter evaluated in terms of downwind distance R

2) Point Source Puff Equation (weak wind conditions)

$$C(R, z) = \sqrt{\frac{1}{2\pi}} \cdot \frac{Q_p}{\frac{\pi}{8}\gamma} \cdot \left[\frac{1}{\eta_-^2} \exp\left\{-\frac{u^2(z - He)^2}{2\gamma^2\eta_-^2}\right\} + \frac{1}{\eta_+^2} \exp\left\{-\frac{u^2(z + He)^2}{2\gamma^2\eta_+^2}\right\} \right]$$

$$\eta_-^2 = R^2 + \frac{\alpha^2}{\gamma^2}(z - He)^2$$

$$\eta_+^2 = R^2 + \frac{\alpha^2}{\gamma^2}(z + He)^2$$

$$R^2 = x^2 + y^2$$

Where,

$C(R, z)$: pollutant concentration at point(R, z)
R	: downwind distance from source
z	: height of point from ground where concentration is calculated
Q_p	: pollutant emission rate ($\mu\text{g/s}$)
u	: wind speed (m/s)
He	: effective stack height (m)
α	: horizontal diffusion parameter (m/s)
γ	: vertical diffusion parameter (m/s)

Correction for wind direction rate in weak wind conditions;

Wind direction divided by 16 bearings defined as $i, i+1, \dots$, wind direction rate by measurement defined as f_i, f_{i+1}, \dots . Where the rate f_i of wind direction i is corrected by wind speed u and horizontal diffusion parameter α , examples:

$$\begin{aligned} u/\alpha < 1, & \quad \hat{f}_i = \sum_{k=1}^{16} f_k / 16 \\ 1 \leq u/\alpha < 1.5, & \quad \hat{f}_i = \left(f_{i-4} + 2 \sum_{k=1}^3 f_{i+k} + f_{i+4} \right) / 16 \\ 1.5 \leq u/\alpha < 2, & \quad \hat{f}_i = \left(f_{i-3} + 2 \sum_{k=1}^2 f_{i+k} + f_{i+3} \right) / 12 \\ 2 \leq u/\alpha < 3.3, & \quad \hat{f}_i = \left(f_{i-2} + 2 \sum_{k=1}^1 f_{i+k} + f_{i+2} \right) / 8 \\ 3.3 \leq u/\alpha < 6, & \quad \hat{f}_i = \left(f_{i-1} + 2 f_i + f_{i+1} \right) / 4 \\ 6 \leq u/\alpha, & \quad \hat{f}_i = f_i \end{aligned}$$

3) Point Source Puff Equation (dead calm)

$$C(R, z) = \frac{Qp}{(2\pi)^{1/2} \gamma} \left[\frac{1}{R^2 + \frac{\alpha^2}{\gamma^2} (He - z)^2} + \frac{1}{R^2 + \frac{\alpha^2}{\gamma^2} (He + z)^2} \right]$$

(2) Diffusion parameters

The approximate value by Pasquill-Gofford diagram shown in Table 8A-2-1 is used for the diffusion parameter σ_y , σ_z for the Plume equation of wind speeds over 1.0 m/s.

Table 8A-2-1 Pasquill-Gofford Approximations

$$\sigma_y(x) = \gamma_y \cdot x^{\alpha_y}$$

Stability	α_y	γ_y	Downwind distance
A	0.901	0.426	0 - 1,000
	0.851	0.602	1,000 -
B	0.914	0.282	0 - 1,000
	0.865	0.396	1,000 -
C	0.924	0.1772	0 - 1,000
	0.885	0.232	1,000 -
D	0.929	0.1107	0 - 1,000
	0.889	0.1467	1,000 -
E	0.921	0.0864	0 - 1,000
	0.897	0.1019	1,000 -
F	0.929	0.0554	0 - 1,000
	0.889	0.0733	1,000 -
G	0.921	0.0380	0 - 1,000
	0.896	0.0452	1,000 -

$$\sigma_z(x) = \gamma_z \cdot x^\alpha$$

Stability	α	γ	Downwind distance
A	1.122	0.0800	0 - 300
	1.514	0.00855	300 - 500
	2.109	0.000212	500 -
B	0.964	0.1272	0 - 500
	1.094	0.0570	500 -
C	0.918	0.1068	0 -
D	0.826	0.1046	0 - 1,000
	0.632	0.400	1,000 - 10,000
	0.555	0.811	10,000 -
E	0.788	0.0928	0 - 1,000
	0.565	0.433	1,000 - 10,000
	0.415	1.732	10,000 -
F	0.784	0.0621	0 - 1,000
	0.526	0.370	1,000 - 10,000
	0.323	2.41	10,000 -
G	0.794	0.0373	0 - 1,000
	0.637	0.1105	1,000 - 2,000
	0.431	0.529	2,000 - 10,000
	0.222	3.62	10,000 -

The diffusion parameters α and γ used for the Puff equation of wind speeds 0.5 - 0.9 m/s (weak) are shown in Table 8A-2-2.

Table 8A-2-2 Weak Wind Condition Diffusion

Pasquil stability class	α	γ
A	0.748	1.569
A - B	0.659	0.862
B	0.581	0.474
B - C	0.502	0.314
C	0.435	0.208
C - D	0.342	0.153
D	0.270	0.113
E	0.239	0.067
F	0.239	0.048
G	0.239	0.029

The diffusion parameter α and γ used for Puff equation of wind speeds under 0.4 m/s (dead calm) are shown in Table 8A-2-3.

Table 8A-2-3 Dead Calm Diffusion

Pasquil stability class	α	γ
A	0.948	1.569
A - B	0.859	0.862
B	0.781	0.474
B - C	0.702	0.314
C	0.635	0.208
C - D	0.542	0.453
D	0.470	0.113
E	0.439	0.067
F	0.439	0.048
G	0.439	0.029

(3) Definition of effective stack height

Effective stack height is defined as follows:

Concave equation (for windy conditions)

$$\Delta H = 0.175 \times Q_H^{1/2} u^{-3/4}$$

Briggs equation (for dead calm and weak wind conditions)

$$\Delta H = 1.4 \times Q_H^{1/4} (d\theta/dz)^{-3/8}$$

where,

$$Q_H \text{ (exhaust heat value, cal/s)} = \rho \cdot Q \cdot C_p \cdot \Delta T$$

$$\text{approximately } \rho = 1.293 \times 10^3 \text{ g/m}^3$$

(density of exhaust gas at 0 °C)

Q : Exhaust gas volume per unit time (Nm³/s)

C_p : 0.24 cal/°K g (isopiestic specific heat)

ΔT : T_G - 15

(temperature difference between exhaust gas temperature T_G and atmospheric temperature, °C)

- u : wind speed at top of stack (m/s)
- $d\theta / dz$: $dT/dz - \Gamma_d$ (potential temperature gradient, °C/m)
- Γ_d : 0.0098 °C (dry-adiabatic temperature lapse rate)

(4) Pile up calculation

The concentrations calculated from each prediction equations piled up and led to annual mean concentration pattern by using following equation according climate condition (wind direction and wind speed).

$$C = \sum_i \sum_j [C_{u(i,j)} \cdot f_u(i,j) + C_{j(i,j)} \cdot f_j(i,j)] + C_c f_c$$

- C : Annual mean concentration
- $C_{u(i,j)}$: Concentration when windy, wind direction i, and wind-force scale j
- $f_u(i,j)$: Appearance ratio when windy, wind direction i, and wind-force scale j
- $C_{j(i,j)}$: Concentration when weak wind, wind direction i, and wind-force scale j
- $f_j(i,j)$: Appearance ratio when weak wind, wind direction i, and wind-force scale j
- C_c : Concentration when dead calm
- f_c : Appearance ratio when dead calm

2-2-3 Prediction conditions

(1) Climate

The climate model is based on the results of the site survey (Tables 8A-1-1 and 8A-1-2).

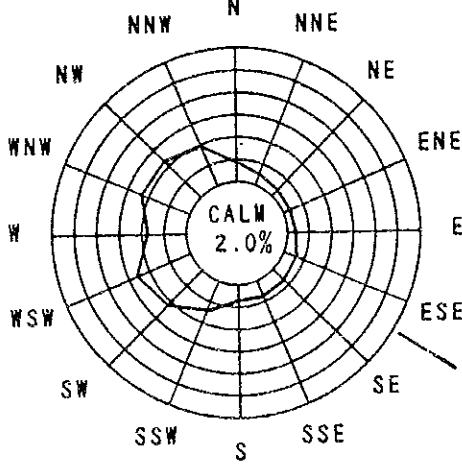
Monthly mean speed is used as wind speed with 12 bearings and calm converted to 16 bearings and calm for wind direction.

Atmospheric stability is D (neutral).

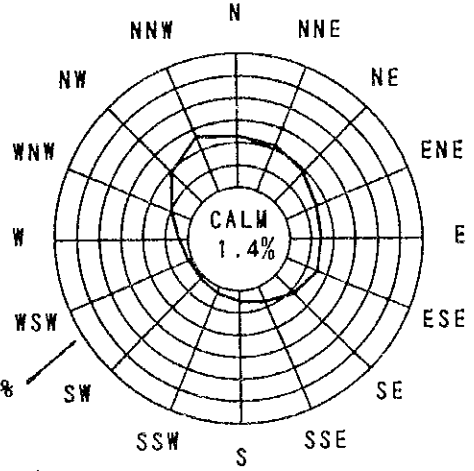
Figure 8A-2-2 shows the ratio of monthly mean and annual mean wind directions after conversion.

Figure 8A-2-2 Wind Direction Ratio(1)

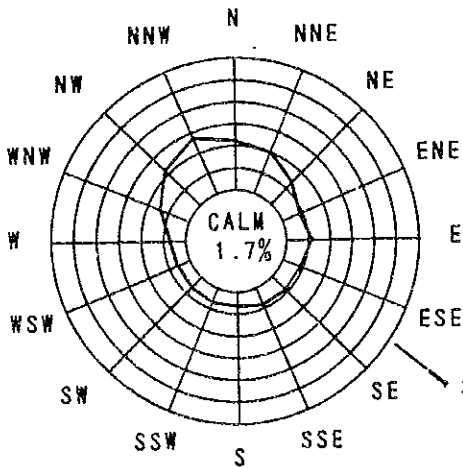
Jan.



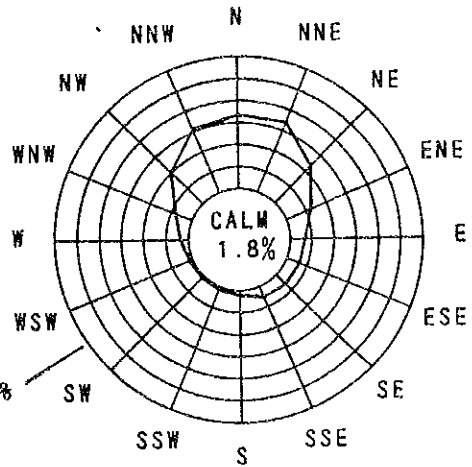
Apr.



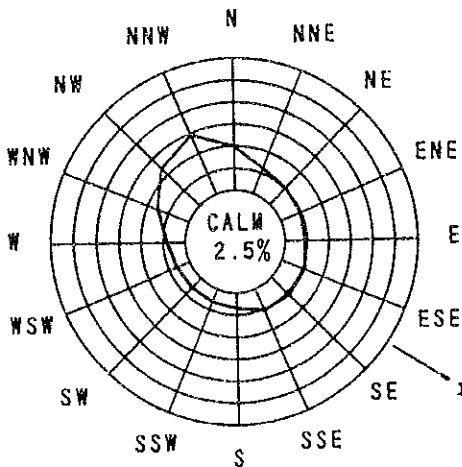
Feb.



May



Mar.



Jun.

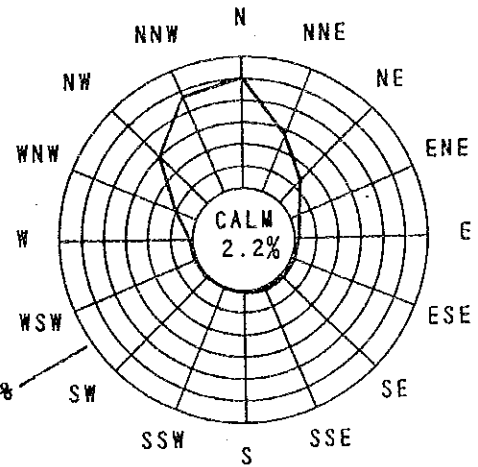
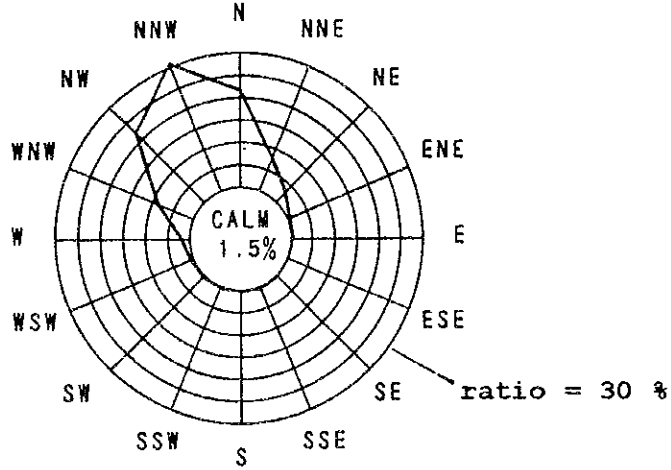
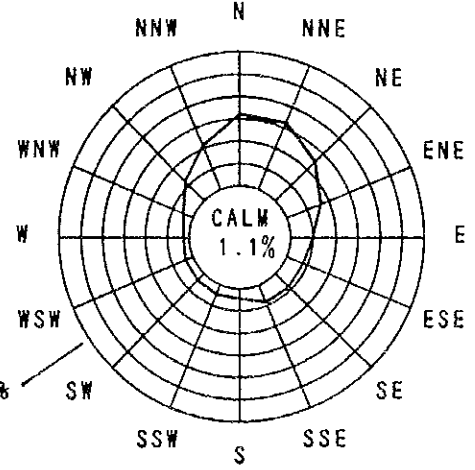


Figure 8A-2-2 Wind Direction Ratio(2)

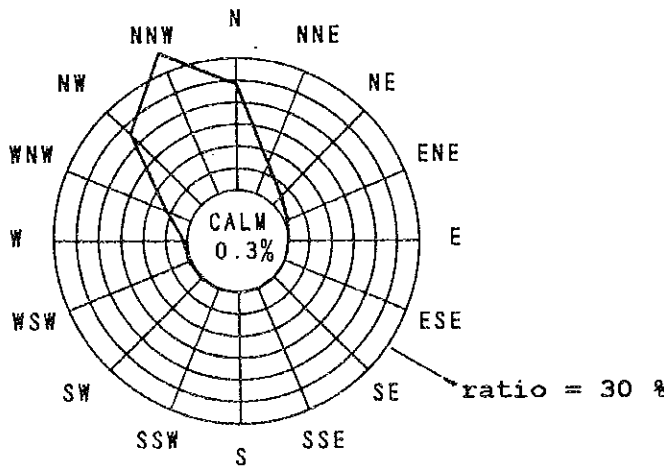
Jul.



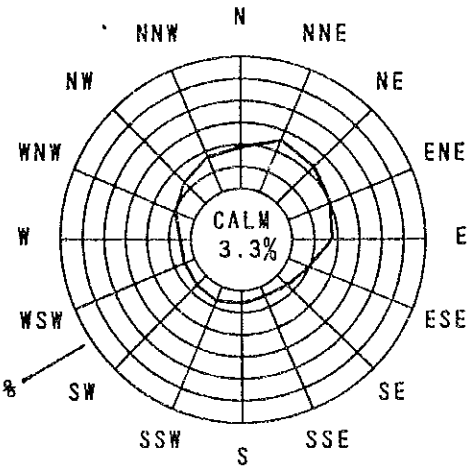
Oct.



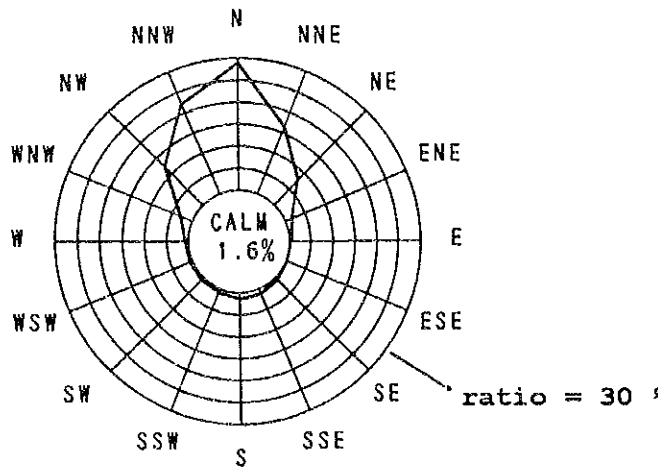
Aug.



Nov.



Sep.



Dec.

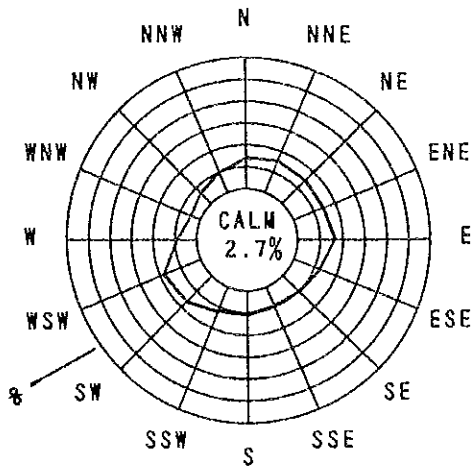
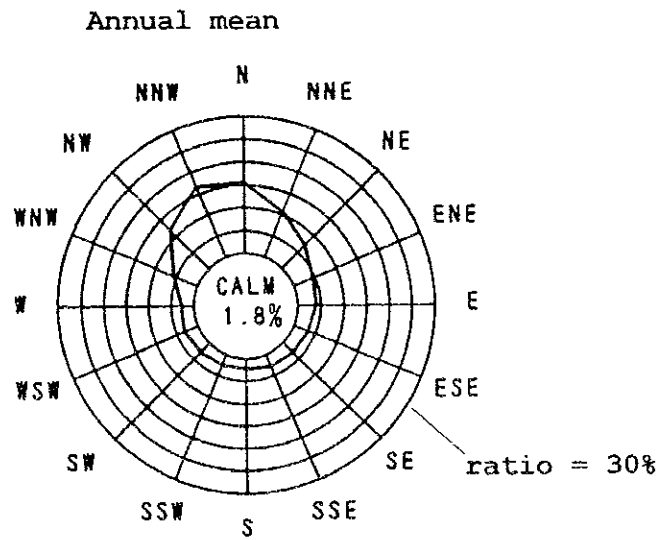


Figure 8A-2-2 Wind Direction Ratio(3)



(2) **Conditions at exhaust point**

According to Table 8A-1-6

(3) **Back ground value**

According to Table 8A-1-3

(4) **NO₂ conversion**

According to measured data in Japan, conversion of NO_x to NO₂ is defined as follows:

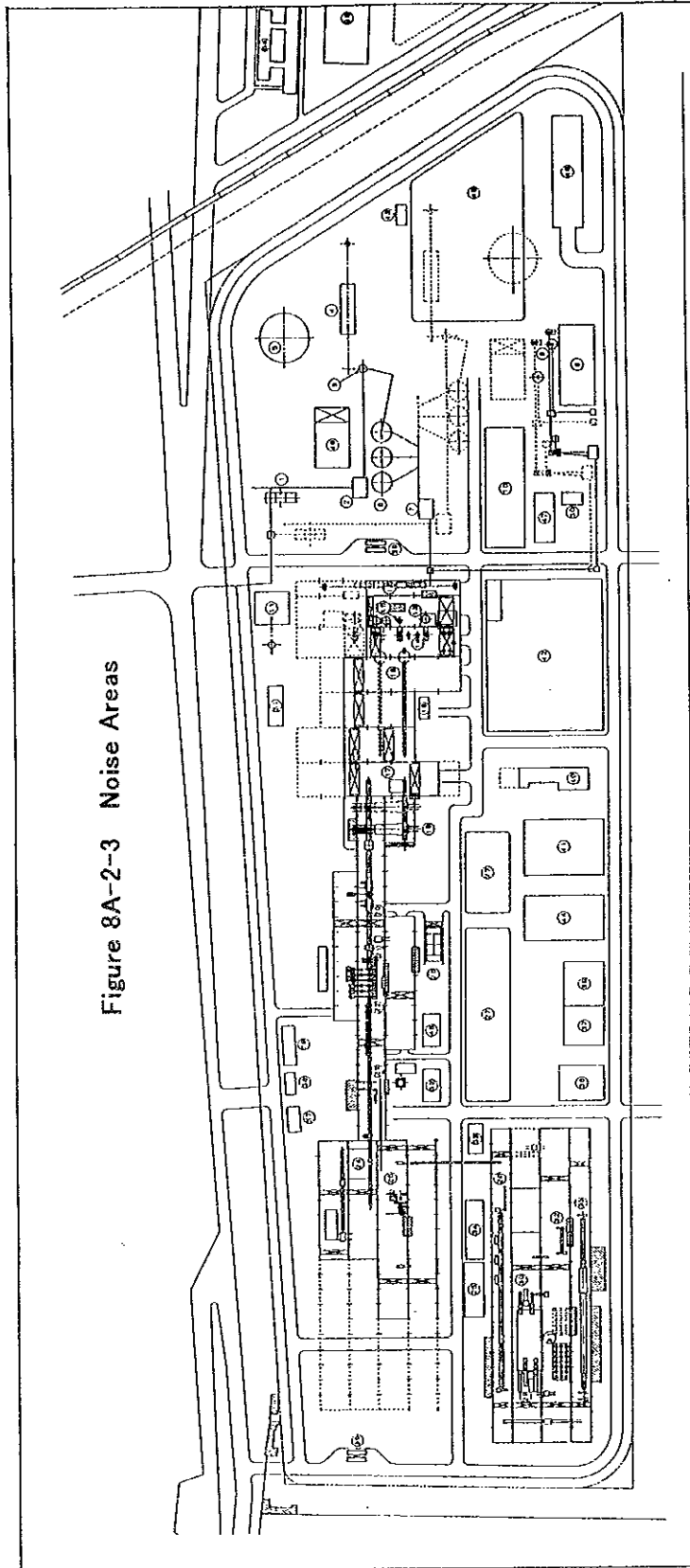
$$[\text{NO}_2] = 0.565 \times [\text{NO}_x]$$

2-3 Noise

2-3-1 Area

The prediction area is within the plant boundary shown in Figure 8A-2-3.

Figure 8A-2-3 Noise Areas



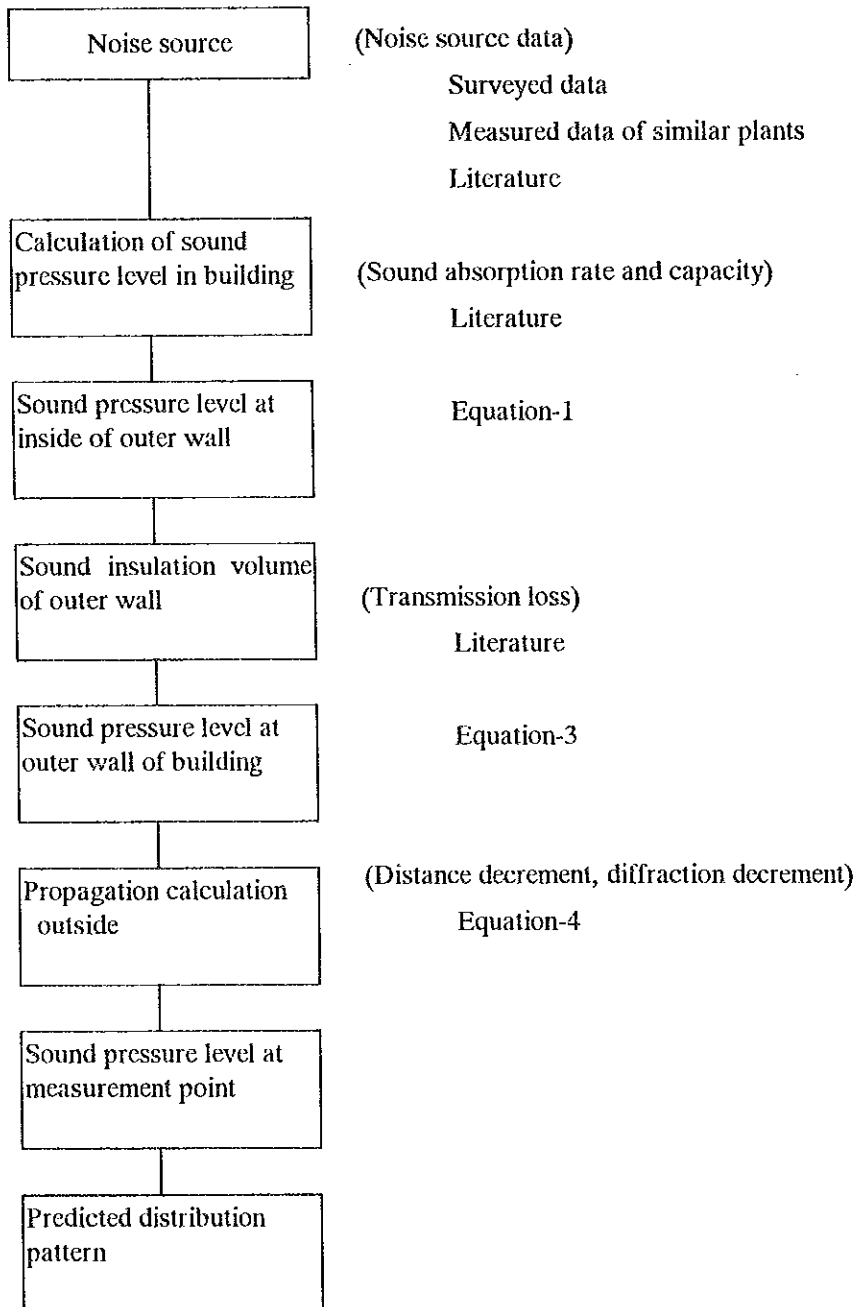
1	OXIDE PELLET STORAGE BIN	11	DUST COLLECTOR	21	COIL BOX	31	RAW WATER RECEIVING STATION	41	SMP OFFICE
2	OXIDE PELLET SCREEN	12	MATERIAL HANDLING SYSTEM	22	FINISHING MILL	32	MAIN SUBSTATION	42	HSM OFFICE
3	REDUCTION FURNACE	13	ELECTRIC ARC FURNACE	23	DOWN COILER	33	NATURAL GAS RECEIVING STATION	43	CRM OFFICE
4	REFORMER	14	LADLE TRANSFER CAR	24	PLATE LINE	34	SEWAGE TREATMENT STATION	44	MAIN OFFICE
5	CLARIFIER	15	LADLE FURNACE	25	SKIMPASS MILL	35	SCRAP YARD	45	MAINTENANCE SHOP
6	DRI STORAGE BIN	16	LADLE FURNACE	26	SCALE PIT FOR HSM	36	SLAG YARD	46	REFRACTORIES WAREHOUSE
7	DRI SCREEN	17	SLAB CASTER	27	SCALE PIT FOR CRM	37	ADDITIONAL WAREHOUSE	47	GUARD OFFICE
8	LIME STORAGE BIN	18	SLAB CONVEYOR	28	WATER TREATMENT FOR HSM	38	OIL STORE	48	LABORATORIES
9	LIME STORAGE YARD	19	SCALE PIT FOR CCM	29	PIGELING LINE	39	WASTE STORE	49	CLINIC
10	LIME CALCINING PLANT	20	REHEATING FURNACE	30	REVERSING MILL	40	TRUCK SCALE	50	DRP OFFICE
11	WATER TREATMENT FOR SMP	21	ROUGHING MILL	31	TAMPER MILL	41	AIR COMPRESSOR ROOM	51	LCP OFFICE
12	BATCH ANNEALING FURNACE	32	RECOILING LINE	42	WATER TREATMENT FOR CRM	52	UTILITY PLANT	62	LABORATORIES
13	HOT DIP GALVANIZING LINE	43	ACID REGENERATION	53	OIL STORE	63	WASTE STORE	73	LABORATORIES
14	WATER TREATMENT FOR CRM	54	WASTE STORE	64	TRUCK SCALE	74	DRP OFFICE	84	FIRE FIGHTING STATION
15	WATER TREATMENT FOR HSM	65	ROUGHING MILL	75	RESTAURANT	85			

2-3-2 Method

(1) Calculation procedure

The calculation of noise is executed by Figure 8A-2-4.

Figure 8A-2-4 Calculation Procedure



(2) Equations

1) Sound Pressure Level Equation

$$L_r = L_p + 10 \cdot \log_{10} \left(\frac{Q}{4\pi r_0^2} + \frac{4}{R} \right) \quad (\text{dB}) \quad [\text{Eq-1}]$$

where,

L_r : sound pressure level inside wall of building (dB)

L_p : power level of noise source (dB)

r_0 : distance between noise source and measurement point (m)

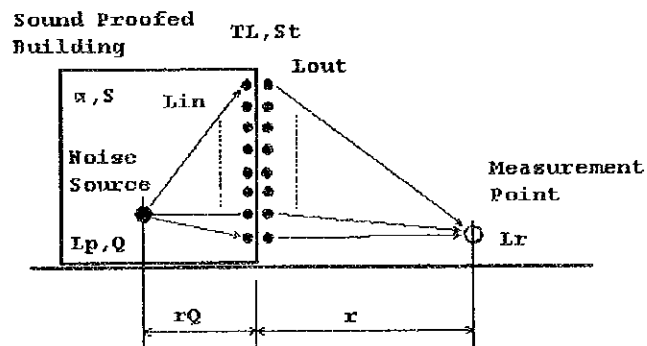
Q : directivity coefficient of noise source

R : room constant

$$R = \frac{S \cdot \alpha}{(1 - \alpha)} \quad (\text{m}^2) \quad [\text{Eq-2}]$$

α : average absorption rate

S : total room area (m²)



2) Sound Pressure Level Equation (outer wall)

$$L_{out} = L_r - TL \quad (\text{dB}) \quad [\text{Eq-3}]$$

where,

L_{out} : sound pressure level at outer wall of plant (dB)

L_r : sound pressure level inside wall of building (dB)

TL : total transmission loss (dB)

3) Outside Distribution Pattern

$$L_r = L_{out}' - 20 \log_{10} r - 8 - \Delta L \quad (\text{dB}) \quad [\text{Eq-4}]$$

where,

L_r : sound pressure level at r(m) distance from noise source (dB)

L_{out}' : sound pressure level (after correction) at outer wall of plant (dB)
(level corrected area of wall to L_{out})

r : distance between noise source and measurement point (m)

ΔL : diffraction decrement effect by barrier wall (dB)

$$\Delta L = 5 \pm 20 \log_{10} \frac{\sqrt{2\pi|N|}}{\tanh \sqrt{2\pi|N|}} \quad (\text{dB})$$

tanh : hyperbolic tangent

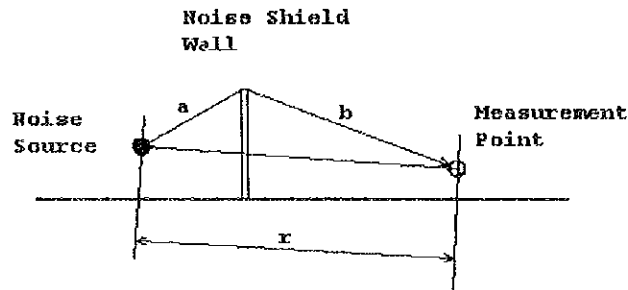
$$N = \frac{2 \cdot f}{C} \cdot \delta \quad N < 0 \rightarrow \pm = (-)$$

N : Fresnel's number

C : the speed of sound (340 m/s)

f : frequency (Hz)

δ : path difference (m) $\delta = a + b - r$



2-3-3 Conditions

(1) Plant facility noise levels

Four noise sources were selected for simulation shown as Table 8A-2-4. The frequency property of noise is defined according to measured data at similar plants.

Table 8A-2-4 Facility Noise Levels

Facility	Noise level L_{Aeq} (dB)	Measurement point
DRP reformer	95 - 105	Inside of room
SMP EAF	105	Inside of building wall
HSM mill	(105)	Inside of building
Air compressor	95	Inside of room

Source Noise Power Levels are estimated as Table 8A-2-5.

Table 8A-2-5 Noise Source Power Levels and Frequencies
(Property A, unit: dB(A))

Facility	Noise level	1/1 octave band center frequency (Hz)							
		63	125	250	500	1 k	2 k	4 k	8 k
Reformer	108	73	85	97	103	104	101	95	83
EAF	132	100	111	121	127	128	125	116	101
Reheating furnace	118	91	104	114	112	111	105	98	86
Rolling mill	117	78	89	102	110	114	110	101	90
Finishing yard	114	80	89	105	107	108	109	106	100
Compressor	118	83	95	107	113	114	111	105	93

(2) Plant building component materials sound characteristics

Plant buildings except the compressor room are composed of concrete floors, and corrugated sheet ($t = 0.8$ mm) walls and roofs. Tables 8A-2-6 and 8A-2-7 show the sound characteristics of these components. The compressor room is composed of concrete floor and walls, and corrugated sheet roof.

Table 8A-2-6 Component Material Absorption Rate

unit: %

Material	1/1 octave band center frequency (Hz)							
	63	125	250	500	1 k	2 k	4 k	8 k
Corrugated sheet (0.8 t)	8	22	15	10	8	8	8	8
Concrete	1	1	1	1	2	2	3	3

Table 8A-2-7 Component Material Sound Insulation Volume

unit: dB

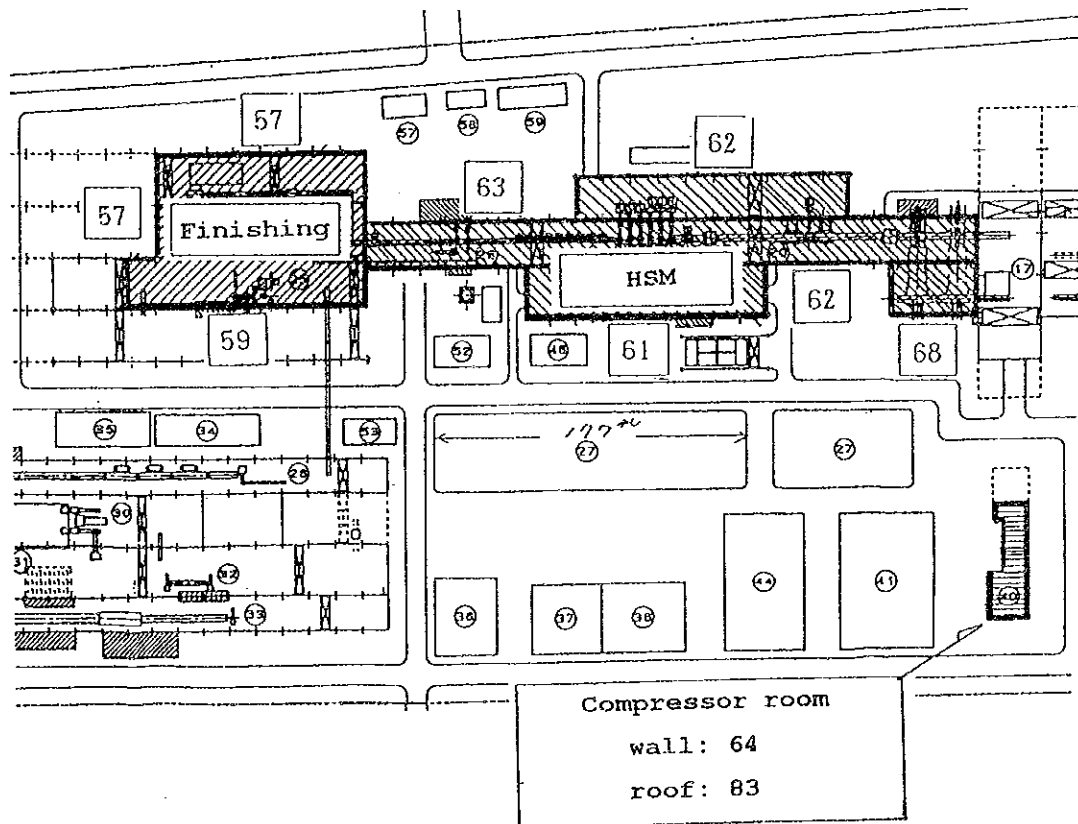
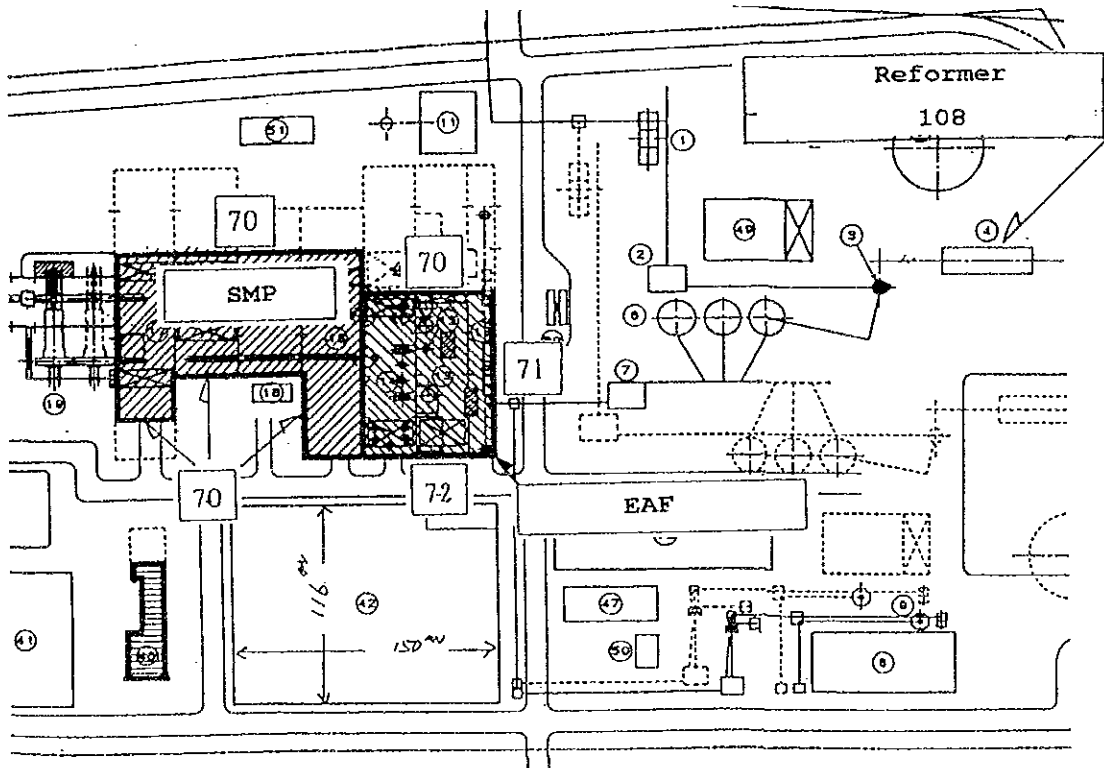
Material	1/1 octave band center frequency (Hz)							
	63	125	250	500	1 k	2 k	4 k	8 k
Corrugated sheet (0.8 t)	10	15	20	25	28	30	30	25
Concrete	22	26	32	37	41	46	46	41

note: safety factor = 0.8

(3) Plant outer wall noise levels

The noise levels at the plant outer walls shown in Figure 8A-2-5 are calculated from the sound pressure at the outer wall calculated by equation-1.

Figure 8A-2-5 Outer Wall Noise Levels



(4) Area

The area for noise level calculation is 1,450 m on the X axis and 600 m on the Y axis. Each axis is divided by 40 and height is 1.2 m on the Z axis.

For outside noise transmission, the buildings between noise sources and measurement points are dealt with as sound barriers, but other facilities in the yard were not considered.

Building height as a barrier is 42 m for the SMP-EAF, 7 m for the air compressor and 20 m for the others.

2-3-4 Results

The predicted noise levels in the plant are shown in Figure 8A-2-6 for the DRP reformer, Figure 8A-2-7 for the air compressor, Figure 8A-2-8 for the SMP-EAF, and Figure 8A-2-9 for the HSM.

Figure 8A-2-6 Noise Distribution Pattern (DRP Reformer) unit: dB

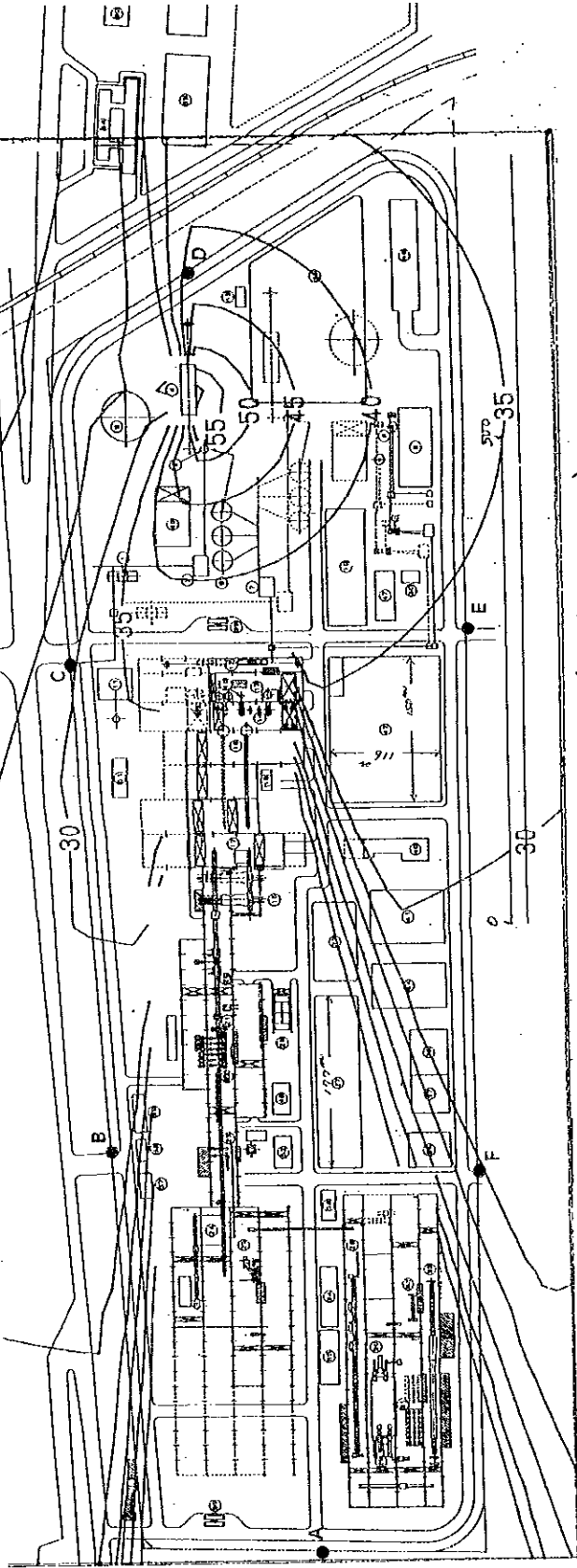
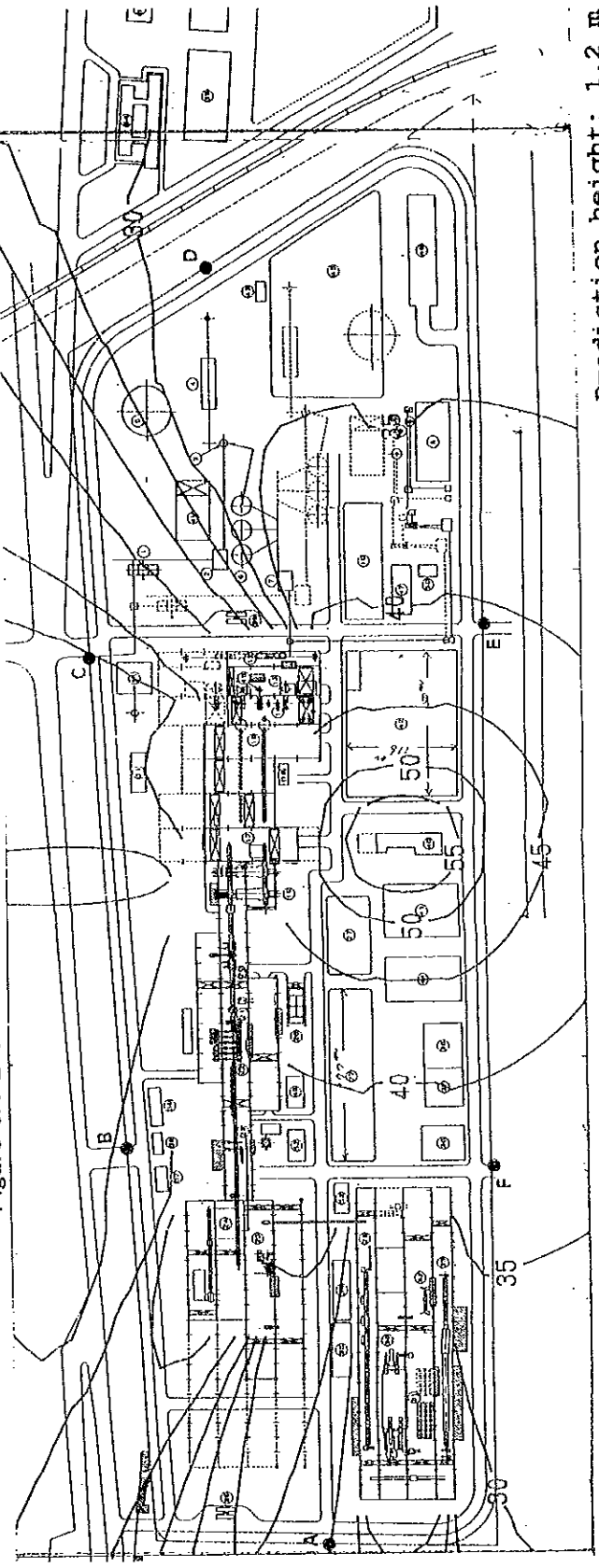


Figure 8A-2-7 Noise Distribution Pattern (Air Compressor)



Prediction height: 1.2 m

Figure 8A-2-8 Noise Distribution Pattern (SMP-EAF)

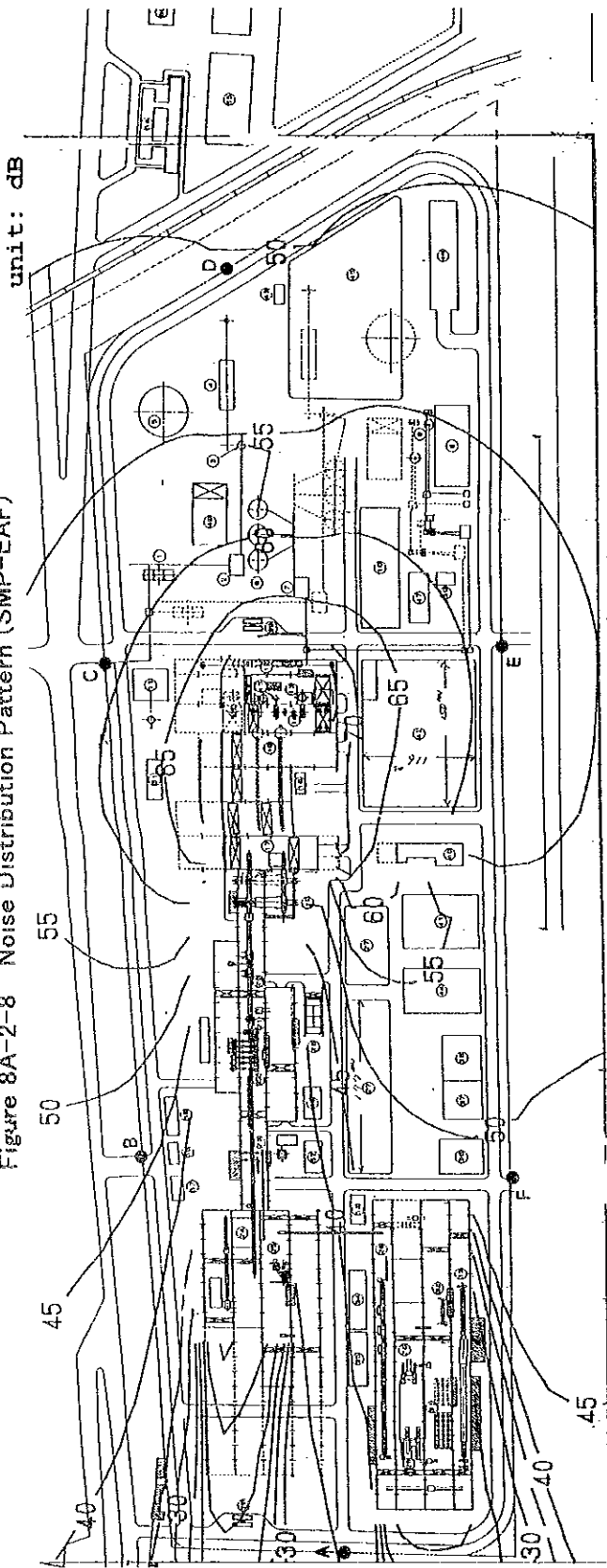
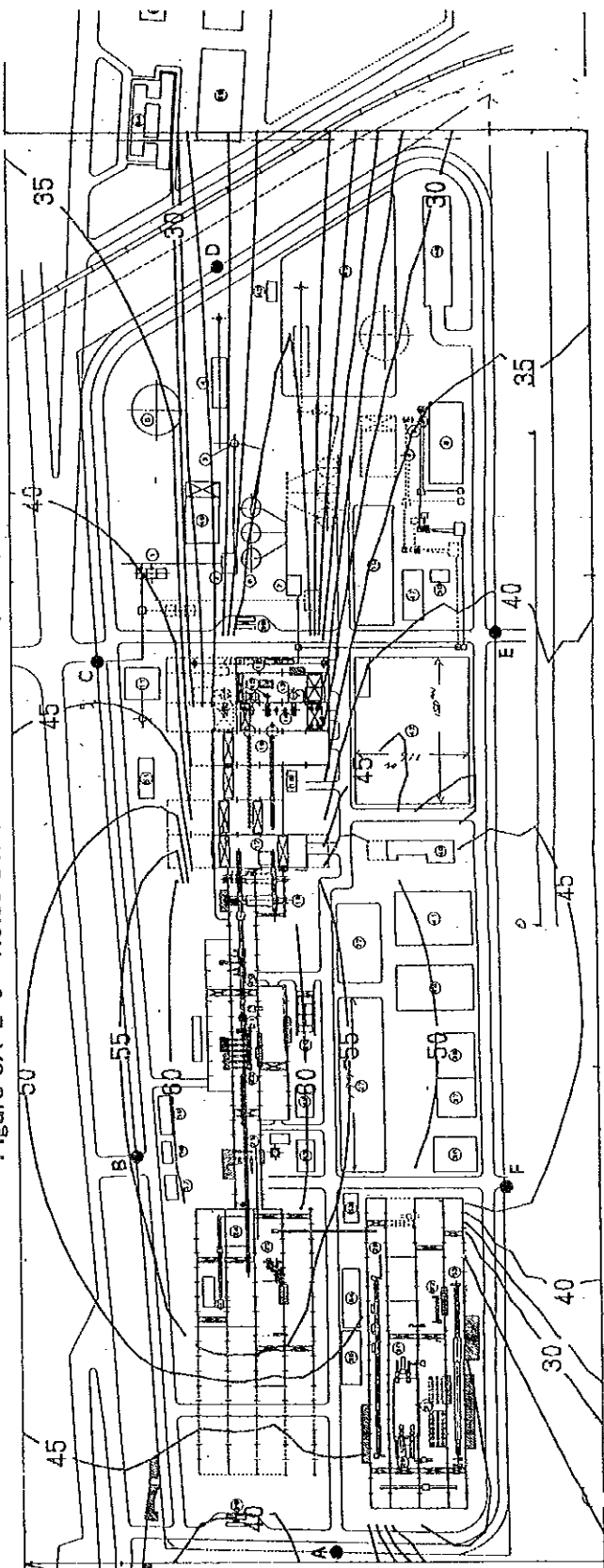


Figure 8A-2-9 Noise Distribution Pattern (HSM)



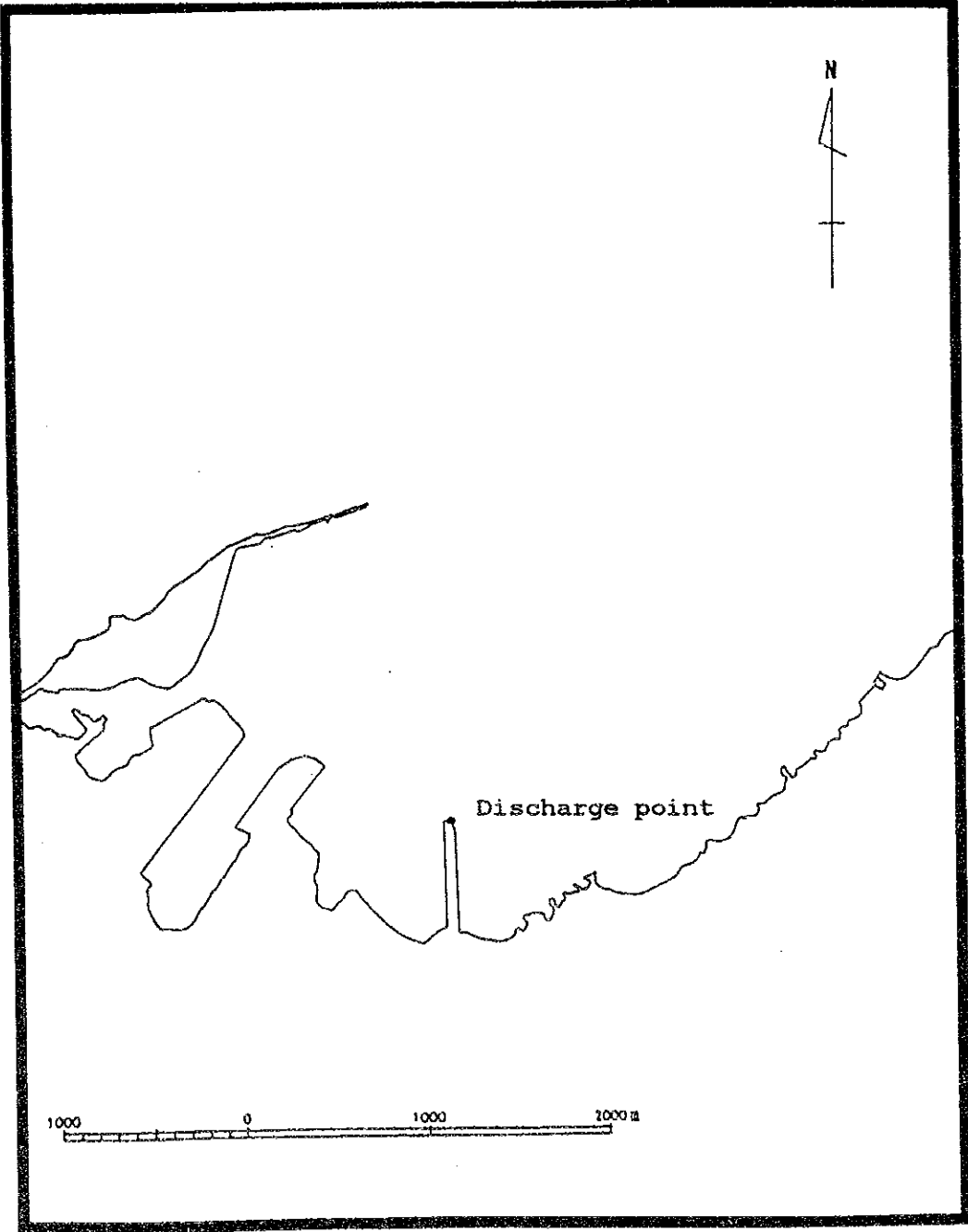
Prediction height: 1.2 m

2-4 Water

2-4-1 Area

The area of sea water quality affected by waste water is shown in Figure 8A-2-10.

Figure 8A-2-10 Sea Water Quality Area



2-4-2 Method

For sea water with steady, unidirectional flow, the following equation was used as the diffusion equation in the case when effluent is discharged continuously from a point source.

$$S = \frac{q}{2\pi d \sqrt{K_x K_y}} \exp\left[\frac{xu}{2K_x} - \lambda t\right] K_0\left\{\frac{u}{2} \sqrt{\frac{1}{K_x} \left[\frac{x^2}{K_x} + \frac{y^2}{K_y}\right]}\right\} \quad [\text{Eq-1}]$$

where,

- S : effluent concentration (mg/l)
- q : mass quantity of effluent per unit time ($\mu\text{g/s}$)
- u : steady flow rate on X-axis (cm/s)
- K_x : diffusion coefficient on X-axis (cm^2/s)
- K_y : diffusion coefficient on Y-axis (cm^2/s)
- λ : decrement coefficient of effluent (l/s)
- d : mixing layer thickness of effluent (cm)
(average depth)
- x, y : X and Y-axes distances from origin (cm)
- $K_0(x)$: coefficient of Bessel function of the 2nd kind

$$K_0(x) = \int_0^\infty \frac{\exp(-ux)}{\sqrt{u^2 - 1}} du$$

$$\exp(x) = e^x$$

The actual calculation was executed using the following assumptions, not directly from equation-1.

- no consideration of effluent reduction ($\lambda = 0$)
- horizontal diffusion coefficients are uniform
($K_x = K_y = K$)

Therefore, equation-1 will change as follows:

$$S = \frac{q}{2\pi d K} \exp\left[\frac{xu}{2K}\right] K_0\left[\frac{u}{2K} \sqrt{x^2 + y^2}\right] \quad [\text{Eq-2}]$$

As equation-2 includes the Bessel function, the Bessel function table shown in Table 8A-2-12 was used.

Table 8A-2-12 Bessel Function of the 2nd Kind

X	$K_0(x)$	X	$K_0(x)$
1	0.8825696×10^{-1}	10	0.0556711673
2	0.5103757	20	0.0626405968
3	0.3768500	30	- 0.1172957317
4	$-0.1694074 \times 10^{-1}$	50	- 0.0980649955
5	0.3085176	100	- 0.0772443134

2-4-3 Conditions

Conditions are shown in Table 8A-2-13.

Table 8A-2-13 Sea Water Conditions

Parameter	Value
Effluent concentration	1.36 mg/l
Discharge water quantity	150.00 m ³ /hr
Horizontal Diffusion coefficient (Kx, Ky)	10 ⁴ cm ² /s
Effluent Reduction coefficient (λ)	0
Average sea water depth	15 m
Tidal direction	E + 11.5° NW + 11.5°
Tidal speed	0.08 m/s 0.23 m/s

2-4-4 Results

The result at 0.08 m/s tidal speed is shown in Table 8A-2-14, and at 0.23 m/s in Table 8A-2-15.

Figure 8A-2-11 0.08 m/s Tidal Speed Results.

unit: 10^{-4} mg/l

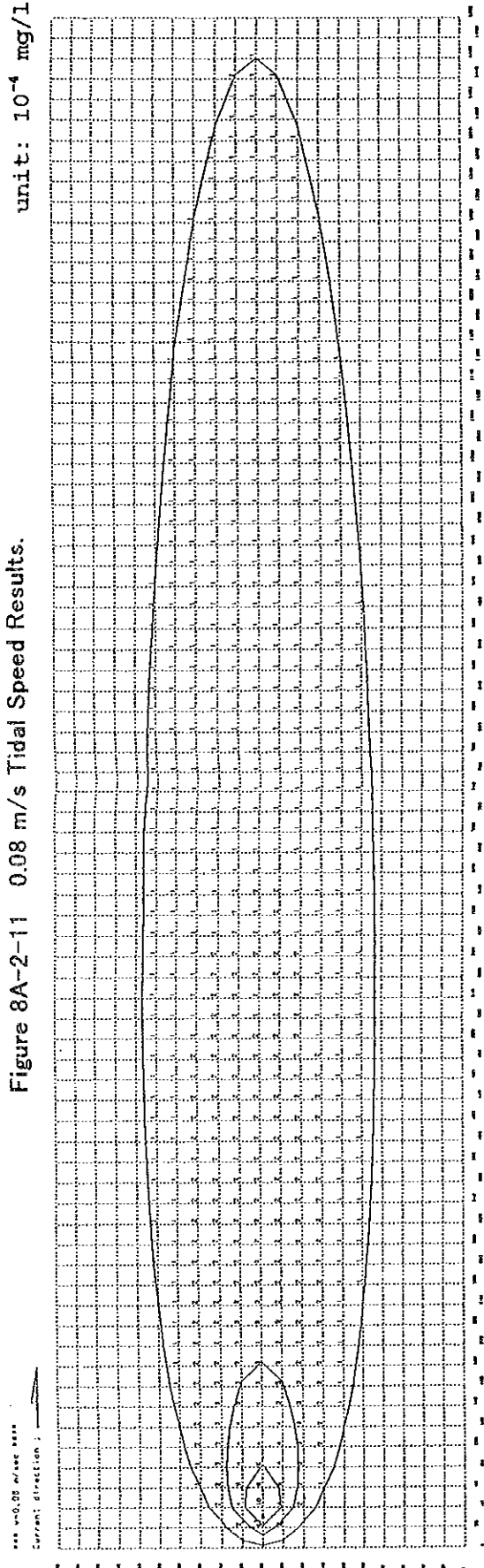
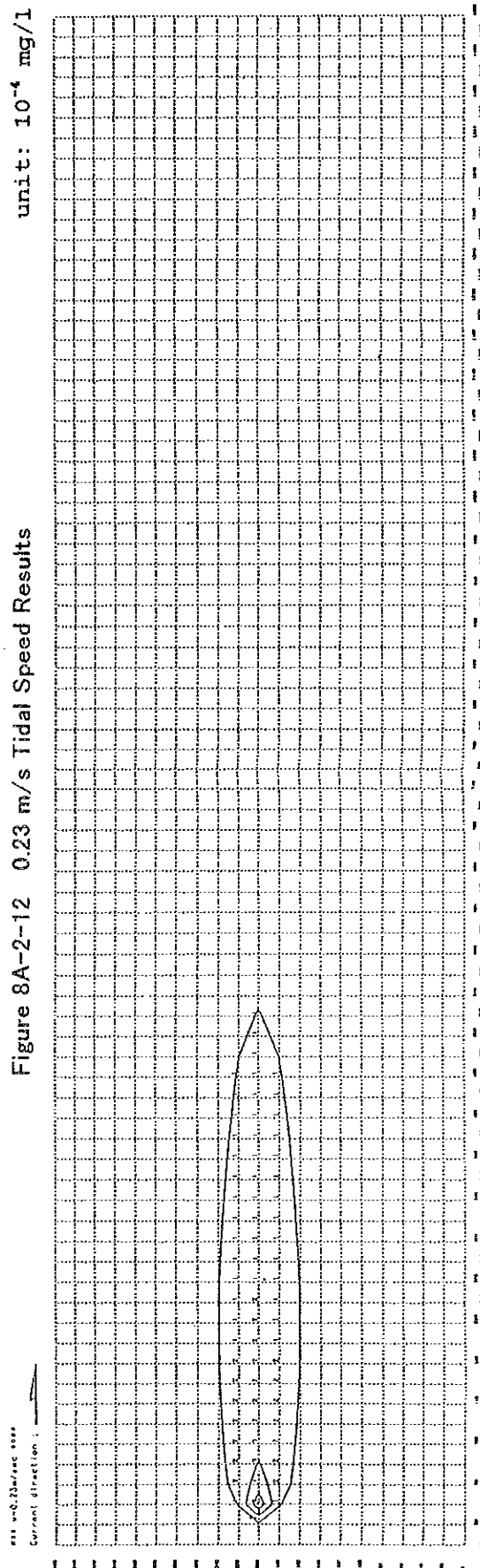


Figure 8A-2-12 0.23 m/s Tidal Speed Results

unit: 10^{-4} mg/l



3. Relationship between COD values by the Dichrome Method COD(Cr) and Permanganate Method COD(Mn)

The Study Team obtained COD data (= 300 mg/liter) from the Alexandria Governorate on 28 August.

The value (COD = 300 mg/liter) is abnormal, extremely high.

Presumably this value was obtained by the dichrome method which is not suitable for sea water because sea water includes chloride ions. In this case, the permanganate method should be adopted.

It is difficult to exchange this value to a permanganate method based value by calculation. According to experience with the analysis of both methods (the dichrome method and the permanganate method), the estimated coefficient value (COD(Cr)/COD(Mn)) is about 70 for the 300 mg/liter results of the dichrome method.

Therefore the estimated value based on the permanganate method is $300/70 = 4.3$.

Also, according to the JICA report of the Suez industrial area development plan (1993), COD(Mn) values are 2.4 - 7.3. Therefore the value 4.3 is not far from the sea water quality existing along the Egyptian coast.

Figure 8A-3-1 Relationship between COD(Cr) and COD(Cr)/COD(Mn)

