REPORT OF DISPATCHED SPECIALISTS FOR THE ENVIRONMENTAL MANAGEMENT AT CHINESE STEEL INDUSTRY (UNEP)

JUNE 1987

JAPAN INTERNATIONAL COOPERATION AGENCY

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INTRODUCTION

UNEP (UNITED NATIONS ENVIRONMENTAL PROJECT) requested Japanese Government as the follow-up project of WICEM (World Industrial Conference for Environmental Management) to send specialists to make diagnosis and recommendation in connection with the environmental issues of Chinese steel industry.

In response to the request, Japan International Cooperation Agency has dispatched three specialists to China for two weeks from November 1986.

The report herewith is summerized by their diagnoses and recommendations made in China with reference to the environmental problems of the steel industry.

We are extremely grateful to the many individuals and parties concerned for their various cooperations in dispatching our specialists.

JAPAN INTERNATIONAL COOPERATION AGENCY

YASUO KITANO

Manager

Dispatching Department

CONTENTS

I GENERAL DESCRIPTION OF ASSIGNMENT

At the request of UNEP, we have visited three (3) steel mills at HANGZHOU, WUXI, NANJING and Ministry of Metallurgical Industry of Chinese Government at Beijin to make diagnosis and recommendation on environmental management at Chinese steel industry.

II ITINERARY AND ASSIGNMENTS

Date	Remarks
30 November	Travel from Tokyo - Shanghai - Hangzhou
1 December	Hangzhou Iron and Steel Works
2 December	Ditto
3 December	Move to Wuxi
4 December	Wuxi Iron and Steel Works
5 December	Ditto
6 December	Ditto and move to Nanjing
7 December	Holiday
8 December	Nanjing Iron and Steel Works
9 December	Ditto
10 December	Move Nanjing to Beijin
11 December	Chinese Ministry of Metallugical Industry
12 December	Ditto
13 December	Return trip from Beijin to Osaka

III Name and title of persons interviewed by the specialists

Government of the people's republic of China

LI YOU HU	Vice Director, Engineer, Safety and environmental protection department, The ministry of metallurgical industry, The people's Republic of China
HUANG DAN YING	Area Manager, International Cooperation department, China metalliurgical importd and export cooporation

HANGZHOU IRON AND STEEL WORKS

ZHANG SI MING	Director
YU YU HUA	Vice director
XU CHENG FANG	Chief engineer
WANG ZHI DE	
HE WEN ZAN	
ZHU YONG SHU	Translator

WUXI IRON AND STEEL WORKS

LI WEI	Vice director
YIN YONG XI	
ZHANG JU XIA	
WU QIA MEI	
XIANG MING YUAN	
WAN WEN HAO	
MAO JIAN ZHUANG	
PAN BAN XIN	
JIANG HUAN JIAG	
FAN XIAO BIN	
YU LIANG KUN	

NANJING IRON AND STEEL WORKS

LIU PEI ZHI	
HU LI QUN	
CHANG ZHONG	
YUAN HONG JUN	
WANG JIU XI	
TAN MAO	
FEI YUAN GAO	
ZHENG DE SHENG	
ZHANG RONG	
YE PING	

CHINESE GOVERNMENT, BEIJING

LIU PEI SHAN	Chief of environmental protection department, Ministry of metallurgical industry
WANG YONG SHENG	Deputy manager, International cooperation division, foreign affairs department
YE ZHOU ZHANG	
LIU CHUN GUANG	
LU CHUN	

STATUS OF EXECUTION OF ASSIGNMENT

On first day, we have been explained with regard to general description of the plant and problems (what Chinese considered as their points of problem) of the Environmental Protection.

On second day, we have introduced the current Japanese status of the environmental protection and followed by discussion of the problems raised on the first day in addition to the free talking over the issues pointed out by the dispatched specialists.

The discussions have been continued in the afternoon of the second day at Nanjing as well as in the morning of the third day at Wuxi.

RESULTS

In the execution of the assignment, the following restrictions we have been encountered which resulted an incompletion of the diagnosis and limited accomplishment of our recommendations for the improvement on the basis of our inspections and the discussions over the problems raised by Chinese part:

Insufficient time of stay for two days at respective works.
Difficulty for overall undetstanding, since the sites we visited were pre-arranged by Chinese part at where have been concentrated on most of problem areas only.
With some exceptions, we could not inspect plants in operation.
Non-supply of drawings of location map of adjacent to the works and layout plan of the premises in addition to lack of information with reference to the monitoring points and conditions required to analize and understand data thereof.
Lack of communication due to the inadequate interpreters.

Some of above restrictions and difficulties could have been overcome if sufficient time were given and spared.

We summarized the general description (production data, current level of environment and countermeasure) of respective works based on their lectures and data on our questionnaires of visited works, in Attached Sheet-1.

We also summarized our recommendations based on inspections and discussions, and questiions raised by Chinese part and itemized answers thereto, in Attached sheet-2, also answers have been prepared item by item in Appendix 1 through 14.

SUMMARY

Three (3) works we have visited were built in 1958 of medium size of the steel works which are designed through production of steel equipped with blast frunace except WUXI works.

The current status of pollution is similar level to that of Japan in early 1965. Air pollution resulting from dust, soot and sulfur oxides and polluted water are specially big problems.

In accordance with the extent of Chinese concerns, they have been paying more closer attention to the recycle of wastes generated from anti-pollution facilities such as sludge, and improvement for efficiency of recycling water in addition to the method for design of dust precipitator. We considered that their concerns were due to the primary factor of the guidances of central and local governments, and the works we visited were designated under the national 7th five-year project. And the works are located at famous sight-seeing district in China.

The environmental management system within the works is properly organized and enthusiastically operated, but the coordination between production departments and the environmental management is not adequately maintained and thereby high technology of each individual is not effectively and properly reflected overall function, we assume, due to less skill and experience.

We also have felt that behind or lack of systemized text for general issues of the environment, establishment of educational system and exchange of environmental information among the works.

The pollution as we have inspected at the sites was not appeared to be much serious, we however assumed that it was due to the present lower operating rate and rather smaller scale of production and an increasisng pollution at higher operational level expected in any future must be pointed out.

The quality of environment for Chinese steel works should be more higher standard because of their characteristics of walking distance between employee's residence and the works accompanied by boarding houses, schools and parks within same premises.

The education for safety and environmental problems at working place where generates the pollution is not considered to be sufficient and the strict attitude of management for obediance to required standard seems rather to be weak. Since it is so much important in view of not only environmental problems but also economic problems to observe rules for pollution control, we however considered that some of penalty measures against violation of the rules for standard are partly vague.

In consideration of Japanese operation only by self control system to set the target of management for not exceeding the standard level under any circumstances, we have found it so much difference in the standard level of both countries and it is unsensible to make comparison of both levels at this stage.

We also have found that facilities of coutermeasure for the environment are designed unbalance between actual generation and the capacity, and lower productivity resulting from inefficient rate of process due to manufacturing and operating facilities without porper understanding of the essence of the facilities. More serious consideration should specially be given to softwares for operation and maintenance.

Generally, we have been requested more of our instruction with regard to designing level of pollution control facilities, we however have found it rather necessary to train the workers the procedures of operation and maintenance to be skillful for full and efficient utilization of the facilities.

It is very possible to achieve a great improvement of the environment with steady and continous efforts to improve abovementioned points.

In future, it will be more effective to send personnel responsible for promoting environmental management and actual administration thereof in the works to be trained such management technique in environmentally advanced countries.

The following contents of trainning are desired to be preponderantly implemented:

Actual status of operation and software for practical maintenance of anti-pollution devices.

Method of measurement of point of origin, process facilities and water, and method of control and application of data.

Organization of anti-pollution , system and coordination with the site manager at the point of origin of pollution within the works.

Method of monitoring within the works and adjacent area, and method of utilization of data to be applied on establishment of priority for countermeasure.

Safety management system at production site.

OTHERS

We have prepared our questionnaire which handed over Chinese counterpart on the preceeding day to be filled out and followed by their lectures according to items listed thereon, due to the necessity of obtainning overall description effectively in limited period of time given.

For the reference, the format of the questionnaire is attached herewith.

We have explained them to understand collectively current status of countermeasures for environment in Japan with the presentation of the following materials and slides projection:

1. Pollution control in Japan (Material 1)
2. Environmental management in steel industry (Material 2)
3. Slides included panoramic view of Wakayama works of Sumitomo Metal Industries, overall view of Kashima works, Kainan works with cherry trees, outer-port of Wakayama and green belt, dust precipitators for coke oven, blast furnace and sintering machine, MOLETANA, SNT burner, present Yawata works and its in 30 years ago, birds-view of Hikari works, green plantation and forest development, water disposal facilities for materials, blast furnace, converter and hot rolling machine, improving effect of environment including graphs.
4. Brochure of Wakayama works, Yawata works and Hikari works, and Pollution Monitoring Center in Kita Kyushu city.

SUMMARY OF VISITED WORKS

(1) Production

Name of Steel Works		HANGZHOU	WUXI	NANJIN
Number of employees (related to environment)		15000 (30)	7500 (15)	15000 (20)
Coke Oven	Scale	42 x 1	--	42 x 1
	Capacity (t/yr)	280000	--	270000
	C gas (Nm^3/H)	13500	--	13300
Sintering Machine	Scale	$24m^2$x2, Pellet $8m^2$x1	--	$39m^2$ x 2
	Capacity (t/yr)	300000	--	600000
	Exhaust Gas (Nm^3/H)	100000 (pellet)	--	384000
Blast furnace	Scale	255m3 x 2	--	300m3 x 3
	Capacity (t/yr)	310000	--	550000
Converter	Scale	15T x 2	--	15T x 1
	Capacity	240000	--	400000
Electric furnace	Scale	5T x 3	5Tx3, 10Tx2	--
	Capacity	--	150000	--
Continous casting process		None	None	Equipped
Products and Capacity(t/yr)	Shape steel	60000	70000	90000
	Bar steel	180000	70000	115000
	Sheet steel, thin	18500	--	40000
	Pipe steel	18200	23000	--
	Others	--	340000	--
Remarks		Built in 1958	Built in 1958 Area 650000m3 Green area 5.9%	

(2) PRESENT ENVIRONMENTAL LEVEL

Name of Works		HANGZHOU		WUXI		NANJING	
		Standard	Actual	Standard	Actual	Standard	Actual
Air pollution	SO_2	0.25	0.143	0.25	0.074	0.15	0.063 (annual average)
Environmental concentration	NO_2	0.15	0.045	0.15	0.042	0.10	ND-0.208 (spot)
	SPM	0.25	0.22	0.25	-	0.15	0.04 - 4.358
	Dust fall ($t/km^2/M$)	12 own target	19	-	46.08 (In-Works)	13.5(city target)	26
Exhaust volume	SOX (kg/H)	unit control of stack	unknown	unit control of stack	196 (annual average)	unit control of stack	434 (annual average)
	NOX (kg/H)	No control	Unknown	No control	59 (annual average)	No control	Unknown
Water Pollution							
Concentration at drainage	COD (PPM)	100	63.3	100	5 - 63	100	4.9
	SS (PPM)	500	128	300	50 - 400	500	273
	OIL (PPM)	10	2.2	15	2 - 10	10	2.0
Volume of Effluent	(m^3/H)	-	10000	-	1660	-	7020
Noise Pollution	(dB)	55 at night	61 - 68	-	-	-	-

(3) CONTENTS OF ANTI-POLLUTION MEASURE

Name of Works						
	Air Pollution	Water Pollution	Air Pollution	Water Pollution	Air Pollution	Water Pollution
Facilities						
Coke oven	Venturi scrubber	Activated mud treatment	-	-	Collector (unknown type)	Activated mud treatment
Sinter plant	Cyclone + EP	-	-	-	Cyclone	Natural sedimentation
Iron plant	Gravity sedimentation + EP	Cohesive precipitation	-	-	Flushing type	Unknown type
Steel plant	Revolving furnace (venturi) Electric furnace (bag filter)	Horizontal current settling pond (Natural sediment)	Electric furnace (Bag filter)	-	Venturi scrubber	-
Other plant	-	-	-	Natural sediment	-	Natural sediment
Control system Monitoring items and frequency	Environmental SO_2, NO_2, Dust fall, SO_2 emission, soot and dust, exhaust gas volume (quarterly per year)	Volume of Effluent, SS, COD, BOD, S, CN, OIL, Zn, Mn, Pb, F, Cu, PH (3 times per month)	Environmental SO_2, NO_2, Soot and dust (quarterly per year)	SS, COD, OIL, PH (3 times per month)	Environmentl SO2, NO2 SPM (quarterly per year) Soot and dust (once a month)	SS, COD, PH, OIL CN (3 times per month)

INSPECTION AND DIAGNOSIS OF WORKS (1/2)

Name of Works	HANGZHOU	WUXI	NANJIN
Inspected sites	1. Water disposal facility for collected water from blast furnace. 2. Dust collector of pellet plant. 3. Front side of coke furnace. facility thereof. 4. Activated sludge treatment of coke oven. 5. Boiler.	1. Electric furnace and its dust collector. 2. Constructon site of new electric furnace. 3. Acid pickling facility of steel pipe mill. 4. Roller of wire plant and surface treatment 5. Water disposal facility of wire plant.	1. Front side of blast furnace and relining blast furnace. 2. Facility for water sludge. 3. Revolving furnace of steel mill, processes of continous casting and ingot. 4. Water returning facility for continous casting and it's operation room. 5. Operation room for sintering plant and electric dust precipitator. 6. Treatment facility of activated sludge for coke plant. 7. Overflow opening of drainage and environmental analysis room
Recommendations based on diagnosis	1. Recommended to prevent inflow of indirect cooling water and use of high molecular coagulating agent. 2. Recomended remodel of valve and use of jet bag for countermeasure of escape, since rescatter of dust as escape from cyclone of the pellet plant is ecxpected. 3. Judged that activated sludge treatment was complied with the specification of required production capacity. 4. Explained the calculation method of diffusion of sulfate gas from chimney of the pellet plant. 5. Recommended the need of education of safety and pollution for the employed.	1. Pointed out inadequate dust collector of electric furnace with reason of obscurity and a lack of strictness for conditions and control of bag filter and recommeded the need of control for temperature and loss of pressure. 2. Presented calculation method of wind volume to surpass the blowing speed for dust collector of a new electric furnace, and recommended the need of model experiment for effectiveness. 3. Recommended the method of adjusting PH and removal method of dissoluted iron by flocking settling for water disposal of pickling facility of steel pipe mill. 4. Presented the most optimum PH condition of Pb for water disposal of pickling facility of wire products line. 5. Recommended generally to identify targets for production and anti-pollution in addition to careful investigation as specification of the facility is planned.	1. Recommended the need of dust collection as worse generation of dust and soot was found from top and casting hearth of blast furnace. 2. Noticed strong odor of hydrogen sulfide at front of the furnace due to the use of high sulfur contained material. 3. Recommended to widen the open pit near mouth of the drainage as emergency measure since the collected water has been discharged without proper treatment. 4. Pointed out that the surface area is not large enough in comparison with capacity of the thickener now under construction. 5. Recommended to modify materials for skimmer and oil recoverer of oil-water separator for water disposal facility of continous casting line. 6. Recommended to modify the using form of recovery pit to use 1/2 to 2/2 for water disposal facility of steel bar plant. 7. Recommened that continued visual surveillance of smoke and dust should be maintained for priority of countermeasure to be given.

INSPECTION AND DIAGNOSIS OF WORKS (2/2)

Name of Works	HANGZHOU	WUXI	NANJIN
Questions raised by Chinese part	1. Production method of ammonium sulfate by reaction of sulfurous acid gas from pellet plant and ammonia formed by COG. 2. Recovery method of Zinc from dust sludge from the collected water of blast furnace. 3. Measuring system of environment.	1. Method of dust collection on electric furnace. 2. Effective use of dust from electric frunace. 3. Treatment method of drained pickling water.	1. Recycling method of collected water from blast oven. 2. Recycling method of collected water from revolving oven. 3. Reycling method of waste water from rolling mill. 4. Method of lowering NOX by improved burning.
Answers and reported materials	1. Production method of ammonium sulfate. 2. Recovery method of ammonia from coke oven gas. 3. Removal method of zinc from collected water from blast furnace. Flow of zinc carbonate from dust contained zinc. 4. General environmental monitoring system.	1. Flow of collected dust of electric furnace. 2. Method of effective use of oxidizing slag. 3. Flow of treatment for water drained from acid pickling. 4. Concept for use of circulating water. 5. Concept for low NO_x burner.	1. Recycling flow of collected water from blast furnace. 2. Recycling flow of collected water from converter. 3. Recycling flow of drained water from rolling mill. 4. Concept for use of circulating water.

1. REMOVAL METHOD OF AMMONIA FROM COKE OVEN GAS

Method	Wash-off	Description	Characteristics	Ref.
1. Recovery of ammonium sulfate	Diluted sulfuric acid	To recover ammonium sulfate by absorbing NH3 with diluted sulfuric acid.	High removal rate of NH3	Fig-1
2. Koppers	Water	To burn distilled ammonia after absorbing NH3 by water.	NOx tends to be formed	-
3. Karlstill	Water	To burn resoluted H2 and N3 by catalyst after distilling NH3 scanveged by water.	Need of catalyst and fuel	Fig-2
4. Phosam	1-phosphate ammonium	To produce pure ammonium sulfate by refined and distilled NH3 vaper of stripped NH3 scanveged by 1-phosphate ammonium.	High purity of NH3 is recovered.	Fig-3
5. Nasco	1-phosphate ammonium	To burn NH3 scanveged same as above.	NOx tends to be formed	-

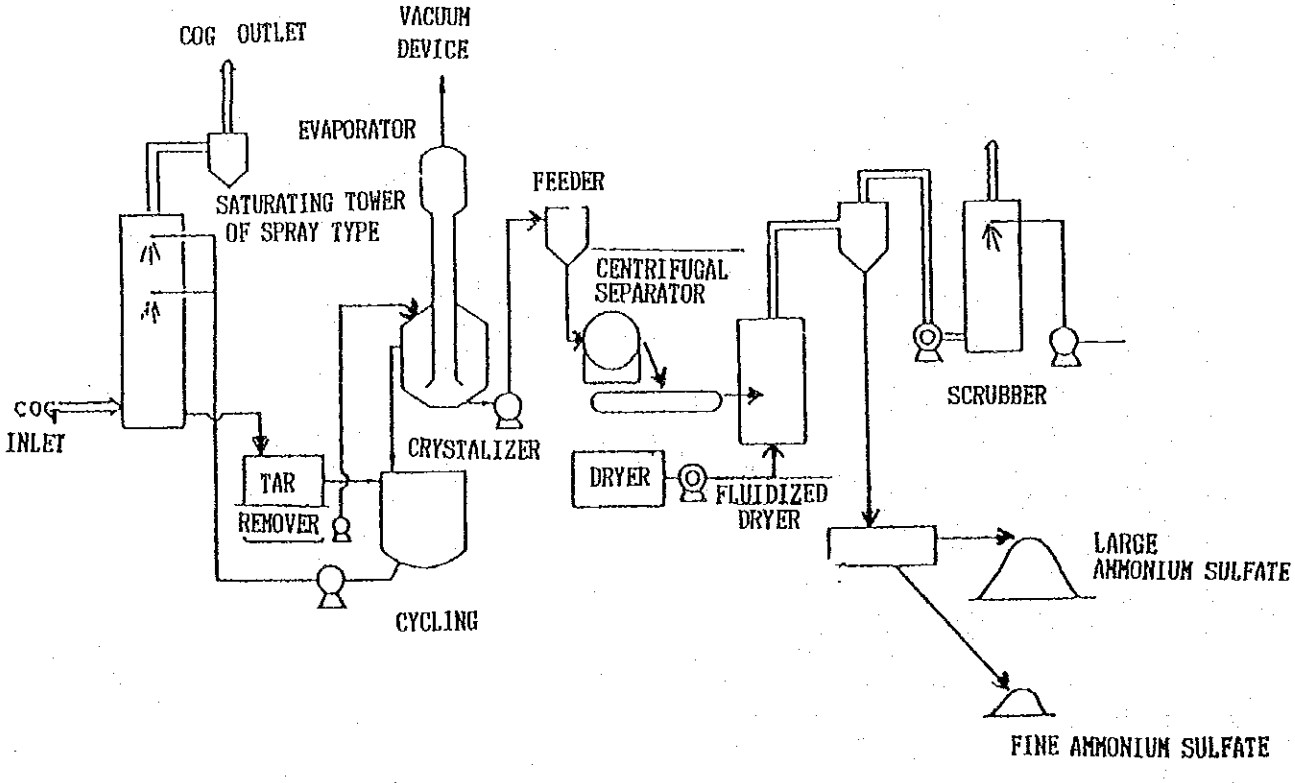


FIG-1 · PRODUCTION FLOW FOR PELLET OF AMMONIUM SULFATE

There is another production process of powder form of ammonium sulfate, but the process for pellet form of ammonium sulfate is dominated in the industry.

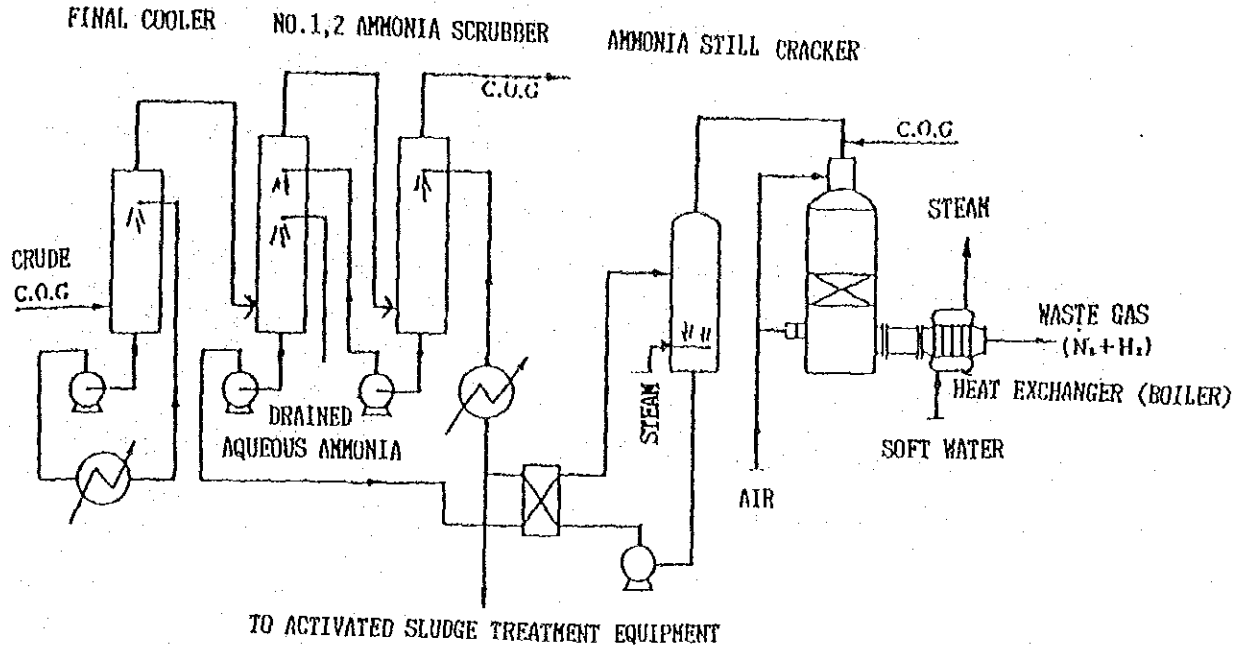


FIG-2 KARL STKLL METHOD

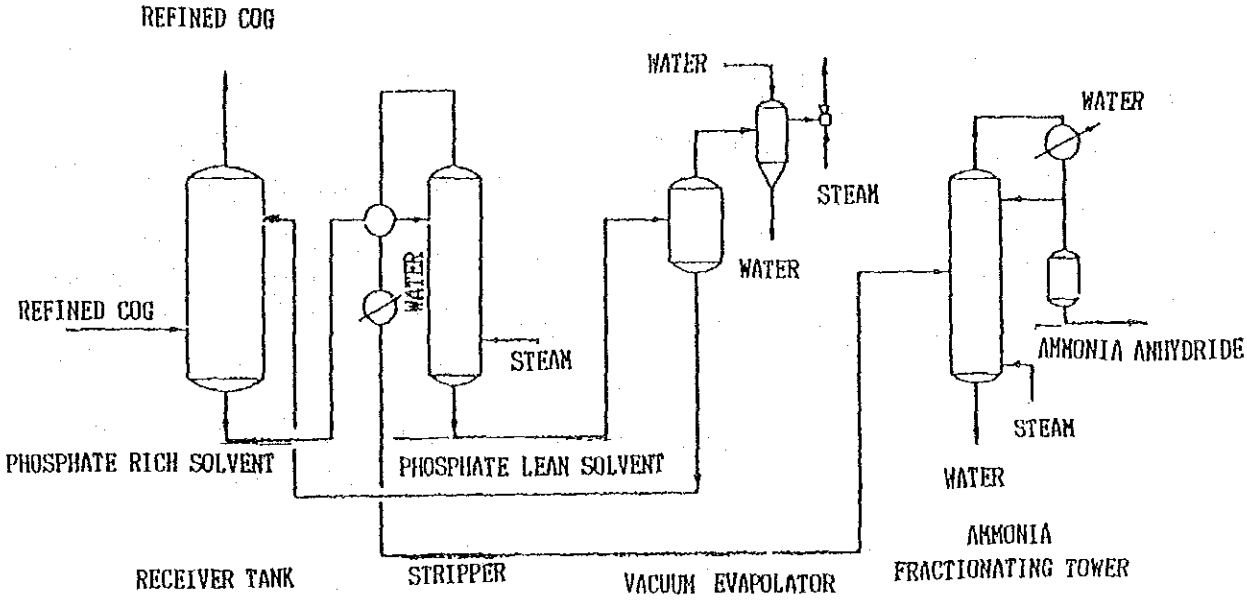


FIG-3 PHOSAM METHOD

BILIOGRAPHY: HANDBOOK FOR AROMATIC AND TAR INDUSTRY (JAPAN AROMATIC INDUSTRIAL ASSOCIATION)

2. COUNTERMEASURE FOR ZINC OF COLLECTED WATER FROM BLAST FURNACE

The collected water from blast furnace contains zinc. Most of zinc has been distributed to wet dust processed by the collected water.

In consideration of recovery of iron source, as the wet dust is recycled as pellet or sintering material, zinc contained in the collected water and zinc in the treating water therefor also will consequently be increased.

It therefore is the classification method of wet cyclon available to reduce zinc contained in the treating water and the wet dust, which is introduced as follows:

The principle of the method is simple and 60 to 80 % of zinc shall easily be removed at the point of efficient classification of approximately 15 μm by the blast furnace wet dust to be passed through the wet cyclon which is capable of volume process.

The flow of process equipment is shown in Fig-1.

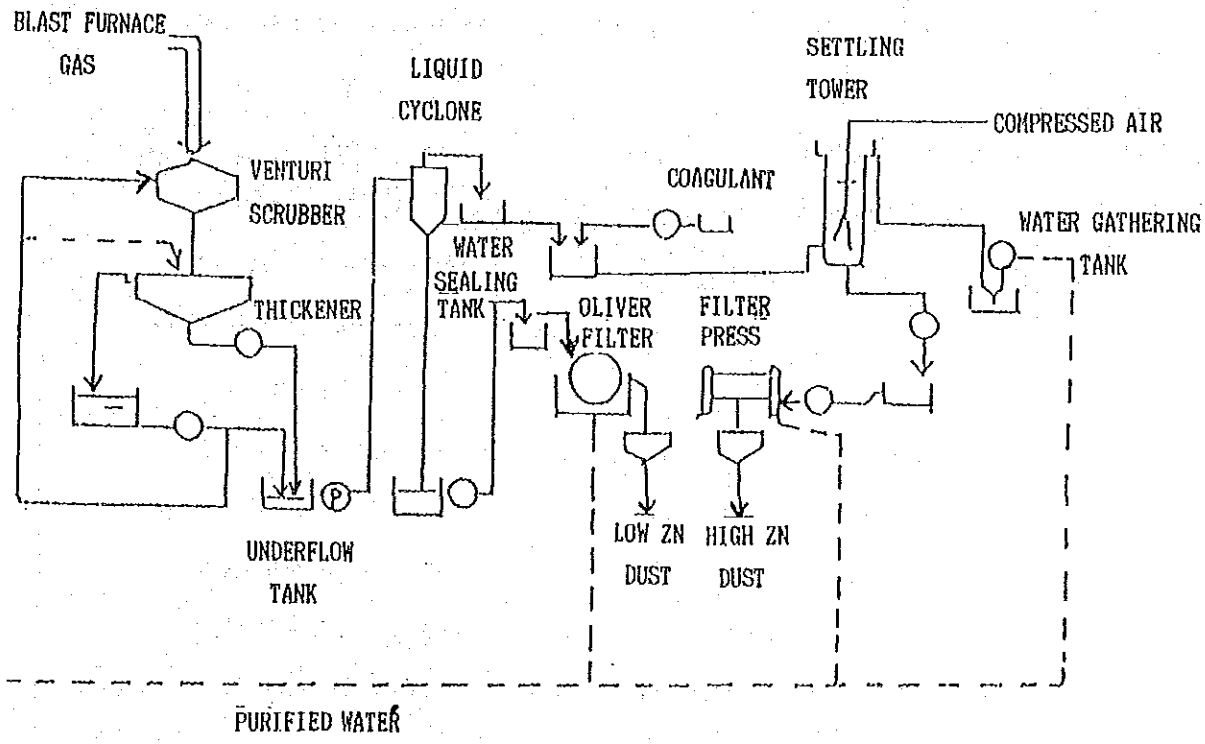
The underflow which is removed 60 - 80% of zinc can be used as materils for sinter or pellet after dehydration by the oliver filter, and the overlow will be placed in settling tank and the supernatant of which will be returned to the thickener, and the cconcentrated slurry at bottom containing high zinc will be dehydrated by the filter press, and the dust of which will either be reused as zinc source or disposed as waste.

ACTUAL OPERATIONAL DATA

FEED DUST	4 - 5% Zn
OVERFLOW DUST	8 - 16% Zn
UNDERFLOW DUST	1 - 3% Zn

Zinc concentration of disposed wated collected from blast furnace was 1 - 5 ppm.

Fig-1 Flow sheet of classification process facility



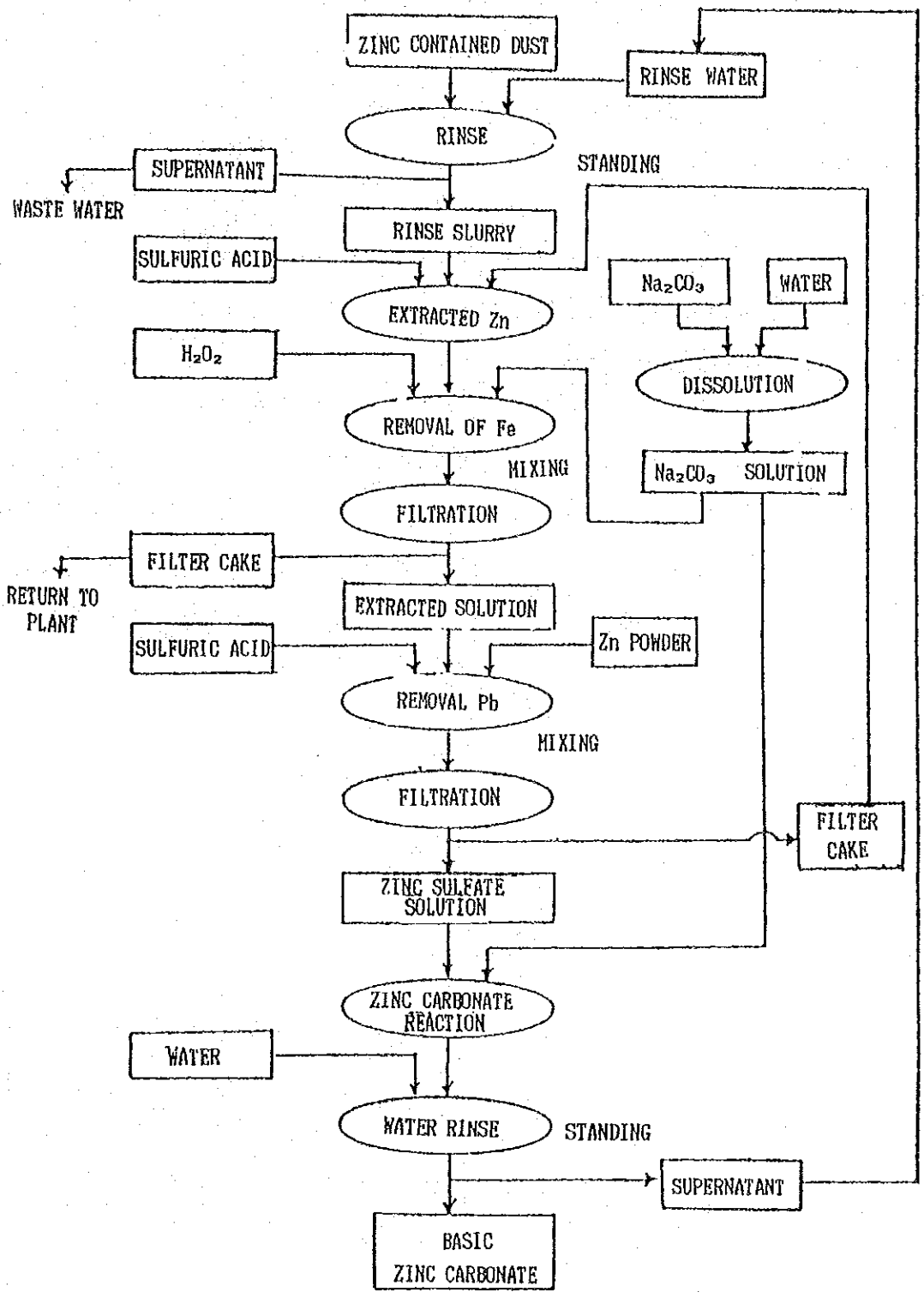
3. METHOD OF FORMATION OF ZINC CARBONATE FROM SLUDGE CONTAINED ZINC

It is already practical to recover an iron by method of centrifugal separation and so on, in case of implementation for an effective utilization of the sludge generated from treatment equipment for waste of collected dust of blast furnace, but other method to form basic zinc carbonate from unrecovered zinc is shown hereunder. It is however noted that this method is still remained as the experimental level of laboratory, but not commercialized yet.

1. General process

PROCESS	OBJECT	METHOD
(1) Extraction	Extraction of Zn by adding sulfuric acid.	To extract Zn of sludge by adding sulfuric acid into reacting tank $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$
(2) Removal of Iron	Removal of Iron by adding hydrogen peroxide within proper pH range by addition of sodium carbonate.	H_2O_2 H_2O ↓ ↓ $Fe^{2+} \rightarrow Fe^{3+} \rightarrow Fe(OH)_3$ Precipitate above is to be separated by hydrator.
(3) Refining	Removal of Lead by addding Zn powder within proper pH range by adddion of sulfuric acid.	$Pb^{2+} + Zn \rightarrow Pb + Zn^{2+}$ Precipitate of Pb is to be separated by hydrator.
(4) Formation	To form basic zinc carbonate within proper PH temperature range by addition of sodium carbonate solution to zinc sulfate solution.	$ZnSO_4 + Na_2CO_3 + 4H_2O \rightarrow 2ZnCO_3 \cdot 3Zn(OH)_2 \cdot H_2O + 3CO_2 + 5Na_2SO_4$

2. FLOW SHEET


ZINC CONTAINED DUST
RINSE WATER
RINSE
SUPERNATANT
WASTE WATER
STANDING
RINSE SLURRY
SULFURIC ACID
Na_2CO_3
WATER
EXTRACTED Zn
H_2O_2
DISSOLUTION
REMOVAL OF Fe
MIXING
Na_2CO_3 SOLUTION
FILTRATION
FILTER CAKE
RETURN TO PLANT
EXTRACTED SOLUTION
SULFURIC ACID
Zn POWDER
REMOVAL Pb
MIXING
FILTRATION
FILTER CAKE
ZINC SULFATE SOLUTION
ZINC CARBONATE REACTION
WATER
WATER RINSE
STANDING
SUPERNATANT
BASIC ZINC CARBONATE

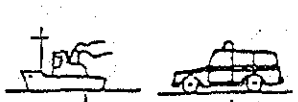
4. ENVIRONMENTAL MONITORING SYSTEM

The monitoring of the environmental conditions of respective origins of generation and status around a steel works in an inevitable factor to develop rational and scientific countermeasure of environment.

Japanese steel works make assurance doubly sure that not only surveillance by telemetering monitors is maintained but also the patrol teams are assigned for the purpose.

While the local environmental monitoring system adopted by some of works has been very successful which keeps very active dialogue with the people of local communityin order to grasp the environmental conditions through human senses.

IMPLEMENTATION OF ENVIRONMENTAL PATROL



(MARINE PATROL)

<TRANSPORTATION CONTROL DEPARTMENT>
- MARINE PATROL
- MARINE EMERGENCY ACTION (at oil run-off)
- SAMPLING OF SEA WATER AND BOTTOM DEPOSIT

(IN-PLANT PATROL)

<GAS REFINING PLANT>
- ABNORMAL DUST, SMOKE AND DUST, WATER QUALITY
- NOISE, OFFENSIVE ODOR
- EMERGENCY COMMUNICATION & REPORT
- ACTION FOR FIRE OR ACCIDENT

Sample

EMERGENCY ACTION & REPORT

EMERGENCY COMMUNICATION & DAILY REPORT

<ENERGY TECHNICAL DEPARTMENT>
- WATER QUALITY ANALYSIS (SEA WATER, DRAINED WATER)

ANALIZED RESULT

<ENVIRONMENT-ANTIDISASTER MANAGEMENT ROOM>
- IN-HOUSE TOTAL MANAGEMENT
- EMERGENCY INVESTIGAION · COUNTERMEASURE

ANALIZED RESULT

<TEST & ANALYSIS DEPARTMENT>
- CHEMICAL ANALYSIS OF HEAVY METALS INGREDIENTS
- CHEMICAL ANALYSIS OF BOTTOM DEPOSIT
- CHEMICAL ANALYSIS OF DUST FALL

EMERGENCY CONTACT

<PLANTS>
- OPERATIONS
- EMERGENCY CONTACT & ACTION

EMERGENCY CONTACT

Sample

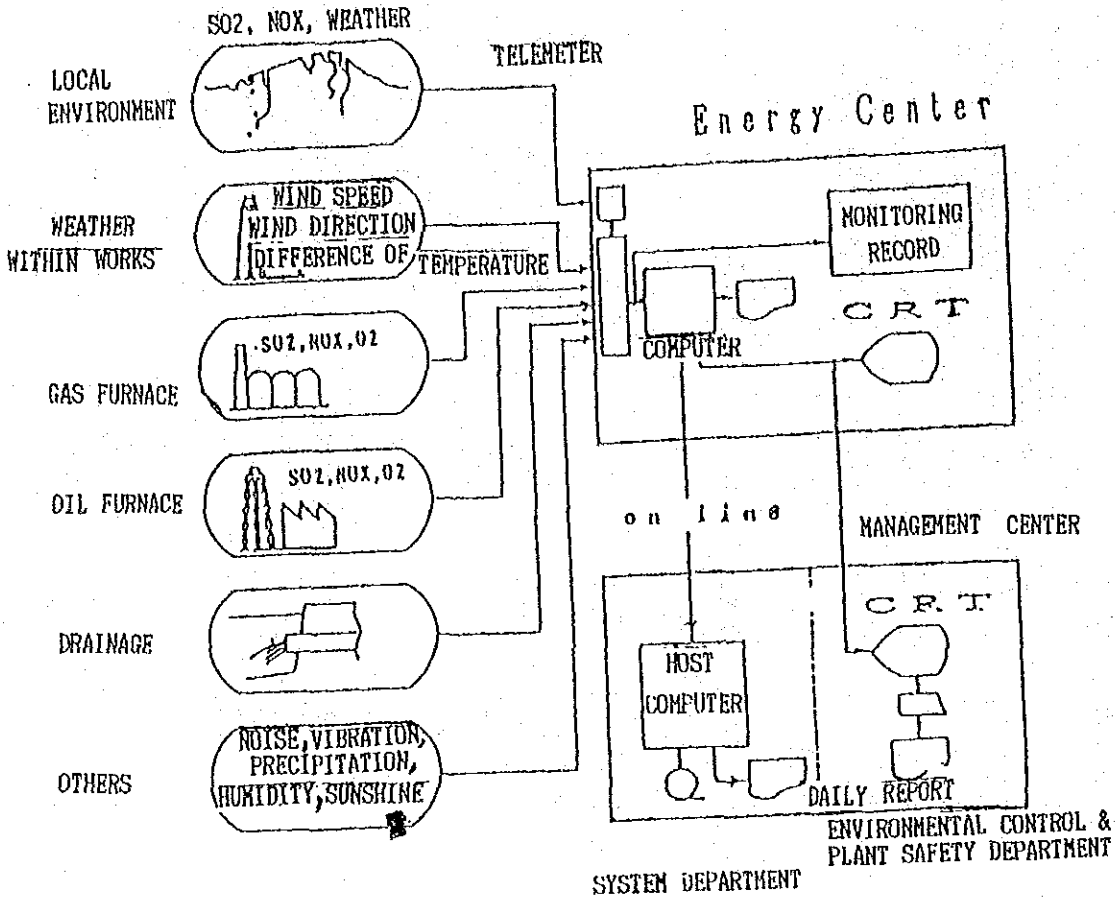
<HEAT TECHNOLOGY DEPARTMENT>
- SAMPLING OF DUST FALL

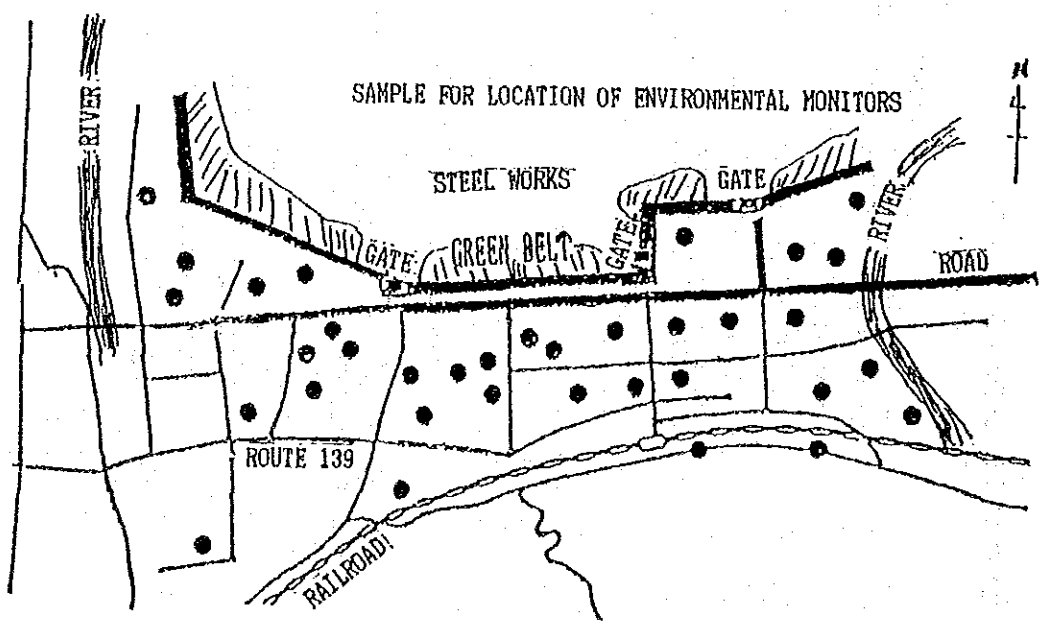
<POWER PLANT>
- ENVIRONMENTAL
- MONITORING

STATUS OF ORIGIN OF OCCURANCE

MANAGEMENT · FORECAST · ALERT

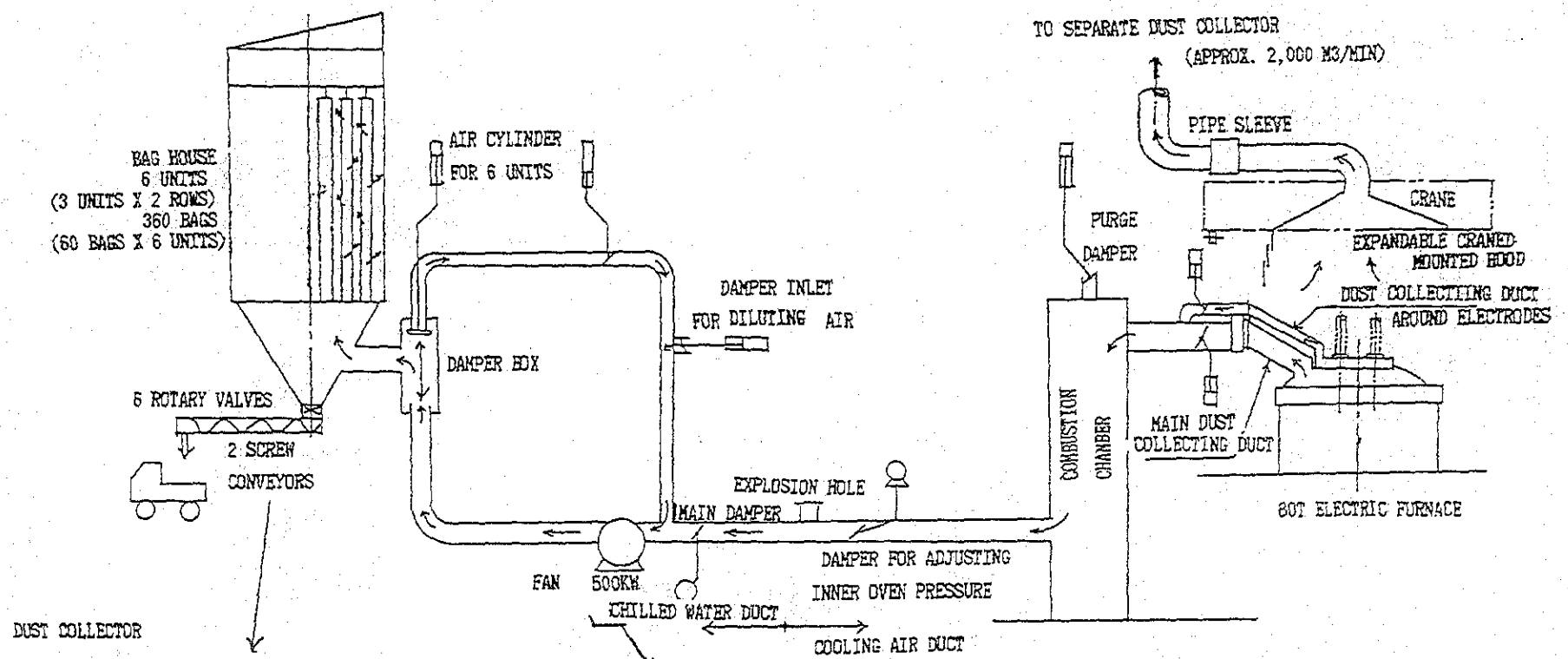
CENTRAL SURVEILLANCE SYSTEM BY AUTOMATIC MONITOR





5. DUST COLLECTION METHOD FOR ELETRIC FURNACE

FLOW OF 80T ELECTRIC FURNACE AT CERTAIN PLANT



1. TYPE	PUSH-IN BAG FILTER
2. WIND VOLUME	2,000 Nm³/MIN
3. PRESSURE LOSS	APPROX. 250 MM Aq
4. INLET CONCENTRATION	3 - 16 Gr/Nm³
5. OUTLET CONCENTRATION	0.033 - 0.1 Gr/Nm³
6. FILTER MEDIA	φ292 X 9.600L X 360 BAGS GLASS FIBER MADE, 6 UNITS OF CHAMBER
7. TYPE OF DUST OFF	SHAKING METHOD

1. TYPE AND MADE	DUAL PLATE SUCTION, BY NAKAJIMA
2. CAPACITY	WIND VOLUME : 2,000 Nm³/MIN TEMPERATURE : 250°C PRESSURE : 600mm Aq
3. MOTOR OUTPUT	500 KW

6. USE OF ELECTRIC OVEN SLAG FOR BASE MATERIAL OF ROAD

The slag discharged from an electric furnace is transported to the crushing plant to scatter for cooling, in process of which the reducing slag is powdered, and an unpulverized portion of reducing slag and oxidation slag is crushed and screened after sorting out of a metal. The repeated process of crushing and screening to obtain required grain size which makes the crushed slag. A sample of standard flow of the process is shown as FIG-1. The granulated crushed slag is placed at an open yard for a certain period of time as an aging to stabilize unreacted lime contained in the crushed slag is allowed to react with water.

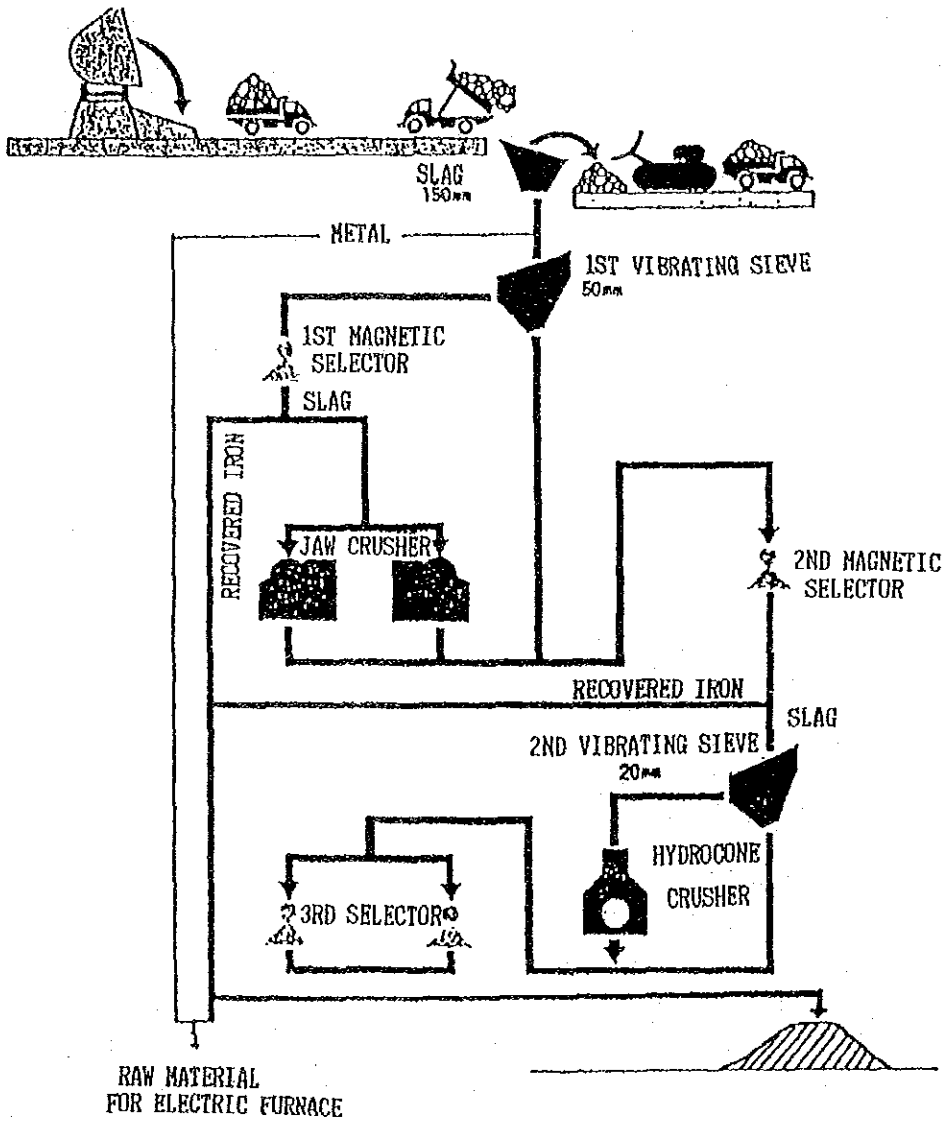


FIG-1 CRUSHING FLOW OF ELECTRIC FURNACE SLAG (EXAMPLE)

The quality of an electric furnace slag for base material of road is fully complied with the related specifications in their items as shown in TABLE-1.

TABLE-1 QUALITY OF AN ELECTRIC OVEN SLAG FOR BASE MATERIAL OF ROAD (EXAMPLE)

	JIS-A5015	GUIDANCE FOR DESIGN & CONSTRUCTION OF BASE BY STEEL SLAG (*)	BASE MATERIAL OF ELECTRIC OVEN SLAG MADE BY FIRMS				
	MS-25 SPEC	MS-25 SPEC	A	B	C	D	REMARKS
GRAIN SIZE	As per attached Fig-2						JIS-A1102
MASS OF UNIT VOLUME (kg/l)	Over 1.50	Over 1.50	1.96	2.01	1.96	2.12	JIS-A-1104
ADJUSTED CBR (%)	Over 80	Over 80	145	112	163	120	Asphalt Paving Guide
MOST OPTIMUM MOISTURE CONTENT (%)	-	-	8.0	7.3	8.3	7.3	JIS-A1210
MAXIMUM DRIED DENSITY (g/cm³)	-	-	2.54	2.63	2.51	2.61	JIS-A1210
EXPANSION STABILITY (%)	-	Under 1.5	0.33	0.06	0.21	0.03	Guidance(*)
MOISTURE CONTENT (%)	-	-	4.8	5.6	5.3	5.3	JIS-A1203

Also the electric furnace slag for base material of road is properly mixed with the reducing slag of an electric furnace to improve the compactibility at the time of construction, as the result of which is shown in FIG -2 which is fully complied with above MS-25 specification.

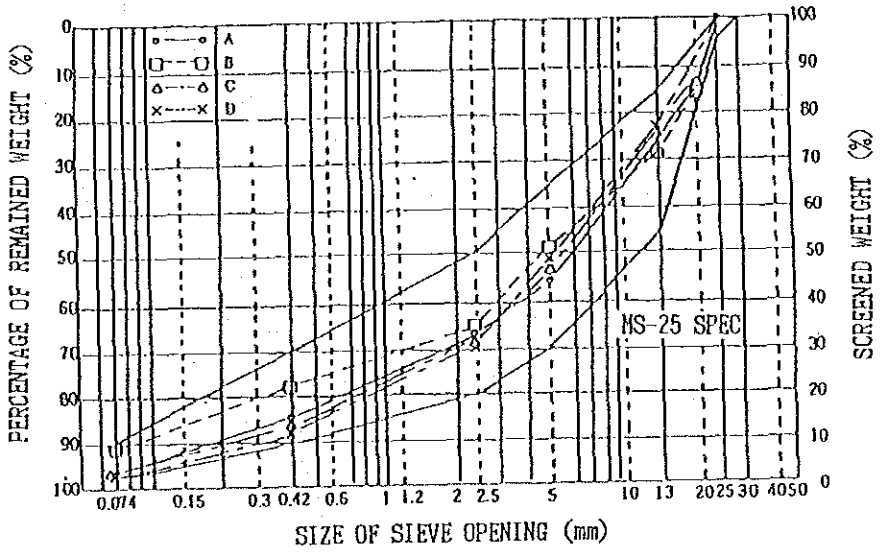
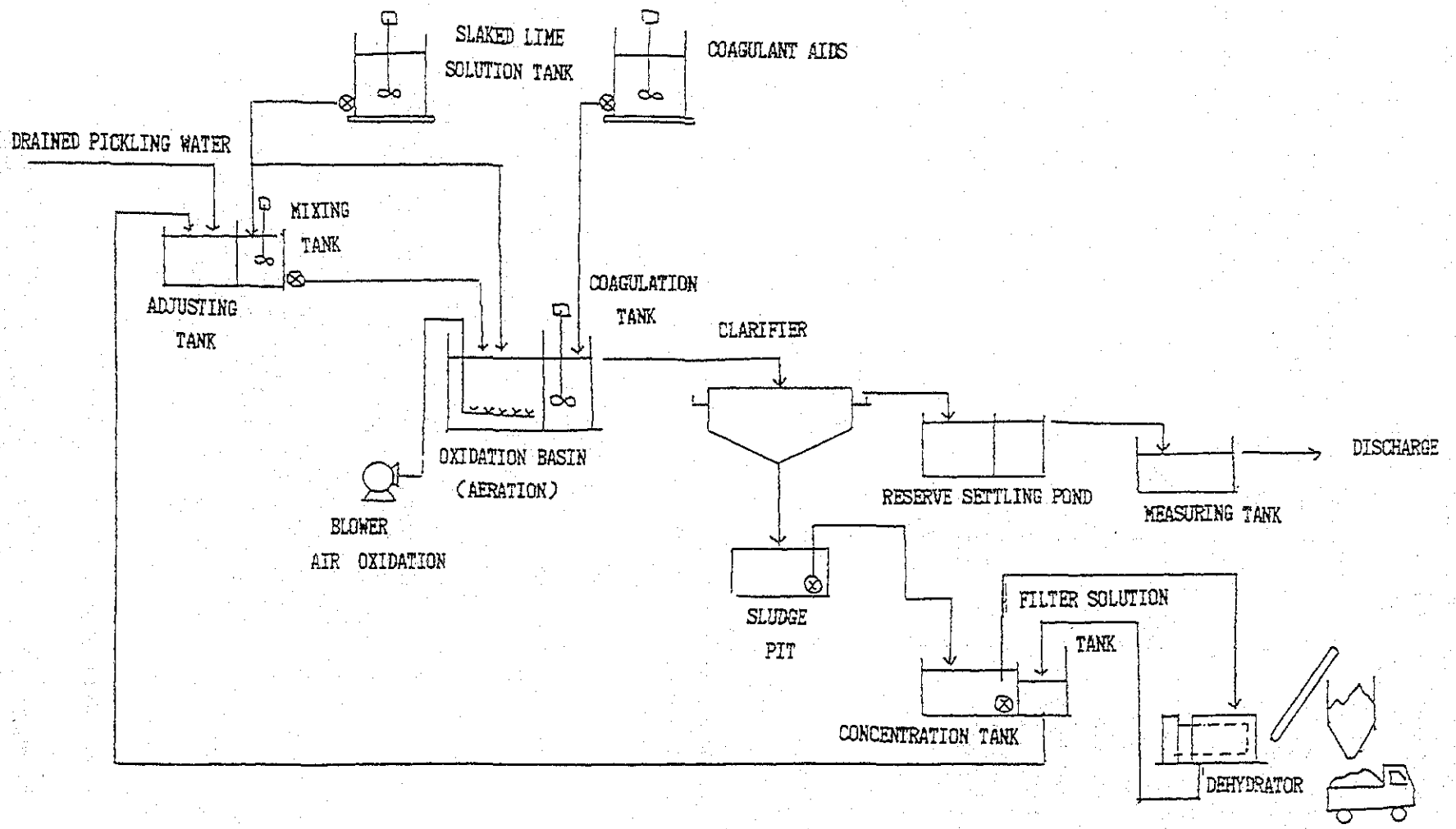


FIG-2 GRAIN SIZE OF ELECTRIC FURNACE SLAG FOR BASE MATERIAL OF ROAD

BIBLIOGRAPHY; TECHNICAL DATA OF FURNACE SLAG FOR BASE MATERIAL OF ROAD
(APRIL 1985 STEEL SLAG ASSOCIATION WESTERN JAPAN BRANCH)

7. DISPOSAL OF DRAINED ACID WATER



8. REUSE OF WATER (RECYCLE)

It is required to examine the current status of water usage prior to the implementation of recycle of water to conserve the water (rationized use of water) before the recycle of water is planned.

1) RATIONALIZATION PLAN OF WATER USAGE

The investigation of actual condition of water use (examination of changes of water amount and quality), specially dissolved salts should be checked in the water quality.

↓

Flow sheet of supply and waste water, balance sheet of substances.

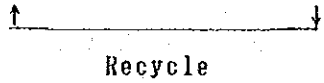
↓

Definition for investigation of origin of prime generation, fractionation of drainage system, and reusable water.

2) SCHEMA OF REUSE AND RECYCLE

Reuse: fresh water → use I → treatment → use II → treatment → discharge

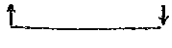
Recycle: fresh water → use → treatment → partial discharge



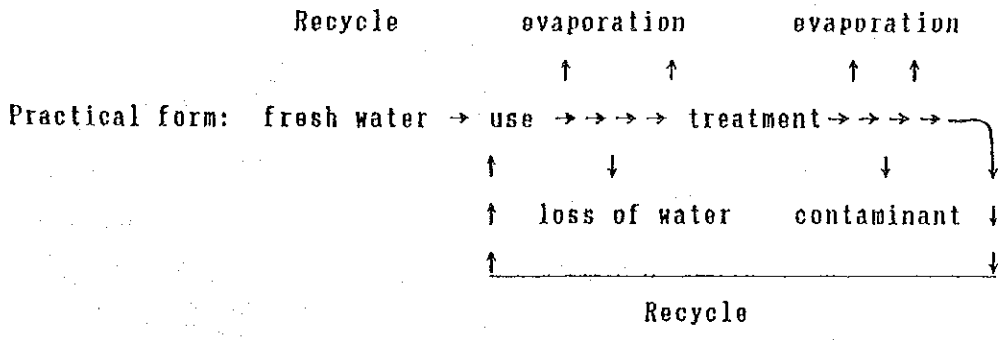
Recycle

Closed system:

Ideal form: use → treatment



Recycle



Recycle

The closed system is considered to be the final ideality, which however is inpractical to repeatedly recycle the water forever and is practically appeared to be without discharge resulting from the evaporation or loss of water.

3) REMARKS FOR PLAN OF CLOSED SYSTEMAZATION OF WATER

① Balance sheet of water

② Removal of salts

③ Overall consumption of energy

④ Anti-pollution for air and solid wastes

4) REMARKS FOR RESUE AND RECYCLE OF WATER

① Object is not anti-pollution but rationalized use of water.

② The rationezed use of water should be achieved with the minimum treatment (high level of the treatment costs a high energy).

③ Origin of water must be selected only from distinctly known contaminants as much as possible but not to be mixed with waste water of differnt characteristics or of unknown contaminants.

5) TREATMENT METHOD OF WATER FOR REUSE AND RECYCLE

Method by separation of contaminants in water as solid substances

Coagulating (chemical) Sedimentation

Biographical treatment

Filteration

Method for removal of dissolving impurities

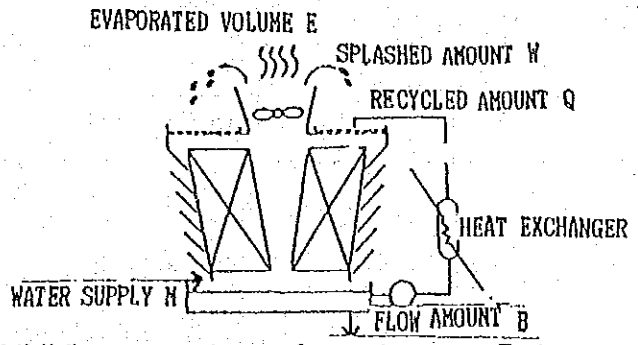
Absorption by active carbon

Ion exchange : concentration of contaminants

Separation process by membrane: concentration of contaminants

6) IMPLEMENTED SAMPLE FOR REUSE AND RECYCLE OF COOLING WATER

The water of cooling tower is concentrated by the evaporation.
As the result of increased concentration of dissolved salt by the concentrated water, which is liable to form a metal corrosion or deposit a scale, therefore discharge a portion of the recycling water as blow-water out of the system and in exchange therefor, the concentration of salts is controlled by supply of fresh water to the system.
The water balance of recycle cooling water system is shown in FIG-1 and the relationship between the coefficient of concentration and amount of supply water and amount of blow water is shown in FIG-2.
The corrosion is greatly influenced by the concentration of chlorine ion.
The deposition of scale is often found in case of deposition of calcium carbonate as the result of concentration of calcium ion, and it is also required to be aware of the scale deposition of silicate compounds.
The countermeasure to prevent from such hindrance is shown in FIG-3.

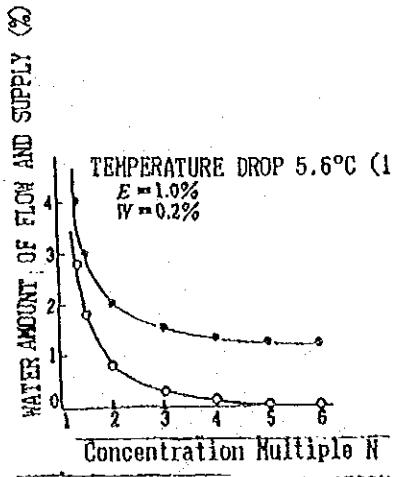


E,W,M,B are percentages of recycling amount of water.

CONCENTRATION MULTIPLE N

$$N = \frac{E + B + W}{B + W} = \frac{M}{B + W}$$

FIG-1 WATER BALANCE OF CYCLING WATER OF COOLING TOWER



RELATION BETWEEN CONCENTRATION MULTIPLE AND WATER AMOUNT OF FLOW AND SUPPLY

FIG-2

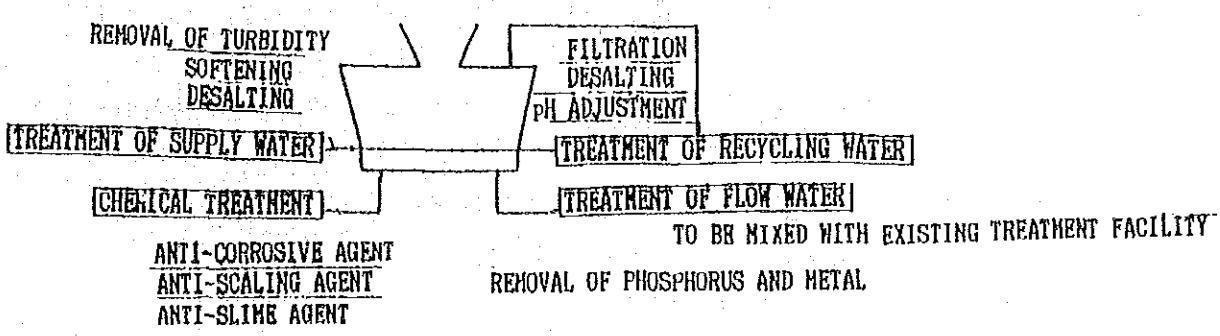
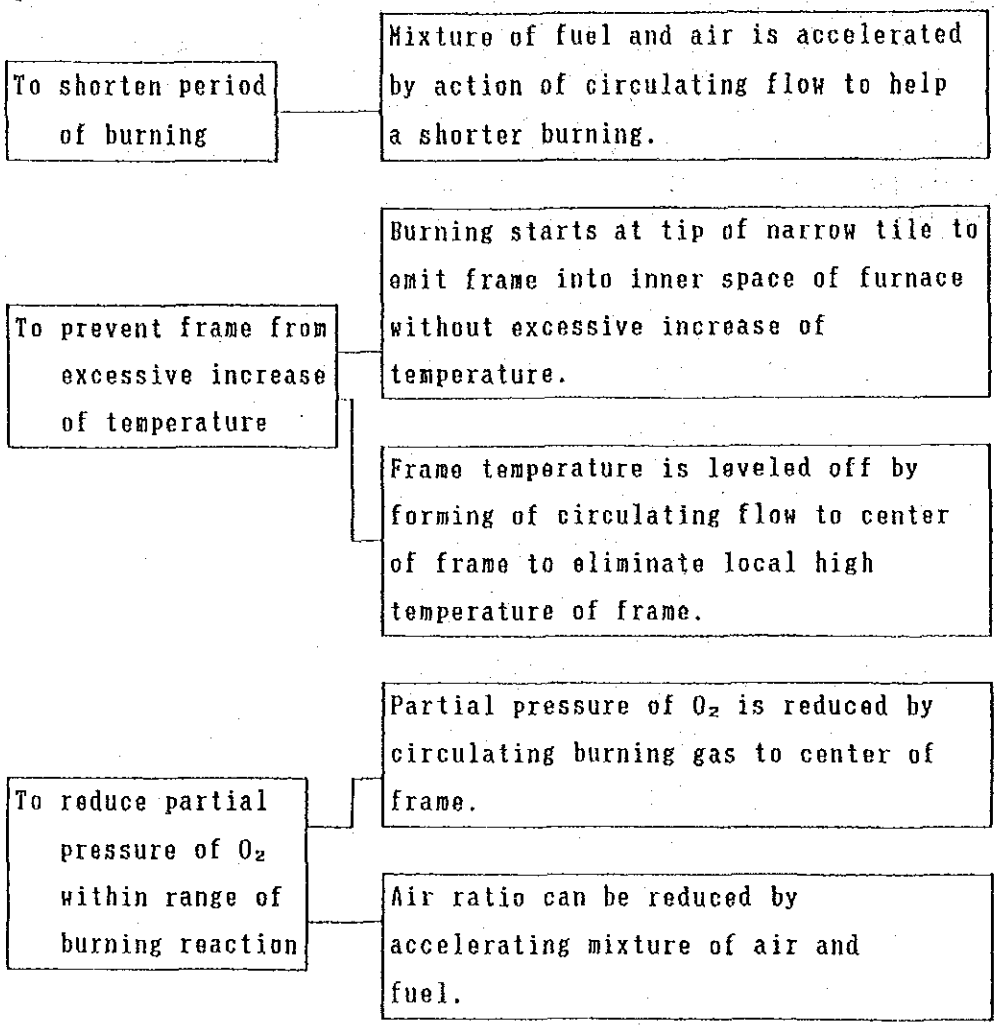


FIG-3 COUNTERMEASURE FOR OPERATION OF COOLING TOWER AT HIGH CONCENTRATION AND BLOW-CUT

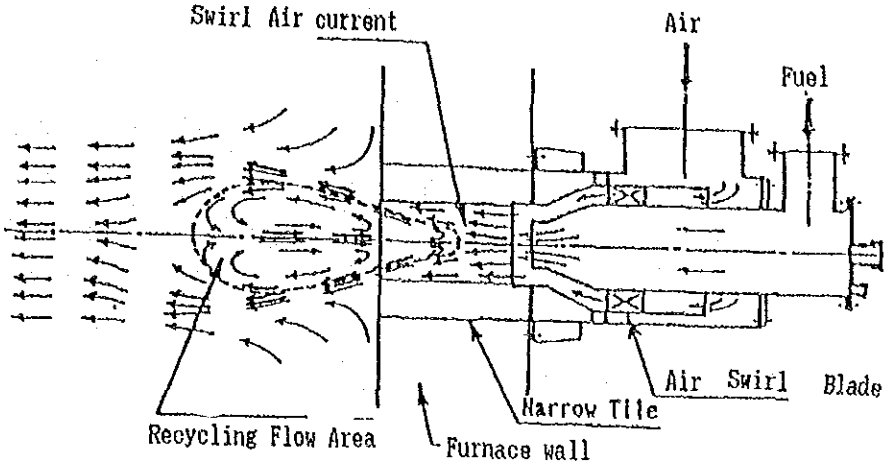
9. LOW NOx BURNER

The low NOx burner of various kind of principle is introduced, a type of which is called 'Mixture accelerated self-recyoling' of burner is shown hereunder.

1. Principle of low NOx burner



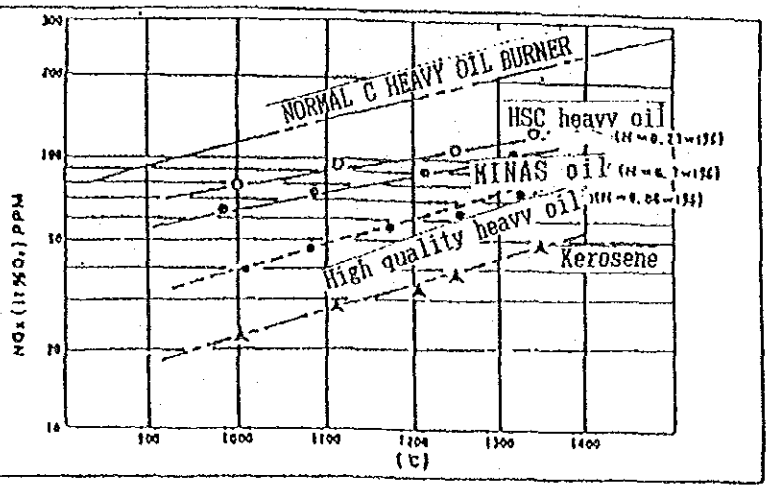
This type of burner is charactristic of combustion inside of furnace to avoid combustion in burner title resulting from action of narrow tile which is accelerated air flow and air flow with a strong gyration.
The gyration given to air forms self-circulating flow by pressure difference between positive pressurized part of outer circle and negative pressurized part at center part of air flow generated by the principle of vortex.
This circulation flow helps to accelerate the combustion and to homogenizethe frame temperature for a perfect combustion at low air ratio and also to stabilize the frame whcih controls NOx.



2. FORMING AMOUNT OF NOx (EXAMPLE)

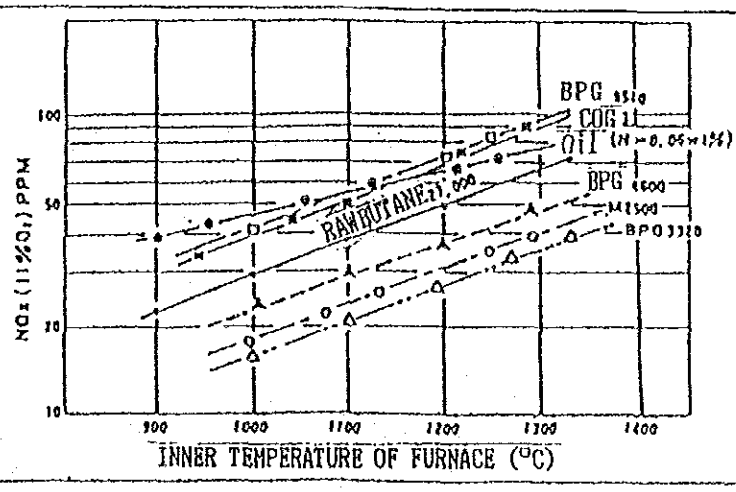
(OIL BURNER)

AMOUNT OF FUELING
240 X 10^4 Kcal/Hr
AIR MIX RATIO 1.2
PREHEATED AIR 350°C
STEAM ADDED

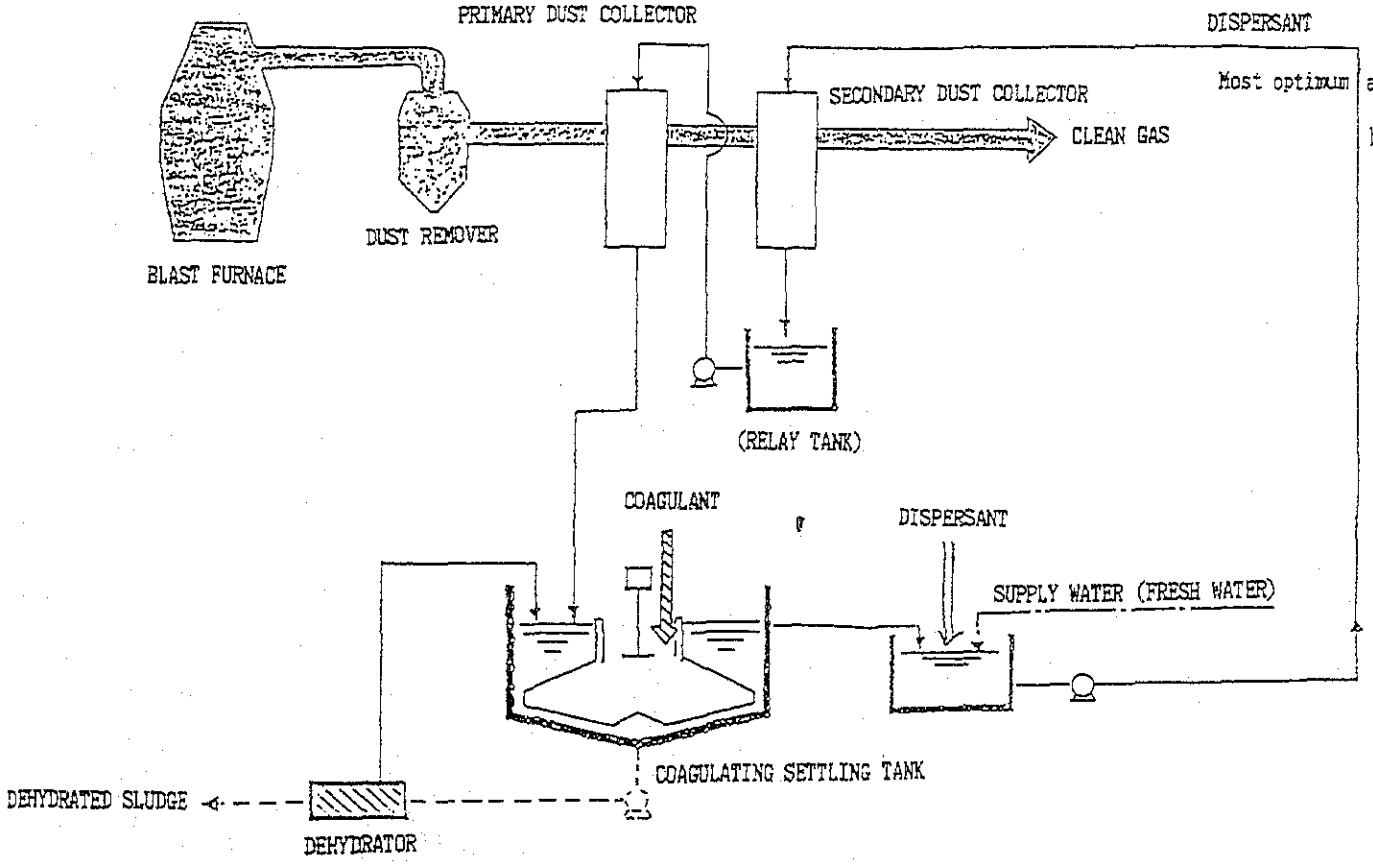


(GAS BURNER)

AMOUNT OF FUELING
2,400 X 103 Kcal/Hr
AIR MISING RATIO OIL=1.2
GAS=1.1
PREHEATED AIR
250 - 350°C



10. DISTRIBUTION DIAGRAM FOR DISPOSAL OF RECYCLING WATER FOR DUST COLLECTOR OF BLAST FURNACE

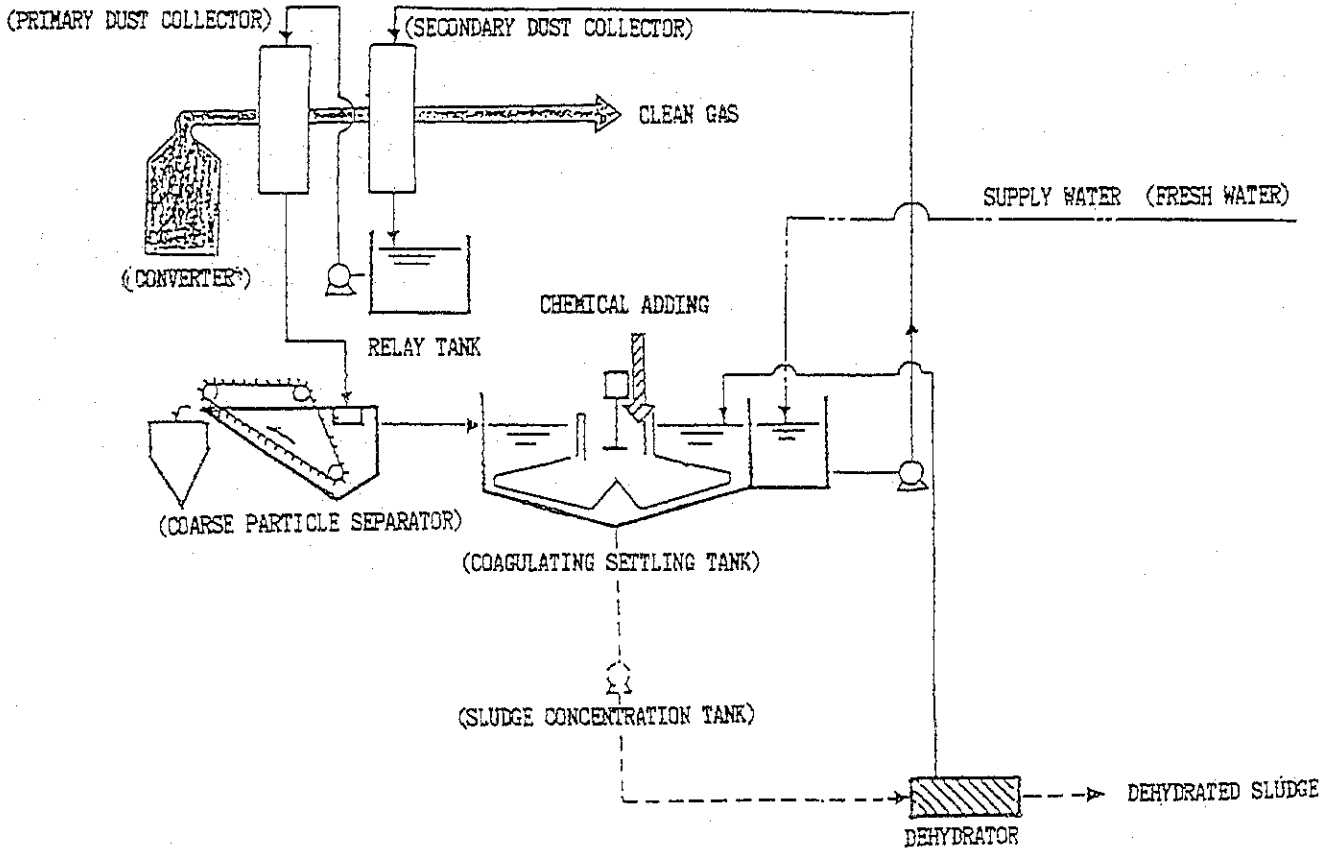


VOLUME OF ADDED CHEMICALS

INORGANIC COAGULANT (PAC)	20 - 30 mg/l
HIGH MOLECULAR COAGULATING ASSISTANT	0.3 - 0.5 mg/l
DISPERSANT	1.5 - 2.0 mg/l

Most optimum amount of the agents to be used should be decided upon cecking disposal effect.

11. DISTRIBUTION DIAGRAM FOR DISPOSAL OF RECYCLING WATER FOR DUST COLLECTOR OF CONVERTER



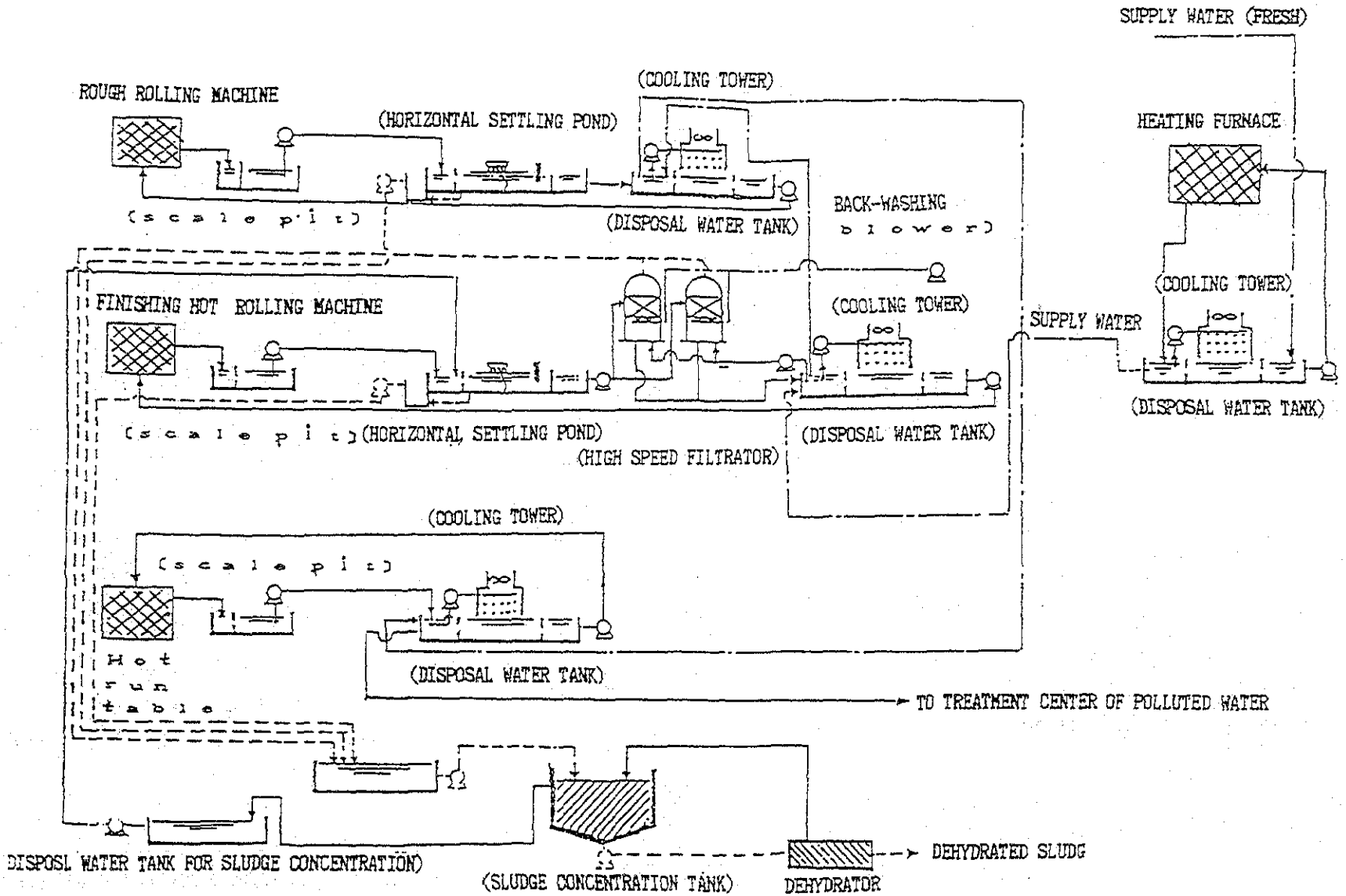
AMOUNT OF CHEMICAL TO BE ADDED

HIGH MOLECULAR COAGULATING AID

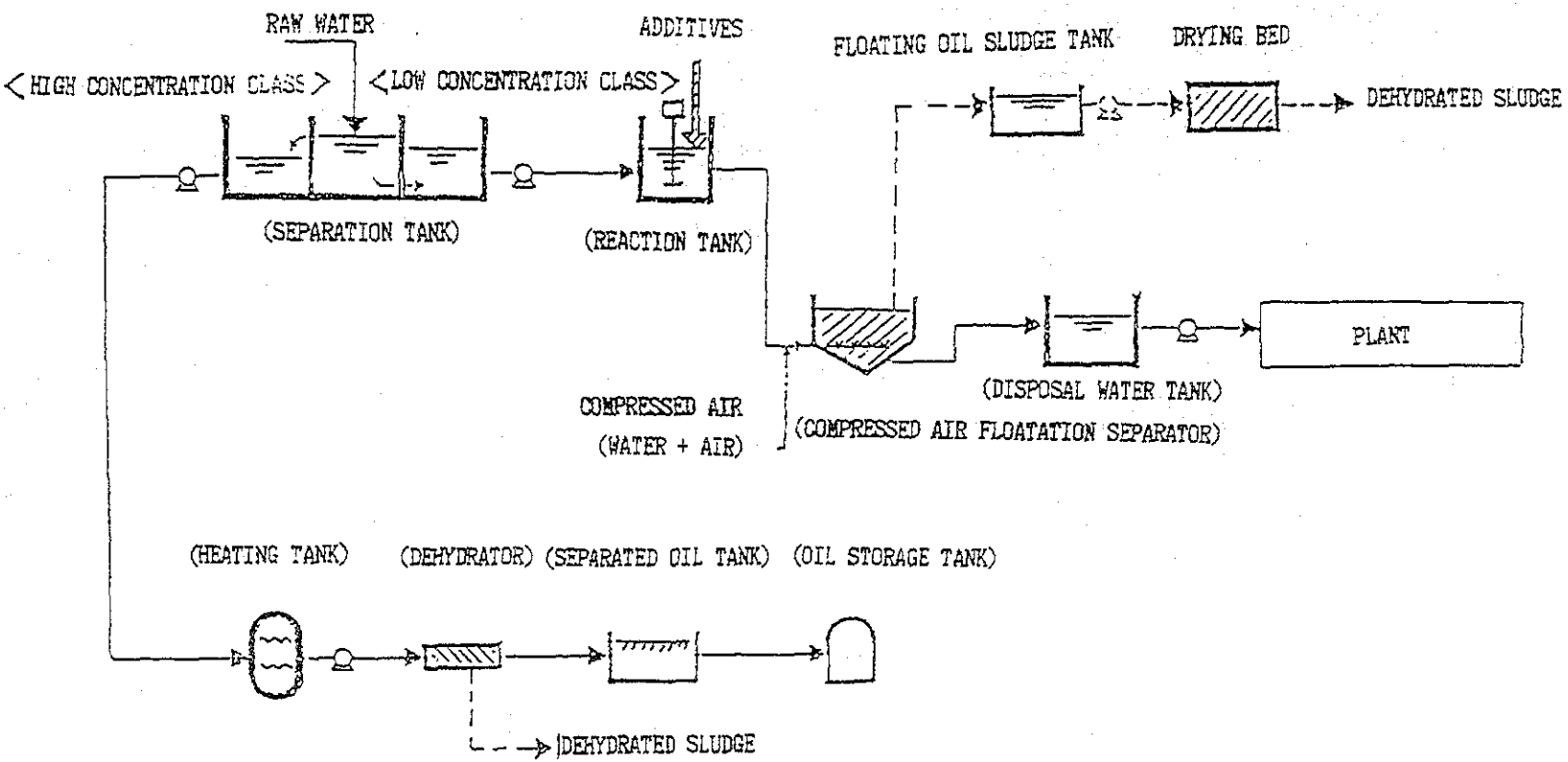
0.3 - 0.5mg/ℓ

Proper amount of additive should be determined upon checking up on result of disposed effectiveness.

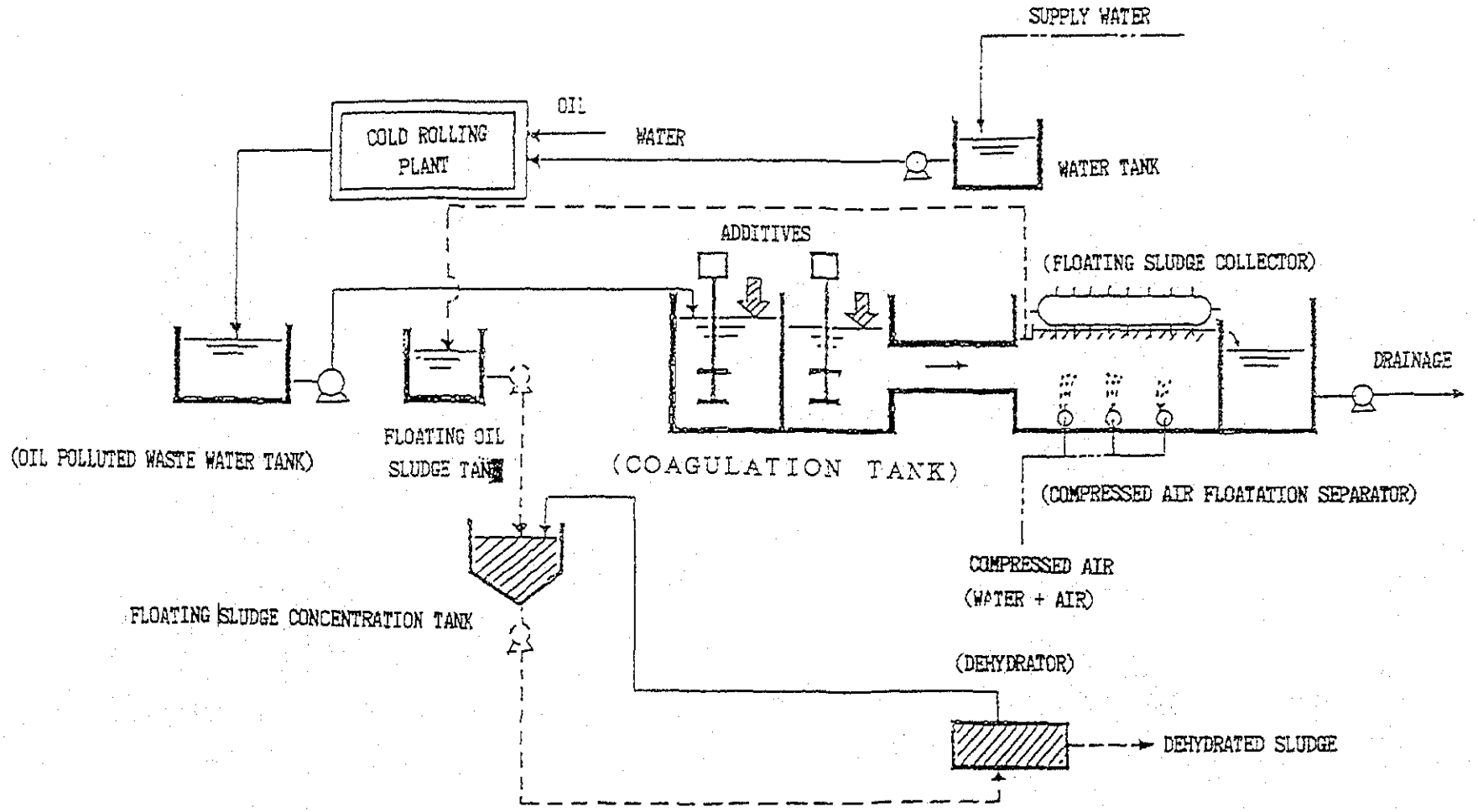
12 DISTRIBUTION DIAGRAM FOR DISPOSAL OF WASTE WATER FOR HOT ROLLING PROCESS



13 SEPARATOR FOR OIL AND WATER



1 4 DISTRIBUTION DIAGRAM FOR DISPOSAL OF WASTE WATER FOR COLD ROLLING PROCESS



I. ENVIRONMENT AND CONTROL

KINDS OF POLLUTION	ENVIRONMENTAL PROBLEMS				CONTROL (NATIONAL)					
	DESCRIPTION	ENVIRONMENTAL QUALITY STANDARD	EMERGENCY MEASURE	SENSITIVE POLLUTION	DESCRIPTION	TYPE OF CONTROL				
						CONCENTRATION	K-VALUE (CONCENTRATION ON GROUND LEVEL)	TOTAL EMISSION	STANDARD FOR FACILITY	BOUNDARY LEVEL
AIR	DUST FALL			○	SOOT AND DUST	○				
	SUSPENDED PARTTICULATE MATTER	○	○		COARSE PARTICULATE				○	
	SO2	○	○		SOx		○	○		
	NO_2	○	○		NOx	○		○		
	PHOTOCHEMICAL OXIDANT	○	○							
	CARBON MONOXIDE	○	○							
					Cl, Cl_2, HCl					
					F_2, HF	○				
					Si, $(HF)_z$, Pb					
WATER	TOXIC SUBSTANCE (Cd, CN, ORGANICS, Pb, Cr +6, As, Hg, ALKYL Hg, PCB)	○			TOXIC SUBSTANCE { SAME AS LEFT }	○				
	LIVING ENVIRONMENTAL ITEMS (PH, COD, (BOD), SS, DO, COLITIS GERM, OIL)	○		ONLY OIL ○	LIVING ENVIRONMENTAL ITEMS IN ADDITION TO LEFT (PHENOL, Cu, Zn, Soluble Fe, Soluble Mn, Cr, F)	○		ONLY COD ○		
NOISE	SAME AS LEFT	○		○	SAME AS LEFT					○
VIBRATION	SAME AS LEFT			○	SAME AS LEFT					○
ODOR	SAME AS LEFT			○	SAME AS LEFT		○			○

VALUE OF ENVIRONMENTAL QUALITY

(1) AIR

ITEM	ONE HOUR VALUE	8 HOURS VALUE	DAILY AVERAGE VALUE
SO2	0.1ppm		0.04 ppm
NO2			0.04 - 0.06 or less than the range
CO		20 ppm	10 ppm
SPM	0.20 mg/m3		0.10 mg/m3
PHOTOCHEMICAL OXIDANT	0.06 ppm		

(2) QUALITY OF WATER

RELATED TO HUMAN HEALTH CARE	
ITEM	LEVEL
Cd	0.01 ppm
CN	No trace
Organic phosphorus	No trace
Pb	0.1 ppm
Cr +6	0.05
As	0.05
Total Hg	0.0005
Alkyl Hg	No trace
PCB	No trace

PROTECTION OF LIVING ENVIROMENT									
	RIVER						SEA AREA		
	AA	A	B	C	D	E	A	B	C
pH	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	7.8 - 8.3	7.8 - 8.3	7.0 - 8.3
BOD(COD)	1 ppm	2 ppm	3 ppm	5ppm	8ppm	10ppm	2ppm	3ppm	8ppm
SS	25	25	25	50	100	-	-	-	-
DO	7.5	7.5	5	5	2	2	7.5	5	2
COLITIS GERM	50MPN/100ml	1000MPN/100ml	5000MPN/100ml	-	-	-	1000MPN/100ml	-	-
N-HEXANE EXTRACTS	-	-	-	-	-	-	No trace	No trace	-

RIVER AA: POTTABLE 1ST CLASS

A: POTTABLE 2ND CLASS/FISHERY 1ST CLASS

B: POTTABLE 3RD CLASS/FISHERY 2ND CLASS

C: FISHERY 3RD CLASS/INDUSTRIAL 1ST CLASS

D: INDUSTRIAL 2ND,

E: INDUSTRIAL 3RD CLASS.

SEA AREA A: FISHERY 1ST CLASS/BATHING QUALIFIED

B: FISHERY 2ND CLASS/INDUSTRIAL CLASS

C: OTHER THAN LISTED ABOVE

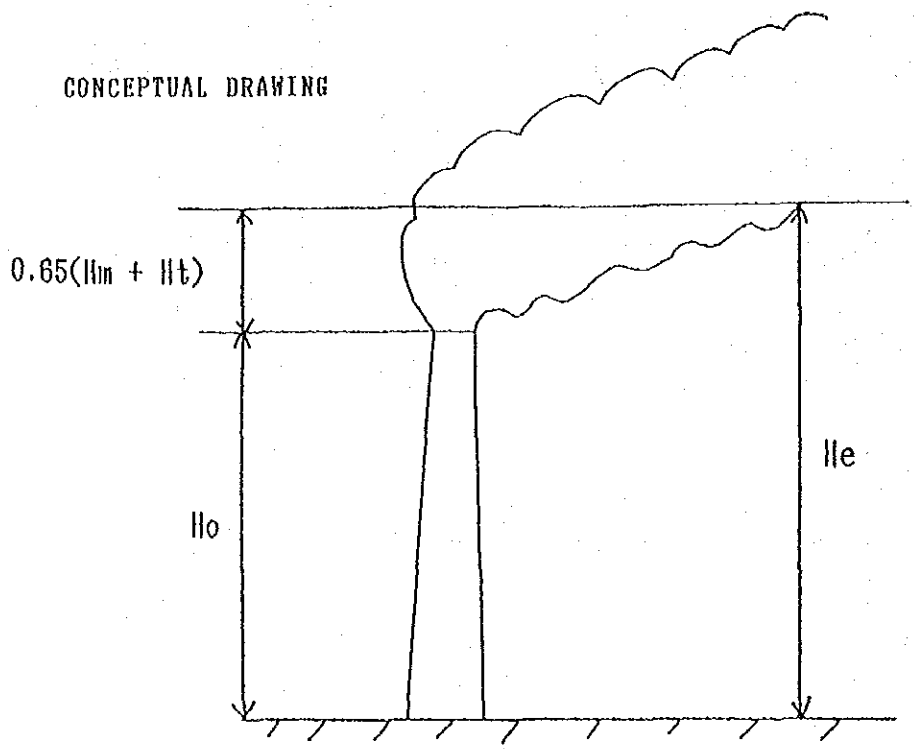
II. NATIONAL CONTROL LEVEL

1. SOx

(1) K-VALUE CONTROL (CONTROL FOR CONCENTRATION ON GROUND OF RESPECTIVE ORIGIN OF SMOKE)

Q: SOx ALLOWABLE DISCHARGE AMOUNT
K: CONTROL VALUE (SUBJECT TO DIFFERENT AREA)
He: EFFECTIVE HEIGHT OF STACK (m)
Ho: ACTUAL HEIGHT OF STACK (m)
Hm: HEIGHT OF RISING BY MOVEMENT (m)
Ht: HEIGHT OF RISING BY HEAT (m)

CONCEPTUAL DRAWING



K=3.0 - 17.5 16 RANKS

	NORMAL K-VALUE	SPECIAL K-VALUE (NEW FACILITIES)
RANK 1	3.0	1.17
RANK 2	3.5	1.75
RANK 3	4.0	2.34

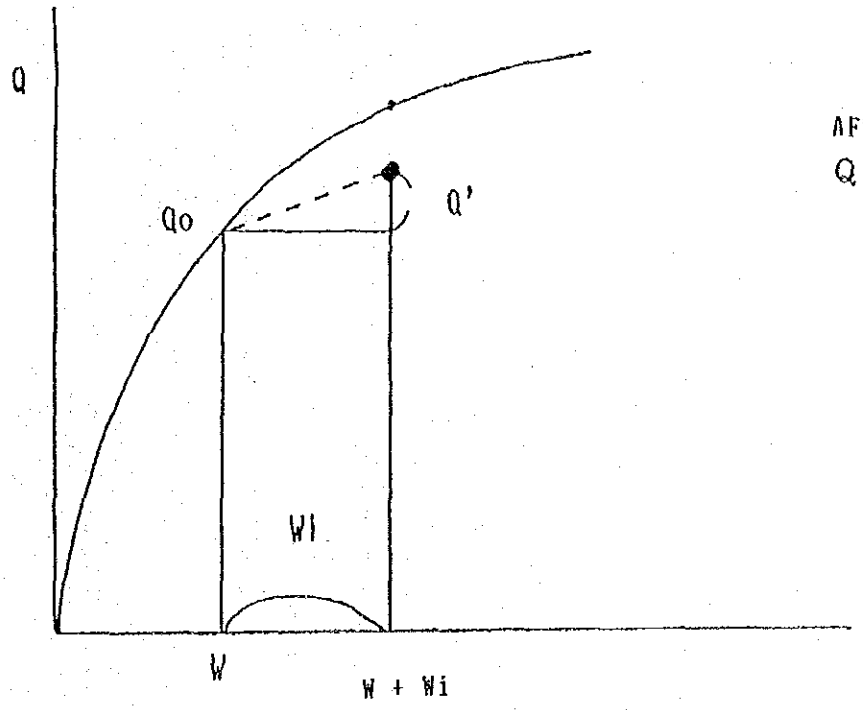
(3) REGULATION OF TATAL EMISSION (TOTAL EMISSION OF WORKS)

$$Q = aW^b + ra \{ (W + Wi)^b - W^b \}$$

Q : SOx ALLOWABLE AMOUNT OF DISCHARGE (Nm3/H)
W : AMOUNT OF FUEL USED EQUIVALENT TO HEAVY OIL (kℓ/H)
Wi : SAME AS ABOVE FOR NEW FACILITIES (kℓ/H)
a, b, r : CONSTANT

PREFECTURE	a	b	r
Tokyo	0.57	0.8	0.3
Kanagawa	1.5	0.865	1/3
Osaka	2.0	0.85	0.3
Wakayama	4.73	0.8	0.5

CONCEPTION OF CONTROL



AFTER NEW FACILITIES
$Q = Qo + Q'$

2 NOx AND SOOT AND DUST

(1) REGULATION OF EMISSION (CONCENTRATION)

FACILITIES	Discharged gas volume (Nm^3/H)	NOx CONTROL VALUE			SOOT CONTROL VALUE		
		Built before 1973 (ppm)	Built 1975-1977 (ppm)	Based O_2 (%)	Discharged gas volume (Nm^3/H)	g/Nm^3	Based O_2
SINTERING MACHINE	100,000~	260	220	15	40,000~	0.15	O_2
OPEN-HEARTH FURNACE	-	-	-	-	40,000~	0.1	O_2
CONVERTER	-	-	-	-	40,000~	0.13(a)	O_2
						0.1 (b)	O_2
COKE OVEN	-	-	200	7	-	0.15	7
HEATING FURNACE	100,000~	160	100	11	40,000~	0.1	11
BOILER (HEAVY OIL)	100,000-500,000	190	130	4	200,000~	0.05	4
BOILER (COAL)	200,000-250,000	450	400	6	200,000~	0.1	6

(a)Burning type of exhaust gas

(b) Non-burning type of exhaust gas

(2) AREAWIDE TOTAL POLLUTANT LOAD CONTROL ON NOx

AREA	Standard of Areawide Total Pollutant Load Control			Special Standard of Areawide Total Pollutant Load Control	
	SYSTEM	FACTOR a (k)	FACTOR b (ℓ)	SYSTEM	FACTOR (r)
TOKYO	$Q = k\,[\Sigma\,(C \cdot V)]^{1}$	0.51	0.95	$Q = k\,[\Sigma\,(C \cdot V) + (Ci \cdot Vi)]^{1}$	
KANAGAWA	$Q = aW^{b}$	1.37	0.95	$Q = aW^{b} + r \cdot a\,[(W + Wi)^{b} - W^{b}]$	0.7
OSAKA	$Q = k\,[\Sigma\,(C \cdot V)]^{1}$	0.6	0.95	$Q = k\,[\Sigma\,(C \cdot V) + (Ci \cdot Vi)]^{1}$	

Q : Standard of Areawide Total Pollutant Load Control on NOx (Nm^3/H)

C : Facility Factor

V : Exhaust gas volume (10,000 Nm^3/H)

W : Amount of fuel used (Kl/H)

Ci = factor of new or additional facilities

Vi = Exhaust gas volume from new or additional facilities

Wi = Amount of fuel used for new or additional

3. OTHER SUBSTANCES OF AIR

SUBSTANCES	CONTROL VALUE	COUNTERMEASURE FACILITIES
Cd and its compound	0.001 g/Nm3	Ceramic products, Roaster furnace, Melting furnace
Cl	0.03	Chlorine quick cooler, etc.
HCl	0.7	Waste incinerator
	0.08	Chlorine quick cooler, etc.
F, HF,	0.01	Ceramic products, Roaster furnace, Melting furnace, etc.
SiF4,	0.001	Aluminum electrolytic furnace
SiF6	0.015	Reaction concentrator for production of Phosphorus and Phosphuric acid
	0.02	Open-hearth furnace for above
Pb and its	0.02	Roaster furnace and Melting furnaces for production of glass
compound	0.01	Roasting furnace for refining of Cu, Pb and Zn
	0.03	Roaster furnace and etc. for above

4. WATER QUALITY (CONTROL AT DRAINAGE OPENING TO BE DISCHARGED TO PUBLIC WATERS)

TOXIC SUBSTANCE		ITEMS FOR LIVING ENVIRONMENT	
CONTROL SUBSTANCE	CONTROL VALUE	ITEMS OF CONTROL SUBSTANCE	MAXIMUM CONTROL VALUE (DAILY AVERAGE)
Cd and its compound	0.1 ppm (as Cd)	pH	5.0 - 9.0
CN compound	1	BOD	160 ppm (120 ppm)
ORGANIC PHOSPHIDE	1	COD	160 ppm (120 ppm)
Pb and its compound	1 (as Pb)	SS	200 ppm (150 ppm)
Cr^{+6} compound	0.5 (as Cr^{+6})	n-Haxane extracts (mineral oil)	5
As and its compound	0.5 (as As)	same as above (animal and plant oil)	30
Hg and Alkyl Hg and			
other Hg compound	0.005 (as Hg)	Phenol kinds	5
Alkyl Hg compound	Not traced	Cu	3
PCB	0.003	Zn	5
		Soluble Fe	10
		Soluble Mn	10
		Cr	2 ppm
		F	15
		Coliform group	(3,000 units/cm³)

STRICT EFFLUENT STANDARD

Strict Effluent Standard at merine area of Seto-Naikai

Line of industry (facility)		Items and substance with its allowable limits									
		Biochemical Oxygen Demand or Chemical Oxygen Demand (unit mg/ℓ)		Amount of suspended solids (unit mg/ℓ)		Amount of extract of normal hexane (unit mg/ℓ)		Amount of contained phenol kinds (unit mg/ℓ)		Cyanide (unit of cyanide mg/ℓ)	Arsenic and its compound (unit of arsenic mg/ℓ)
						Amount of animal and plant oil	Amount of mineral oil				
		Daily average	Maximum	Daily average	Maximum	Maximum	Maximum	Maximum	Maximum	Maximum	Maximum
Steel Industry	Over 2000 m3 of normal daily amount of drainage	15	20	40	50	10	2	1	0.5	0.5	0.5
	Under 2000m3 of normal daily amount of drainage	60	80	70	80						

Standard of Areawide Total Pollutant Load Control

Standard of Areawide Total Pollutant Load Control ($L = C \times Q \times 10^{-3}$) is applied to the specified plants discharging daily average amount of water more than $50m^3$ in order to accomplish the targeted amount of reduction.

L: STANDARD OF AREAWIDE TOTAL POLLUTANT LOAD CONTROL ON COD (kg/day)

C: VALUE SHOWN IN ATTACHED TABLE-3 (ppm)

Q: MAXIMUM DISCHARGING AMOUNT OF SPECIFIED WASTE WATER (M^3/DAY)

Effective date or effective period

C-VALUE OF AREAWIDE TOTAL POLLUTANT LOAD CONTROL

	CLASSIFICATION BY INDUSTRY OR OTHER	CHEMICAL OXYGEN DEMAND (unit mg/ℓ)			REMARKS
		TARGET (1984)	MEDIUM (1981)	NEW AND ADDITIONAL BUILDING	
162	Steel works with blast furnace and rolling mill	20	30	20	With Coke oven, figures of 60, 70, 60 are respectively replaced in same order.

ENVIRONMENTAL MANAGEMENT IN STEEL INDUSTRY

1. PREFACE

(1) STRICT ENVIRONMENTAL LEVEL AND CONTROL OF DISCHARGE

(2) ACTIVE COOPERATION TO ACCOMPLISH ENVIRONMENTAL LEVEL

(CHANGES OF TOTAL INVENSTMENT FOR ENVIRONMENTAL PROTECTION AT STEEL INDUSTRY)

	Total investment facilities (A)	Total investment environmental protection (B)	(B/A) (%)	Air pollution control	Effluent Control	Noise control	Industrial wastes	Others related to environmental protection
1971	7,749	690	8.9	351	178	6	10	145
1972	6,516	859	13.2	520	230	7	12	89
1973	5,928	1,030	17.4	627	215	20	55	113
1974	8,922	1,671	18.7	1,038	238	51	222	123
1975	11,474	2,091	18.2	1,526	301	63	84	119
1976	12,646	2,654	21.0	1,999	410	81	46	118
1977	6,841	812	11.9	520	150	35	45	63
1978	5,805	629	10.8	375	124	17	60	53
1979	6,183	680	11.1	452	172	13	19	25
1980	6,068	321	5.3	125	53	22	94	28
1981	7,922	464	5.9	169	120	14	136	25
1982	10,645	694	6.5	212	153	15	288	25
Total	96,699	12,595 (100%)	13.0	7,914 (62.8%)	2,344 (18.6%)	344 (2.7%)	1,071 (8.5%)	926 (7.4%)

Notes ① Estimated in 1982, ② Investment amount is on basis of construction

③ Neither amount or total may be agreed due to the round off of each item.

2. CHARACTERISTICS OF IRON AND STEEL WORKS IN VIEW OF ENVIRONMENTAL MEASURE

(Layout sample for continous production process of steel mill is shown in FIG-1)

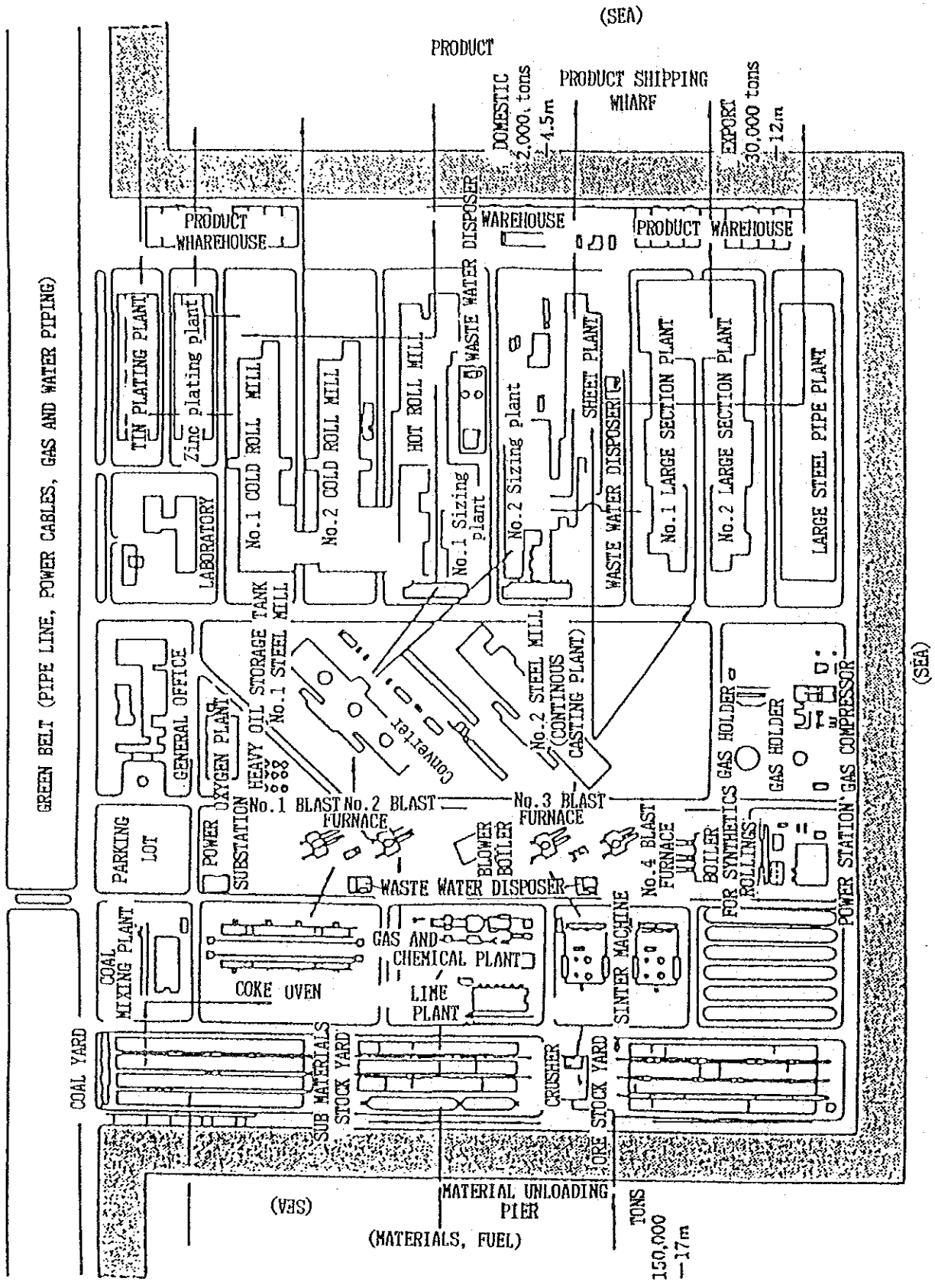
(1) A long production line with various different kind of equipment and facilities.

(2) A large area.

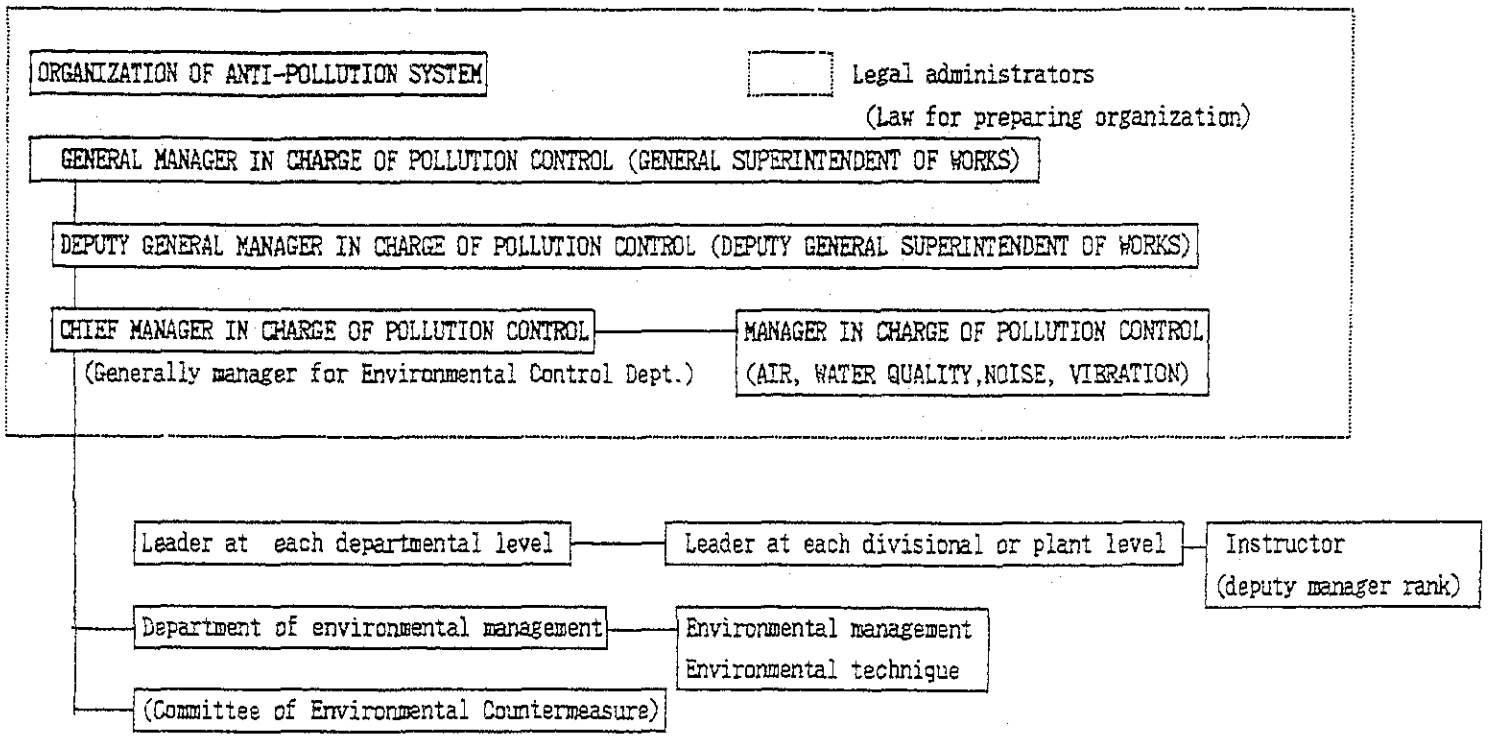
(3) A critical criteria (※) for selection of site.

(※) is restrictions of land, harbor, transportation and industrial water which is required a special ingenious scheme.

FIG-1 LAYOUT SAMPLE FOR CONTINOUS PRODUCTION PROCESS OF STEEL WORKS

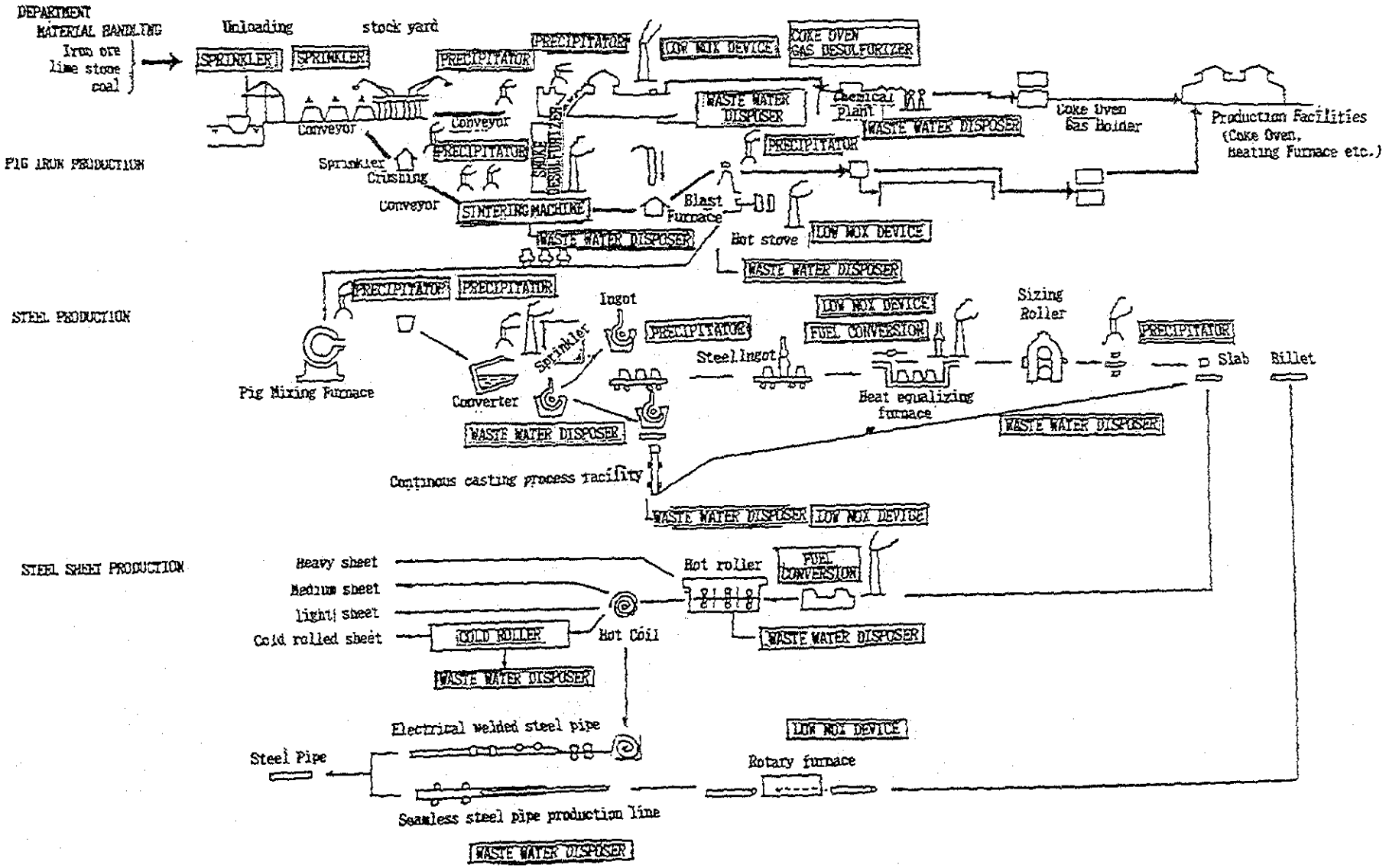


3 ENVIRONMENTAL MANAGEMENT SYSTEM OF STEEL WORKS



4. ENVIRONMENTAL MEASURES IN STEEL INDUSTRY

(1) Environmental measures at respective production line



Note: ▭ indicates a kind of environmental measures

(2) ANTI AIR POLLUTION MEASURES

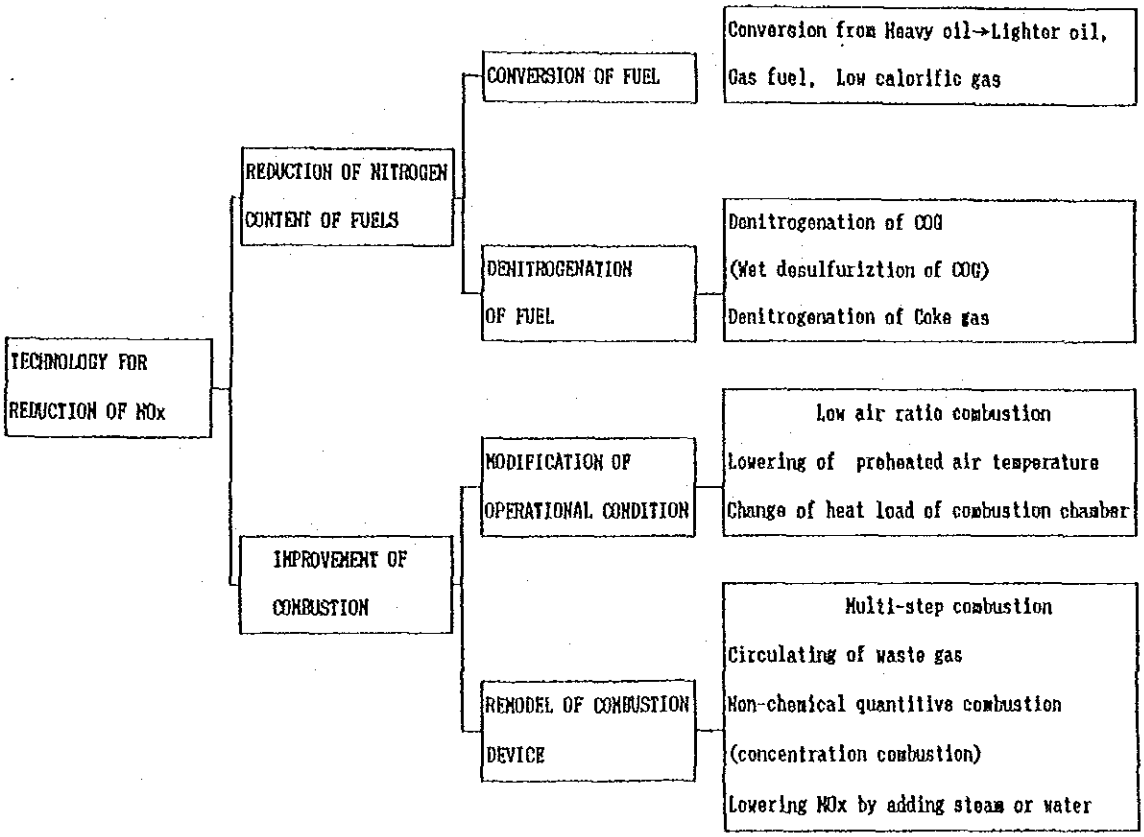
A. SULFUR OXIDE

a. Lower sulfur of fuel

b. Desulfurization of sintering exhaust gas

c. Desulfurization of coke oven gas

B. NITROGEN OXIDE



C SOOT AND DUST

PROCESS	ORIGIN OF DISCHARGE	COUNTERMEASURES
MATRIAL UNLOADING	Vessel's Hatch Unloader Hopper	Sprinkler
MATERIAL STOCK YARD	Storage Yard Stacker	Sprinkler, Spray of surface, Solidifying agent
MATERIAL PREPARATION	Crusher, Sizing, Conveyor, Conveyor transfer, Hopper	Dust collection Conveyor cover
COKE OVEN	Coal crusher, Coal mixer, Storage tank, Coal tower, Coal cart, Guide car, Hydrant tower, Coke cutter	Dust collection Smokeless devices
LIME FURNACE	Main exhaust gas, Screen, Hopper	Dust collection
SINTERING MACHINE	Main exhaust gas, Cooler exhaust air, Conveyor, Hopper, Crusher, Screen	Dust collection
BLAST FURNACE	Storage tanks for ore and Coke, Casting hearth, Top of blast furnace	Dust collection Dust collection also inside of plant building
CONVERTER	Top of converter, Circumference of converter (Melting pots for pig and steel, Sub materials), Main exhaust gas	Dust collection Dust collection also inside of building
ELECTRIC FURNACE	Top of furnace, Circumference of furnace	Dust collection Dust collection also inside of building
ROLLING FACILITY	Preparation of steel, rolling	Dust collection

(3) COUNTERMEASURE FOR EFFLUENT

A WASTE WATER DISCHARGED FROM MAIN PROCESS

PROCESS	WASTE WATER DISCHARGED FROM	MAIN POLLUTION ITEM	REMARKS
RAW MATERIALS	WHARF, YARD	SS	Dirty water of rain
COKE	WASHING COKE	SS	Waste water of Hydrant tower, Precipitator
	GAS LIQUID (AQUEOUS AMMONIA)	PHENOL (COD), AMMONIA, CYAN	Cooler, Tar cottrell, piping drain, etc.
PIG IRON	WASHING GAS	SS	Waste water from gas washing, precipitator
STEEL	WASHING GAS	SS	Waste water from gas washing, precipitator
SIZING	ROLLING	SS, OIL	Waste water form roll cooling, scale washing
HOT ROLLING	ROLLING	SS, OIL	Waste water from roll cooling, scale washing
COLD ROLLING	ROLLING	SS, OIL	Waste water from rolling oil
	ACID PICKLING	pH, SS, OIL	Waste water from pickling process
	WASHING ELECTROLYSIS	pH, SS, OIL	Waste water from electrolytic process
	PLATING	pH, SS, COD, Cr	Waste water from pre-treatment process
STEEL PIPE	COOLING AND WASHING	SS, OIL	Cooler, scale washing
	EMULSION	OIL	Emulsified oil and cooling water of equipment
	ACID PICKLING	pH, SS, OIL, COD	Various pickling water, cooling water
OTHERS	LIVING	COD, BOD, OIL	Waste water from office subsistence

B PRINCIPAL ORIGIN OF POLLUTANTS AND DESCRIPTION OF COUNTERMEASURES

POLLUTANTS	MAIN ORIGIN	COUNTERMEASURE TECHNICS
COD	WASTE LIQUID OF COKE OVEN GAS	BIOLOGICAL TREATMENT + COAGULATING SEDIMENTATION + (COMPLETE TREATMENT)
	WASTE WATER FROM ROLLING PROCESS	SETTLING SEPARATION, FLOATING SEPARATION
	WASTE WATER FROM PICKLING OF COLD ROLL	COAGULATING SEDIMENTATION + NEUTRALIZTION
OIL	WASTE WATER FROM HOT ROLL PROCESS	NATURAL FLOATING SEPARATION
	WASTE WATER FROM COLD ROLL PROCESS	COMPRESSED-AIR FLOATATION SEPARATION

(4) COUNTERMEASURE FOR WASTES

A TYPICAL WASTES

CLASSIFICATION	TYPICAL EXAMPLE	PRINCIPAL DISCHARGING PROCESS
SLAG	BLAST FURNACE SLAG, CONVERTER SLAG, ELECTRIC FURNACE SLAG	BLAST FURNACE, CONVERTER, ELECTRIC FURNACE
DUST	BLAST FURNACE DUST, CONVERTER OVEN DUST, COLLECTED DUST OF SINTERING AND OTHER ROLLINGS, ETC.	BLAST FURNACE, CONVERTER, ELECTRIC FURNACE SINTERING PLANT AND ROLLING MILL
SLUDGE	SLUDGE FROM RETURN WATER OF ROLLING, ETC.	ROLLING MILL
WASTE OIL	WASTE OIL FROM ROLLING MILL, ETC.	ROLLING MILL

B STATUS OF WASTES

KIND	DISCHARGED AMOUNT		RECYCLED AMOUNT		DISPOSED AMOUNT	
	10^3t	%	10^3t	%	10^3t	%
SLAG	36,769.6	100	33,581.5	91.3	3,188.1	8.7
DUST	4,357.1	100	4,154.8	95.4	202.3	4.6
SLUDGE	461.8	100	276.4	59.9	185.4	40.1
WASTE OIL	43.6	100	26.7	61.2	16.9	38.8
OILY SCUM	39.6	100	6.7	16.9	32.9	83.1
TOTAL	41,671.7	100	38,046.1	91.3	3,625.6	8.7

(5) COUNTERMEASURE FOR NOISE POLLUTION

A NOISE PREVENTIVE COVER

B SILENCER

C SOUND-PROOF WALL

(6) COUNTERMEASURE FOR GREEN

QUESTIONNAIRE PRIOR TO DIAGNOSIS OF PLANT

DESCRIPTION OF PLANT

(1) GEOGRAPHICAL CONDITION AREA MAP FOR RELATED LOCATION OF ADJACENT HOUSES
LAYOUT PLAN OF PLANT
FLOW SHEET OF PRODUCTION PROCESS

(2) PRODUCTION SCALE OF AMIN FACILITIES

PROCESS	FACILITY	QUANTITY	ANNUAL CAPACITY (ton)	CURRENT MONTHLY PRODUCTION (ton)	REMARKS
PIG IRON	COKE OVEN				GENERATED VOLUME OF COKE GAS Nm^3/H
	SINTERING OVEN				DISCHARGED WASTE GAS Nm^3/H
	LIME KILN				
	BLAST OVEN				INNER CAPACITY M^3
STEEL	REVOLVING OVEN				UNIT CAPACITY Ton
	ELECTRIC OVEN				UNIT CAPACITY
	OTHERS				
CONTINOUS CASTING					NAME OF PRODUCTS

(3) NAME AND VOLUME OF PRODUCTS

ITEM	QUANTITY OF FACILITY	ANNUAL CAPACITY (Ton)	CURRENT MONTHLY PRODUCTION VOLUME (Ton)
SHAPE STEEL			
STEEL BAR			
HEAVY SHEET			
LIGHT SHEET			
COLD ROLLED SHEET			
SURFACE TREATED STEEL SHEET			
STEEL PIPE			
OTHERS			

2. DESCRIPTION OF COUNTERMEASURE FOR POLLUTION

A AIR POLLUTION

ITEM		SOx	NOx	SUSPENDED DUST	FALL-OUT	OTHERS
LEVEL	ENVIRONMENTAL LEVEL	ppm	ppm	g/m^3	$T/km^2/month$	
	DISCHARGE LEVEL	Nm^3/H	Nm^3/H			
	CURRENT TARGET	ppm Nm^3/H				
CURRENT CONDITION	OUTSIDE OF PREMISES	ppm	ppm	mg/m^3	$T/km^2/month$	
	AMOUNT OF DISCHARGE	Nm^3/H	Nm^3/H			

B WATER POLLUTION

ITEM		BOD	COD	SUSPENDED MATTERS	OIL	OTHERS
LEVEL	ENVIRONMENTL LEVEL	ppm	ppm	ppm	ppm	
	DISCHARGE LEVEL	ppm	ppm	ppm	ppm	
	CURRENT TARGET OF DISCHARGE	ppm	ppm	ppm	ppm	
CURRENT CONDITION	CONCENTRATION OF DISCHARGE	ppm	ppm	ppm	ppm	
	VOLUME OF DISCHARGE					

C OTHERS

ITEM	ENVIRONMENTAL LEVEL	DISCHARGE LEVEL	CURRENT TARGET	CURRENT STATUS

(2) COUNTERMEASURE FOR FACILITIES

PLANTS	AIR POLLUTION	WATER POLLUTION	OTHERS
MATERIALS			
COKE			
SINTERING			
PIG IRON			
STEEL			
OTHERS			

(3) MANAGEMENT SYSTEM

ORGANIZATION	
MONITORING SYSTEM	(EXAMPLE) ITEMS OF MEASUREMENT, FREQUENCY, PATROL, ETC.

3. PROBLEMS, ETC.

CURRENT PROBLEMS

STUDY AND DETAILED MEASURES FOR PROBLEMS
GUIDE THEME TO THE DISPATCHED SPECIALIST UNDER THE UNEP
(EXAMPLE) TECHNICS FOR FACILITY, MEASUREMENT AND MANAGEMENT; ASSESSMENT OF INFLUENCES, OTHERS