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Industrial Cooperation for Promotion of Investment Project
in Developing Countries US/GLO/90/292
Technical Report:

FEASIBILITY STUDY
ON
RATIONALIZATION & MODERNIZATION
FOR
PRZYJAZN COKERY
IN
REPUBLIC OF POLAND

Prepared for the Government of the Republic of Poland
by UNIDO Based on the Work by the Team of:

NICHIMEN CORPORATION
KOBE STEEL, LTD
THE KANSAI COKE AND CHEMICALS CO., LTD.

OCTOBER, 1992

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
(UNIDO)
VIENNA, AUSTRIA

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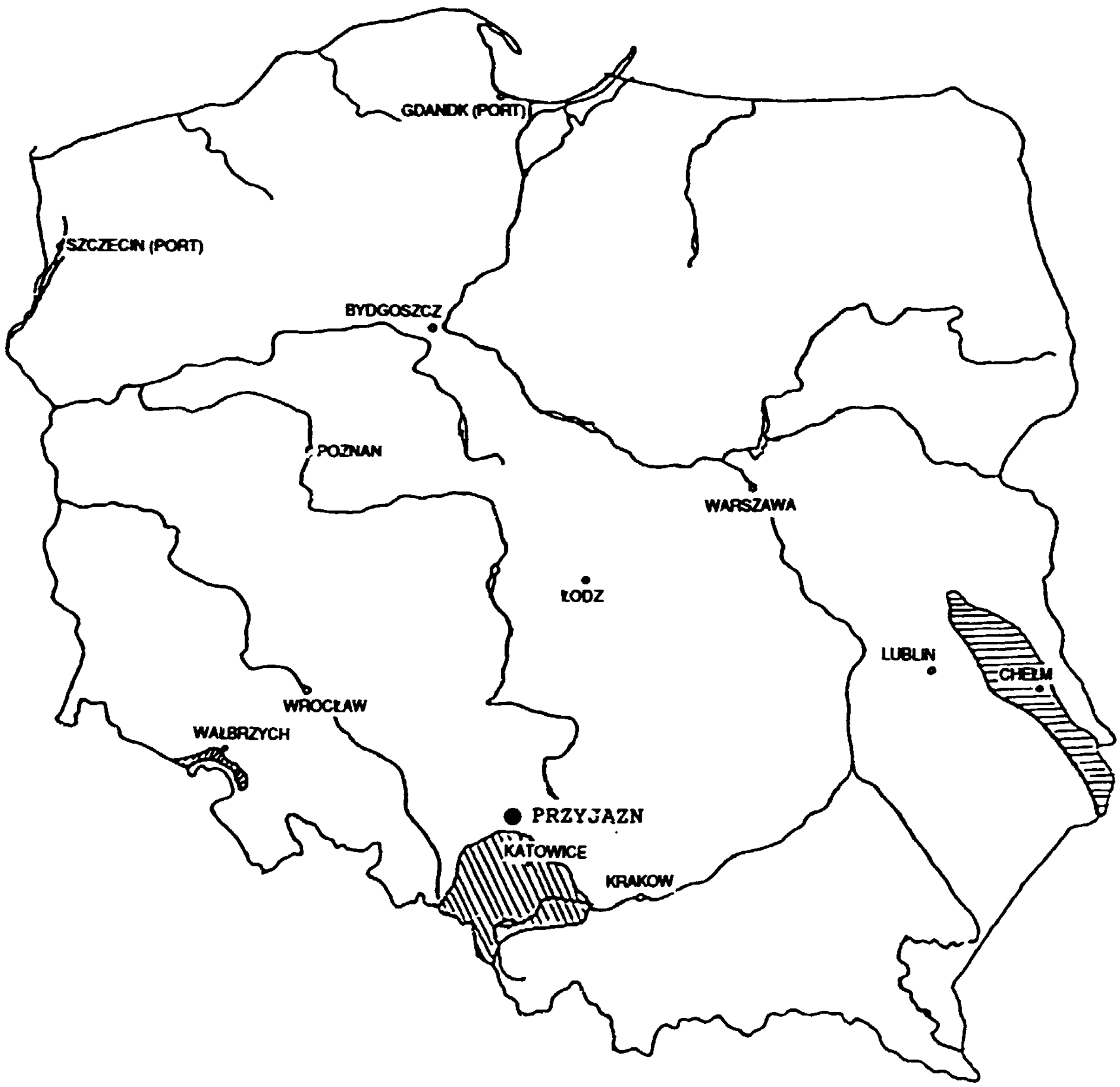
LIST OF ABBREVIATION

PC	:	Przyjazn Cokery
NC	:	Nichimen Corporation
KSL	:	Kobe Steel, Ltd.
KC	:	The Kansai Coke and Chemicals Co., Ltd.
CDQ	:	Coke Dry Quenching
COG	:	Coke Oven Gas
IISI	:	International Iron and Steel Institution



	area km^2	coal resources billion ton
Dolny Śląsk Coal-basin	500	0.5
Górny Śląsk Coal-basin	5400	55.5
Lublin Coal-basin	4000	6.9

Total area of Polish Coal-basins - 9900 km^2

Total coal resources in Poland - 63 billion ton

Location of PRZYJAZN, ports (Gdansk, Szczecin) and reserves of hard coal in Poland

CHAPTER 1

EXECUTIVE SUMMARY

CHAPTER 1. EXECUTIVE SUMMARY

1.1 Project Background and History

Przyjazn Cokery (PC) started its operation in 1987. It took 10 years of planning and preparation until start-up with specification details by former USSR-made technology since Poland belonged to the Communist Bloc.

The political conversion in 1989 with the overthrow of communist rule in Poland had a large impact on political and economical reforms.

The operation of PC is now being supervised by the Ministry of Industry of Poland witch is the owner of the plant.

Some of the current problems of PC are caused by operation under the planned economy of the communist system. Insufficient measures for pollution prevention, excessive employees and inefficient plant operation are major causes aggravating its financial condition.

Polish Ministry of Foreign Economic Cooperation requested UNIDO to carry out a full-scale investigation in order to streamline the plant operation and financial support. A preliminary investigation for fact finding was conducted in September 1991, and a feasibility study aiming at investment decision making was taken up by a group of Nichimen Corp., Kobe Steel, Ltd. and the Kansai Coke and Chemical Co., Ltd.

1.2 Market Study

1.2.1 Purpose of Market Survey

The average production of PC was approximately 2,260,000 tons/year and it is about 80 % of the design capacity. An investigation aimed at reviewing the marketing possibility for the increased output by 20 % (approximately 600,000 tons) on new markets through streamlining PC plant, and modernizing the management.

A possibility of sales drive in the regions of Poland and Europe where PC had traditionally been supplying coke was investigated. It concluded that a sales increase in these regions in the short term can not be expected. Therefore, from the view point of long term, new market study has been conducted.

1.2.2 Market Overview

Since a coke plant requires heavy equipment and a high investment for pollution control facilities, advanced countries expect that a new coke plant will not likely be constructed in the near future. Furthermore, obsolete coke oven in some of existing plants are causing an increase of repairing costs or a close-down of the plant under the tight regulation of pollution. Therefore, the world wide supply of coke tends to be tight in the long run.

1.2.3 Demand

Prospective markets for selling the additional 600,000 tons of coke from PC are US and Brazil.

The shortage of metallurgical coke in US is 3,783,000 tons in 1990 and 5,192,000 tons in 1991. The shortage of coke used in blast furnace ironworks is widening. Furthermore, the coke oven facilities in US are too old to be improved to clear the Air Clean Act which becomes tighter every year. One can predict that the number of shutdowns of coke oven will certainly increase. Therefore, increasing amounts of imported coke are required. The amount of import requirement of coke in Brazil is approximately 1,100,000 to 1,400,000 tons per year.

At present, Japan, Australia, Poland and China are exporters of coke to those two countries. The expected amount of import of both countries in 1992 will be 3,800,000 tons and it is expected that they need to import about 4,000,000 tons in the future. Therefore, the sales of 600,000 of PC cokes in these countries would be very possible.

1.2.4 Price

The sale price is set on follows (US \$) FOB Polish Boarders or Ports
Europe : 89.37/t
CIS : 94/t
North America : 89.37/t

1.3 General Management and Long Term Objectives

1.3.1 General

PC must reorganize the structure from a goverment-run enterprise to a private one through rationalization and modernization of the management. The participation of the competent foreign partner may make it possible to decrease the production cost at the same time to increase quantity of production by 600,000 t/y for additional new markets in due course.

1.3.2 Recommendation and Plan

The assessment of the projects feasibility yielded a favorable conclusion provided that the following improvement would be attained;

-Technical aspects-

1) Production Capacity Increase
2) Labor Productivity Improvement
3) Energy and Raw Materials Saving
4) Environmental Control Measures Betterment

This study is based on the following assumption which would constitute the future rationalization plan of PC.

1) In conjunction with a request of PC, the feasibility study for the project is based on a partnership with foreign companies who can participate as equity partner.
2) The measures for pollution control indispensable for the project are included. However, measures for the perfect air pollution control are not included since it costs unrealistically a huge amount of investment. A separate feasibility study may be conducted on condition that a soft loan is available.
3) The proposed J/V is to be given a full authority to sell the products including appointment of sales agencies.
4) Polish government is to follow the procedures necessary for a privatization of PC.
   A reassessment of PC's assets valuation has to be conducted in order to make the project viable for investor(s).
5) PC is to solve the problems concerning the contract of the usufructuary right of its land and other legal issues before the establishment of J/V.
6) The Polish investing partners are to take care of the union and labor issues, especially to reduce the PC's excessive employees to the optimum number.

1.4 Technical Examination of the Existing Plant

Along the line by the above mentioned long term objections, there are four main areas that require attention for the plant's modernization:

1) Increase of production capacity
2) Labor cost reduction
3) Raw material- and energy-saving
4) Improvement of Environmental Control

Bearing in mind these four objectives technical investigation took place on the following areas:

A. Location

In Japan most coke plants are integrated with a steel mill plant and almost all coke and COG are consumed in a steel mill. As all the raw material, i.e., coal, has to be imported, coke plants are located on the coast where coal is unloaded in large quantities.

By contrast PC is located inland near the coal mine and coke is exported to the former USSR by rail. In addition, unlike coke plants in Japan, PC Cokery is no longer integrated, administratively speaking, with a steel mill.

Therefore an extra cost to transport coke to new customers is involved and COG has to be sold at an unreasonable cost.

B. Environment

Environmental concerns are also brought more into focus due to the location of PC. In Poland, there are regulations to limit total amount of waste water, emissions and solid waste in order to prevent and minimize pollution of the environment. When the factory disposes waste, it has to pay tax in accordance with the total amount of waste disposed. In addition, a penalty that amounts to ten times the tax is added onto disposals where the density exceeds certain limitations.

This year, enforcement of the regulations have become much more severe, to the point where it is predicted that the taxes and penalties will be as high as $ 8,000,000. The sewage is disposed of via the Bobrek River and empties eventually in the Baltic Sea. The water of such rivers is used as drinking water, hence the severity of the water discharge regulations. Considering the long course through Poland that the river runs, i.e., almost the entire length of the country, controlling the pollution caused by the cokery's waste water is the most pressing concern. Therefore an effective environmental protection facility on PC must be installed further to reduce pollution materials in order to meet Polish regulations as much as possible.

C. Production Record

The following is a table of PC's Production Record.

	1989	1990	1991	Design
1. Coke Production (10^3 tons/year)				
1) Stabilized Coke	1,907	2,002	1,900	2,473
2) Pea Coke	134	138	134	174
3) Breeze Coke	157	161	176	203
Nominal Coke Production Capacity	2,198	2,301	2,210	2,850*
4) Dust Coke	45	45	34	60
Total Coke Production	2,243	2,346	2,244	2,910
2. Byproducts (tons/year)				
1) Tar	106,451	131,948	123,300	158,900**
2) Crude Benzol	30,077	33,592	28,425	36,630**
3) Ammonium Sulphate	26,929	35,230	31,890	41,090**
4) Phenolate	956	1,520	841	1,080**
5) COG (10^3 Nm^3/year)	544,655	581,932	525,740	759,630**

Note : * Design Capacity possible following modification.
** Based on coke production rate estimate for 1991.

The production capacity following modernization is expected to be increased to the Design Capacity as noted above.

D. Labor Reduction

The following table shows the number of employees compared with the Kakogawa Plant at KC which has almost the same coke production capacity.

The administration department and Sales & Trade department are not easily compared due to different Socio-economic environment and marketing practice in Poland. However it seems obvious that PC operation has been over staffed.

Department	Przyiazn		Kakogawa
General Manager	1		1
Administration	White	106	21
	Blue	141	4
Sales & Trade	White	88	- (including in Administration)
	Blue	447	
Production and Maintenance	White	276	65
	Blue	2,222	615
Total	White	470	87
	Blue	2,810	619
	Total	3,280	706

E. Plant Layout

All facilities such as Coal Handling, Coke Oven, CDQ and Sieve, Gas Refinery, and Waste Water Treatment are plotted in an area of about 1,300,000m^2. This is almost double that of the Kakogawa Plant of KC where almost the same capacity of coke (2,400,000 tons per year) is produced in Japan. Therefore each unit at PC is installed with an ample amount of space. However it is inconvenient for patrolling and monitoring the operation, which results in higher maintenance operation costs.

In order to rectify the problems associated with the vast area of floor space, the following two systems should be introduced.

1) Industrial ITV System
2) Individual Communication System

F. Raw Material

The cost of raw material is 75 % of the direct coke production cost. In Japan, the cost of raw material is the same as PC or more. Therefore it is a main target for coke producing companies to reduce the cost of coal as a raw material to reduce the coke production cost. Cheap and slightly coking coal or "Gas Coal" such as non-coking coal with High Volatile Matter, Semi-anthracite and Weathered Coal are not blended into the raw material for coke production at PC since it uses traditional coal evaluation technology. However a modern method of technological blending is possible, for blending these cheap coals into coking coal while retaining the quality to meet the stable operation of a blast furnace, For PC, it is suggested to use Type 33 (slightly coking coal) by introducing coal blending technology where it will be possible to blend by approximately 5 %, resulting in a cost savings.

G. Upgrade & Modernization

The condition of the coke oven, especially the brick work, is indicative of the quality and maintenance of the plant. It indicates that good maintenance has been kept over the last four or five years at PC since commencement of commercial operation. Generally the expected life-span of a coke oven will be 35-40 years, if it is maintained by using advanced maintenance technology such as a ceramic welding method, etc. In this regard, after the year 2000, it is foreseen that coke will be exported to Western countries from PC due to the exhausted life spans of coke ovens in the US, Western countries and Japan. In other words, many coke plants in these countries will reach the obsolete stage of the operation after year 2000.

There are many other advantages at Przyjazn, such as:

- The abundance of high quality coking coal,
- The availability of low cost and highly skilled laborers,
- The young age of the coke oven in comparison with Western countries and Japan.

As for the design philosophy of the coke oven and CDQ facility, all hot coke discharged from the coke oven is processed by Coke Dry Quenching (CDQ) without using Coke Wet Quenching (CWQ). This system gives PC the triple merits of:

- The ability to produce high quality CDQ coke;
- No atmospheric emission of dust;
- The ability to generate low cost high pressure steam.

PC thus, has persisted in keeping two hot standby CDQ chambers and two cold CDQ chambers. There is no way however to go to the Coke Wet Quench (CWQ) in case of emergency. This causes a high maintenance cost.

Although the maximum design capacity of PC is 2,850,000 tons per year, PC does not produce this capacity for long periods because the CDQ has a bottleneck which is insufficient for discharging coke from the bottom of the chamber. Therefore bottleneck should be removed by modifying the discharging device for the bottom section of the CDQ chamber.

Among other modernization items specified detail in Chapters 5 and 6, the current efficiency of the dust collectors is inadequate. In order to increase their efficiency, minor modification at site as well as training to improve the operation and maintenance for the dust collectors are required.

H. Energy Saving

The Heat Consumption (HC) for PC in 1991 was about 630 kcal/kg which was approximately the level at a Japanese cokery 10 years ago. This means that energy saving technology has not yet been adequately introduced.

HC shows a tendency to increase in the case where the coke production is increased. In fact, it is necessary to increase the coke oven temperature so as to increase the heat loss from the coke oven and the sensitive heat loss from coke. Therefore HC will be increased by more than 630 kcal/kg if the coke production is increased without introducing energy saving technology.

It is recommended to install the following two technological methods in order to save energy consumption and reduce environmentally degrading emissions.

1) Automatic Combustion Control System
2) Ins:allation of COG Holder to prevent COG emissions to the flare stack.

1.5 Rationalization and Modernization Plan

The following is a brief summary of the modernization and improvements.

A. Increase Production Capacity

1) To increase the coke production capacity through Modernization of the CDQ Facility.

B. Labor Cost Reduction

1) To introduce Automatic Bucket Operation for the Bucket Cars using Programmable Logic Controllers (PLC) and position detectors.
2) To introduce Automatic Crane Operation systems in the CDQ also using a PLC.
3) To introduce an Automatic Combustion Control System into the Coke Oven Batteries to establish optimum coke oven control by means of automatic measurement of coke oven temperature and automatic determination of coal carbonization completion depending on the target coking time for optimum Coke Oven Battery (COB) operation. This system is also connected to item 2-1 and 2-2 above.
4) To introduce a modernized Cleaning Device for the Ascension Pipings to minimize cleaning reduce the labor requirement.
5) To introduce as Industrial Television (ITV) System for the four major work sites of the plant, namely Coal Handing, CDQ × 2, and Coke Transport, for supervision and labor reduction.
6) To introduce an Individual Communication System between the local work sites and the Control Rooms.
7) To introduce a Conveyor Belt Protective Device, i.e,. Metal Removal Units, for both the Coal and Coke Conveyor Belts for smooth operation and reduced repair and maintenance.
8) To introduce an improved Tar Sludge Discharge System for the Tar Decanter for improved working conditions.
9) To introduce a Deodorant Device for the Tar Decanter for improving the working conditions.
10) To provide Technology Transfer and Technical Assistance for improved plant control and operation, as well as labor reduction.

C. Energy and Raw Material Saving

1) To introduce Analytical Equipment for quality control of Coal Blending to enable the use of cheap and slightly coking coal as a raw material.
2) To install a COG Holder to avoid the discharge of COG during the interval when the COG flow direction is reversed. Thus an extra 49,670,000 Nm^3/yr of COG can be sold as well as reducing gas emission, thereby also reducing tax and penalties.

D. Improvement of Environmental Control

1) To install a Dust Collector for the Machine Side of the Coke Oven Batteries which will decrease the amount of dust discharged from 89.2 t/yr 12.9 t/yr.
2) To introduce an improvement on the Low Pressure Desulphurization Facility to increase the capacity of the gas flow-rate and improve the efficiency of desulphurization by introducing a more efficient internal filler in the H_2S Absorber. This will reduce the amount of SO_2 discharged.
3) To introduce an improvement for the Waste Water Treatment Facility by installing a new denitrification process, rearranging the Retention automatic discharge and cleaning system for the coagulation precipitators and thickener. These automation systems will contribute to the steady and stabilized of the waste waste treatment facility.

E. Cost Summary

For convenience, the estimated cost of modernization and improvements are shown below.

The cost levels shown herein are those available August, 1992, and therefore an adequate escallation is to be applied at the time of actual cost.

Unit : US$ 1,000

I.D.	IMPROVEMENTS AND EQUIPMENT (Method)	Total
1-1	Modernization of CDQ	4,762
2-1	Automatic Bucket Operation	6,350
2-2	CDQ Automatic Crane Operation	2,802
2-3	Auto Combustion Control System for Coke Oven	4,979
2-4	Cleaning Device for Ascension Piping	904
2-5	Industrial (ITV) System	444
2-6	Individual Communication System	948
2-7	Metal Removal Units	339
2-8	Tar Sludge Discharge System	337
2-9	Deodorant Device for Tar Decanter	241
2-10	Supervisor & Operator Training (Technology Transfer & Technical Assistance)	2,415
3-1	Analytical Equipment for Coal Blending	341
3-2	COG Holder	1,091
4-1	Dust Collector for M/S of Coke Oven Batteries	2,469
4-2	Low Pressure Desulphurization Facility	1,151
4-3	Waste Water Treatment Facility	6,687
	Total	36,260

Notes :

1.6 Plant Operation

The production plan is scheduled for gradual increase of the production capacity over three years to the full design capacity of 2,850,000 tons per year. The production of cokes excluding dust in these three years are as follows year I 2,210,000, year II 2,530,000, year III 2,850,000. In addition PC will produce the byproducts such as tar, crude Benzol, $(NH_4)_2SO_4$, Sodium Phenolate and COG. **Table 7.1** shows each production schedule.

As discussed throughout this feasibility study, the number of personnel requires for the plant's operation can be greatly reduced using basic automation and computer equipment. For each modernization a specific number of personnel can be reduced as detailed in Chapter 7. Basically, the plan involves reorganizing maintenance personnel from the Coal Handing, Coke Oven, COG Gas Refinery and Environment sections of the Production and Technical Department to two Maintenance sections, namely, Mechanical Maintenance and Energy Maintenance, For details of the reduction schedule and breakdown by department, please refer to Chapter 7.2.3 to 7.2.5. Raw material consumption tables can also be found in Chapter 7.

Concerning environmental regulation adherence, excess sludge from the activated sludge process and other residual sludge can be greatly reduced though beginning operation of the plant's incinerator, which has so far been delayed. Modification of the waste water treatment facility and emissions control will also be introduced, which will reduce substantially the taxes and penalties levied on PC.

1.7 Project Implementation Plan

In order to handle the project implementation, including the period from the establishment of a new joint venture company to the start of commercial production, the implementation team should be appropriately organized within the new Joint Venture Company as a task force.

The major activities of this team are as follows:

1) Preparation of Tender Documents
2) Tendering
3) Opening of Bids
4) Evaluation of Bids
5) Negotiation and Award of Contract
6) Executing the Project with Contractor under the Contract

The type of Contract for this Project is assumed to be on a CIF + Supervisor basis.

The construction work on site, including procurement of locally available materials such as carbon steel piping materials, ordinary cables, materials for civil, building and structure, etc., will be performed by the new joint venture company using their own manpower from the maintenance department. The training of key personnel will be under taken to master the technology and related operating methods in a foreign country as well as in PC on an on-the-job-training basis. The detailed schedule and training plan are described in Chapter 6. The project schedule, especially for the construction work on site, has to be well planned in advance so that interruption of the production process is minimized. Time Schedule in Chapter 8 can be referred to for more details.

Major milestones of the project are as follows:

Mile Stone	Planned Date
Effective date of the contract for this project	January 1st, 1994
Start of the construction work at site	October 1st, 1994
Mechanical Completion	September 30th, 1995
Commencement of the commercial operation	March 1st, 1996

1.8 Financial and Economic Evaluation

1.8.1 A basic Assumption for J/V Establishment :

After the privatization of PC, the organization of this plant is changed into J/V of the Polish partners and the foreign partners. The Polish partners invest the PC's fixed assets in kind and the foreign partners invest the foreign money for the facilities necessary to modernize the plant and the funds necessary to introduce the technology. The capital structure is as follows, if the assets evaluated by a Polish Chartered Accountants through the book value are considered as basis of negotiation. The Polish partners' share will be US$ 221,549,000 and the foreign capital is US$ 29,526,000, totaling US$ 251,075,000.

1.8.2 Conclusions :

The conclusion obtained by the financial evaluation conducted on the above-mentioned assumption is as follows;

1) The net profit will be negative for the first two years, but it will turn to be positive in the third year when the plant will operate at full capacity and in the fourth year the red in the first two years will be offset and the plant will yield an earned surplus carried forward to the following term.
2) The 14th year profit after the taxes will be the biggest and it will amount to approximately US$ 140,000, and even if 50 % out of this amount is paid out in dividends, the dividend rate will be only 3 % or less.
3) IRR is 5.31 % and this percentage is not appealing for the foreign investors.
4) The break even point is 77.8 % in the 5th year in 1988.

1.8.3 Sensibility Analysis :

Since the IRR of the base case is as low as 5.31 % which does not satisfy the investors, the sensitivity analysis was conducted on the following assumption in order to pursue a possibility of improvement of IRR.

1) Selling price of coke

   If the selling price is raised by 10 %, IRR increases by 6.9 % and will be 14.98 %. However, judging from a relation between the supply and demand of coke it seems very unrealistic to expect that the price would be maintained at 10 % higher than the base case for a long period of time.

2) Initial investment cost

   The Polish partners' investment in kind is the initial investment cost, and if this value could be reassessed to the level of 1/2 and 1/3 of the book value, IRR is 12.21 % and 17.08 %, respectively. The evaluation of the present assets of PC turned out to be a major critical factor to review whether this project under J/V arrangement can be materialized or not.

The international financial institutions such as EBRD, IFC set IRR to 15 to 20 % as a hurdle rate to approve the required loans and investments.

In short, the amount of evaluation of various PC's assets which are taken over from PC is an important point in the negotiation between the foreign investors and the Polish partners.

1.8.4 Premises of Economic Analysis :

1) For Economic Internal Rate of Return, the cost which is excluded from the base case is only taxes to conduct an economic analysis. The calculation excluding this cost results in 8.63 %.

2) Effect of this project

   The prime objective of this project is that J/V which takes over PC in the market economy should survive in many difficulties as an international enterprise. In addition to this prime objective, the secondary effects lie in saving effects such as an energy saving and environmental tax saving, an increase of acquisition of foreign currencies by exporting the increased products the ternary effects are social benefits such as a reduction of pollution, an increase of opportunity for employees engaging in the distribution due to the production increase, a stimulation to foreign investors future investments in Poland, etc..

1.9 Recommendations

The financial indicators of the project are not so favorable in light of the investment decision making. International financial institutions such as International Finance Corporation (IFC) and European Bank for Reconstruction and Development (EBRD) may not appraise this project positively for their equity participation. For instance, IRR of 5.31 % is too low for active promotion of this privatisation project vis-a vis international business community and financial institutions. No realistic scenario for materialization can not be drawn unless the project environment and parameters of financial variables would be changed.

The most critical variable influencing the commercial profitability is the value of PC's asset assessed through the existing book value. The sensitivity analysis suggests that the commercial profitability increases drastically if the value was assessed by 1/2 and 1/3. This manipulation of the present asset assessment is not the objective of this study. As is stated in the long term objective (Chapter 4), however, the privatisation should take place as the first step to ensure the survival of PC in the free international competitive market. Thus the plant should be modernized with foreign technology and capital. All the modernization programmes analyzed in this study are geared to this long term objective. The main argument would therefore be how to make this investment project saleable and attractive. There seems to be a room for negotiations in reassessment of PC assets between the local project owner and foreign potential investors.

Another variable strongly influencing commercial profitability is the sales price. The potential project proponents i.e. Polish authorities and foreign investors should look after carefully the world market trend of cokes particularly some fluctuation of the sales price in the near future. Although the report concluded that the increase of the sales price by 10 % may not be a realistic forecast, the world situation of the demand and supply equilibrium may change.

The economic impact on the environmental protection should be taken into account. One of the objectives of this project focus on this issue. The modernization of PC plant will contribute to a great extent for ensuring cleaner environment in the region. In light of this regional/national economic view point and the survival issue mentioned above, again, the study recommends strongly materialization of the privatisation and modernization of PC through foreign technology and capital.

CHAPTER 2

BACKGROUND AND HISTORY

CHAPTER 2. BACKGROUND AND HISTORY

2.1 Introduction

In the tidal wave of political and economic reform which have even taken the Communist Bloc, Poland is no exception. One eminent change of this political conversion is recognition by the Polish Government and the public for the urgent need to secure the survival of existing production facility under free market economy. With this change, industries inheriting the structure of the state-owned enterprise from the former socialistic economy have begin to realize that poor productivity will hinder international competitiveness. Since PC is also a state-owned enterprise, it bears a heavy burden of excessive employees, ineffective facilities and the high operating costs. PC thus presently continues to be lost in elaboration of modernization frameworks to have an international competitive power. Under this circumstances, Polish coke cannot be competitive in international markets in terms of price. In other words, PC is in the situation where it cannot survive without rationalization.

PC approached a Japanese company to rationalize its plant and provide a technological and financial support in the spring of 1990. Afterwards, after consulting with the Japanese related enterprises and examining the request, Nichimen sent a Japanese fact finding mission consisting of NICHIMEN, Kobe Steel Ltd. and the Kansai Coke and Chemical Co., Ltd. was fielded and grasped the actual situation. On that occasion this mission noted PC's enthusiastic participation in the management through J/V establishment.

This feasibility study was prepared by the same team members, i.e. NICHIMEN corporation (hereafter referred to as NC), and Kobe Steel, Ltd. and the Kansai Coke and Chemical Co., Ltd., in compliance with the UNIDO Terms of Reference dated 28th January 1992 for Przyjazn Cokery concerning the modernization of the Cokery as Katowice, Poland.

2.2 General Outlook of PC Plant

PC is one of the largest cokeries in Poland. They are currently reviewing a possibility of rationalization of their production process as well as modernization of both the production process and waste water treatment facility. The capacity of PC's coke production is close to 3 million tons per year and it is the biggest coke supplier in the country.

PC took nearly ten years from it's initial planning until start-up, and its cokery plant began operation in 1987. While general attention has currently been drawn to the general deterioration of coke plant in western countries, PC can be highly evaluated as one of the newest and largest in the world.

The coking industry has a long history in Poland, and there appears to be enough potential to maintain steady production if proper modernization and rationalization are adopted for the PC plant.

PC's detailed specifications were made before the reform of USSR, using USSR-made technology. It is advantageous that a high level of technology was applied to the plant at that time. For instance It has been equipped with systems such as a dust collecting system for oven discharge, smokeless charging system, COG gas leakage prevention device for the oven cover, etc., which are essential requirements for a modern coke plant.

At PC, the number of personnel employed for the production, operation and maintenance of the Cokery is considerably high.

Thus, one of the purposes of this project is to rationalize and modernize the production process through introduction of automation and upgrading of certain facilities, as well as to install a sufficient waste water treatment facility.

2.3 Environmental Concern

Average waste disposals of PC adhere in general to the environmental regulation in Poland and PC frequently are forced to discharge more than the regulated limit. This causes heavy penalties and taxes in the form of fines. Since the regulations have become much more stringent this year resulting in exorbitant fines, and will remain in force in future, and much of the waste is discharged as effluent into the nearby river which is used drinking purposes, the Cokery is seeking to improve its waste treatment facility. The PC accordingly had an independent research institute conduct a study of the Plant, including recommendations for rectifying the situation.

2.4 Objectives of Study

Taking the above into account, the study presumes that the introduction of modernizing equipment, systematizing the production process, and introducing an improved waste water treatment facility in the most realistic and attainable solution to the problems currently affecting PC. Based on these premises, the objectives of this study are as follows:

1) To recommend and select the most suitable course of action for modernizing the production process to:

- increase production capacity,
- increase the raw material/product ratio,
- minimize personnel in the plant's operation and maintenance, and,
- minimize utility consumption.
- In order to achieve the above objectives, the study is to:

2) investigate the existing facilities in operation in order to identify the items to be repaired, replaced or installed with a view to maximizing the utilization on the existing facilities and minimizing the required new investment,
3) investigate the market situation for coke in order to support the relevant capacity for the Plant,
4) to recommend the most suitable and efficient project implementation plans and
5) present a financial and economic analysis on the proposed project implementation plan and to present the evaluation result.

2.5 Scope of Study

2.5.1 Modality of Investigation-General

In order to fulfill the above-mentioned objectives, our scope of this study includes the following modality of investigation.

1) Field Survey

   The team visited the PC from March 29 to April 11 1992. Technical and financial information were gathered at PC during this visit. Furthermore, a Polish accounting company was hired and conducted the conversion of financial data appeared in Polish accounting system to western system. The team also visited a number of governmental organizations concerned to obtain information and data, in particular, environmental policy and present regulations as well as the coke industry and market in Poland.

2) Environmental Study

   The term investigated regulations now in force in Poland and the EC concerning waste water and emissions control.

3) Market Study

   The market survey was conducted covering new markets such as Europe, U.S.. and Brazil, as well as existing domestic market in Poland. The kind of information concerning coal and coke was also supplemented by statistical data published both inside and outside Poland.

4) Technical Study

   The study team compared available production technologies to upgrade the existing facilities. Also, energy consumption, safety and ease of operation and maintenance and product quality were examined. From the result of the site survey and equipment selection, which was completed at home office of consultants after the field survey, the team suggests the most technically sound plan configuration and the most time effective project implementation plan.

5) General Information

   General information concerning social, economic and political situation in Poland was collected mainly from recent publication and materials.

6) Financial Analysis

   Based on the estimated project cost, the following financial analysis was made, using UNIDO COMFAR.

- Profit and loss statement
- Cash flow statement
- Financial internal rate of return
  ETC.

7) Economic Analysis

Economic analysis highlights the calculation of economic IRR and expected effects and gains of the project.

8) Overall Evaluation

The conclusions and Recommendations are drawn on the basis of the technical and financial/economic analysis. Before reaching the sound conclusions, intensive discussions with potential investors took place. Both in Japan and Poland their views are well reflected in this report.

2.5.2 Other Ramifications Associated with this Scope of Study

1) Labor rationalization and production modernization

In order to implement the proposed reduction of labor by introducing new facilities and equipment and to up-grade the productive efficiency by improving the organization and system of the Cokery, some adjustment must be made in terms of labor practices in Poland.

As current labor policy practices generally extend over long periods, it may be difficult to alter the amount of labor employed at the Cokery, from the initial stage of operation.

Nevertheless, the proposed labor requirement was put forward referring similar plan Japan as an example. If the Cokery management would process to rationalizing the labor requirement, then this proposal could be the one to save costs and to wake PC profitable and competitive in the international market.

2) Energy

As far as energy is concerned, the cost of energy in Poland is substantially lower than in Japan. Therefore, even if a rationalized investment plan for energy savings could be favorably executed in Japan, it may be unprofitable in Poland. For the purpose of modernizing the operation system to a standard level of energy efficiency, computer technology is to be applied for combustion control, which is very important for the operation of a coke plant in terms of saving energy costs, keeping a high product quality, controlling efficient gas, and reducing the number of operators. Therefore this item is included in our proposal.

3) Environment

In order to cope with increasingly stringent environmental regulations as well as having a means of assessing the pollution, an improved waste water treatment system is included in this study.

4) Coal blending technology

Finally, in order to reduce the cost of raw material for coke, coal blending technology, which has been highly rated and has proved cost-efficient in Japan, is also included in this study together with laboratory analytical equipment.

2.5.3 Overview of Specific Rationalization Concept

Throughout this study, the technical evaluation was made referring to KAKOGAWA COKE PLANT OF KC in Japan. In order to make this technical assessment and suggestions more persuasive for potential investors, the reference to KAKOGAWA plant's data was made as an easy reference wherever appropriate.

1) Cost Reduction Measures

For achieving competitiveness by cost reduction through rationalization of factory management:

a) To reduce and minimize total labor by the method of rechecking the organization and also raising efficiency by training.
b) To decrease costs by introducing coal blending technology now available in Japan.
c) To raise the efficiency of COG and reduce the cost of coke by:
Installation of an automatic combustion control system for the coke oven;
Installation of a COG holder.

2) Technical Elements to be considered, including Environmental Protection Measures

a) Improvements to modernize the CDQ facility for the purpose of maximizing full capacity and reducing labor:
Improvement of coke discharge device;
Provision of unmanned system for bucket car;
b) To meet with the environmental regulation of the authorities concerned as much as possible by (the fund for investment for this purpose is to be financed by soft loans):
Modification of existing waste water pre-treatment system;
Improvement in efficiency of the desulfurization system;
Installation of a de-dusting facility for machine side of coke oven.
c) To install an industrial television viewing system and audiovisual communication system for educing labor and raising efficiency.

d) To modernize the facilities by the installation of a metal removal unit for the conveyor belt.

3) Financial Elements to be Considered

a) Privatisation of the factory, as a base assumption, by establishing a new joint venture with foreign partner(s) is a prerequisite for the materialization of this proposed modernization and rationalization. Foreign partner(s) is to make equity participation for the hard currency portion of the total requirement for modernization.

b) Sensitivity Analysis.
The profitability of the project is studied on the above basis of the above assumptions. The social and economic elements surrounding this project are variable. Therefore, this sensitivity will be undertaken based on different variables such as selling price of coke, and value of fixed assets.

CHAPTER 3

MARKET ANALYSIS AND PLANT CAPACITY

CHAPTER 3. MARKET ANALYSIS AND PLANT CAPACITY

3.1 Market Situation

3.1.1 Objections

The nominal production capacity of PC is 2,850,000 t/y. However, PC presently produces 2,260,000t per year, of which 80 % and 56 % were for export in 1990 and 1991 respectively. The modernization and rationalization in question will enable PC to enjoy nearly full production capacity. It is crucial that the study ensures that PC can maintain the domestic as well as CIS and European market share and furthermore the 600,000 t of increased production volume can be absorbed in the American market. For effective marketing strategy formation the price structure, coal availability and future price trends, as well as particular attributes in distribution channels have to be clearly understood. Bearing this requirement in mind, a series of intensive market surveys took place in Europe and the American Continent.

3.1.2 Basic Premises

The export among the total output of coke at PC Plant in 1991 accounted for about 56 %. (See 3.2.1.) That of 1990 accounted for about 80 %. 800,000 tons or more of coke have been exported to the former USSR, and the year 1991 was exceptional when the export was about 500,000 tons because of the confusion of the political and economical revolution of the former USSR. Therefore, it is possible to export 800,000 tons a year to the former USSR in the future and the study regards this figure as the basis of the calculation.

The consumption of PC coke in Poland is considered to be 20 % of the output of the stabilized coke of the basic year. The sales of the stabilized coke for Europe, a stable customer, is considered to be the same as before.

Therefore, an increase of the stabilized coke caused by the modernization of the plant is allotted for a new market aiming to sell it to the American Continent as described later in the investigation and analysis. The increase and the amount of sales of the existing product for a place of destination are as follows. A financial analysis was made on the basis of this amount of sales.

	Basic year	The 2nd fiscal year	The 3rd fiscal year (production at full capacity)
1) Stabilized coke:			
For domestic use:	389,000 tons (20 %)	389,000 tons (18 %)	389,000 tons (16 %)
For the former USSR:	800,000 tons (41 %)	800,000 tons (36 %)	800,000 tons (32 %)
For Europe:	758,000 tons (39 %)	758,000 tons (34 %)	758,000 tons (30 %)
For the American Continent:	nil	282,000 tons (13 %)	563,000 tons (22 %)
Total:	1,947,000 tons	2,229,000 tons	2,510,000 tons
2) Other coke:*	317,000 tons,	363,000 tons	409,000 tons

*Note: The domestic/export share is 40/60 %, respectively based on the past results and the increase is sold to the traditional buyers.

Tar, benzol, ammonia and COG are produced secondarily as by-products. Since an effect of production increase is small in terms of money, they should be sold to the traditional customers.

3.1.3 General Situation of the World Coke Industry

According to an IISI report, the average age of a coke oven approx. 17 years as of the end of 1988, while the average lifetime is approx. 35 years. Although there is generally an effort to prolong their lifetime to more than 40 years, i.e. by lowering the load on the coke oven and through the performance of proper maintenance work. In the near future the fact that the total production capacity of coke will be insufficient for meeting market demand, particularly following the eventual closure of the other older plants, will be unavoidable.

As a huge amount of investment is required to establish a new cokery or to replace an old one, the exiting young large scale cokeries are very valuable from this point of view. This is eminent in the USA, Europe and Brazil. For easy reference, the average age of western world coke making capacity is shown on the **Fig. 3-1**.

In addition, despite efforts to develop new technology, steel manufacturing by way of the blast furnace will remain the major method for steel manufacture and therefore demand for blast furnace coke will remain in its present position with a high level of production.

3.1.4 Price of Cokes

The following figures indicate trend of coke price exported from Japan. Since Japanese export plays as a price leader in the world market, and the amount of exports more than two million tons per year, its price can be considered as the world market price.

1985 average FOB Japan US$ 87.45/t
1986 84.53
1987 71.36
1988 87.14
1989 112.28
1990 98.22
1991 94.25
(Source: Coal Report)

The price fluctuation in the first half of year 1992 is as follows;

	CF U.S. port	Ocean freight (by panamax/40,000t)	financing cost	FOB
For US market	US$ 1 00.00/t	$13/t (from Japan)	nil	$87.00
For Brazil market	US$ 100.95/t	$12/t (from Poland)	$4.00/t	$84.95
	$ 99.0	$13/t (from Japan)	$2.58/t	$83.42

Remarks:
1) The financing cost was calculated: with supplier's credit of 180 days after B/L date for export to Brazil.
2) Ocean freight varies depending on negotiation.
3) In case of Polish coke for seaborne export, such costs as railway transport of approximately US$11.50 and port charge / agent commission, $4.50/t must be calculated in sales cost.
4) Manufacturer's name of Polish coke is Zdzieszowice cokery.

3.1.5 Future Price Forecast

The basic year of starting this project is set to 1994 and the standard price in the financial analysis of the new company concerning stabilized coke for the respective destination is set as follows:-

- For Europe and the American continents ------- at FOB US$89.37/t which is an average export price in the past 7 years (weighted average) as per 3.1.4.
  Incidentally the international price of the stabilized coke in the first half of 1992 was US$85.-/t, the FOB average value, and this value is equivalent to a 5% decrease of the above-mentioned standard value of US$89.37.
- For domestic consumption in Poland -- at US$76.83/t, ex-factory price, which is set to PC's average sales price of the last 3 years (US$70.86/1992, US$85.87/91, US$73.70/90).
- For the former USSR ------ at FOB US$94.-/t which is set to PC's average export price of the last 3 years (US$94.02/1991 and average price level of US$94 for 1989-90) and PC has particularly favorable conditions in terms of factory location and transportation for export to the former USSR.

Since PC is located on an inland area, in the case of seaborne export from Poland, the port charges including loading and unloading at harbor is required in addition to the inland transportation cost. These expenses should be charged separately and they are appropriated as sales cost in the financial analysis reports (See **Table 9-6A-C**).

The average export price of the metallurgical coke in the last 7 years has been US$ 89.37/t and it is predicted that the price of the metallurgical coke in 15 years from now will fluctuate based on this price. When we forecast the behavior of production of the blast furnace ironworks in the world, conversion to the electric arc furnace with less manufacturing cost is conceivable. However, since there is no other choice but to depend on the blast furnace for mass production, a big structural conversion is impossible at the present stage. Therefore, it is forecasted that the conversion to the electric arc furnace does not greatly affect the demand of coke. The introduction of PCI, however, leads to a decrease of consumption of coke with certainty. The coke oven will become older year by year and the facilities have such nature that improvement is impossible to cope with the regulations of the environmental pollution which become tighter every year. Accordingly, it is considered that the coke oven will continue to be closed down with certainty. This fact will offset decrease of demand caused by PCI. Also, the supply and demand situation of the coking coal, the primary material of coke, greatly affects the cost. The past price changes show the same behavior as that of the coke price. (See **Fig. 3-2** and **Fig. 3-3**.) Therefore, when the price of coke is forecast, it is necessary not only to see the situation in the short term but to see it in the medium and long terms, and the price of coke should be forecasted from the past price changes. The prices for the year 1992 projected by PC based on the past sales results are set as the selling prices of other types of coke and by-products in the financial analysis of this study.

3.1.6 Buyers for the Increased 600,000 tons

The main countries importing foreign coke are the USA and Brazil. The estimated import of the USA and Brazil in 1992 is 2,700,000 tons and 1,100,000 tons, respectively, total 3,800,000 tons. As a result, both countries will need to import total 4,000,000 tons/year more or less in the future. 600,000 tons of Przjyazn coke will be sold to US Steel, Bethlehem Steel and Inland Steel in the USA, and to Cosipa, CSN and Belgo Mineira in Brazil. The price competition with such rivals as Japan, Australia and China is inevitable so that reduction in costs by modernizing the PC plant is essential.

Specifically, the world production of coke as appeared in the **Table 3-1** is 341 million tons, of which 312 million tons are used for blast furnace. Major steel producing countries rely on domestic coke, however, a number of coke manufactures in Europe, USA and Brazil are being forced to close down the plant due to strict environmental requirements and obsolescence of the plant. The steel manufactures in those countries began to import cokes from Japan, Australia and Poland. China recently become exporter of cokes in the world market.

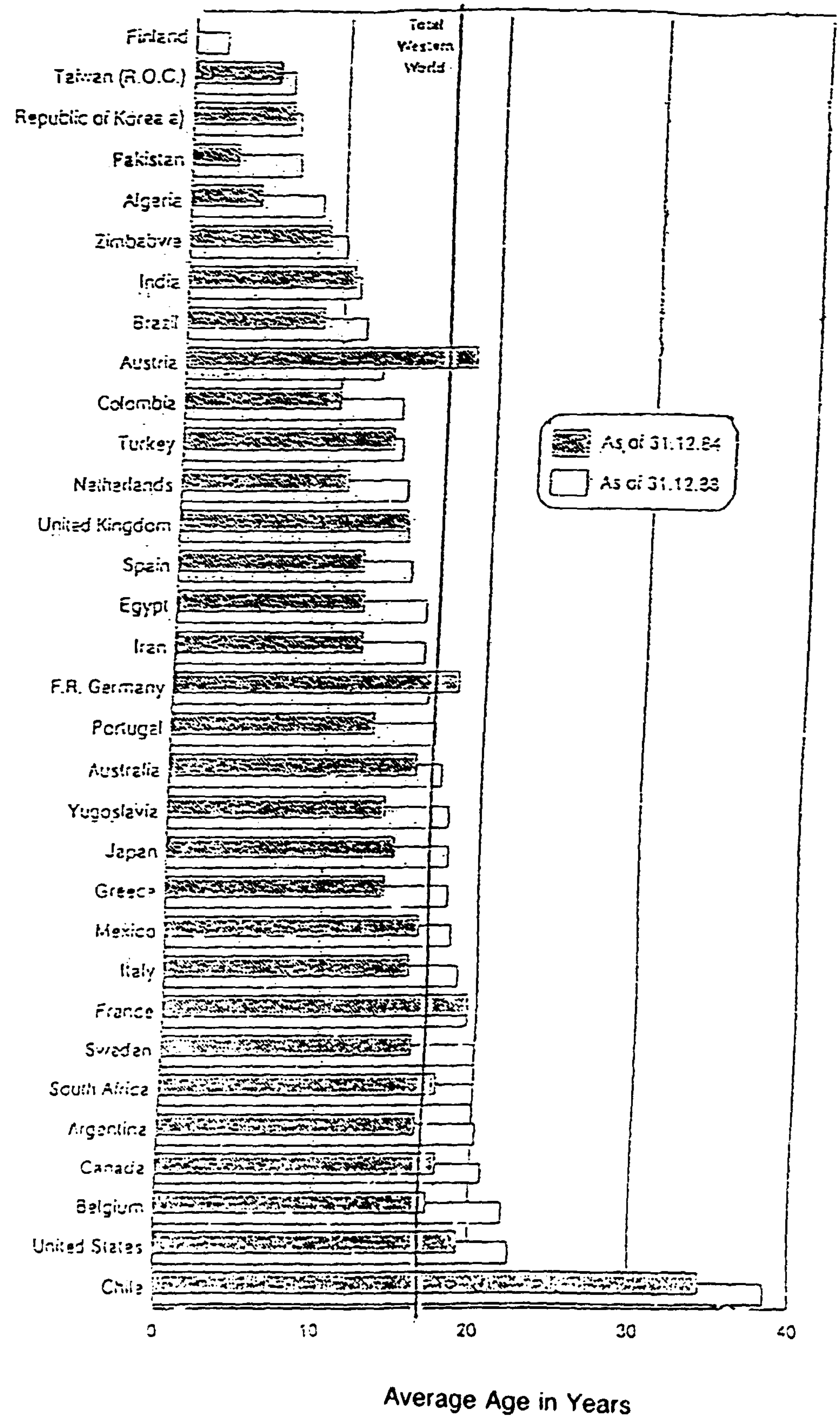


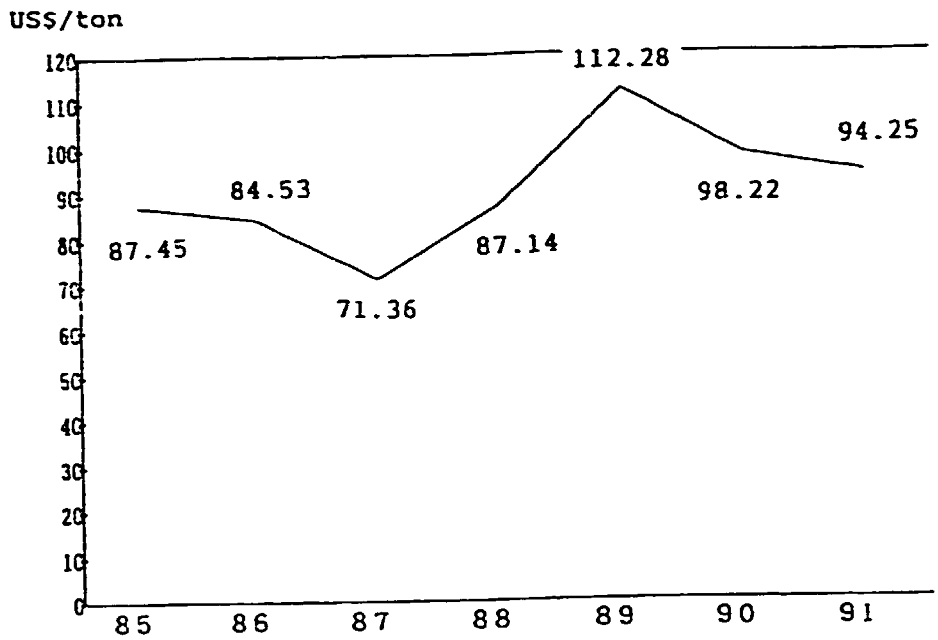
Fig.3-1 Average Age of Western World Coke making Facility

Table 3-1 Quantity of Coke Production

(source:statistical yearbook U.N. 1987) Unit:1,000 ton

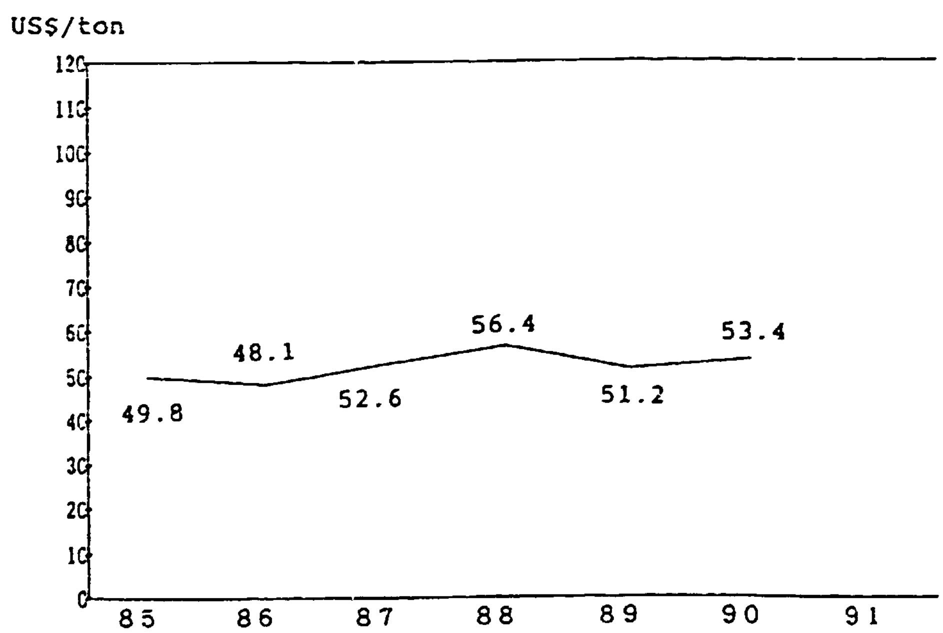
World-Wide	341,088
Africa	2,351
U.S.A.	31,822
Canada	4,561
Mexico	2,229
South America	8,359
incl Brazil	6,857
Asia	121,758
incl India	7,682
Japan	42,135
R. of Korea	5,630
N. Korea	3,150
Turkey	3,247
Europe	96,292
incl Austria	1,668
Belgium	5,082
CSFR	10,049
France	6,717
Former East Germany	5,145
Germany	19,909
Italy	6,751
Netherlands	2,661
Poland	16,196
Rumania	4,655
Spain	3,006
Sweden	1,049
United Kingdom	8,111
Yugoslavia	2,717
Oceania	3,096
Australia	3,086
USSR	77,400

Fig. 3-2 Export Price Trend of Cokes from Japan 1985-1991 (FOB Japan)



source : Coal Report, Japan

Fig. 3-3 CIF import prices of coal into Japan



source : Cokes Note, 1992

3.1.7 General Concept of Coke

Coke is essential for the operation of a blast furnace (BF) as the heat source in order to melt iron ore, limestone, and other metallic stones, as well as performs the function of being a reducing agent for iron ore in the BF. Furthermore, coke has an important role as a spacer for permeability in the BF.

Many kinds of coke are produced, depending on the coke's purpose of use, however, BF coke must meet the following special requirements:

1) Be hard and strong as physical properties;
2) Be suitable and uniform size, and;
3) Be contained with less ash, moisture and other impurites, especially sulphur.

In order to produce coke having the above-mentioned properties, the coal selected as the raw material is required to have a high coking capacity (Coking Coal / Hard Coal).

The outline of raw materials and utilities which are required for producing one ton of pig iron in the blast furnace is as follows:

Iron Ore	213 kg
Sinter	1,223
Pellet	178
Other Iron Metal	7.4
Manganese Ore	2.9
Coke	480
Limestone	2.6
Electric Power	47.3 kwh
Water	172 m^3

3.1.8 PCI

PCI is the abbreviation of Pulverized Coal injection, which is the recently developed technology of fuel injection for the BF. This technology is used to inject the BF with pulverized coal, of which the size is usually less than 0.7 mm in diameter. Heavy oil injection into the BF has been traditionally popular technology, however, PCI was developed as a substitute for heavy oil following the Oil Crisis in 1973 to overcome that difficulty. PCI also has the following advantages.

1) Provides stable conditions of operation for the blast furnace;
2) Provides a fuel cost reduction;
3) Is a suitable countermeasure to a decreased supply of coke due to aging coke ovens.

Recently, PCI has been applied to more than 60 % of blast furnaces operated in Japan, and usually 50 to 120 kg of pulverized coal is injected for the production of one ton of pig iron.

3.2 Coke and Hard Coal Industry in Poland

3.2.1 Export Situation of Polish Coke

Production of coke from hard (coking) coal in Poland for 1990/91 was 13.7/11.4 million ton, and 2,976,500 ton was exported to the other countries in 990. (See **Table 3-2** and **3-3**)

Export quantity of PRZYJAZN coke was 1,825,727 ton in 1990 and 1,264,200 ton in 1991 respectively.

Outcome of PRZYJAZN coke in 1991 was as follows.

total production in 1991 2,261,200ton
export to the former USSR 454,600ton
export to the other countries 809,600ton
domestic sales 979,500ton

POLISH COKE EXPORTS CY 1986-1990)

[1] Exports by Destinations (in 1.000MT)

	CY 1986	CY 1987	CY 1988	CY 1989	CY 1990
Former Socialist Count.	1.061.5	1.664.2	2.223.7	2.355.0	1.983.2
Bulgaria	17.7	18.9	13.5	13.5	11.3
North Korea	87.6	82.1	80.3	46.5	23.7
Germany. East	148.6	149.3	150.7	150.8	222.2
Romania	99.4	99.5	100.3	100.4	-
Hungary	113.0	112.4	110.2	111.2	39.1
Russia(U.S.S.R.)	595.2	1.202.0	1.763.7	1.932.6	1.586.9
Western Countries	358.1	483.2	484.3	684.8	993.3
Algeria	-	-	-	-	60.0
Austria	145.8	156.1	155.6	135.7	153.1
Belgium	60.8	168.8	163.7	173.3	310.1
Finland	7.5	7.9	13.4	54.6	28.5
France	-	-	14.1	-	-
Netherlands	-	-	-	-	20.6
Spain	50.5	39.2	12.6	-	55.8
Norway	-	-	-	-	4.2
Mexico	-	-		-	10.1
Portugal	-	-		1.4	-
Germany. West	39.2	86.3	76.4	182.1	200.3
Switzerland	33.0	15.0	5.0	-	16.5
Sweden	-	7.8	29.9	22.5	10.9
U.S.A.	-	-	-	108.6	106.2
U.K.	-	-	-	-	5.3
Italy	15.3	-	13.6	6.6	-
Berlin(Germany)	6.0	2.1	-	-	1.7
TOTAL	1.419.6	2.147.4	2.708.0	3.039.8	2.976.5

[2] Exports by Type (in 1.000MT)

	CY 1986	CY 1987	CY 1988	CY 1989	CY 1990
Former Socialist Count.	1.061.5	1.664.2	2.223.7	2.355.0	1.983.2
B.F.Coke	1.017.3	1.612.9	2.179.7	2.311.4	1.925.9
Foundry Coke	44.1	51.2	43.9	43.6	28.8
Domestic Coke	0.1	0.1	0.1	0.04	28.5
Non-CPE Countries	358.1	483.2	484.3	684.8	993.3
B.F.Coke	17.3	46.6	48.7	132.7	300.4
Foundry Coke	2.2	2.8	3.7	4.9	9.5
Domestic Coke	122.5	105.4	91.4	97.2	114.2
Fine Coke	216.1	328.4	340.5	400.0	569.1
TOTAL	1.419.6	2.147.4	2.708.0	3.039.8	2.976.5
B.F.Coke	1.034.6	1.659.5	2.228.4	2.494.1	2.226.3
Foundry Coke	46.3	54.0	47.6	48.5	38.4
Domestic Coke	122.6	105.5	91.5	97.2	142.7
Fine Coke	216.1	328.4	340.5	400.0	569.1

Polish Imports of Coking Coal. Anthracite and Natural Gas (CY 1986-1990)

	CY 1986	CY 1987	CY 1988	CY-1989	CY 1990
Coking Coal(1.000MT)	1.150	1.092	1.058	N/A	N/A
Anthracite (1.000MT)	20	20	20	N/A	N/A
Natural Gas (10^6 m^3)	7.135	7.531	7.484	N/A	N/A

3.2.2 Reserve of Hard Coal in Poland and its Structure

Poland has immense hard coal reserves estimated to be around 63 billion tons (with geological evidence); less than half of them are presently being exploited (30.62 billion tons).

These resources are located mainly in Upper Silesia area (88.4 % or 55.5 bn. tons) and in a new coal-center near Lublin (10.8 % or 6.9 bn. tons). Less than 1% of the Polish coal is placed in the Walbrzych area but this coal center is to be practically liquidated. (Source: Jaskowski Andrzej, "Present State and the Perspectives of Development of Hard Mining in Poland till the Year 2000", Przeglad Gorniczy 1982 v.1 pp.5-12). There are as estimated 28 bn. tons of coal up to the depth of 1000 m. Between 1000-1500 m there are around 15 bn. tons and, perspecively, another 30bn. tons are placed up to 1500 m. (among them 21 bn. are resources placed till the depth of 1000 m-these resources should be exploited in the future). Generally, Polish resources of hard coal are settled in 121 deposits, 73 of which are currently in exploitation.

3.2.3 Present State and Tendency of Coal in Poland

In view of the fact that coal mines in Poland are free to establish their prices themselves - as from April, 1992 - the Government had fixed the maximum allowable level of yearly raise: it was decided that the price of coal was not to increase than by 35 per cent over the whole 1992. Notwithstanding the governmental provisions, the coal is treated as a product in a nearly free market. Its price depends on its class - the extent of sulpher content, ash content, etc. Encountering the barrier of limited demand, Polish coal - mines are forced to compete fiercely with one another. Prices resulting from such competition are not likely to reach the limit of government - conceded hikes: real prices of coal are going down and even well - standing coal mines can hardly earn their own regular costs. This phenomenon leads to gradual decapitalization of particular mines and is unfavorable for the whole Polish Coal Industry. Another unfavorable phenomenon is the export competition of Polish coal producers - lack of a common exterior pricing policy results in unreal dumping of prices.

The coking coal, which is a main raw material for cokes, is facing an internationally competitive market. Therefore, the cost for raw material for PC plant is also affected by international market fluctuation.

3.2.4 Production of Coal and Coke 1979-1991

Coal production over recent years has settled at 140 mn.t/y. The twin difficulties of steadily rising extraction costs and the granting to the unions of a basic five-day week make it difficult to increase the supply.

Table 3.3 Hard Coal Production in Poland 1950-1980

(in million tons per year)

	1950	1955	1960	1965	1970	1975	1980
hard coal	78	94.5	104	119	140	172	193

Source: GUS Production Department

Table 3.4 Production of Hard Coal and Coke from Hard Coal in Poland 1985-1991

(in million tons per year)

	1985	1986	1987	1988	1989	1990	1991
hard coal	192	192	193	193	178	148	140.3
coke from hard coal	16	16.4	17.1	17.1	16.5	13.7	11.4

Source: GUS Production Department

3.2.5 Loading Conditions in Poland

Generally, Polish coke for export is used to be delivered by railway, based on delivery at the border and was rarely delivered via port. Since the major portion of increased production volume will be exported to the American market, loading conditions at Gdansk will become a critical factor.The information obtained from Commercial Sea Port Gdansk (MPHG: Morski Port Handlowy Gdansk) marks the situation more explicit.

There are 2-piers for loading coal in Gdansk.

1-old pier

Direct seaborne loading from freight car by crane. Depth of water- 9.5 m., Loading capacity-8,000~10,000 t/day

Vessel capacity of 16,000~17,000 ton can lie at pier.

Stockyard capacity for coal is 30,000 ton and Weglokoks, Polish National Trading House, has a concession for the use of this stockyard without termination (concession renewed every year).

2-Another pier at Gdansk is used for loading coal only. This pier is equipped with a Japanese shiploader with capacity of 3,200 t/hour.

Depth of water is 15 m. This port is not suitable for the loading of coke, due to the danger of the coke crumbling and of contaminate from coal dust.

Therefore, the only choice is to use the old pier for coke loading, however it is necessary to adjust the timing for arrival of wagon and vessel at the pier.

Thus, there seems to be no major problem in the port facility at Gdansk.

Whichever port in Poland may be used, the same rate of tariff on the port facility is to be applied on the basis of those in Hamburg and Stockholm and is to be contracted with MPHG. Apart from Gdansk, both Gdynia and Szczecin are allowed to use and load by port crane. There is also a stockyard for 45,000~50,000 ton in Gdynia with concession of Weglokoks.

3.2.6 Domestic Production and Export

There are about 10 coke plants in Poland and only Przyjazn and Powstancow Slaskich (Zdzieszowice Cokery) export coke. Most of the coke plants supply it to the neighboring ironworks.

The biggest plant, Powstancow Plant, has a 20-year old coke oven battery. A huge amount of money is required as a repairing fund. In addition, the plant is faced with the problem of pollution and produces coke of low quality and is also a main supplier of Huta Katowice (Steel mills).

Table 3-5 Output of particular Polish coke producers

Coking Plant	Output in tons/day (approximately)
POWSTANCOW SLASKICH	over 10,000
WALBRZYCH	N.A
SEDZIMIRA	over 700
PRZYJAZN	over 6,000
CZESTOCHOWA	over 700
ZABRZE:	
MAKOSZOWY	1300
JADWIGA	720
KNUROW	700
DEBIENSKO	1350
RADLIN	750

3.3 European Market

With the change from the socialist economy to the market economy in East European countries in 1990, those countries are faced with the economic difficulties and a loss of momentum of heavy industry growth. In particular, in the former USSR and the former East Germany the iron/sttel industry is on the decline owing to a crushing blow in the industries and the demand of coke greatly decreased. The two countries were important Polish markets in the past, but the markets extremely shrank. Therefore, the export results of Polish coke for Europe in 1991 were no more than 1,950,900 tons.

Now that the European iron/steel industry is inactive from the viewpoint of the short term, the demand of coke cannot be expected to increase unless the market becomes active again and the actual demand of iron/steel increases. That is, since almost all the countries are under the self-sufficient system except some countries, it can be said that they are not affected by a market condition and the supply and demand of coke is stable. (See **Table 3-6**.)

However, they have the problems mentioned later in the medium and long terms and these problems will increase the actual demand of iron/steel so that a phenomenon is possibly occur where coke becomes gradually scarce.

The most of the countries have the following problems from the viewpoint of the long term,

1) The cokery will become obsolete.
2) Pollution control measures against the regulations of the environmental protection which become tighter every year
3) The time will come in the near future when the subsidy for the coal industry is reduced.

In order to take measures against these problems, each mill plans to use PCI and increase portion. Furthermore, Ruhrkohle and Ilva constructed a new plant. From now on there is a limit to construct a new facility requiring an investment of huge amount of money, meanwhile in the medium and long terms a closedown of obsolete plants is inevitable and it is forecast that the supply of coke will become scarce.

We visited and interviewed some European countries and the following is a report of the situation of the mills in those countries.

A market surveyor visited and interviewed the following companies during April 1992:

CTC Minemet/Paris (Trader for non-ferrous materials)
Hoogovens Ijmuide/Amsterdam (Blast furnace mill)
Cokerrill/Belgium (Blast furnace mill)
Ruhrkohle Handel/Dusseldorf (Representative office in Germany)
NSC/Dusseldorf (Representative office in Germany)
ILVA/Italy (Blast furnace mill)
Altos Hornos de Vizcaya/Spain (Blast furnace mill)

Other mills aside from those stated above, such as Usinor Salicor, Sollac, Jsolmer, Ini, Ensidesa and BSC rejected interviews because they have no interest to procure coke from outside their respective countries.

Market Trend in Europe

As far as blast furnace mills in Europe are concerned, almost all have their own coke manufacturing factory, while at the same time the present iron/steel market is stagnant. Therefore there seems to be almost no expectation for further demand at this stage. Under such conditions, we presume that there will be difficulty in selling more Polish coke in Europe in the short term.

However, we must also look at the demand prospects for the long-term.

Environmental problems in the form of contamination from coke production have induced severe restrictions in many countries and the various governments occasionally force shutdowns of cokeries and.or impose high penalties or taxes. Therefore a shortage of coke supply is expected in the long-term. Under such a situation, a sales plan must be established for worldwide markets. Therefore a market survey was done in North and South America.

3.4 The U.S.A. Market

Future uncertainty is forcing of the big U.S. steel companies to reform.

Big steel, the giant corporations have poured over US$ 20 billion into the modernization of U.S. plants during the past decade to combat two potentially deadly threats which have battered the leviathans for more than 20 years. One is the seemingly unstoppable growth of electric arc furnace mills, so called mini-mills and the other cheap imported steel.

Mini-mills have much lower capital demands and operating costs than the giants mills. Big steel has undergone a remarkable transformation for the better.

As a key factor of blast furnace mills, the coke factory must be modernized without fail. However the operation of the coke oven is hardly maintained due to severe environment protection laws as per attached list of shutdown, even if invested for repairing. The details of battery shutdowns are shown on the following table.

In 1990, the figure of production and consumption was 23,715 and 27,498 thousands of tons respectively, so accordingly it's shortage was 3,783 thousands of tons. In 1991, it shortage was also 5,192 thousands of tons.

A severe shortage of coke in the U.S.A. thus may be anticipated in future. The actual situations of big mills which was confirmed by the survey visit to the USA (See Annex D).

Table 3-6

COKE BALANCE SHEET FOR 1991

08-Jul-91

(1000 TONNES)

	BELGIQUE	DANMARK	DEUTSCHLAND	ESPANA	FRANCE	HELLAS	IRELAND	ITALIA	LUXEMBOURG	NEDERLAND	PORTUGAL	UNITED KINGDOM	EUR - 12
1. PRODUCTION	5240		15900	3400	6500			5703		2800	230	7000	46773
2. RECEIPTS FROM ECSC COUNTRIES	360	35	400	45	1160	10	5		1281	200	13	100	3609
3. IMPORTS FROM THIRD COUNTRIES	440		200	50	130	20	5		88	100		100	1133
4. AVAILABILITIES (1+2+3)	6040	35	16500	3495	7790	30	10	5703	1369	3100	243	7200	47906
5. INLAND DELIVERIES (TOTAL)	5140	35	15200	3495	7180	30	10	5556	1369	2300	242	7000	47357
A. STEEL INDUSTRY	4955		13600	3200	6250	20	8	5000	1368	2000	222	6100	42723
B. OTHER INDUSTRIES	160	30	800	295	650	10	2			100	20	200	2267
C. DOMESTIC SECTOR	10		200		120							500	831
E. MISCELLANEOUS OF WHICH :	15	5	600		160			556		200		200	1736
- ISSUES TO WORKERS	10	(-)	330	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	340
- OWN CONSUMPTION	(-)	(-)	5	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	5
- OTHERS	5	5	265	(-)	160	(-)	(-)	556	(-)	200	(-)	200	1391
6. DELIVERIES TO ECSC COUNTRIES	820		1400		189			52		750	2	100	3313
7. EXPORTS TO THIRD COUNTRIES	80		100		36			95			9	100	420
8. TOTAL DELIVERIES (5+6+7)	6040	35	16700	3495	7405	30	10	5703	1369	3050	253	7200	47977
9. STOCK MOVEMENT AT PRODUCTION AND IMPORTS (4-8)			-200		385					50	-10		-71

source : EC Committee, Coal Commission

Table 3-7

BATTERY SHUTDOWNS 1986 -- 1990

COMPANY	NUMBER OF BATTERIES	NUMBER OF OVENS	ANNUAL CAP'Y (MNT)	APPROX. DIRECT EMPLOYMENT
CARONDOLET	3	93	210	80
CHATTANOOGA COKE	2	44	120	50
TOLEDO COKE	1	57	130	60
BETHLEHEM STEEL	2	150	550	220
NATIONAL STEEL	1	85	480	190
ROUGE STEEL	3	119	510	200
U.S. STEEL	2	154	510	200
TOTAL	14	702	2510	1000

Table 3-8

BATTERY SHUTDOWNS 1991

COMPANY	NUMBER OF BATTERIES	NUMBER OF OVENS	ANNUAL CAP'Y (MNT)	APPROX. DIRECT EMPLOYMENT
LTV STEEL - CLEVELAND	3	153	690	280
INDIANA GAS & CHEMICALS	2	60	130	60
NATIONAL STEEL	1	78	330	130
DETROIT COKE	1	70	330	130
LONE STAR STEEL	1	70	510	200
BETHLEHEM STEEL SPARROWS POINT	3	210	1360	540
INLAND STEEL	1	87	180	70
TOTAL	12	728	3530	1410

Table 3-9

BATTERY SHUTDOWNS 1992 -- 1993

COMPANY	NUMBER OF BATTERIES	NUMBER OF OVENS	ANNUAL CAP'Y (MNT)	APPROX. DIRECT EMPLOYMENT
INLAND	5	359	1610	640
LTV STEEL CLEVELAND	2	126	530	210
TOTAL ?	7	485	2140	850

(souse : USX)

Table 3-10

Production and Consumption of Coke

(Thousands of net tons)

	1990	1989	1988	1987	1986
Production:					
Metallurgical	23,715	24,507	23,927	22,164	20,527
Other Coke	317	393	470	305	184
Total Production	24,032	24,900	24,397	22,469	20,711
Consumption:					
Blast furnaces	27,498	29,175	29,442	25,476	22,332
Other	107	87	101	86	256
Total Consumption	27,605	29,262	29,543	25,562	22,588

source : American Iron and Steel Institutes, 1990

Table 3-11

Production and Consumption of Coke

(Thousands of net tons)

	1991	1990	1989	1988	1997
Production:					
Metallurgical	19,606	23,715	24,507	23,927	22,164
Other Coke	176	317	393	470	305
Total Production	19,782	24,032	24,900	24,397	22,469
Consumption:					
Blast Furnaces	24,798	27,498	29,175	29,442	25,476
Other	106	107	87	101	86
Total Consumption	24,904	27,605	29,262	29,543	25,562

source : American Iron and Steel Institutes, 1991

3.5 Market Research in Brazil

The total output of crude steel in Brazil is approximately 23,000,000 tons (The share of the blast furnace accounts for 79.4 %, about 18,000,000 tons).

The country consumes about 8,000,000 tons of coke in 1991 and uses about 1,100,000 to 1,400,000 tons of the imported coke. The detailed demand analysis for blast furnace mills is shown in the following **Table 3-12.**

The coke plants in Brazil depends on coking coal of the USA, Australia, Canada, etc., and they also use coke from Brazilian charcoal like the Belgo Mineira. An introduction of PCI coal is also planned to reduce the amount of imported coke. However, first of all Brazil must privatize all the blast furnace mills for the moment except Usiminas which has been already privatized so that she is planning to introduce PCI after this privatization (until 1995). The Usiminas has already introduced the PCI and the consumption of coke will decrease after a few years. As long as it continues to produce its own coke (using a 20 years old coke oven), it does not procure coke from the outside.

The possible improvements of the blast furnace mills in Brazil are an introduction of the PCI, switching from charcoal to coke, a closedown of old coke ovens and their substitutes. Considering that the ironworks, the key industry of the country, continues to exist with certainty, the consumption of coke should not be decreased over a span of 10 years from now on. Therefore, it is forecast that the minimum 700,000 tons/year of imported coke will be needed.

The detailed import data is shown in the **Table 3-12.**

Table 3-12 ★METALLURGICAL COKES IMPORT BY SUPPLIER/IMPORTER IN BRASIL 1992

1992/ 7/13

	COSIPA	CSN	CST	ACOMINAS	USIMINAS	BELGO MINEIRA	TOTAL
MITSUBISHI CHEMICAL	1 (40,000T)	5 (200,000T)	—	—	5 or 6 (200 - 240,000T)	4 (160,000T)	15or16 CARGO (600 - 640,000T)
POLAND	1 (40,000T)	1 (40,000T)	—	—	1 (40,000T)	1 (40,000T)	4 CARGO (160,000T)
MITSUI MINING	—	3 (120,000T)	—	—	—	—	3 CARGO (120,000T)
CHINA	1 (40,000T)	2 (60,000T)	—	—	—	—	3 CARGO (100,000T)
BHP (AUST)	1 (40,000T)	1 (40,000T)	—	—	—	—	2 CARGO (80,000T)
TOTAL	4 CARGO (160,000T)	12 CARGO (ABOVE PLUS ALPHA) (500,000T)	—	—	6 or 7 CARGO (240 - 280,000T)	5 CARGO (200,000T)	27-28 CARGO (ABOVE PLUS ALPHA) (1,100 - 1,140,000T)

3.6 Other Markets

3.6.1 Japan

The output of coke for self-consumption of the blast furnace mills in Japan is 35,476,000 tons in 1990 (The output of pig iron by means of the blast furnace mill is 79,651,000 tons in 1990.).

The total output by other manufacturers specializing in coke is 4,566,000 tons in 1990 and the export is about 1,300,000 tons in 1990.

Most of the coke plants in Japan are favorably located on the seaside. In addition, since the maritime freight is rather inexpensive by means of the mass transportation and those plants are equipped with modernized port facilities, they import coking coal in a large-size ship from Canada, the USA and Australia and process it into coke with an added value, and export the surplus of the coke. In particular, the manufacturers specializing in coke can ship a large amount of coke to the domestic blast furnace mills when the steel industry is active so that the export decreases. Also, the life of the furnaces has 10 to 15 years more, and the depreciation expense of the these 10 to 15 years which have already passed is also covered so that the manufacturing cost of coke is lower than that of the newly established plants and the coke of the old plants has a competitive power for export. Therefore, although the steel industry is now inactive, these plants are competitive on the world coke market with an export drive. (See the **Table 3-13.**) The domestic steel production tends to decrease from 1991 and the demand for coke has been also decreasing. The actual export record was 2,700,000 tons in 1991 with an export drive. The current export price of metallurgical coke is a company secret of each manufacturer so that it is not disclosed. It is not fixed and depends on the country, the client, the term of payment, the long-term contract or spot contract, and the period of production and shipment, etc.. The trend of the past price is as described in the preceding section 3.1.3.

For the above-mentioned reasons, the export to Japan is not taken into consideration for the moment. (See **Table 3-13**)

Table 3-13

Export Quantity Trend of Coke from Japan

(Unit : ton)

Year / Destination	1985	1986	1987	1988	1989	1990	1991
R. of Korea	94.414	86.517	132.253	107.866	102.888	110.839	112.008
N. Korea	24.432	22.490	32.207	7.000	-	3.500	-
Taiwan	175.839	165.480	156.932	146.175	132.459	109.976	154.934
Hong Kong	921	892	868	502	155	1.207	324
Vietnam	5.850	2.400	-	100	-	-	-
Thailand	31.005	24.577	52.718	38.770	38.450	60.382	39.2[illegible]7
Singapore	18.783	15.117	20.634	16.867	24.734	10.534	17
Malaysia	3.387	6.123	6.528	19.049	8.916	11.233	7
Philippines	179.497	298.745	352.210	232.891	256.846	106.917	54.188
Indonesia	17.597	11.862	19.473	15.171	4.519	11.711	3.628
India	69.700	85.415	33.044	77.618	11.174	58.098	49.124
Sri Lanka	150	54	172	72	36	90	36
Bangladesh	3.917	1.507	3.500	2.500	2.500	3.000	—
Netherlands	-	57.160	75.247	-	101	-	—
Iran	-	-	500	-	-	-	—
U.A.E	85	-	98	28	28	-	—
Belgium	-	38.394	19.263	-	-	-	—
France	77.417	16.893	38.113	-	-	-	—
Spain	-	49.330	54.300	-	-	-	—
Italy	-	-	4.945	-	-	-	—
Greece	35.458	138.981	11.000	-	-	-	11.000
Hungary	34.582	-	-	-	-	-	-
Russia	110.822	-	-	-	-	-	-
United Kingdom	-	-	-	36.920	-	37.160	-
F.R.Germany	38.363	-	-	11.000	632	-	79.236
Roumania	566.124	801.879	528.970	232.500	167.904	277.760	230.826
Bulgaria	151.841	102.744	22.000	21.000	-	-	-
Sweden	78.924	-	-	-	-	37.249	62.635
Venezuela	52.800	19.598	64.708	-	-	-	-
Peru	119.638	161.446	47.550	-	-	-	-
Algeria	-	-	40.000	-	-	-	-
United States	308.073	203.007	939.691	1.107.478	1.020.299	768.934	1.118.011
Chile	57.220	35.677	68.336	94.038	98.362		
Brazil	-	119.246	627.841	464.255	402.634	253.559	770.746
South Africa	-	3	3	-	-	-	-
Australia	-	-	11.000	11.000	11.000	11.017	32.909
Qatar	6	5	-	-	140	636	221
Finland	-	-	-	-	-	-	24.986
Yugoslavia	-	-	-	-	-	-	11.000
Other	27	100	-	-	-	5.083	100
Total	2.256.872	2.465.642	3.364.104	2.642.800	2.283.777	1.878.885	2.755.173

source : MOF Japan, Trade Statistics

3.7 Production and Sales Plan

The Production and sales plan of stabilized coke and other coke which are main products of PC are depicted on **Table 3-14**. Based on the past sales record, the planned production and sales at 1994 as base year is 526,000 tons for domestic market, 800,000 tons for CIS and 948,000 tons for Europe market. The increased production from the second year after plant modernization is to be exported mainly to US and Brazil. The plant is to be at full capacity operation from the third year after the renovation. Other cokes are to be sold to the same customers since there will be little increase in production.

Table 3-14 Production and Sales Plan : Coke

(Unit:1,000 tons)

Year	Class	Domestic	Export			Total
			CIS	Europe	others	
1994	stabilized coke	389	800	758	—	1,947
	other coke	127	—	190	—	317
	total	526	800	948	—	2,264
1995	stabilized coke	389	800	758	282	2,229
	other coke	145	—	218	—	363
	total	534	800	976	282	2,592
1996	stabilized coke	389	800	758	563	2,510
	other coke	164	—	245	—	409
	total	553	800	1,003	563	2,919

CHAPTER 4

GENERAL MANAGEMENT AND LONG TERM OBJECTIVES

CHAPTER 4. GENERAL MANAGEMENT AND LONG TERM OBJECTIVES

4.1 General

The decline of productivity in the mining and manufacturing industries caused by the drastic change from the former socialist economy to the free market economy dealt a crushing blow to the ironworks, the key industry of the country, and also caused the management difficulties in the coke industry. Even PC with a high export share was compelled to go into the red.

The reason is that both the domestic sales and the export decreased because of the inefficiency caused by a state-owned enterprise, an increase of tax and penalty imposed by a tighter pollution control, a decrease of export for the former USSR, an increase of cost caused by a rise of the coal price, and a decrease of the consumption and price due to a world-wide depression of the steel industry.

In order to overcome and survive these difficulties, there is no choice but to reduce the manufacturing cost, increase production and increase the export by improving an international competitiveness in the modernized plant through an introduction of the most advanced technology and foreign investment.

4.2 Current Situation of Coke Plant in PC

Initially, PC was built in order to be the principal coke supplier to Huta Katowice which operated two blast furnaces and which has a steel production capacity of 4.6 million t/y. PC was supply 2.1 million t/y of coke, while Zdziezdwice cokery could supply 0.3 million t/y.

However, currently Huta Katowice operates only one blast furnace and produces 2.5 million t/y of steel, for which 1 million t/y of coke is supplied from their Zdziezdwice plant and approx. 0.5 million t/y supplied by PC.PC is one of the few producers of the coke and coal chemicals in Poland and the share of these products for export was approx. 60-70 % of all with the following specified trades.

- Stabilized coke	-The former USSR, Belgium, the Netherlands, Austria, The former East Germany, Finland, Sweden, Algeria;-Pea coke - Mexico, Norway, Belgium, The former East Germany, Sweden;
- Coke breeze	-Belgium, Finland, Austria, Spain, The former E-Germany;
- Crude tar, high-temperature	-The former East Germany, Denmark;
- Crude Benzol	-The former East Germany
- Ammonium sulphate	-Yugoslavia

In the case that the coke production is increased by approx. 600,000 t/y owing to the rationalization and modernization of the factory, PC will naturally be forced to develop new market for the additional export.

In addition to the loss in coke demand from Huta Katowice whose future demand is uncertain, PC, as is the case with many state-owned enterprises, facing managerial deficiency stemming from the attributes commonly found in public enterprises.

PC thus must reorganize from a government-run enterprise to a profitable private, entity.

PC will further continue to suffer from operational difficulties due to:

(1) an increased cost of coal,
(2) increase in labor cost,
(3) a rise in energy cost which has so far doubled,
(4) the replacement of barter-based market transactions with the former USSR to transactions on a cash payment basis,

PC is located in the Katowice area, 25 km of Katowice City. It is located in south-western Poland, 350 km from Warsaw. The cokery began operation in 1987. The summery of presently operation is as follows;

a) PC is a state-owned enterprise under the control of the Ministry of Industry of Poland and its privatisation is now under study through application to the competent authorities.
b) Present assets (as of end/1991): US$ 261,624 million
c) Turnover in 1991: US$ 214.9 million; export share-81.8 %
d) Production of coke in 1991: 2.244 million tons (including dust)
e) Maximum capacitv of coke production: 2.85 million tons
f) Initial start-up pla .: with the technology former of the after a 10 years construction pericd.
g) Design concept: 15 years behind that of a typical modern coke plant. The operations mostly done manually rather than the production process being automated and computerized.
h) Number of employees: approx.3,200 persons. This is more than four times that of the Kansai Coke and Chemical plant which has almost the same production capacity.
i) Environmental protection: Treated waste water is out of specification limits set for the Katowice area which are twice as severe as the regulations for the other parts of Poland. Therefore, PC must pay a large sum as special taxes and fines to the relevant authorities.

4.3 Long Term Objectives

The traditional state-owned enterprises were completely protected by the state under the former system. However, the state finance slipped into the red, the state cannot entirely support the state-owned enterprises any more under the free market economy system and the state-owned enterprises cannot maintain the normal management so that they cannot continue business.

Poland has a very limited idea about the restructuring of the state-owned ironworks, the domestic consumer, for its modernization. Prospects of domestic sales are discouraging in the medium and long terms. There is therefore no other choice but to drive the export. If the companies remain unchanged and continue the "Uncle Sam will foot the bill" style management like the present PC, they will lose the competitive power more and more, and the deficit will widen year by year, which will inevitably lead to insolvency and bankruptcy.

Therefore, in order to survive these difficulties as an enterprise PC needs to be founded again as an independent private enterprise, streamline the plant and carry out a modern management through the participation in the management by the foreign investors. As mentioned in Chapter 3, the supply and demand situation fluctuates in the world coke market, but as long as the ironworks exist, coke is needed with certainty. Therefore, the proposed J/V tries to conduct a modern management as mentioned below, aiming to manufacture and sell coke which is competitive in price. Specifically the modern management mentioned herein refers to the following.

- Price competitiveness
- Privatization of management and capital
- Sound labor relation

CHAPTER 5

TECHNICAL EXAMINATION OF EXISTING PLANT

CHAPTER 5. TECHNICAL EXAMINATION OF EXISTING PLANT

5.1 Explanation of Existing Cokery Plant

5.1.1 Location

The Przyjazn Cokery Plant is located in the area of Dabrowa Gornicza town, Katowice Province, 25 km north-east of Katowice City which is located about 350 km from Warsaw, the capital of Poland. The Przyjazn Cokery (PC) is a typical inland coke plant, similar to those of western Europe and is adjacent to a number of coal mines within a radius of 150 km.

Since the Przyjazn Cokery had been established as a part of Huta Katowice, a steel mill company having a capacity of 4.6 million tons of crude steel per year, the product coke and the byproduct COG have been sent to Huta Katowice through a conveyor transportation system and pipeline system respectively, while utilities such items as low pressure steam, nitrogen, etc., which have been received from Huta Katowice. The distance between PC and Huta Katowice is about 15 km.

In case that the coke is exported to the US and Western Europe, about 600 km of rail transport will be required to bring the coke to the port of Gdansk for shipping.

Environmental concerns are also brought more into focus due to the location of PC. In Poland, there are regulations to limit the total amount of waste water, emissions and solid waste in order to prevent and minimize pollution of the environment. When the factory disposes waste, it has to pay tax in accordance with the total amount of waste disposed. In addition, a penalty that amounts to ten times the tax is added onto disposals where the density exceeds certain limitations.

The Katowice area where this coke factory is located is one of the worst polluted areas in Poland. In fact, the taxes and penalties resulting from waste water, emissions and solid waste is in some cases as much as twice that of other areas in Poland. Much of these taxes and penalties are attributed to the disposals made by the cokery. The plant has been equipped with emissions control and a waste water treatment facility, however their performance is inadequate for meeting the requirements of the pollution regulations. PC paid tax penalties of almost $2,600,000 in 1991 alone.

This year, enforcement of the regulations have become much more severe, to the point where it is predicted that the taxes and penalties will be as high as $8,000,000. As a preventitive measure, as far as the waste water is concerned, (so far the only pollutant with a penalty), it is impossible to dilute it further by adding sea water because the factory is situated so far inland. Therefore, the sewage is disposed of via the Bobrek River and eventually empties in the Baltic Sea. The water of such rivers is used as drinking water, hence the severity of the water discharge regulations. Considering the long course through Poland that the river runs, i.e., almost the entire length of the country, controlling the pollution caused by the cokery's waste water is the most pressing concern.

As for the cokery, the payment of such taxes and penalties also increases the cost of coke. Under these conditions it is imperative that the waste treatment equipment and facilities be improved in order to prevent further pollution as well as to reduce the taxes and penalties levied on PC.

5.1.2 Plant Layout

As shown in the attached layout drawing of Przyjazn (**Fig.5-1**), all facilities such as Coal Handling, Coke Oven, CDQ and Sieve, Gas Refinery, and Waste Water Treatment are plotted in an area of about 1,300,000 m^2. This is almost double that of the Kakogawa Plant of KC in Japan where almost the same capacity of coke (2,400,000 tons per year) is produced. The area of the Kakogawa plant is about 750,000 m^2. Please refer to the layout drawing of the Kakogawa plant (**Fig.5-2**). Each unit at PC is installed with an ample amount of space. However it is inconvenient for patrolling and monitoring the operation, which results in higher maintenance and operation costs.

5.1.3 Production Status

The Production Record for coke and byproducts are shown in the following **Table 5.1** for the last three years showing the design capacity of each facility.

Table 5.1 Production Record for Coke and Byproducts

	1989	1990	1991	Design
1. Coke Production (10^3 tons/year)				
1) Stabilized Coke	1,907	2,002	1,900	2,473
2) Pea Coke	134	138	134	174
3) Breeze Coke	157	161	176	203
Nominal Coke Production Capacity	2,198	2,301	2,210	2,850*
4) Dust Coke	45	45	34	60
Total Coke Production	2,243	2,346	2,244	2,910
2. Byproducts (tons/year)				
1) Tar	106,451	131,948	123,300	158,900**
2) Crude Benzol	30,077	33,592	28,425	36,630**
3) Ammonium Sulphate	26,929	35,230	31,890	41,090**
4) Phenolate	956	1,520	841	1,080**
5) COG (10^3Nm^3/year)	544,655	581,932	525,740	759,630**

Note: * Design Capacity possible following modification.
** Based on coke production rate estimate for 1991.

5.1.4 Raw Materials, Chemicals and Utilities to be used

The following table shows the consumption, buying and generated rate for raw materials, chemicals and utilities in 1991.

	A	B	C
	Consumption	Bought	Generated
1. *Raw Material Coal* as 10^3 dry tons / year (as wet base)	2,980 (3,270)	2,980 (3,270)	0
2. *Chemicals*			
1) Wash Oil (T/Y)	4,032	4,032	0
2) Sodium Hydrate (T/Y)	2,852	2,852	0
3) Sulphuric Acid (T/Y)	24,910	16,333	8,577
4) Potassium Carbonate (T/Y)	151	151	0
5) Others	0	*(59)	0
3. *Utilities*			
1) Electric Power (MWH/Y)	277,817	123,910	153,907
2) Industrial Water (M^3/Y)	6,138	6,138	0
3) Nitrogen ($10^3 NM^3/Y$)	7,717	7,717	0
4) Fuel Oil	-	*(1,220)	0
5) Gasoline	-	*(890)	0
6) Boiler Coal	-	*(876)	0
7) Drinking Water	-	*(1,527)	0
8) Steam			
High Pressure(T/Y)	1,234,384	0	1,234,384
Medium Pressure(T/Y)	147,311	0	147,311
Low Pressure(T/Y)	818,002	42,860	775,142
9) COG ($10^3 NM^3/Y$)	**446,030	***525,740	****1,012,350

Notes:
* million Zl.
** consumption figures for heating the coke oven.
*** selling COG to Huta Katowice.
**** generated COG from coke oven. Balance of C-B-A are emitted to flare stack.

The above table shows the following status of chemicals and utilities of Przyjazn.

1) High pressure steam is generated by the CDQ. This generated high pressure steam is utilized for two power generators.
2) More than half of the electric power is generated by two power generators of which the capacities are 6 and 10 MW respectively. This capacity covers approximately half of the electric power consumption for Przyjazn.
3) The remaining electric power is bought from the electric authority in Poland.
4) All chemicals except sulphuric acid are bought from outside.
5) A part of sulphuric acid is produced in the desulphurization process.
6) About half of COG generated from the coke oven is utilized for heating the coke oven and the remaining COG except that vented to the flare stack is sold to Huta Katowice.
7) Almost all energy consumed in the cokery plant is produced by the cokery.

5.1.5 Facilities

1) Coal Handling Facility (Please refer to **Fig. 5-3**)

Coal is unloaded on the large size rotary tipplers from where it is sent to the coal storage yard by conveyor belt. The capacity of the coal storage yard is 500,000 tons of coal which is approximately two months inventory.The coal storage yard is separated into three areas. Two stack-reclaimers are provided in order to stack and/or reclaim the heap of coal so as to separate by coal type.

From the coal storage yard the coal is supplied to the coal grinding section where it is crushed to the specified grain-size by hammer crushers.The ground coal is then sent via conveyor belt to the blending section where, by automatic weighing feeders, the coking coal is prepared according to the specified blending ratio.

The ready-made blended coking coal arrives at the coal towers located above the coke ovens.

A dual tunnel defrosting building is in front of the rotary tipplers unit in order to defrost the coal during the winter by firing COG as the heating medium.

The Coal Handling Facility consists of the following main units:

- Dual Tunnel Coal Defrosting Building heated by COG (winter only)

- Rotary Tippler:	1,400 t/h x 2
- Coal Storage Yard:	500,000 tons
- Stack-reclaimer:	1,000 t/h x 2
- Hammer Crusher:	180 t/h x 6
- Blending Bin:	1,000 tons x 18
- Coal Tower:	2,400 tons x 2

2) Coke Oven (refer to **Figs. 5-4, 5-5, and 5-6**)

The coke oven was originally designed by the USSR the type is called PWR-63. The coke oven consists of 80 ovens/battery x 4 batteries = 320 ovens. The size of each oven is 15,040 x 5,500 x 410 mm. The production capacity of coke is adjusted by the coking time and the temperature of the coke oven in accordance with the demand of coke. The attached table **Table 5.2** shows the operation capacity vs operating conditions for the past operating record of Przyjazn.

Coal sent from the Coal Preparation Facility is received at the Coal Tower which is located above the coke oven. This coal is sent to a charging car which then moves to an available coke oven.The coal is charged to the oven through three charging holes. The charging quantity is 22 tons/charge. The coal is then carbonized into hot coke (950 - 1,050°C) for about 16 to 20 hours in the coke oven. This hot coke is pushed out of the chamber to a bucket car by the pushing machine via guide car. Hot coke is transported by bucket car to the CDQ where it is cooled down to approx. 200°C.

Additionally, COG generated during the carbonization process that has reached approximately 700°C contacts directly with gas liquor which is separated from the tar in the Gas Refining (Byproducts) Facility, and is cooled down to 80°C in each ascension pipe installed at both the Machine Side (M/S) and Coke Side (C/S) of the Coke Oven.

Major units of the Coke Oven are:

- Coke Oven

Type:	PWR-63 (designed by the USSR) Double Main Type (2 Ascension Pipes/Oven)
No.of Coke Ovens:	80 ovens / Battery x 4 Batteries (320 ovens)
Dimensions:	5,500H x 410W x 15,040L (mm)
Effective Volume:	30.3 m3 / Oven (22 tons-dry coal / Charge)

-Pushing Machines:	6 units, of which 2 units are spare
-Guide Cars:	6 units, of which 2 units are spare
-Bucket Cars:	6 units, of which 2 units are spare
-Charging Cars:	6 units, of which 2 units are spare

3) CDQ and Sieve Facility (refer to **Fig. 5-7**)

The CDQ at Przyjazn is a "Giprokoks" type designed by the USSR and consists of two units which are applicable to the No.1 & 2 Batteries and No.3 & 4 Batteries respectively. Each unit consists of 6 sets of Cooling Chambers, 6 sets of Boilers and 3 sets of Lifting Cranes which lift the coke bucket to the top of the cooling chamber from the bucket car. Since at PC all the coke is cooled by CDQ and not CWQ, in one CDQ unit there are 4 sets of cooling chambers which are normally operating with one set on hot stand-by for emergency and one set on cold stand-by for maintenance purposes. As for the lifting cranes, a long time is required for repair work and therefore two sets are normally operating and one set is on stand-by.

Hot coke, having a temperature of 950 - 1,050°C is pushed out from the coke oven is contacted counter currently with circulating inert gas and is cooled to less than 200°C for two to three hours in the cooling chamber and is then discharged from the bottom of the cooling chamber and sent to the Sieving Facility by conveyor belt.

The inert gas following the heat exchange with the hot coke is raised to about 800°C and is de-dusted primarily in the dust box. Then the inert gas is cooled down to 170-180°C in a waste heat boiler where high pressure steam (40 kg/cm^{2}G, 440°C) is generated at about 22 - 25 tons per hour. Inert gas, after being further de-dusted in a cyclone, is recycled by a blower.

The contents of CO, H2 etc., which are generated from the hot coke are accumulated in the circulated inert gas. In order to control the contents of the circulated inert gas, it is partially emitted to the atmosphere and replaced by injected nitrogen to the same quantity level as that which was emitted.

The coke, after being discharged to the CDQ is sent to the Sieving Facility where it is separated into three grades, i.e., Stabilized Coke for blast furnace +25 mm, Pea Coke 25-10 mm, and Coke Breeze 10 mm and under.

Specification of CDQ

- Type:	Giprokoks Type designed by USSR
- No. of Cooling Chambers:	6 sets/unit x 2 units including 4 stand-by
- No. of cranes and traverser:	3 sets/unit x 2 units including 2 stand-by
- Cooling Chamber:	Volume 250m^3/set,
Coke discharge rate:	40 tons/h.set
- Blower capacity:	90,000m^3/h,630kw
- Steam generated:	22-25 tons/h(40kg/cm^2 G,440°C)
- De-duster:	500m^3/min for charging, 500m^3/min for discharging
- Crane:	60 tons/set

Sieve Facility

- Roller Screen
- Coke Cutter
- Vibration Screen

4) Gas Refinery Facility (Please refer to **Fig. 5-8**)

The Gas Refinery Facility is divided into the following three units in accordance with the contaminant refining process of crude COG.

1st Unit: Primary Cooling & Suction Unit
(to separate H_2O and Tar from crude COG and pressurize COG for further processing at the 2nd & 3rd units)

2nd Unit: Ammonia Removal Unit
(Ammonium Sulphate Production)

3rd Unit: Benzol and H_2S Removal Unit
(Crude Benzol and H_2SO4 Production)

In the 3rd Unit, crude COG is processed by dividing into two pressure levels. In the low pressure unit, 1,600 mm aqueous COG is produced for use in heating the coke oven, etc., and in the high pressure unit, 1.3 MPa of COG is produced for sale to Huta Katowice.

The final product specification of each type of COG is as follows:

Contaminants	Crude COG	Low Pressure COG	High pressure COG
Tar	40-50 g/Nm^3	0.02 g/Nm^3	0.02 g/Nm^3
NH_3	6.5-7.5	0.03	0.03
H_2S	5-7	1.5	0.02
HCN	1.2-2.9	0.3-0.4	0.1
Benzol	36-37	2	0.5
Naphthalene	7-9	0.3	0.05

In the 1st Unit, the crude COG generated in the coke oven at a temperature of 80°C is cooled down to 30°C through the Primary Cooler and then pressurized up to 2,600 mm H_2O to a temperature of 40°C by Suction Blower. Pressurized crude COG is then sent to the Electric Precipitator (EP) where tar mist is removed up to 0.02 g/Nm^3-COG. The Tar sludge/Tar/Gas-liquor mixture which is condensed from crude COG in the Primary Cooler is separated into Tar Sludge, Tar and Gas Liquor in the Tar Decanter. The Tar sludge is sent to the Coal Handling Facility and mixed with coal on the coal transporting conveyor belt. The Tar is then sent out by railway as a byproduct for sale.

Most of the Gas Liquor is recycled to the Ascension Pipes of the Coke Oven Batteries in order to cool the COG where the remaining Gas Liquor, which is generated from the water contents of coal during carbonization, is sent to the Ammonia Still through the Phenol Extraction Unit. After removing ammonia and phenol, Gas Liquor is sent to the Waste Water Treatment Facility.

In the 2nd Unit, the ammonia in crude COG is reacted with sulphuric acid to be reduced to 0.03 g/Nm^3-COG in the Ammonia Saturator where the byproduct ammonia sulphate is produced. After separation and drying , ammonia sulphate is sold out as a byproduct. After removal of ammonia, crude COG is sent to a final cooler where COG is cooled to 25 to 28°C.

In the 3rd Unit, crude COG is divided into two different pressure levels of Benzol and H_2S removal units as stipulated before. In the low pressure unit, the H_2S content in COG is reduced to 2.0 g/Nm^3 which is slightly higher than the design value, under the present operation and in the high pressure unit, the H_2S content is 0.02 g/Nm^3 which is the same as the design value. Potassium carbonate solution, which absorbs H_2S from COG in both the low and high pressure H_2S removal units, is regenerated in a common vacuum oil stripping process and recycled to each low and high pressure absorber. H_2S together with the oil is sent to the Catalytic H_2SO_4 Production Unit where H_2S is converted to H_2SO_4. This H_2SO_4 is sent back to the Ammonia Saturator in the 2nd Unit. In the Benzol Removal Unit, benzol absorbed in the wash oil is recovered as Crude Benzol in the Benzol Stripper and is sold out as byproduct.

5) Environmental Unit: Waste Water Treatment Facility

1. Inlet waste water

The waste water generated in PC is approximately grouped into four stream lines as follows:

a) De-NH_3, De-Phenol gas liquid
b) Waste water from production
c) Social waste
d) Rain water & industrial waste water

The discharge source of the respective source lines is shown in the Waste Water Stream Flow sheet **(Fig. 5-9)**. The discharge source and discharge volume shown in the drawing is what they were at the time of planning and is different, though only slightly, from what they are at present.

a) De-NH_3, De-Phenol gas liquid

The main contaminant included in the waste water generated at PC is traced back to this stream line. The contaminant liquid is included in the charge coal, and transferred to the waste water treatment system through the De-NH_3, De-Phenol process. The contaminant includes highly concentrated COD, NH_3, Phenol, CN, etc.

b) Waste water from production

This waste water ranks second in amount of contaminant included, following the gas liquid. The contaminant is included in drainage, seal water and blowdown from the respective unit in the Gas Refinery and rain water deposited in the tank dike.

c) Social waste

This includes domestic water such as discharge from bath, laundry, toilet, etc.

d) Rain water & industrial waste water

The waste water is the highest in volume, but low in concentration of contaminant. It includes blowdown from cooling tower, regeneration waste water from demineralized plant, etc., in addition to rain water.

Quantity and quality of each stream in 1991 is shown below.

<u>Quantity</u>

	Max.	Min.	Ave.
De-NH_3, De-Phenol gas liquid	2,260	1,608	1,964
Waste water from production	3,423	1,309	2,232
Social waste	2,028	1,362	1,720
Rain water & industrial waste water	10,818	7,939	8,764

Quality

a) De-NH_3, De-Phenol gas liquid

		Max.	Min.	Ave.
pH	(-)	11.1	8.2	9.1
COD	(mg/1)	9,860	4,124	5,954
Total-CN^-	(mg/1)	300	21	72
SCN^-	(mg/1)	850	204	463
Free-Phenols	(mg/1)	1,350	185	1,135
NH_4-N	(mg/1)	975	127	334

The above values were obtained during 1991. The fluctuation of water quality was monitored for one month during the site survey (from March 10,1992 to April 8, 1992).

The fluctuation is significant as shown below.

		Max.	Min.
pH	(-)	10.9	8.2
COD	(mg/1)	9,000	4,000
CN^-	(mg/1)	220	70
SCN^-	(mg/1)	850	400
Total-Phenols	(mg/1)	3,500	1,500
Free-Phenols	(mg/1)	2,000	500
Total-NH_3	(mg/1)	750	150
Free-NH_3	(mg/1)	120	20
Cl^-	(mg/1)	5,000	2,000

Fluctuations exist in time and frequency ranges other than this fluctuation pattern.

b) Waste water from production

		Max.	Min.	Ave.
pH	(-)	12	2.0	8.2
COD	(mg/1)	8,250	70	1,620
Total-CN^-	(mg/1)	206	0.1	72
SCN^-	(mg/1)	318	1.4	14
Free-Phenols	(mg/1)	976	1.4	254
NH_4-N	(mg/1)	1,271	2.1	337

The margin of fluctuation in this stream is the largest among four streams.

c) Social waste

		Max.	Min.	Ave.
pH	(-)	8.5	6.0	7.3
Total-CN^-	(mg/1)	2.7	0.01	0.3
SCN	(mg/1)	10.2	0.16	1.2

Data for SS, BOD, COD, NH_4-N, etc., is not available. The reason for the contamination with CN^- and SCN^- is not identified.

d) Rain water & industrial waste water

		Max.
pH	(-)	9.3
COD	(mg/1)	160
Total-CN^-	(mg/1)	1.2
SCN^-	(mg/1)	3.3
Free-Phenols	(mg/1)	4.75

The COD absolute quantity in the four streams above is calculated on an average base is as follows:

(Note)

The COD of Social Waste is assumed to be 300 mg/1.
The COD of rain water & industrial waste water is assumed to be 60 mg/1.

De-NH_3, De-Phenol gas liquid	11,694	72
Waste water from production	3,616	22
Social waste	516	3
Rain water & industrial waste water	526	3
Total:	16,352	100

The above shows that the majority COD in the entire COD at PC is from the stream of De-NH_3, De-Phenol gas liquid. This fact also applies to other contaminant indices other than COD to some extent.

2. Final treated water

The discharge water from the four stream lines is treated at the waste water treatment system for discharge to the Bobrek River. The final waste water quality fluctuates greatly. It is evaluated that hardly any treatment has been steadily done.

		Max.	Min.	Ave.
pH	(-)	8.3	7.0	7.7
SS	(mg/1)	50	15	30
COD	(mg/1)	490	151	286
Total-CN^-	(mg/1)	1.45	0.27	0.68
Free-CN^-	(mg/1)	0.034	0.004	0.014
SCN^-	(mg/1)	9.5	1.4	2.6
Free-Phenols	(mg/1)	0.64	0.04	0.1
NH_4-N	(mg/1)	171	73	109
Total-Fe	(mg/1)	10	1.2	3.7

3. Flow sheet & material balance

The schematic flow sheet of the existing system and the material balance are shown in the attached Flow sheet & Material Balances **(Fig. 5-10).**

The quality of the final waste water fluctuates as greatly as the inlet waste water. This means that the respective treatment units cannot absorb the fluctuation of inlet waste water and thus not perform steady treatment. This is a reflection of the fact that the fluctuation of the final treatment water is significantly large.

As shown in the flow sheet, this treatment system consists of four major blocks:

a) Pretreatment

Pretreatment of activated sludge is done here as well as receiving De-NH_3, De-Phenol gas liquid and waste water from production.

Main units are:
- Gravity Precipitator
- Reaction Tank
- Coagulation Precipitator
- Floatator

for removal of SS, CN^- and oil content.

b) Activated Sludge Treatment
Treated water from the pretreatment and social waste is received here, and biological treatment using activated sludge which is critical to this treatment system is undertaken to decompose organic matter. As post-treatment, SS is coagulated and the balance liquid is discharged to the Bobrek River through the Retention tank which functions as a buffer.

Main units Are:
- Pre-aeration tank
- Aeration tank
- Coagulation precipitator
- Retention tank.

c) Rain water & industrial waste water treatment

Rain water and industrial waste water are received and SS removal is mainly done here.

Main units are:
- Retention Tank
- Gravity Precipitator
- Coagulation Precipitator.

The water treated in this block or inlet water exceeding a certain quantity overflows from the Retention Tank and is discharged to the river together with the water treated at the Activated Sludge System.

d) Sludge Treatment

This is to receive:
- coagulation sludge from pretreatment;
- excess activated sludge and coagulation sludge from Activated Sludge Treatment, and
- coagulation sludge from rain water & industrial waste water treatment

for dehydration and incineration.

Main units are:
- Thickener
- Centrifuge
- Incinerator.

The incinerator's operation has been delayed as it has been under construction, however it is now in the process of being completed.

6) Environmental Unit: Emissions Control Facility

Table 5.3 attached shows the record for air pollutants emitted from Przyjazn Cokery in 1991. All air pollutants listed in Table-5 are regulated by Polish regulations and tax should be paid according to the discharged amount.

(1) Dust Collector

Table 5.4 attached shows dust collectors installed in Przyjazn and their specification.
Table 5.5 attached shows dust collectors installed at the Kakogawa plant of KC and their specification for reference.
Dust collectors are installed for the main sources of dust generating facilities except for the machine side of coke oven at PC.

(2) SOx

Almost all SOx is emitted from the chimney of the coke oven. This SOx is generated from burning COG which is sent from the low pressure desulphurization unit in the gas refining facility. Therefore a high amount of SOx emitted to the atmosphere is as a result of the low efficiency of the low pressure desulphurization unit.

(3) NOx and other pollutants

About 65% of NOx and other pollutants emitted to the atmosphere are discharged from the coke oven.

7) Maintenance Shop

The following table shows the existing main maintenance shops in Przyjazn.

No.	Name of Maintenance Shop	Description
801	Construction, Installation and Overhaul Workshop	Equipment repair and overhaul
802	Construction, Installation and Overhaul Workshop	Equipment repair and overhaul
803	Building Workshop	Castable refractories, Refractor Materials
804	Electric Workshop	Overhaul for Electric Motor, etc.
807	Electric Cars House	Repair for Bucket Car, etc.
808	Mechanic Workshop	Half of them are in operation
809	Wagon Repair Workshop	Repair for railway wagon

Almost all the major equipment such as rotating equipment, electric motors, transformers, etc., can be repaired in these maintenance shops which are equipped with overhead travelling cranes, machine tools, etc.

No. 808 Mechanic Workshop is a large scale workshop at 157 meters x 48 meters x 2 spans (One span is in operation and the other is under construction). In this workshop, equipment fabrication and repair work can be awarded to outside companies as a new business for Przyjazn in future, due to its location and modern machines and tools with highly skilled operators.

Actually, they are fabricating themselves new bucket cars in the Przyjazn maintenance department, using the same drawings as they bought in 1991. This fact highlights the high technology level for equipment fabrication and repair work.

8) Status for Mechanization/Automation in PC

The attached **Table 5.6** shows the present status for automation of equipment and facilities in Przyjazn in comparison with the KC plant.

9) Number of Employees

The following table shows the number of employees compared with the Kakogawa Plant for KC which has almost the same coke production capacity as Przyjazn. The administration department and Sales & Trade department are not easily compared due to different national circumstances and sales organization systems in Poland. However too many blue and white collar employees are working in Przyjazn.

Department	Przyjazn	Kakogawa
General Manager	1	1
Administration	White 106 Blue 141	21 4
Sales & Trade	White 88 Blue 447	- (included in Administration)
Production and Maintenance	White 276 Blue 2,222	65 615
Total	White 470 Blue 2,810 Total 3,280	87 619 706

TABLE - 5.2

Production of Coke vs Operating Conditions for Coke Oven

Production of Coke (10^3 T / Y)	Coking Time (Hr.)	Coke Oven Temperature (℃)						Remark
		No.1 ~ 2 Batteries			No.3 ~ 4 Batteries			
		M / S	C / S	Average	M / S	C / S	Average	
2,850	16.5	1,300	1,340	1,320	1,310	1,340	1,325	Full Operation
2,690	17	1,290	1,330	1,310	1,300	1,330	1,315	
2,540	18	1,280	1,320	1,300	1,280	1,310	1,295	
2,410	19	1,260	1,290	1,275	1,260	1,290	1,275	
2,210	20	1,230	1,270	1,250	1,240	1,270	1,255	Experience Record in 1991
2,180	21	1,215	1,235	1,225	1,220	1,240	1,230	
2,080	22	1,190	1,210	1,200	1,210	1,230	1,220	
1,990	23	1,160	1,190	1,175	1,200	1,220	1,210	
1,910	24	1,130	1,170	1,150	1,190	1,210	1,200	

TABLE - 5.3

Record for Air Pollutants in 1991

(Unit : Ton／Year)

	Dust	SO_2	CO	NO_x	Tar	H_2SO_4	HC	Benzol	NH_3	cl_2	Benzp-yrene	Phenol	H_2S	HCN
Coal Handling	156.3	—	—	—	—	—	—	—	—	—	—	—	—	—
Chimney of Coke Oven	14.5	1502.8	357.84	226.3	—	—	—	—	—	—	—	—	—	—
Operation of Coke Oven (Pushing, Charging)	605.2	20.6	14.76	—	3.0	—	—	—	—	—	—	—	—	—
Coke Oven Battery	89.2	15.2	858.86	214.5	30.0	—	1008.9	3.15	266.8	5.65	0.241	13.0	0.8	14.4
CDQ	41.8	—	1555.2	—	—	—	—	—	—	—	—	—	—	—
Coke Transport & Sieve	175.1	—	—	—	—	—	—	—	—	—	—	—	—	—
Production of H_2SO_4	—	207.2	—	188.6	—	11.62	—	—	—	—	—	—	—	—
Coal Crusher Room	3.9	—	—	—	—	—	—	—	—	—	—	—	—	—
Flare Stack	—	14.5	—	17.0	—	—	—	—	—	—	—	—	—	—
Other	—	—	—	—	—	—	207.1	—	35.2	—	—	1.5	24.5	10.1
Total	1086.0	1760.3	2787.0	646.4	33.0	11.62	1216.0	3.15	302.0	5.65	0.241	14.5	25.3	24.5

TABLE - 5.4
List of Dust Collectors in PC

		Type	Air Rate (m^3 / min)	Concentration of Dust (g / m^3)		Remarks
				Inlet	Outlet	
Coke Oven	No.1 Battery Guide Dust Collector	Bag Filter	3,850	0.20	0.003 ~ 0.05	Common for No.1 CDQ Inlet
	No.2 〃	〃	5,000	0.48	0.016 ~ 0.005	Common for No.1 CDQ Outlet
	No.3 〃	〃	4,480	0.26	0.024 ~ 0.03	Common for No.2 CDQ Inlet
	No.4 〃	〃	2,960	0.69	0.047 ~ 0.092	Common for No.2 CDQ Outlet
	M /S Dust Collector	Non	—	—	—	
CDQ	No.1 CDQ					Common for Coke Oven guide Dust Collector
	No.2 CDQ					
Sieve / Loading	No.1 Dust Collector	E.P.	5,810	3.4	0.1	
	No.2 Dust Collector	E.P.	6,670	5.0	0.1	
Coal Handling	Dust Collector for Crush Room		180	2.2	0.22	

TABLE - 5.5
List of Dust Collectors in KC

		Type	Air Rate (m³ / min)	Concentration of Dust (g / m³) Inlet	Concentration of Dust (g / m³) Outlet	Remarks
Coke Oven	No.1 ~No.2 Battery Guide Dust Collector	Primary De-Duster + Wet EP	4,000	0.4 ~ 0.5	0.01 ~ 0.02	
	No.3 ~No.4 Battery Guide Dust Collector	〃	〃	〃	〃	
	No.1 ~No.4 Battery Guide Dust Collector	Bag Filter	4,000	〃	〃	Common for No.1 - 4 Battery
	No.1 ~No.4 Battery Charging Car, C / S Dust Collector	Primary De-Duster + Wet EP	4,000	0.2	0.01 ~ 0.02	
	No.1 ~No.2 Battery M /S Dust Collector	Bag Filter	500	1.0	>0.01	
CDQ	CDQ Dust Collector	Bag Filter	2,140	5.0 ~ 10.0	>0.02	For No.1 ~ No.2 Battery CDQ
Sieve / Loading	No.1 Sieve Dust Collector	Bag Filter	3,000	5.0	>0.01	
	No.2 Sieve Dust Collector	〃	2,500	〃	〃	
	No.3 Sieve Dust Collector	〃	〃	〃	〃	
	Dust Collector for Coke Loading Belt Conveyer Chute	〃	420	1.0	>0.01	
		〃	〃	〃	〃	
	No.1 Sieve Dust Collector	Primary De-Duster	420	1.0	0.05	
		〃	1,200	〃	〃	
Coal Handling	Dust Collector for Crush Room	Bag Filter	420	1.0	>0.01	

TABLE - 5.6

Present States for Automation of Equipment and Facilities

Classification	Process	Name of Equipment and Facilities	State of Mechanization/Automization ○ = Auto × = Manual	PRAZYJAZN		KAKOGAWA	Remarks
Unloading (I)	From ship to yard	1.Unloader	×	Rotary tipplers - manual remote control		Kobe Steel, Ltd.	
		2.Conveyor Operation		Remote control from control room (manual)	○	Remote control form control room with computer	
		Prevention of snaking		None	○	Snaking detector	
		BC Cleaner		Rubber scraper	○	Steel - Plate Scraper and water washing of BC floor	
		3.Chute	○	Defection of chute clogging - BC stop	○	Defection of chute clogging - BC Stop	
		4.Stacker Operation		No.1 ST - Rec / No.2 ST - Rec		No.1 ST / No.2 ST / No.3 ST	
		Travelling		× / ×		(Manual) / (Unmanned) / (Manned)	
		Slewing		× / ×		× / ○ / ×	
		Stacking		× / ×		× / ○ / ×	
				– / –		× / ○ / ×	
		ITV				0 / 3 units / 0	
						(3 units monitored from control room)	
		5.Meric Scale	×	Rail Car scale prior to unloading	○	BC Scale	
		6.Measures for dust			○	Wet-type dust collector, belt cover and water washing of BC Floor	
		7.Sampling	×	Each delivery	○	Automatic Sampler	
Coal Yard	Yard control	1.Temperature defection	×	Knocking in pipe for use of Hg thermometer	×	Knocking in of pipe for use of mercury thermometer	
		2. ITV		None		2units, man forced in control room	
(II)		3.Measures for rain water		Draining system - Waste water treatment	○	Storage in pit→SS Adjustment →draining	
		4.Prevention of Dispersion		–	○	Automatic sprinkler and sprinkling of chemicals by car	
		5.Measures for dust		–	○	Pressurized water washing of vacancy, water spraying of aisles by reclaimer, car washing station at entrance to yard and water spraying of yard aisles (manual remote control)	
Delivery	Discharging	1.Recleimer Operation					
(III)						No.1. Rec (Unmanned) / No.2.Rec (Manned)	
		Travelling		As point (I) 4.		○ / ×	
		Slewing		As point (I) 4.		○ / ×	
		Discharging		As point (I) 4.		○ / ×	
		ITV		As point (I) 4.		4 units / 0	
						(4 units monitored from control room)	

Classification	Process	Name of Equipment and Facilities	State of Mechanization/Automization ○ = Auto × = Manual	PRAZYJAZN		KAKOGAWA	Remarks
Delivery	Discharging	2.Conveyor					
		Operation		Remote control from control room (manual)	○	Remote control from control room with computer	
		Magnetic separator	○	Automatic Discharging	○	Automatic Discharging	
		Dewatering	×	Manual scraper	○	Automatic dumping of scraper	
		Prevention of snaking		Self aligning carrier	○	Self-aligning carrier and snaking detector	
(III)		Cleaner	×	Rubber scraper	○	Steel-plate scraper and water washing of BC floor	
		3.Sampling	×	Manual sampling	○	Automatic sampler	
		4.Measurement of moisture		Laboratory analysis 2 × per shift	○	Mechanical type	
	Pretreatment	Briquette		–		Not in operation now	
Delivery	On top of blending silo	1. BC Operation on top of blending silo	○	Remote control from control room (manual)	○	Remote control from control room with computer	
		2. Tripper Operation	×	Manual Switch on	○	Remote control from control room with computer	
(IV)		Travelling	×		○	Remote control from control room with computer	
		3. Measures for dust		–	○	Water washing of BC floor	
Blending	Blending silo	1. Quantity of coal in blending silo		Detector of Level	○	Remainder detector	
		2. Prevention of hanging	○	Oscillator	○	Oscillator	
		3. Measures for dust		Closed construction of building		Closed construction of building	
(V)							
Crushing and Transporting	Below bending silo to Coal charging silo	1. Blender Operation Feeding	○	from control room by operator	○	Quantitative feeding equipment with computer	
(VI)		2. Conveyor Operation	○	Remote control from control room	○	Remote control from control room with computer	
		Detection of metal		–	○	Electromagnetic type→ stop of BC	
		Removal of metal		–			
		Cleaner	×	Rubber scraper	×	Steel-plate scraper and water washing of BC Floor	
		3. Crusher Operation	×	Individual crushing Remote control from operation room No.1 - 6 : Hammer crusher	○	3 group crushing Remote control from control room with VVVF control of remolutions No.1 : Impact crusher No.2 - 4 : Hammer crusher	
		Gap change	×	manual	×	Hydraulic manual operation	
		Sampling	×	manual sampling	○	Automatic sampler	
		Measuring of grain size	×	Laboratory analysis	○	Grain size measuring device	
		4. Blended coal silo		–	○	Simplified mixer	
		5. Switching of lines	○	Remote control from control room	○	Remote control from control room with computer	
		6. Measures for dust		Dry-type dust collector	○	Dry-type dust collector, water washing of BC floor and belt cover	
		7. Sampling	×	manual sampling	○	Automatic sampler	
		8. Measuring of moisture		Laboratory analysis	○	Robot (transmitting to coke oven combustion control system)	
		9. Analysis of grain size, moisture, ash volatile matter and fixed carbon		Laboratory analysis according to Polish Standards	×	JIS method	

Classification	Process	Name of Equipment and Facilities	State of Mechanization/Automization ○=Auto ×=Manual				Remarks
				PRAZYJAZN		KAKOGAWA	
Coal Transportatio (VII)	Above the coal charging silo	1. Conveyor Operation		Remote control from control room	○	Remote control from control room with computer	
		2. Scraper Operation		Rubber scraper	○	Remote control from control room with computer	
		3. Measures for dust		Closed construction of building and BC bridge		Closed construction of building.	
	Coal charging silo	1. Coal charging silo		–	○	Remainder detector(stock display in control room)	
(VIII)		2. Prevention of hanging		Sliding accelarator Lining , air hammer	○	The silo lined with sliding accelarator and installation of air hammer(big Blaster)	
		1. Addition of a heavy oil		Not added	○	Interlocked with belt conveyor	
		2. Addition of tar slag		After blending silo , interlocked with BC	○	Interlocked with belt conveyor	
	Others	1. Automatic broadcasting system			○	At start-up of belt conveyor.	
		2. Communicating system		Wire type	○	Wireless type	
	Controlling	1. Control room		Remote control for BC and display of operating conditions of main equipment	○	Operations of coal from unloading, discharging, blending,crushing briquetting and transporting to coal bins are under centralised control at one place.	

Classification	Process	Name of Equipment and Facilities	State of Mechanization/Automization ○ = Auto × = Manual				Remarks
				PRAZYJAZN		KAKOGAWA	
	Coal Piling System	MELCOM 350-30	×		○	Daily Operation Reports · Actual unloading record · Actual receiving record · CF discharging · Coal transporting and receiving · Receiving of coal bins (this day) · Receiving of coal bins (yesterday) · Briquette discharging · Operating condition of main equipment	
		MUCTAS	×	Display on pannel · BC remote control of start-up and shutdown (sequential start-up and overall shutdown) · Monitoring of operation condition		BC Centralized Control BC remote control of start-up and shutdown (sequential start-up and overall shutdown) Monitoring of operating conditions Display of operating conditions with alarm	

Classification	Process	Name of Equipment and Facilities	State of Mechanization/Automization ○ = Auto × = Manual				Remarks
			PRAZYJAZN		KAKOGAWA		
Coke Oven Operation	On top of Oven	1. Coal bin feeder	△	Manual position detection of charging car • Automatic feeding by push button • stop	○	Home position detection of charging car •feeding, detection of hopper in full • stop	
		2. Coal bin weigher	—		○	Hopper scale on charging bar	
		3. Ascension pipe					
		-Opening / closing of top cover	△	Opening by man, Remote closing	○	Air cylinder with computer	
(I)		-Opening/closing of the switching dampe	△	Remote control	○	Air cylinder with computer	
		-Igniting	—		○	Ignition type with computer	
		4. Liquid ammonia High / low switching	△	Remote control	○	Air cylinder (automatic for high pressure from charging car)	
		5. Bend cleaner	△	Spray water type	○	Spray water type	
		6. Mortar blending	--		○	Concentrated blending	
Coke Oven Operation	Below Oven	1. Gas switching Operation	○		○	Interlocked with clock,. with computer	
		2. Air compressor Operation	—		○	Pressure control	
		3. Quenching tower for CWQ		All CDQ			
		water spraying	×		○	Home position detection of the quenching electric car	
		breeze	×		○	Scraper type	
(II)							
Coke Oven Operation	Machinery around oven	1. Charging car		6 Cars (including 2 spares)			
		Coal loading	△	Push button type	○	Home position detection of charging car	
		Travelling	×		○	Unmanned travelling for receiving coal and to the coal charging oven	
		Oven centering	×		×	Manual inching	
(III)		Cover removing, charging cover mounting	○	Push button type	○	One button	
		Weighing	—	Nothing	○	Hopper scale (load cell)	
		Cleaner on top of oven	×		○	Cleaning of charging oven used	
		Cover cleaning	×		○	Oscillating the cover	
		Cover sealing	×		○	Mortar (with automatic flushing of sealed piping)	
		Position of operation room		Lower part of charging car	○	Lower part of charging car	
		2. Pusher machine		6 Cars (including 2 spares)			
		Travelling (centering)	×		×		
		Oven centering	×		×		
		Pushing	△		○	Control of pushing speed and quenching electric car speed	
		Levelling	○	Push button type	○	Control of leveling timing and hopper scale on charging car	
		Mounting / dismounting of cover	○	Push button type	○		
		Opening / closing of small cover	○	Push button type	○		
		Return coke	○	Chain conveyor type infront of coke oven batteries	○	Receiving chute conveyor type	
		Return coal	○	Chain conveyor type infront of coke oven batteries	○	Return coal BC and skip elevator (return coal calculated by load cell on BC)	
		Cleaner			○	Door cleaner and small cover cleaner using high pressure water, and scraper -type frame cleaner	
		Tar pan cleaner	×		○	Scraper type	
		Service home cleaning	×		○	Water washing system	
		Carbon scarfing	×		○	Air scarfing	
		Interlocking	○	Electric sygnal (for guide car and coke bucket car)	○	X ray (for guide car)	
		Temperature measuring device for oven wall	—	Nothing	○	Measured at discharging from oven, using the ram that mounts six radiation thermometers	
		ITV	—	Nothing	○	2 units (monitored in pusher machine operation room)	

Classification	Process	Name of Equipment and Facilities	State of Mechanization/Automization ○ = Auto × = Manual PRAZYJAZN		KAKOGAWA		Remarks
Coke Oven Operation		3. Coke guide car		6 Cars (including 2 spares)		No.1,3 / No.2,4	
		Type		2 Spots Type		Type: No.1,3 1 spot (Internal movable carrier); No.2,4 2 spots	
		Travelling (positioning)	×			Travelling: No.1,3 ○; No.2,4 ×	
(III)						Oven centering: No.1,3 ×; No.2,4 ×	
						Service home cleaner: No.1,3 Automatic scraper type ○; No.2,4 –	
		Service Home Cleaner	×				
		Dismounting / mounting of cover	○		○		
		Grid	×		○		
		Cleaner	–		○	Water-jet door cleaner	
					○	Frame cleaner (scraper type)	
		Disposal of spilled coke	–		○	Receiving chute of chain type	
		ITV	–		○	2 units (monitored in guide car operation room)	
		4. Electric Car		6 Cars (including 2 spares) 1 Spot Type (in receiving coke)	○	Unmanned Operation No.1, 2. CDQ Bucket car. / No. 3, 4. CWQ Quenching car	
		Travelling (positioning)	×		○	(Positioning by wireless guidance)	
		Coke receiving	×		○		
		CDQ Bucket					
		Receiving and Discharging			○		
		CWQ Quenching			○		
		Unloading at wharf			○		
		5. Others					
		Communication system			○	Wireless interphone	
		6. CDQ (No. 1, 2.)					
		Traverser, Crane	×		○	Unmanned	
		Charging equipment	○	X-ray	○	Unmanned	
		Monitoring of chamber level	○		○	X-ray and calculation of stock by load cell	
		Control of feeding quantity	○	Remote control	○	Remote control	
		Control of circulating air volume	○	Remote control	○	Remote control	
		ITV	–		○	2 units (monitored in control room)	

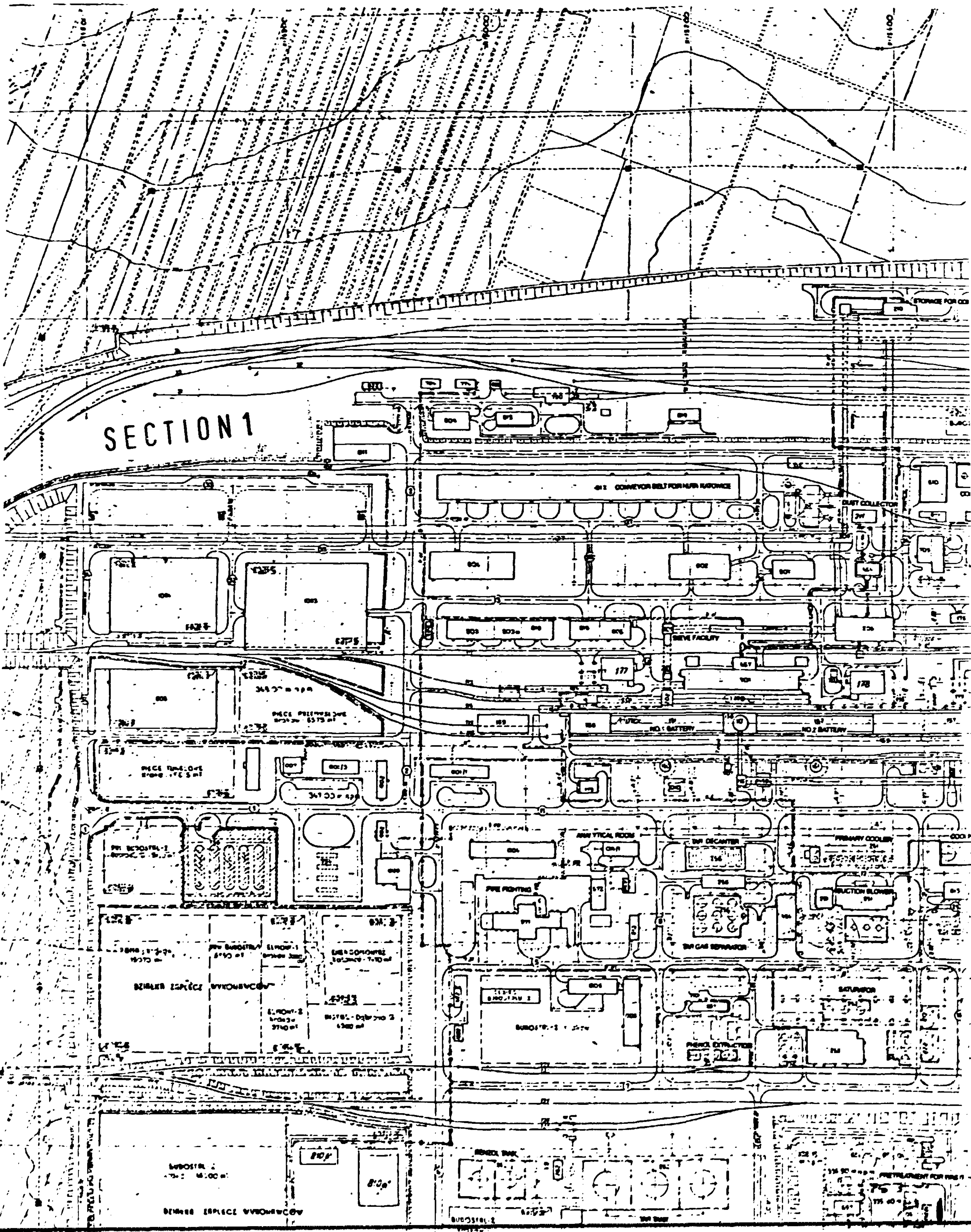
Classification	Process	Name of Equipment and Facilities	State of Mechanization/Automization ○ = Auto × = Manual	PRAZYJAZN			Remarks
Coke Oven Operation	Combustion Control	1. Judgement for coking end point		Nothing	○	Temperature of generated COG, with computer	
		2. Measuring of oven temperature					
		(representative flue)	×		○	Thermocouple	
		(horizontal flue)	×		○	Oven wall temperature measuring device (radiation thermometer)	
		3. Control of oven temperature (battery)	×		○	Computer	
		(each oven)	×		×	Guidance outputting by computer, then manual	
		4. Control of oven pressure	×	Monitoring by processor	○	Top pressure	
		5. Control of gas calorie	×		○	Wobbe Index Control BFG/COG	
		6.Control of combustion exhaust gas	△	O2 meter, CO meter (in Chimney)	○	O2 meter, CO meter, Smoke indicator, Computer	
	Environmental protection	1.Smokeless charging	○	High pressure gas liquor	○	High pressure liquid ammonia	
		2. Dust collection for charging car	-		○	Fan scrubber→preduster + electric dust collector (above ground) with control of fan revolutions	
		3. Dust collection for guide	○		○	Preduster + electric dust collector (above ground) with control of fan revolutions	
		4. Dust collection for oven door	-				
		5. Dust collection and draining	○	Closed system (Dry type)	○	Closed system (thickener 1500m3)	
		6. Dust collection for quenching tower	-		○	Water spraying for dust	
	Countermeasures against power failure	1. Machinery around oven			○	Pusher machine's ram and leveler equipped with stand-by diesel engine	
					○	Closing of charging cover on the charging car by accumulator and battery	
		2. Oven gas switching device	-		○	Accumulator and battery	
		3. Combustion and diffusion tower for generated gas	△	Automatic opening of damper manual ignition	○	Automatic ignition at low voltage and automatic opening of damper	
		4.Gas transportation system	○	Two power supply systems	○	Two power supply systems	
	Others	1. Oven door			○	Multi-spring diaphragm type	
		2. Tipper and lift for oven door.		Lifter	○	Tipper and lift	
Coke transportation	Coke wharf to Coke cutter	1. Coke wharf Storage quantity			○	Remainder detector	
		Feeding	-	All CDQ	○	Rotary feeder type	
		2. ITV	-	Nothing	○	2 units (monitored in control room)	
		3. Detection of remaining fire, then water spraying	○		○	Temperature detection and automatic water spraying	
		4. Detection of metal and then discharging	-		○	Electromagnetic detection and discharging by magnetic separator	
		5. Screening before cutting	○	Roller screen type	○	Roller screen type	
		6. Coke cutter	○	Double roll type	○	Double roll type	
		7. Conveyor Operation	○	Remote control	○	Remote control from control room with computer	
		Cleaner	-		○	Water washing of BC floor	
		8. Dust collector	○	Electric precipitator (Duy type)	○	Bag-filter dust collecting with control of fan revolutions	
		9. Sampling	×		○	Automatic coke sampler, before and after cutter	
	Screening to Silo	1. Screen Operation	○	Remote control	○	Rubber screen type under remote control from control room	
		2. Coke silo Storage quantity	-		○	Ultrasonic level meter	
		3. Coke silo to feeding			○	Vibrating fender	
	Others	1. Automatic broadcasting system	-		○	At the start-up of belt conveyor	
Coke Oven	Control	1. Control room		No. of CDQ control room 2 spots coke oven control room 2 spots	○	CDQ, coke handling, combustion control, and oven discharging schedule are under centralized control by CRT, with automatic printing of slips, etc.	

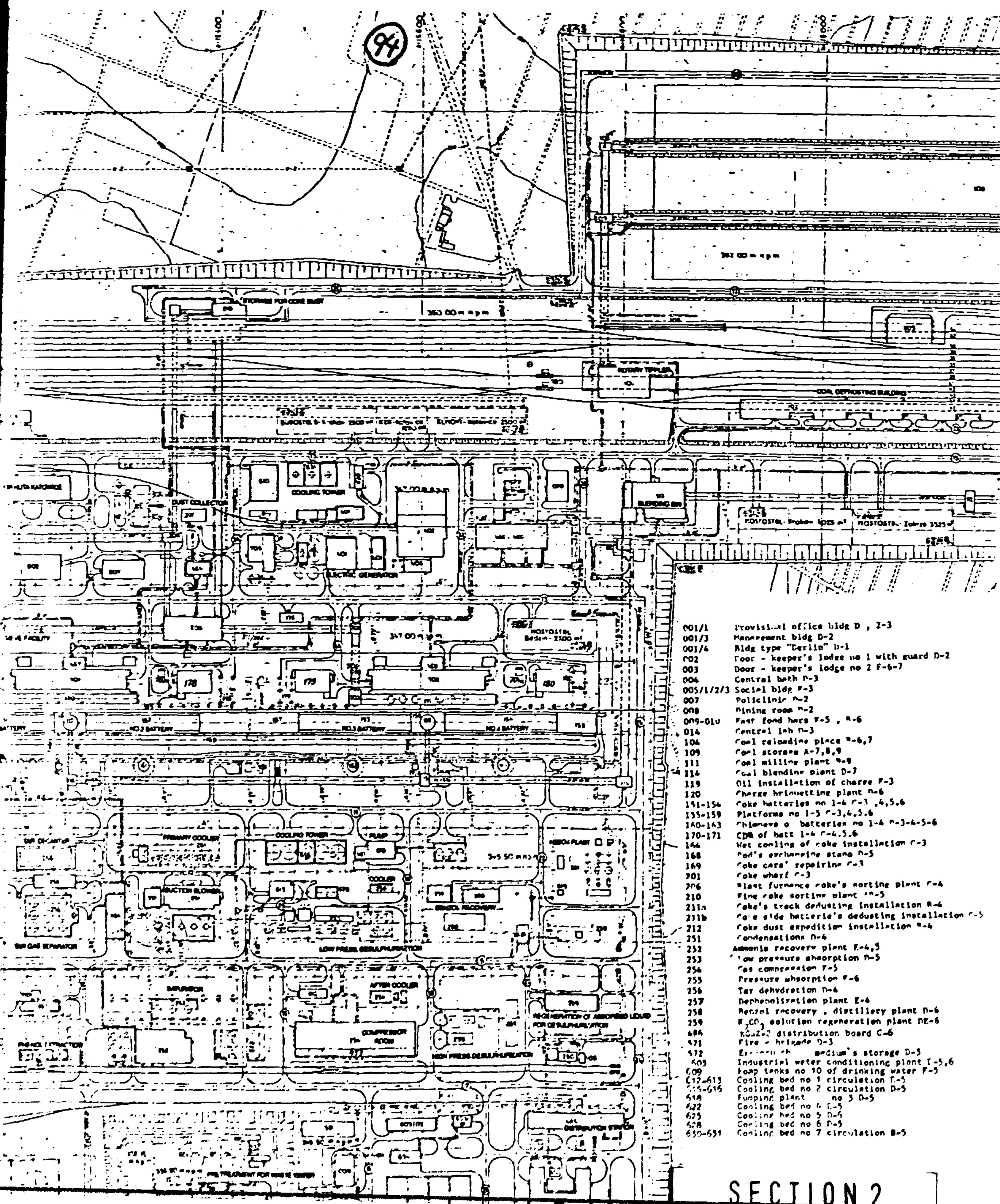
Classification	Process	Name of Equipment and Facilities	State of Mechanization/Automization ○ = Auto × = Manual				Remarks
			PRAZYJAZN		KAKOGAWA		
Coke oven operation	Heating control system	MELCOM 350-50	–	Nothing	○	Daily operation report	
					○	Monitoring of oven discharging conditions	
					○	Guidance for temperature adjustments	
(III)		MUCTAS 620	–		○	Wobble control (MAN, AUTO, CAS, Control)	
					○	Temperature control (MAN, AUTO, CAS, Control)	
					○	Control of O2 in waste gas (MAN, AUTO, CAS, Control)	
					○	Automatic operation of ascension pipe	
					○	Display of operations with alarm	
				Display on pannel			
	Coke transportation system	MUCTAS 620	–	· BC remote control of start-up and shutdown (sequential start-up and overall shut-down)	○	Daily operation report	
					○	BC remote control of start-up and shutdown (sequential start-up and overall shutdown)	
				· Monitoring of BC operations	○	Monitoring of operating conditions	
					○	Display of operations with alarm	
	CDQ control system	MUCTAS 620	–	Display on pannel	○	Daily operation report	
				Monitoring of CDQ operation	○	Monitoring of plant operations	
					○	Automatic operation of plant	
					○	Display of operations with alarm	

Classification	Process	Name of Equipment and Facilities	State of Mechanization/Automization ○ = Auto × = Manual				Remarks
				PRAZYJAZN		KAKOGAWA	
Gas Refining	Suction cooling	1. Gas cooler (PC + DC)	×		○	Cascade control of gas temperature and seawater flow rate	
		2. Blower	○	Remote control from control room (On/Off control of suction valve, automatic control of suction pressure)	○	On / off suction valve : Operation from control room Suction pressure : Automatic control (with monitor for blower vibration)	
		3. Decanter	×		○	Control of tar interface Excessive liquid ammonia : Tar decanter and level control of liquid ammonia tank. Odor : Pressure controlled and returned to COG	
		4. Processing system for decanter slag	×	Automatic raking → Transportation by truck → Blending to coal (Manual)	○	Automatic raking → Crushing → Transportation by pumping → Coa blending (automatic)	
		5. Tar tank	×	Manual control of tar temperature	○	Control of tar temperature	
		6. Processing system for liquid ammonia (activated sludge)			○	Flow control and proportional control of liquid ammonia, industrial water and sea water Filter : Automatic backwashing Analyzer : DO, MLSS, OOO, pH , ORP, Interface Tanks : Control of liquid level	
	Desulferization			Desulfurization efficiency H2S 5~6 → 2~3g/Nm 3 (low pressure process) 0.02g/Nm 3 (high pressure process)		Desulfurization equipment H2 S 3 ~ 5 → Less than 0.0 5g/Nm 3 HCN 1 ~ 2 → Less tnan 0.0 5g/Nm 3	
		[illegible]lferizer	○	Automatic control of circulation liquid quantity temperature, liguid level	○	Control of circulating liquid quantity, temperature and liquid level	
		[illegible]ery tower	○	Automatic control of circulation liquid quantity, temperature, liguid level			
		[illegible] separator	○	Automatic control of circulation liquid quantity temperature, liguid level	○	Centrifugal separator to sulfer transportation by pumping: Control of feed quantity, liquid level of sulfur tank, and liquid level of oven liquid tank Analyzer : pH CRP	
	Ammonia recovery			Sulfuric ammonium unit		Ammonia recovery equipment NH3 6 ~ 8 → Less than 0.0 2g/Nm 3	
		1. Absorber	×		○	L / G control (VVVF)	
		2. Distillation tower	×		○	Control of temperature, Pressure, Flow rate and Liquid level	
		3. Rectifying tower	×		○	Analyzer : NH3, phosphoric acid, pH.	

Classification	Process	Name of Equipment and Facilities	State of Mechanization/Automization ○ = Auto × = Manual				Remarks
			PRAZYJAZN		KAKOGAWA		
	Recovery of light oil	1. Naphthalene scrubber	×	BTX 30~40 ・2g/Nm3 (Low Press. Process) 0.5g/Nm3 (High Press. Process)	○	BTX 30~40 ・2g/Nm3 Control of L / G and Liquid level	
		2. Final cooler	×	Manual control of temperature	○	Temperature control	
		3. Benzole scrubber	○	Automatic control of flow rate and liguid level	○	Control of flow rate and Liquid level	
		4. Distillation tower	○	Automatic control of temperature, Pressure,	○	Control of temperature, Pressure, Flow rate and Liquid level.	
		5. Heating furnace (pipe steel)	×	Flow rate and liguid level			
		6. Heat exchanger	–				
		7. Benzole tank			○	Floating - Roof type Pressure control by N2 charging Analyzer : BTX, O2, Moisture, Specific gravity, Interface	
	Sulfuric Acid	1. Combustion furnace	○	Automatic control of temperature	○	Automatic temperature, up / down	
		2. Gas cooler	–		○	Control of temperature, Pressure, Flow rate, Liquid level, Sulfuric acid concentration, and Neutralization	
		3. Drying tower	–		○	Analyzer : NOx, SOx, pH, Acid concentration	
		4. Gas blower	–				
		5. Converter	○				
		6. Absorber	○				
		7. Harmful gas removal tower	–				
	Control	Control room.		Monitoring of pannel display	○ –	Operation of all plants for COG suction to refining is under centralized monitoring by one CRT.	
	Others	Communication system			○	Wireless type	

Classification	Process	Name of Equipment and Facilities	State of Mechanization/Automization ○ = Auto × = Manual				Remarks
			PRAZYJAZN		KAKOGAWA		
	Chemical Processing System	TDCS3000 LSN		Display on pannel			
					○	Daily operation report	
					○	Compensation of gas flow rate	
					○	Monitoring of plant operations (Operation of [illegible] plants is monitored and controlled by one CRT)	
		TDCS3000 BASIC			○	Preperation of data on transactions and gas balance	
					○	Automatic Operation of plant AOTO control CAS control COMP control	
				Remote control from control room	○	Plant operational guidance	
					○	Automatic start-up and shutdown of plant (such as sulfuric acid combustion furnace)	
					○	Display of operations with alarm	
					○	Telemeter (for transmission to other companies)	
					○	Flow integration and reporting	
					○	Operational data.	
		MUCTAS 620					


SECTION 1
CONVEYOR BELT FOR HUTA KATOWICE
DUST COLLECTOR
SIEVE FACILITY
NO.1 BATTERY
NO.2 BATTERY
TAR DECANTER
FIRE FIGHTING
SATURATOR
BENZOL TANK



001/1	Provisional office bldg D , 2-3
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001/4	Bldg type "Berlin" D-1
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111	Coal milling plant B-9
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155-159	Platforms no 1-5 C-3,4,5,6
160-163	Chimneys o batteries no 1-4 D-3-4-5-6
170-171	CDQ of batt 1-4 C-4,5,6
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169	Coke cars' repairing C-3
201	Coke wharf C-3
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210	Fine coke sorting plant D-5
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211b	Coke side batterie's dedusting installation C-5
212	Coke dust expedition installation B-4
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252	Ammonia recovery plant E-4,5
253	Low pressure absorption D-5
254	Gas compression E-5
255	Pressure absorption E-6
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257	Dephenolization plant E-6
258	Benzol recovery , distillery plant D-6
259	K_2CO_3 solution regeneration plant DE-6
486	KOSZ-2 distribution board C-6
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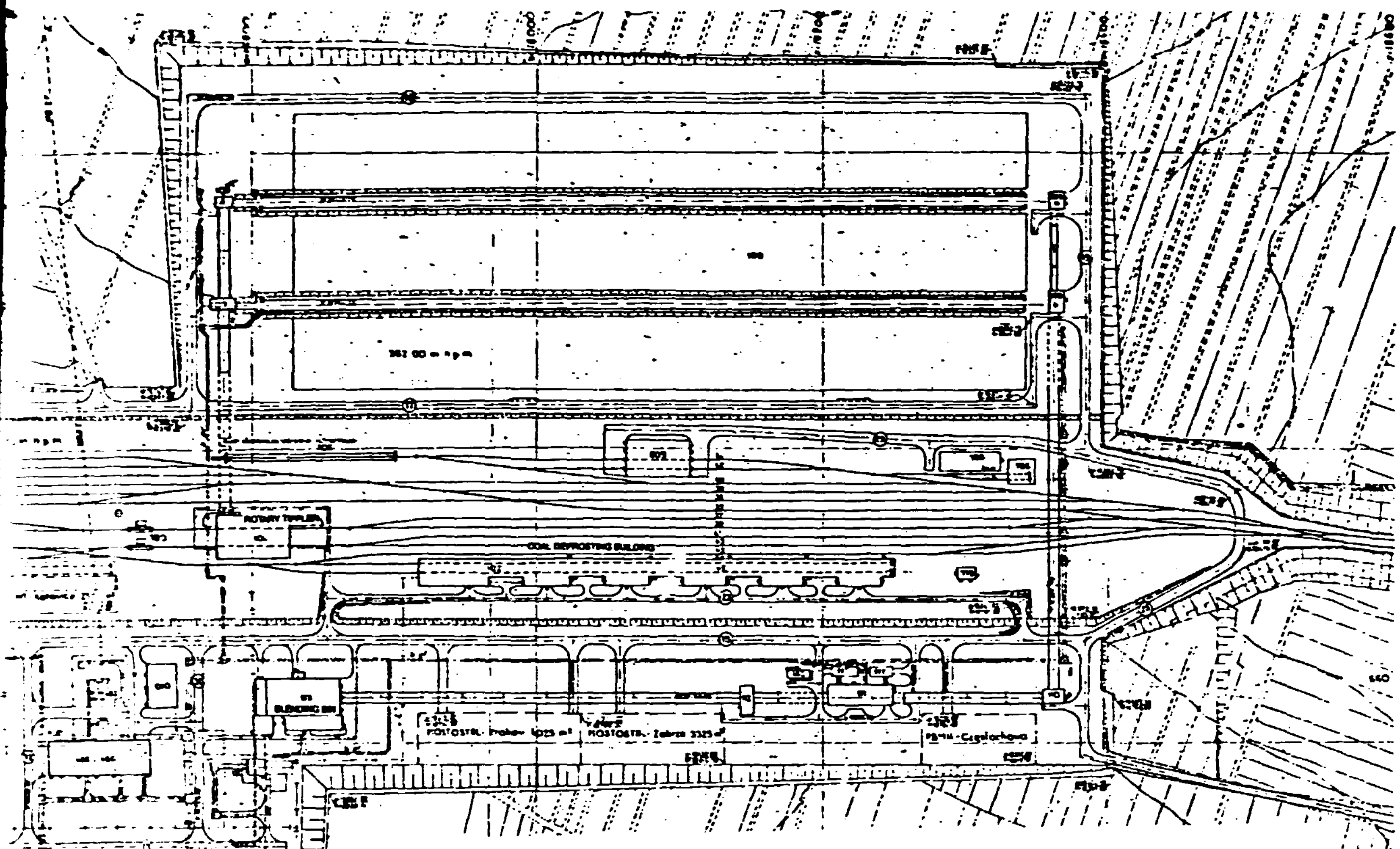
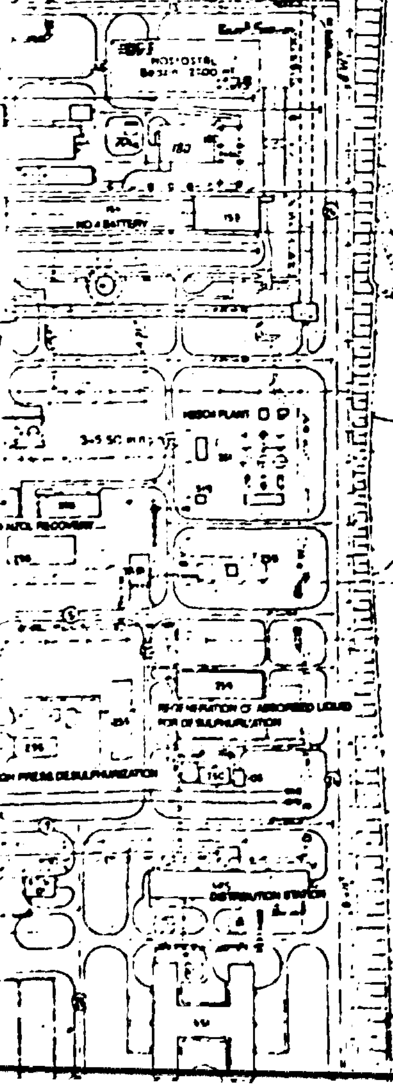
572	Ex[illegible] medium's storage D-3
603	Industrial water conditioning plant E-5,6
609	Foam tanks no 10 of drinking water F-5
612-613	Cooling bed no 1 circulation E-5
615-616	Cooling bed no 2 circulation D-5
618	Pumping plant no 3 D-5
622	Cooling bed no 4 E-5
625	Cooling bed no 5 D-5
628	Cooling bed no 6 D-5
630-631	Cooling bed no 7 circulation B-5

SECTION 2

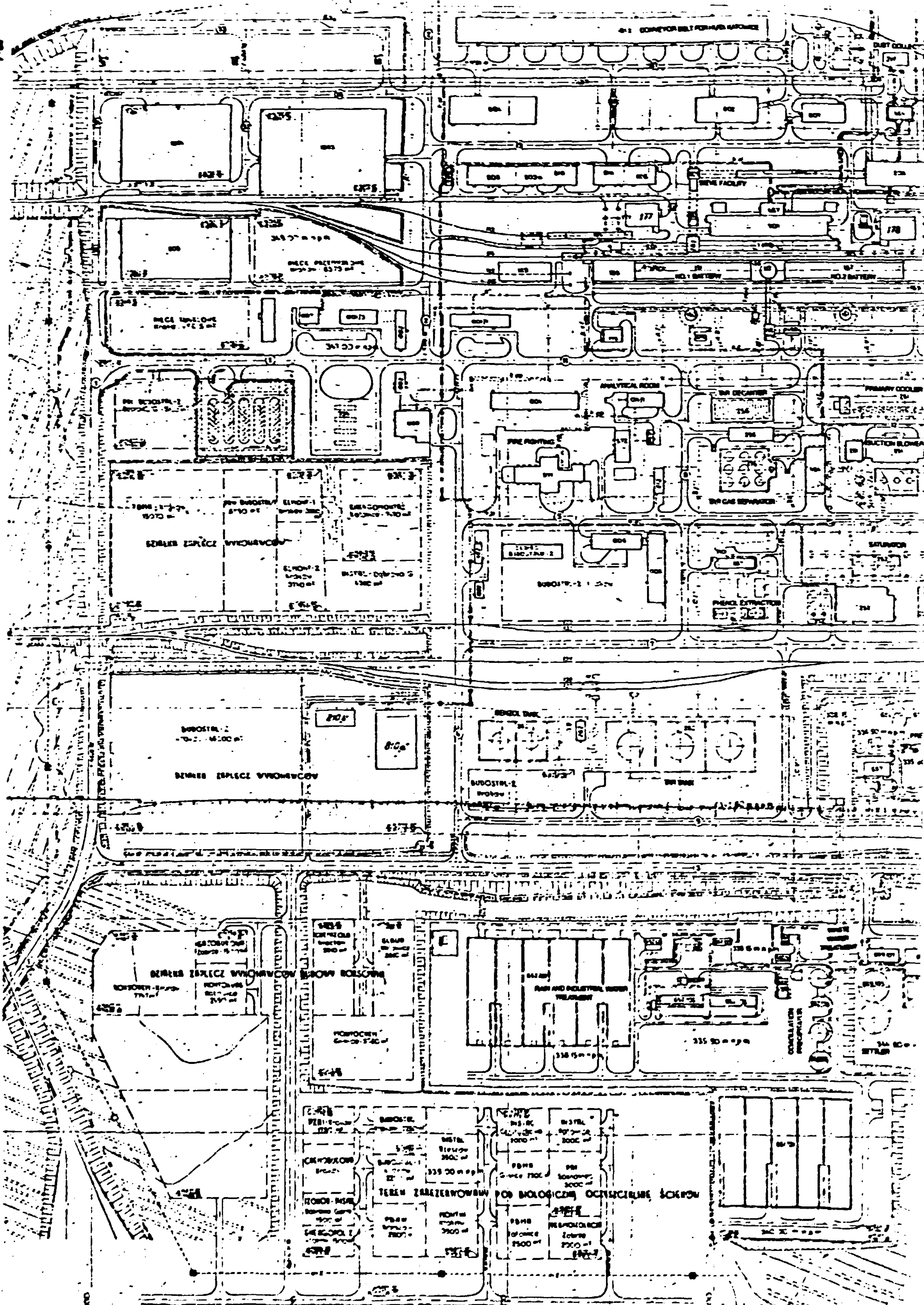




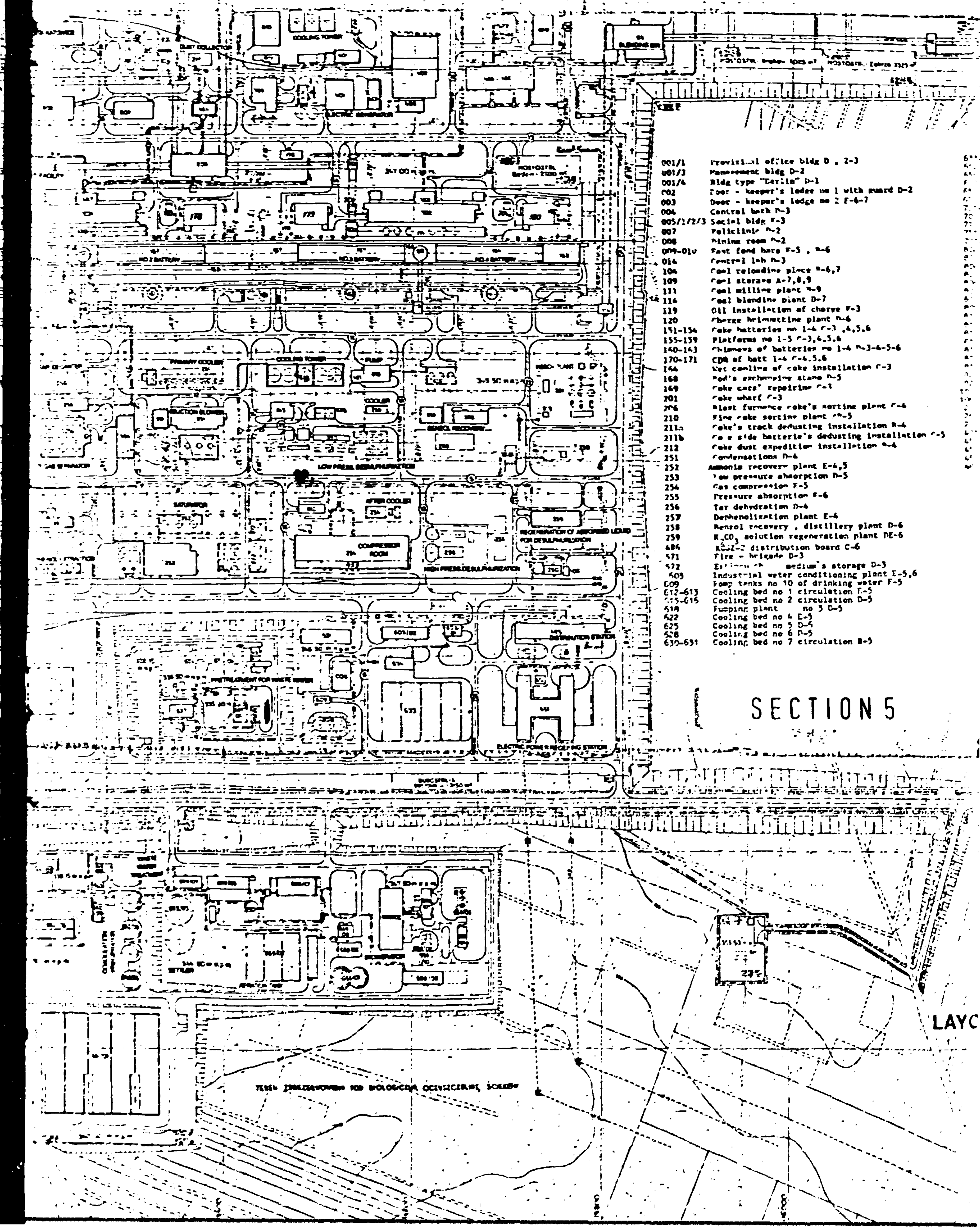
001/1	Provisional office bldg D , 2-3
001/3	Management bldg D-2
001/6	Bldg type "Berlin" D-1
002	Door - keeper's lodge no 1 with guard D-2
003	Door - keeper's lodge no 2 F-6-7
004	Central bath D-3
005/1/2/3	Social bldg F-3
007	Policlinic D-2
008	Dining room D-2
009-010	Fast food bars F-5 , B-6
014	Central lab D-3
104	Coal reloading place B-6,7
109	Coal storage A-7,8,9
111	Coal milling plant B-9
114	Coal blending plant D-7
119	Oil installation of charge F-3
120	Charge briquetting plant B-6
151-154	Coke batteries no 1-4 C-3 ,4,5,6
155-159	Platforms no 1-5 C-3,4,5,6
160-163	Chimneys of batteries no 1-4 B-3-4-5-6
170-171	CDQ of batt 1-4 C-4,5,6
166	Wet cooling of coke installation C-3
168	Rod's exchanging stand B-5
169	Coke cars' repairing C-3
201	Coke wharf C-3
206	Blast furnace coke's sorting plant C-6
210	Fine coke sorting plant AB-5
211a	Coke's track dedusting installation B-4
211b	Coke side batterie's dedusting installation C-5
212	Coke dust expedition installation B-6
251	Condensations D-6
252	Ammonia recovery plant E-4,5
253	Low pressure absorption D-5
254	Gas compression F-5
255	Pressure absorption F-6
256	Tar dehydration D-4
257	Dephenolization plant E-4
258	Benzol recovery , distillery plant D-6
259	K_2CO_3 solution regeneration plant DE-6
484	KGSZ-2 distribution board C-6
571	Fire - brigade D-3
572	Ext[illegible] medium's storage D-3
603	Industrial water conditioning plant E-5,6
609	Pump tanks no 10 of drinking water F-5
612-613	Cooling bed no 1 circulation E-5
615-616	Cooling bed no 2 circulation D-5
618	Pumping plant no 3 D-5
622	Cooling bed no 4 E-5
625	Cooling bed no 5 D-5
628	Cooling bed no 6 D-5
630-631	Cooling bed no 7 circulation B-5
633-634	Pumping plant no 8 tank F-5,6
652	Rain - industrial waste water treatment G-2
656	Phenol wastes pre - treatment F-4,5
657	Wastes and sludges intermediate pumping plant F-4
658	Phenol wastes combustion G-5,6
659	Final wastes treatment plant G-4,5
701-702	1-4 batteries boiler - room B-4,5,6
705	Condensate treatment plant B-5
710	Condensate intermediate pumping installation E-3,1
751-769	Road transport
775-791	Rail transport
802	Construction and installation overhaull workshop B-3,4
803	Building workshop C-2,3
804	Electric workshop C-2,3
805	Vulcanization workshop B-2
806	Woodworking shop C-3
807	Electric cars' house C-4
807	Mechanic workshop C-1
809	Wagons' repairs workshop AB-8,9
810	Office building of cooperating companies F-2
811	Main store B-2
812	Spare parts store A-2,3,4
813	Wood and pattern store C-3
815	Oils and greases store B-3,4
818	Building materials store C-3
819	Paints store B-3
820	Acids and toxic agents' store B-2
822	Oxygen store B-2
1063	Ceramic's store C-2
1064	Store umbrella roof C-1
260	K_2CO_3 solutions purification E-6
261	Hydrogen sulphide utilization installation D-6
262	Tar , benzol and oil store E-3
401-408	Power plant oil's handling C-5,6
451	Main power supply plant KGST-1 F-6
452	Main power supply plant KGST-2 B-6
454	Sorting plant power supply C-4
485	Main distribution board KGSZ-1 E-6

SECTION 3

SECTION 4



FIRE FIGHTING
ANALYTICAL ROOM
TAR DECANTER
PRIMARY COOLER
SATURATOR
PHENOL EXTRACTION
BENZOL TANK
TAR TANK
SIEVE FACILITY
NO.1 BATTERY
NO.2 BATTERY
RAW AND INDUSTRIAL WATER TREATMENT



DUST COLLECTOR
COOLING TOWER
ELECTRIC GENERATOR
BLENDING BIN
PRIMARY COOLER
COOLING TOWER
PUMP
SUCTION BLOWER
COOLER
BENZOL RECOVERY
LOW PRESS DESULPHURIZATION
SATURATOR
AFTER COOLER
COMPRESSOR ROOM
REGENERATION OF ABSORBED LIQUID FOR DESULPHURIZATION
HIGH PRESS DESULPHURIZATION
DISTRIBUTION STATION
PRETREATMENT FOR WASTE WATER
ELECTRIC POWER RECEIVING STATION
SETTLER
001/1 Provisional office bldg D , 2-3
001/3 Management bldg D-2
001/4 Bldg type "Berlin" D-1
002 Door - keeper's lodge no 1 with guard D-2
003 Door - keeper's lodge no 2 F-6-7
004 Central bath D-3
005/1/2/3 Social bldg F-3
007 Policlinic D-2
008 Dining room D-2
009-010 Fast food bars F-5 , D-6
014 Central lab D-3
104 Coal relonding place B-6,7
109 Coal storage A-7,8,9
111 Coal milling plant B-9
116 Coal blending plant D-7
119 Oil installation of charge F-3
120 Charge briquetting plant D-6
151-154 Coke batteries no 1-4 C-3 ,4,5,6
155-159 Platforms no 1-5 C-3,4,5,6
160-163 Chimneys of batteries no 1-4 D-3-4-5-6
170-171 CDQ of batt 1-4 C-4,5,6
166 Wet cooling of coke installation C-3
168 Rod's exchanging stand D-5
169 Coke cars' repairing C-3
201 Coke wharf C-3
206 Blast furnace coke's sorting plant C-4
210 Fine coke sorting plant CD-5
211a Coke's track dedusting installation B-4
211b Coke side batterie's dedusting installation C-5
212 Coke dust expedition installation B-4
251 Condensations D-4
252 Ammonia recovery plant E-4,5
253 Low pressure absorption D-5
254 Gas compression E-5
255 Pressure absorption F-6
256 Tar dehydration D-4
257 Dephenolization plant E-4
258 Benzol recovery , distillery plant D-6
259 K_2CO_3 solution regeneration plant DE-6
486 distribution board C-6
571 Fire - brigade D-3
572 medium's storage D-3
603 Industrial water conditioning plant E-5,6
609 Pump tanks no 10 of drinking water F-5
612-613 Cooling bed no 1 circulation E-5
615-616 Cooling bed no 2 circulation D-5
618 Pumping plant no 3 D-5
622 Cooling bed no 4 E-5
625 Cooling bed no 5 D-5
628 Cooling bed no 6 D-5
630-631 Cooling bed no 7 circulation B-5
SECTION 5
LAYC

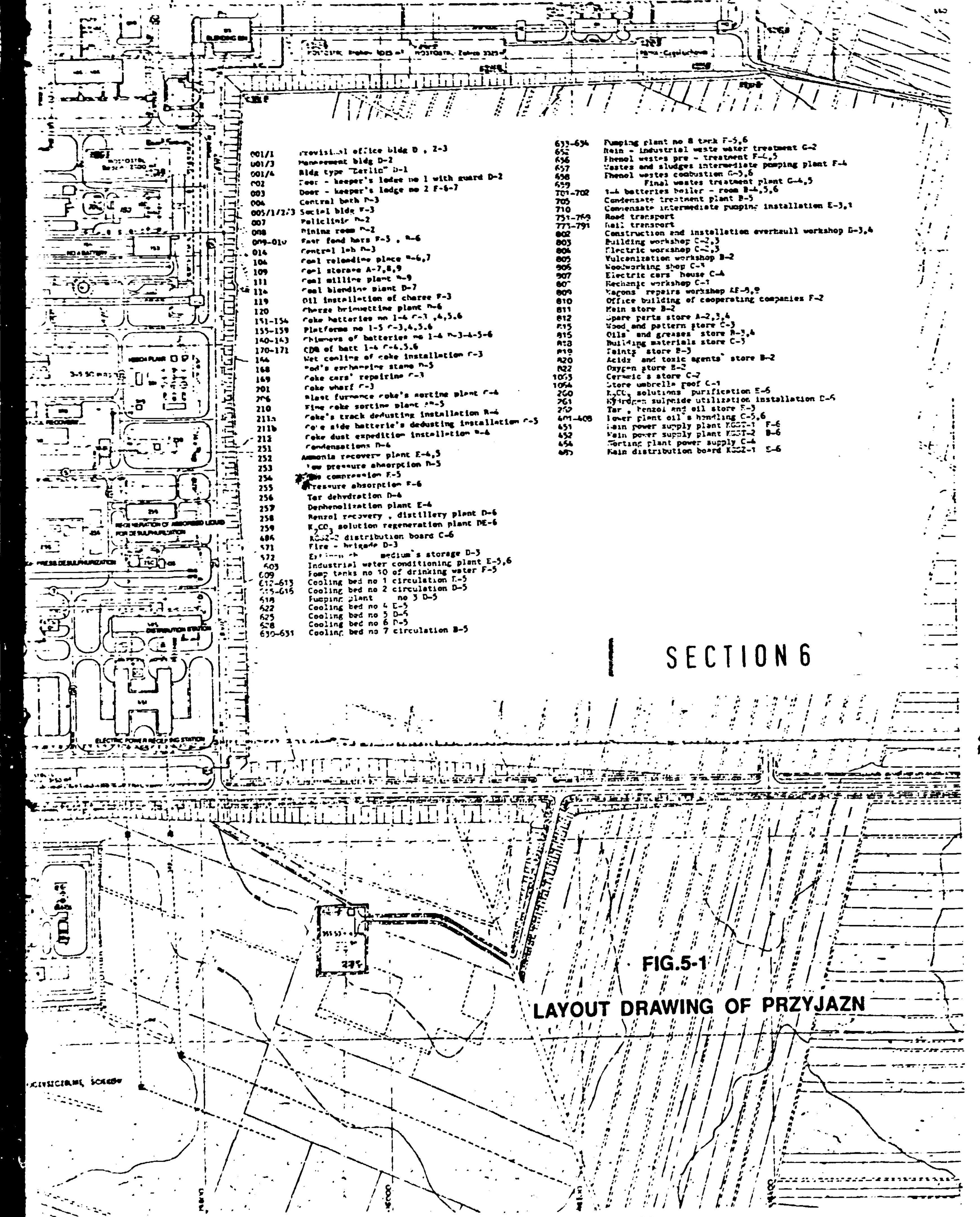
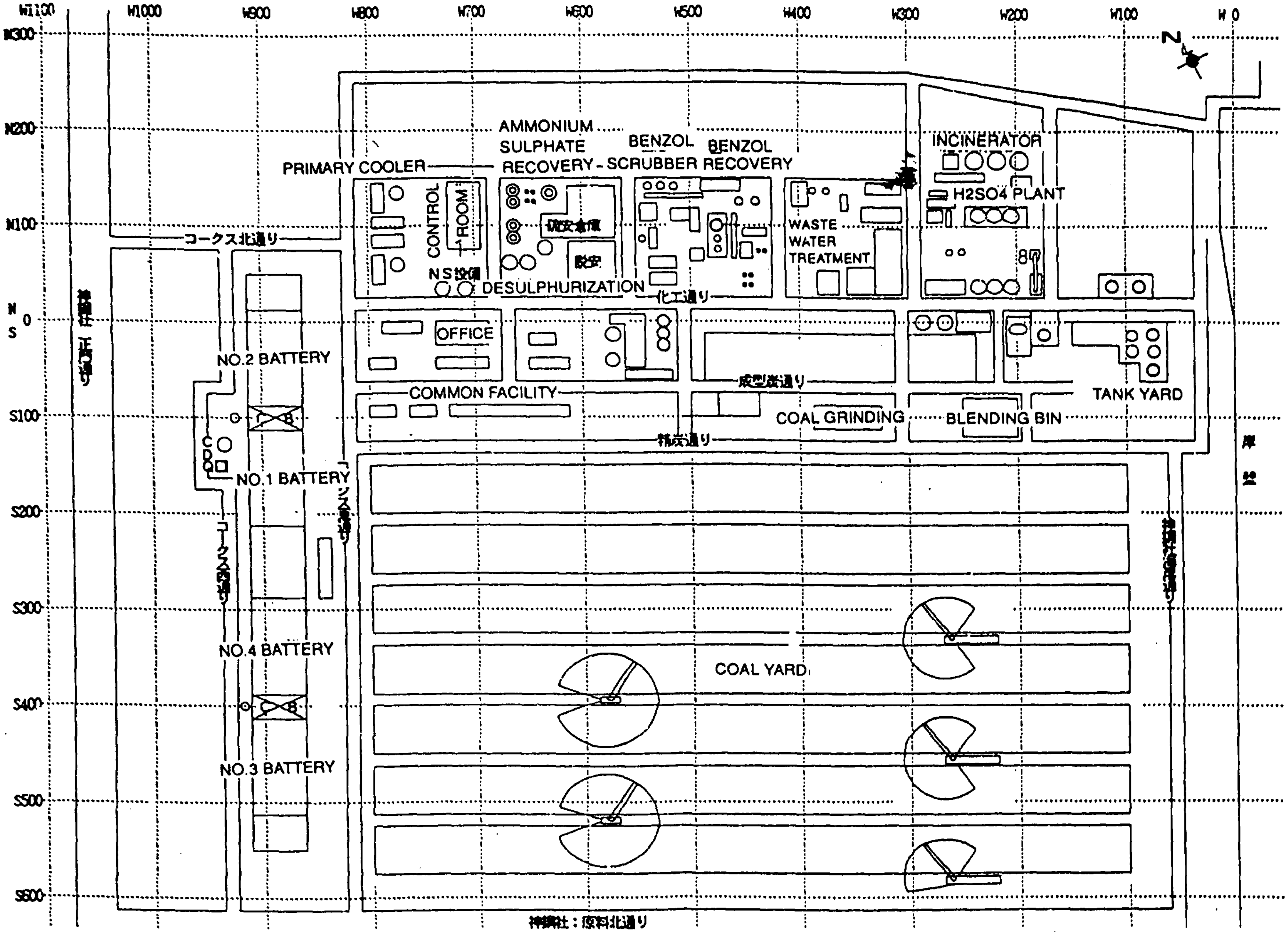


FIG.5-1

LAYOUT DRAWING OF PRZYJAZN

FIG.5-2 LAYOUT FOR KAKOGAWA PLANT OF KC



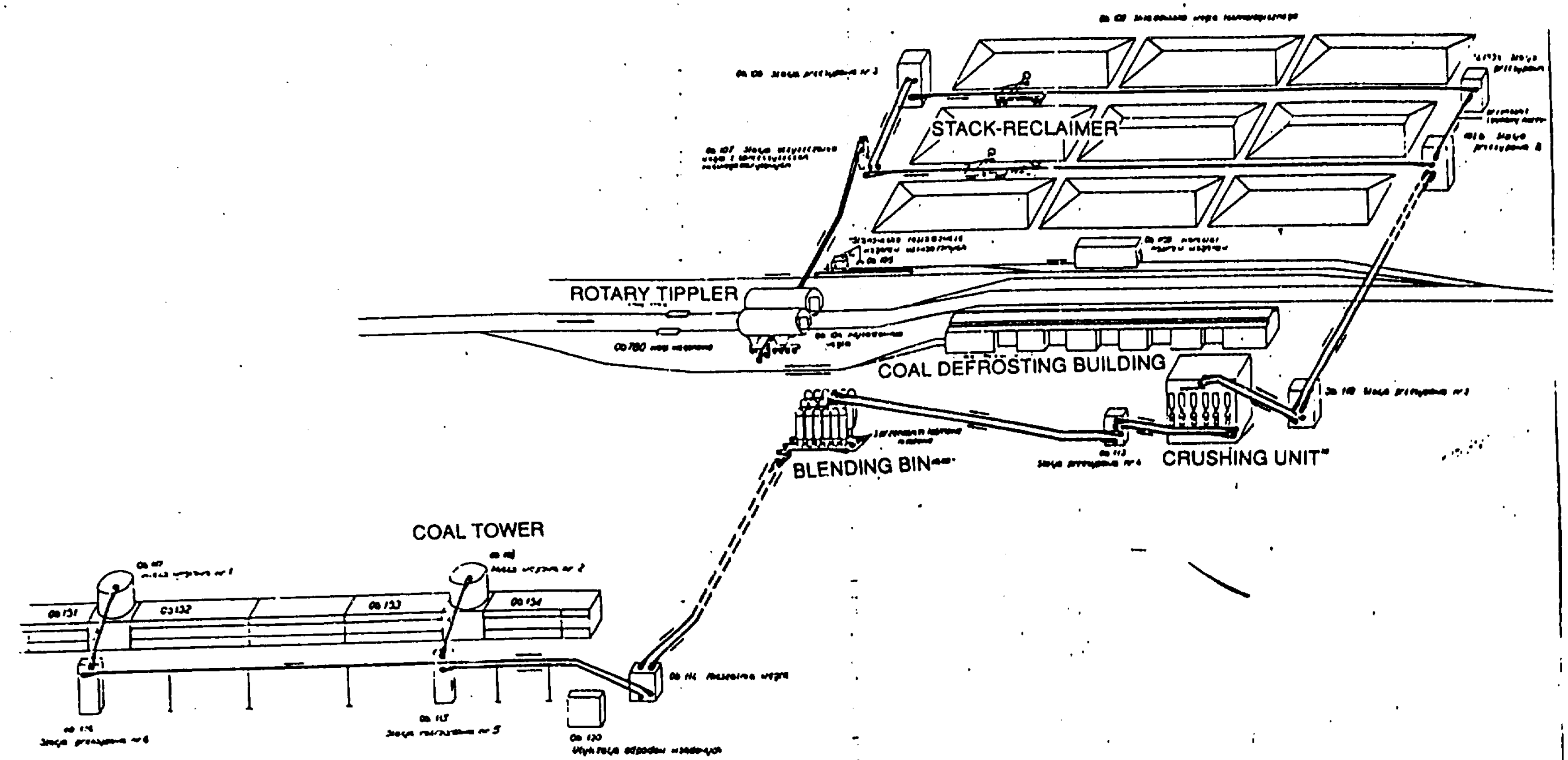
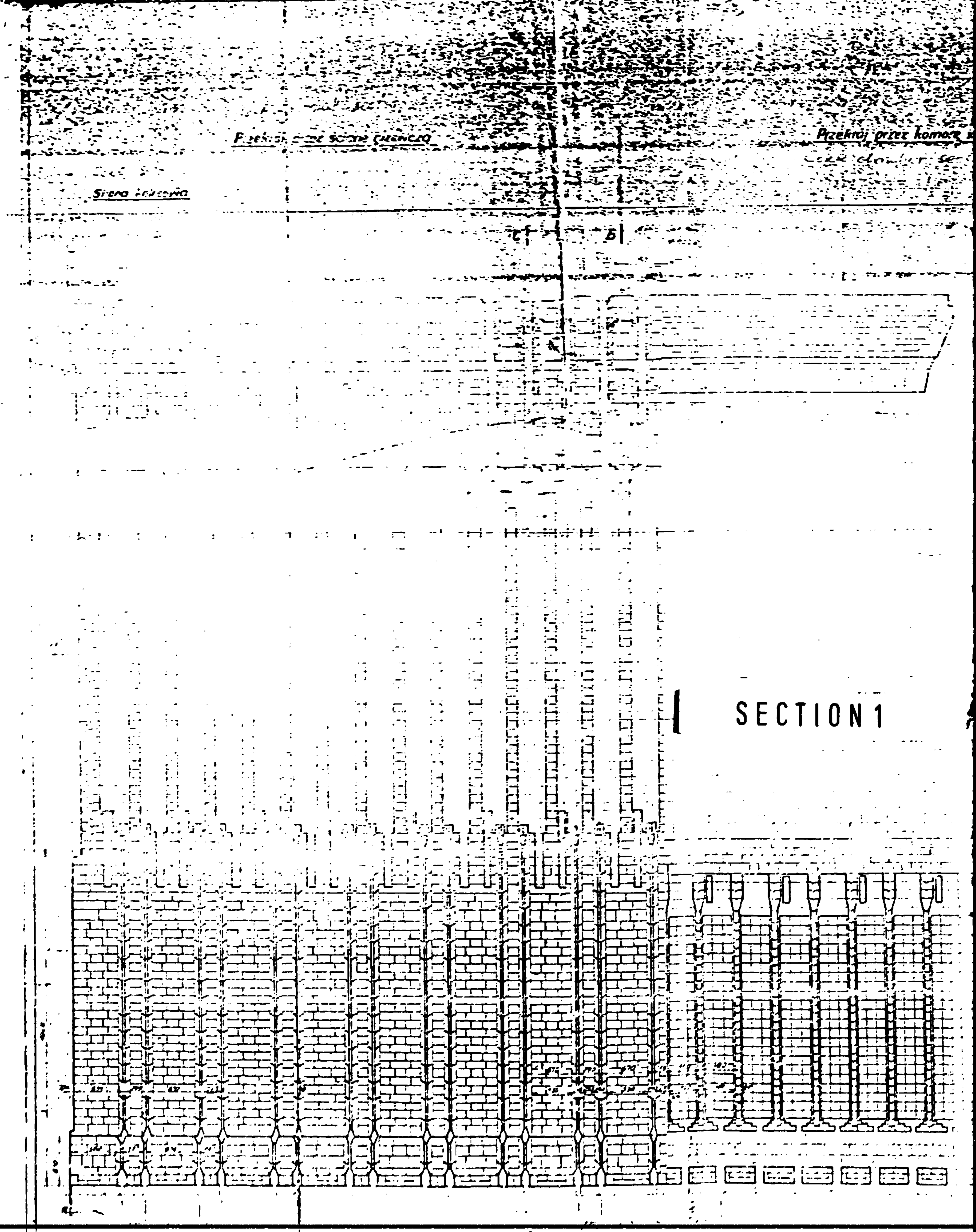
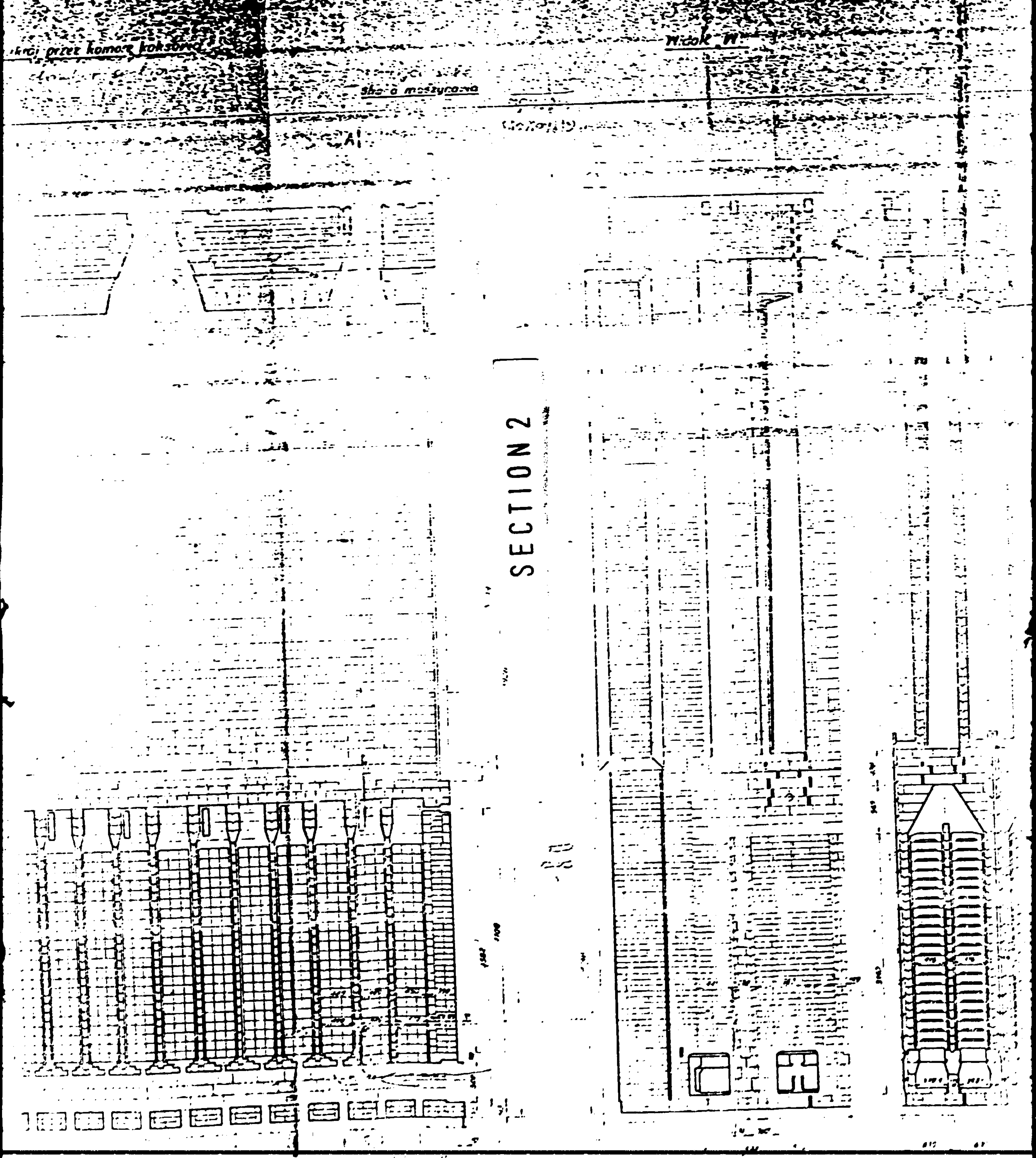


FIG.5-3

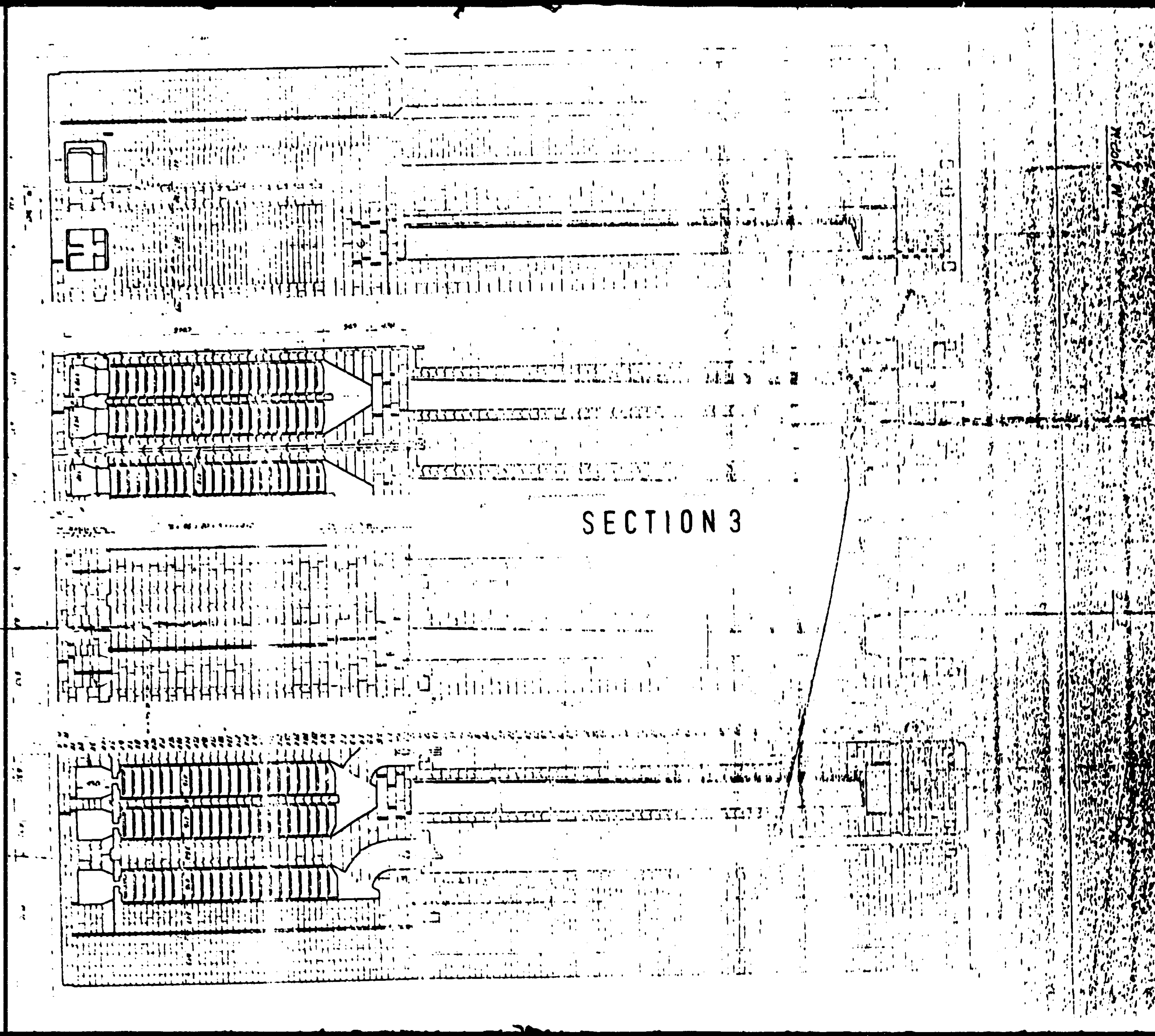
COAL HANDLING FACILITY

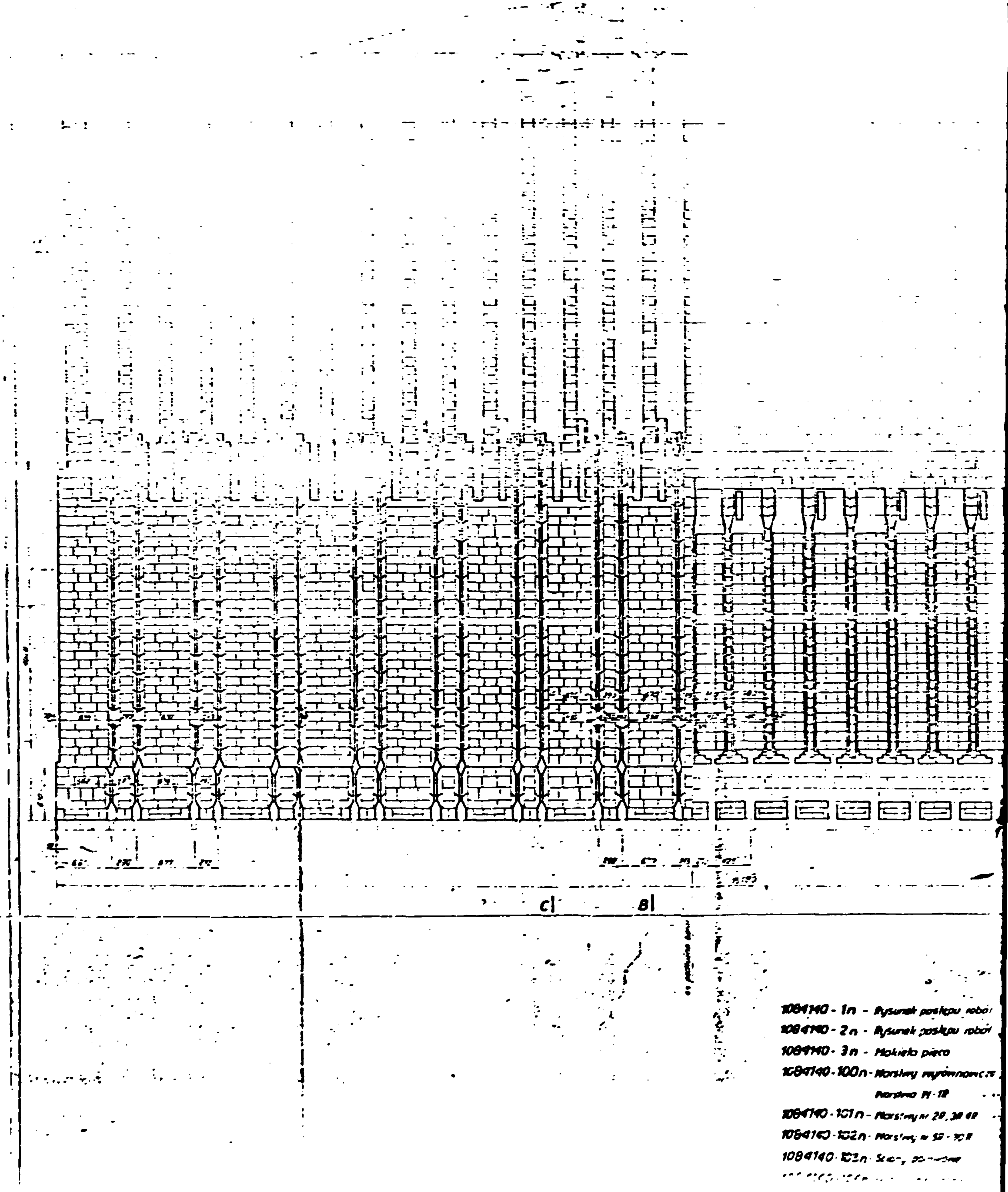
SCHEMAT TECHNOLOGICZNY
WĘGLOWNI


Przekrój przez komorę
C
B
SECTION 1

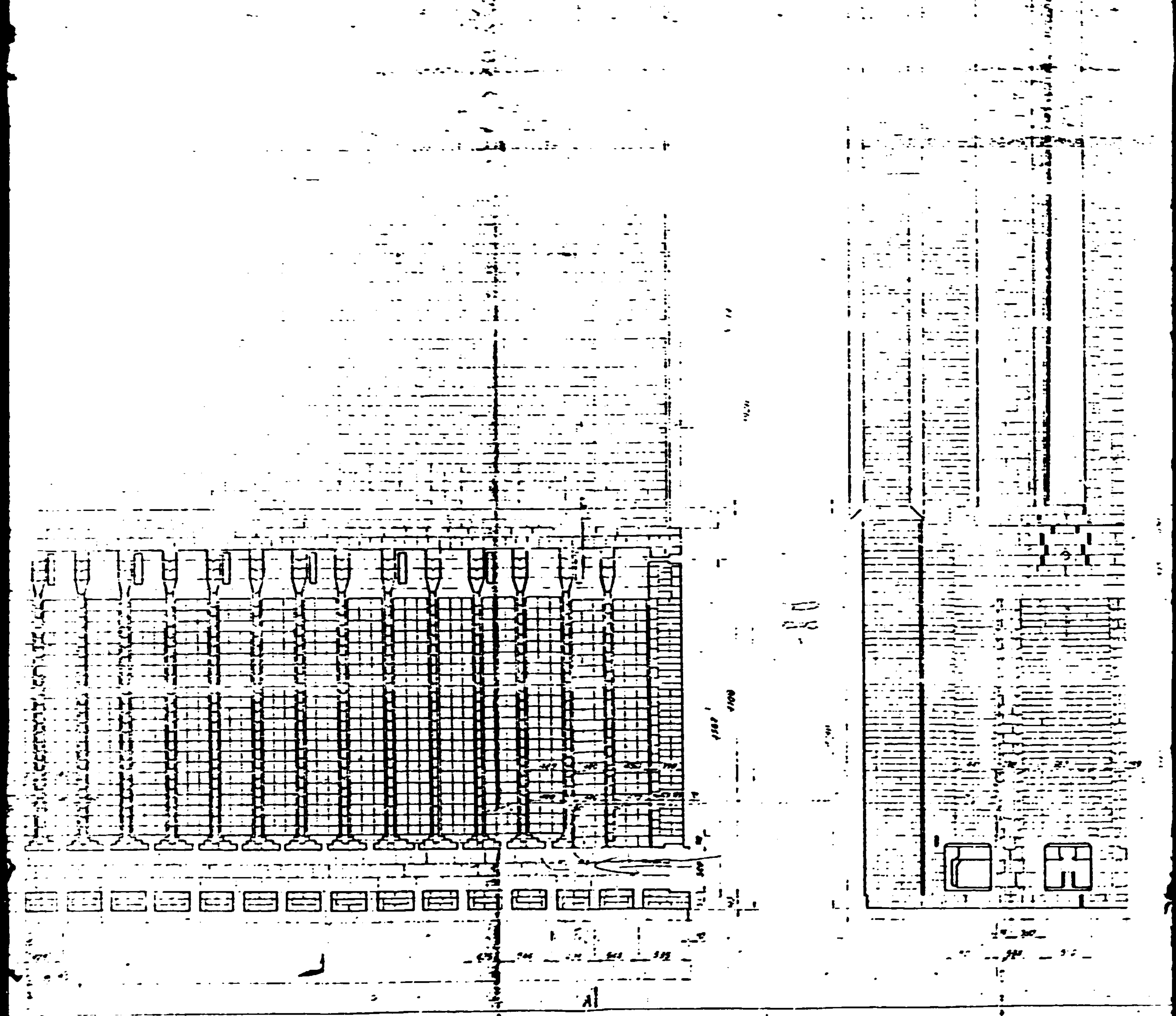


Widok W
SECTION 2


SECTION 3


C
B
1084140 - 1n - Rysunek postępu robót
1084140 - 2n - Rysunek postępu robót
1084140 - 3n - Makieta pieca
1084140 - 100n
1084140 - 101n
1084140 - 102n
1084140 - 102n

SECTION 4



<u>Rysunki przynależne:</u>

1084140 - 1n - Rysunek postępu robót
1084140 - 2n - Rysunek postępu robót
1084140 - 3n - Makieta pieca
1084140 - 100n - Warstwy wyrównawcze „a" „b"
Warstwa 11 - 12 - [illegible]
10[illegible] - 101n - Warstwy nr 28, 38, 48 - [illegible]
10[illegible] - 102n - Warstwy nr 59 - 70 [illegible] - [illegible]
10[illegible] 103n Sc[illegible] - [illegible]

108[illegible]-200n - Warstwy nr T1 ÷ T5 - [illegible]
1084140-201n - Warstwy nr T6 ÷ T9 - [illegible]
1[illegible]-202n - Przekrój trzonu pieca
1084140-300n - Warstwy nr 10 ÷ 53 - [illegible]
10[illegible]-30[illegible] - Warstwy nr 54 - 63 - [illegible]
10[illegible]-3[illegible]n - Rozmieszczenie wkładek regulacyjnych
108[illegible]0-400n - Warstwy nr 64 - 68 - [illegible]
108[illegible]-40[illegible]n - [illegible] nr 69 - 70

SECTION 5

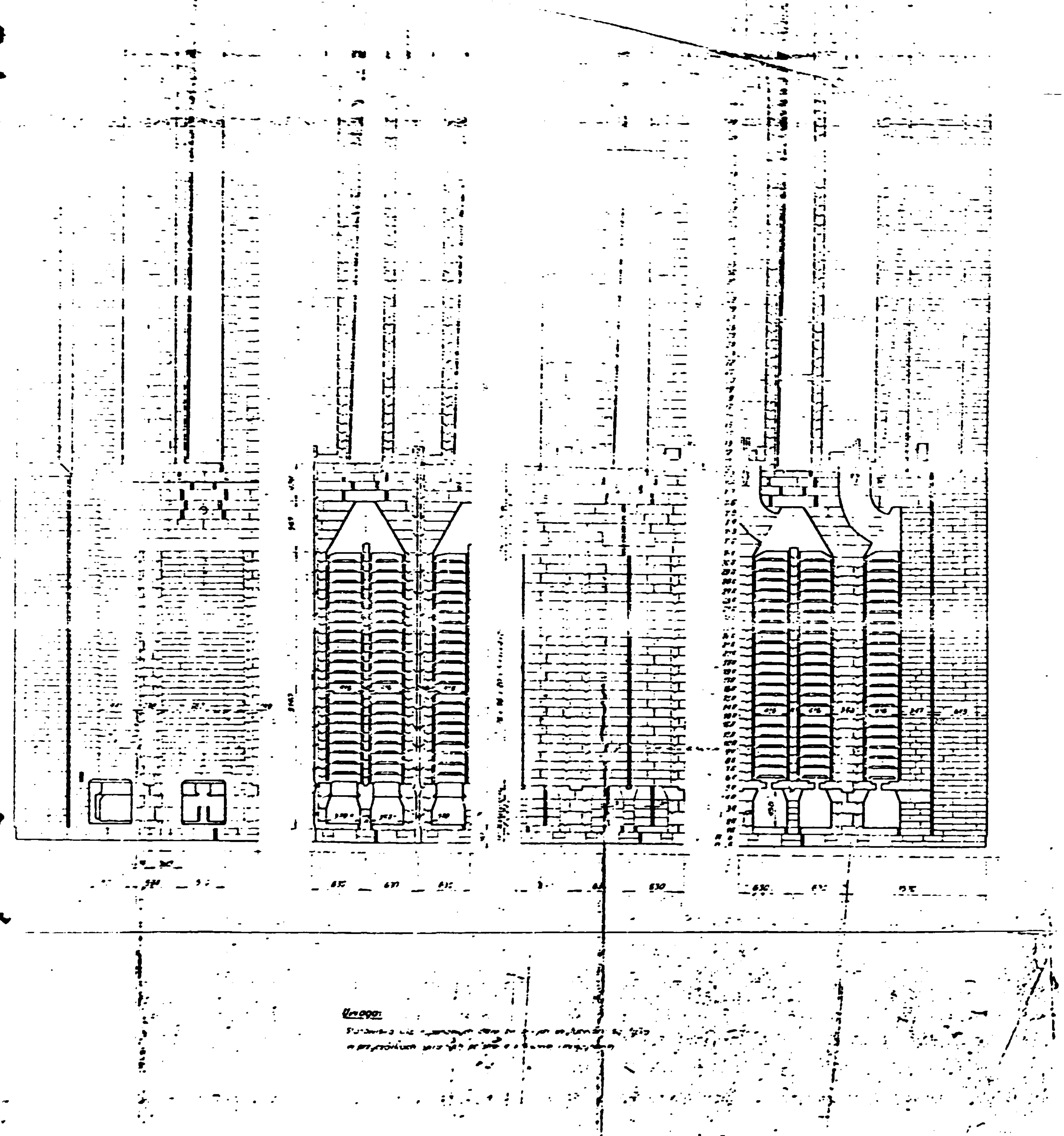
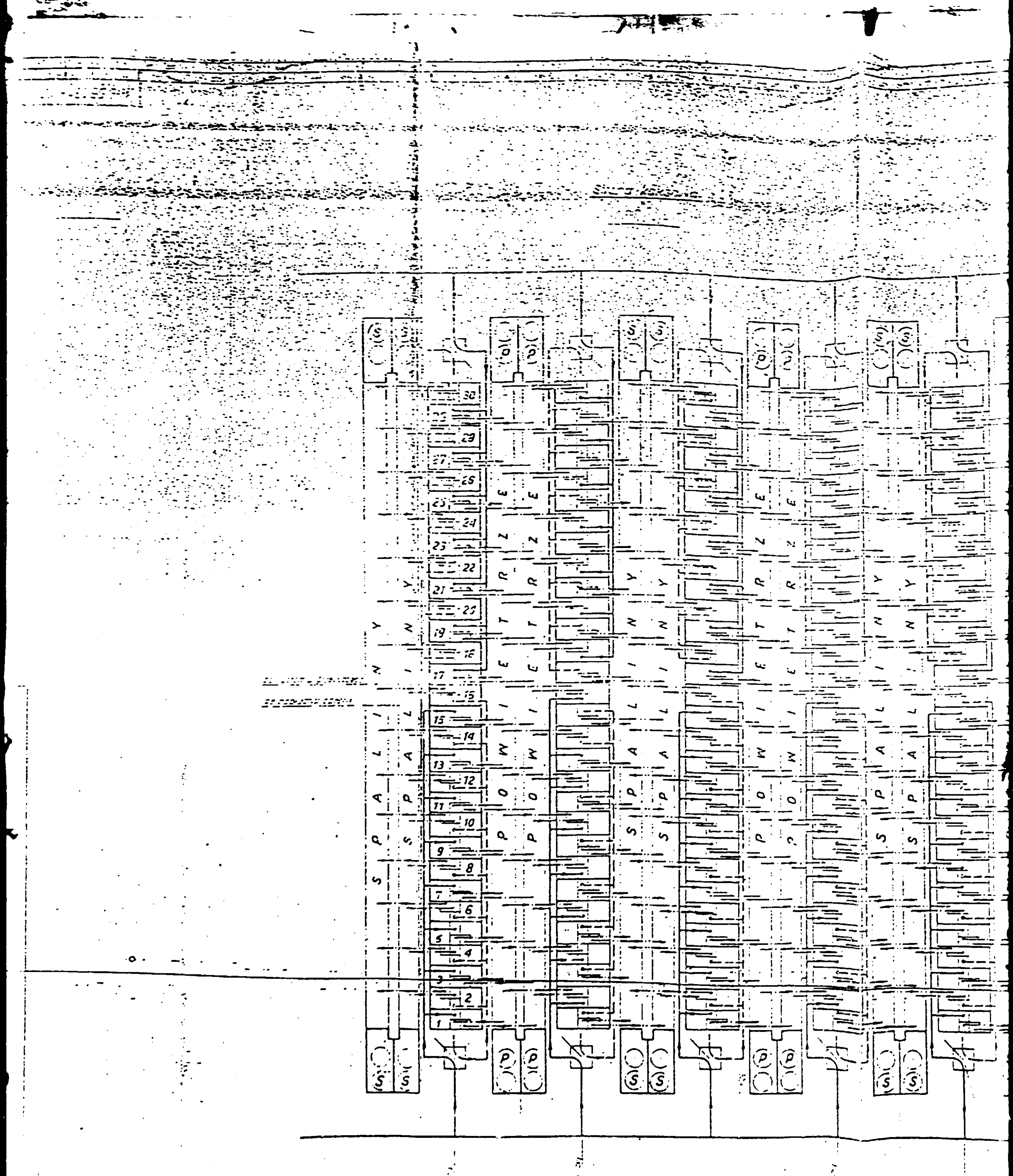


FIG.5-4

DRAWING FOR COKE OVEN

SECTION 6



SECTION 1

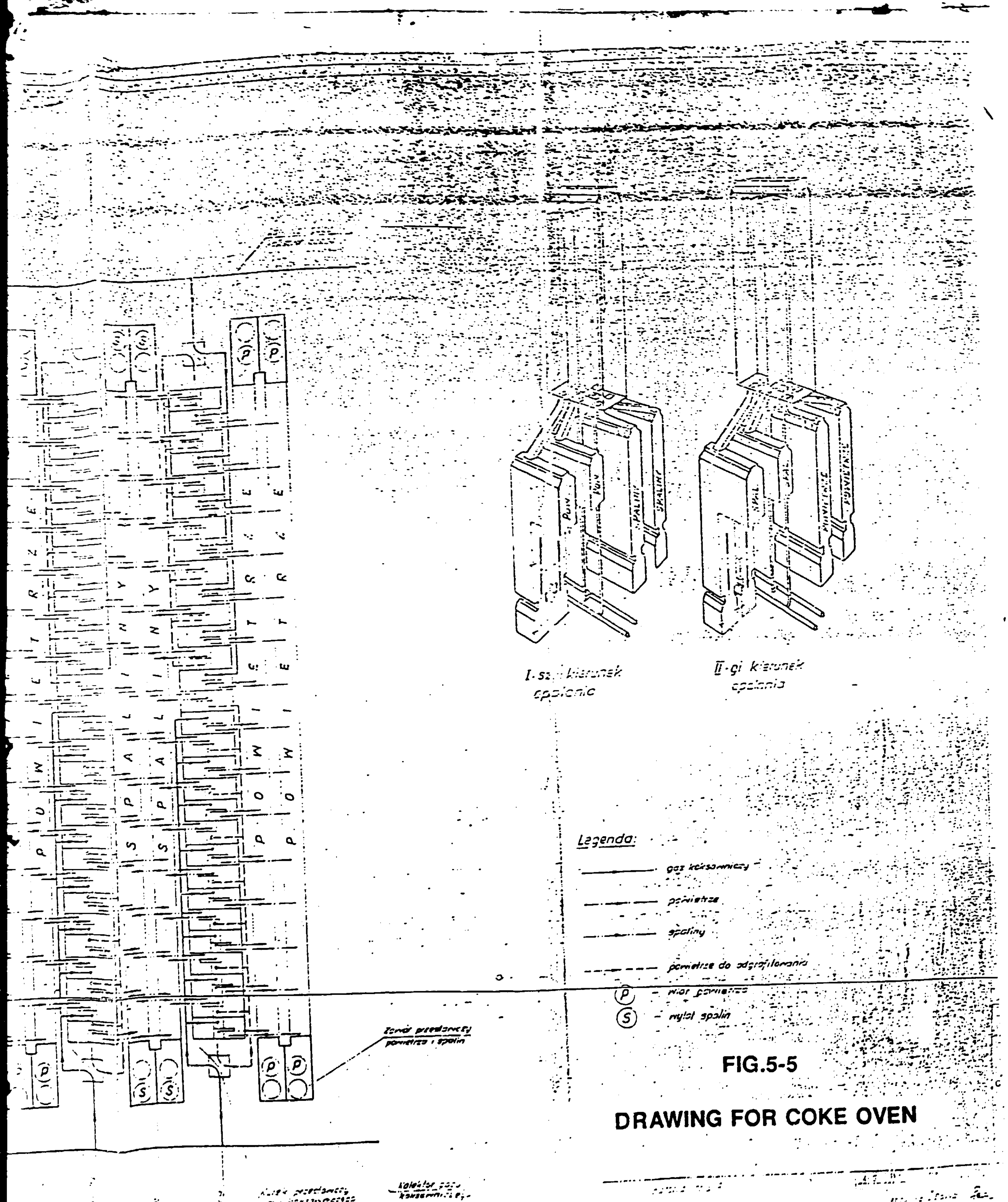
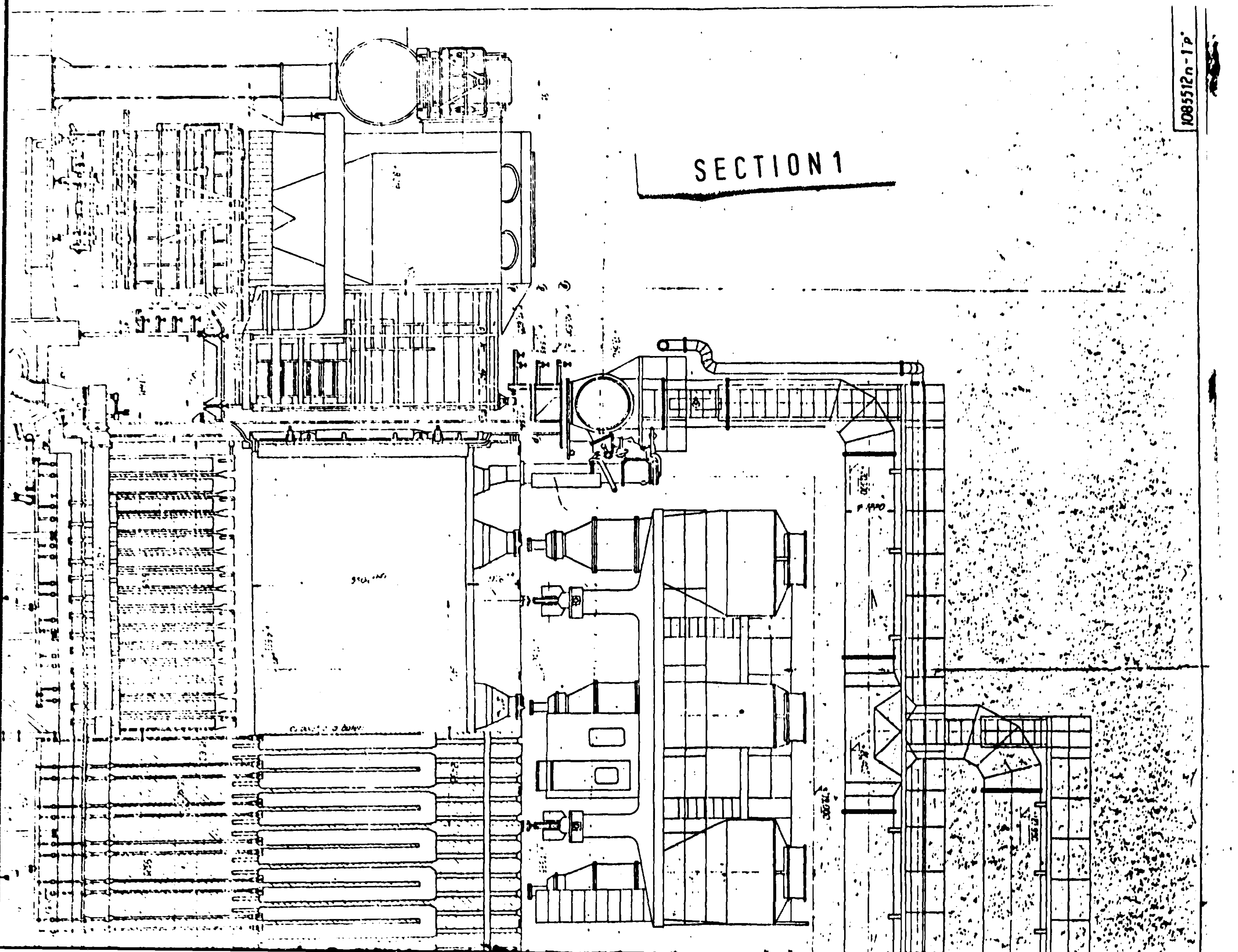
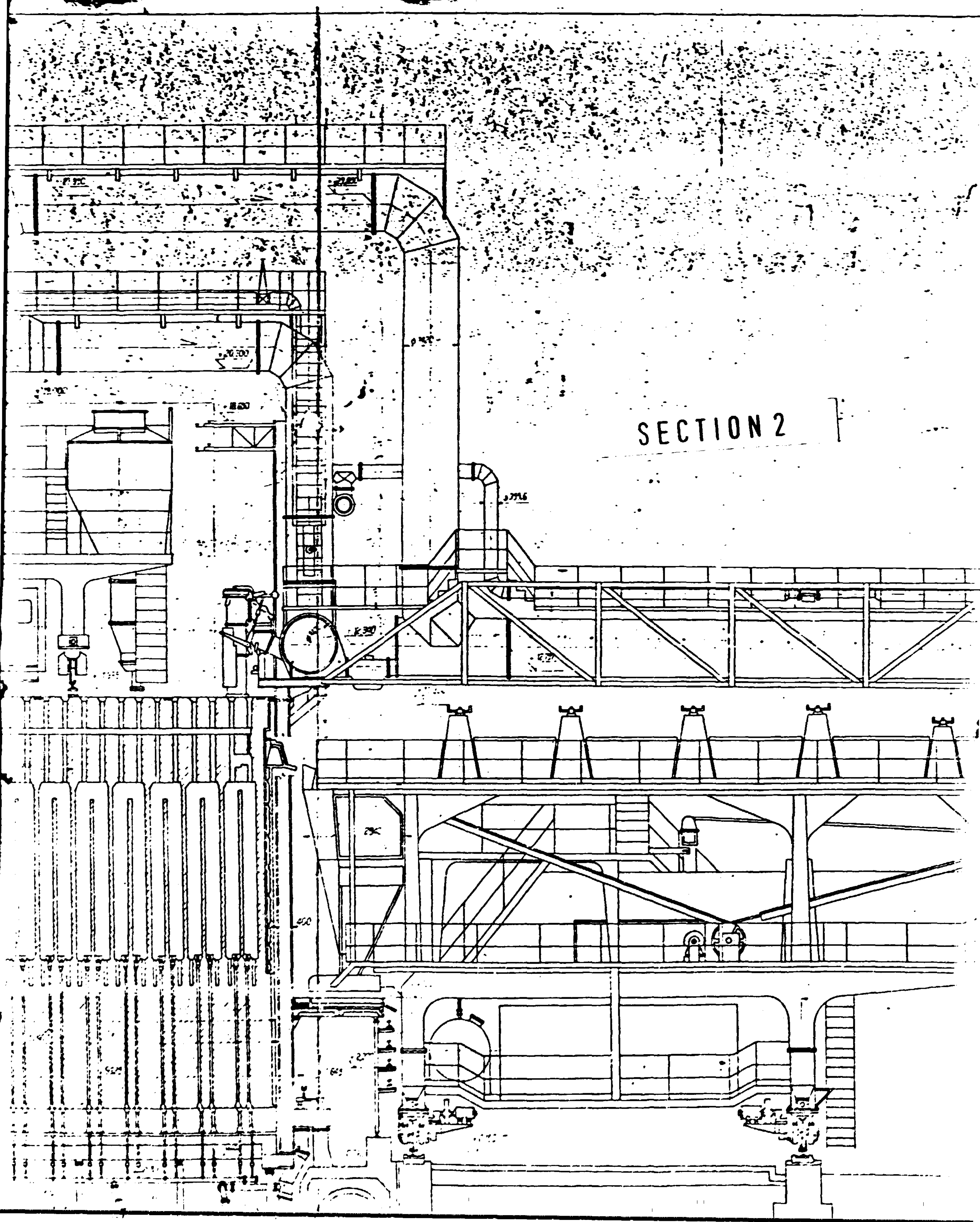


FIG.5-5

DRAWING FOR COKE OVEN

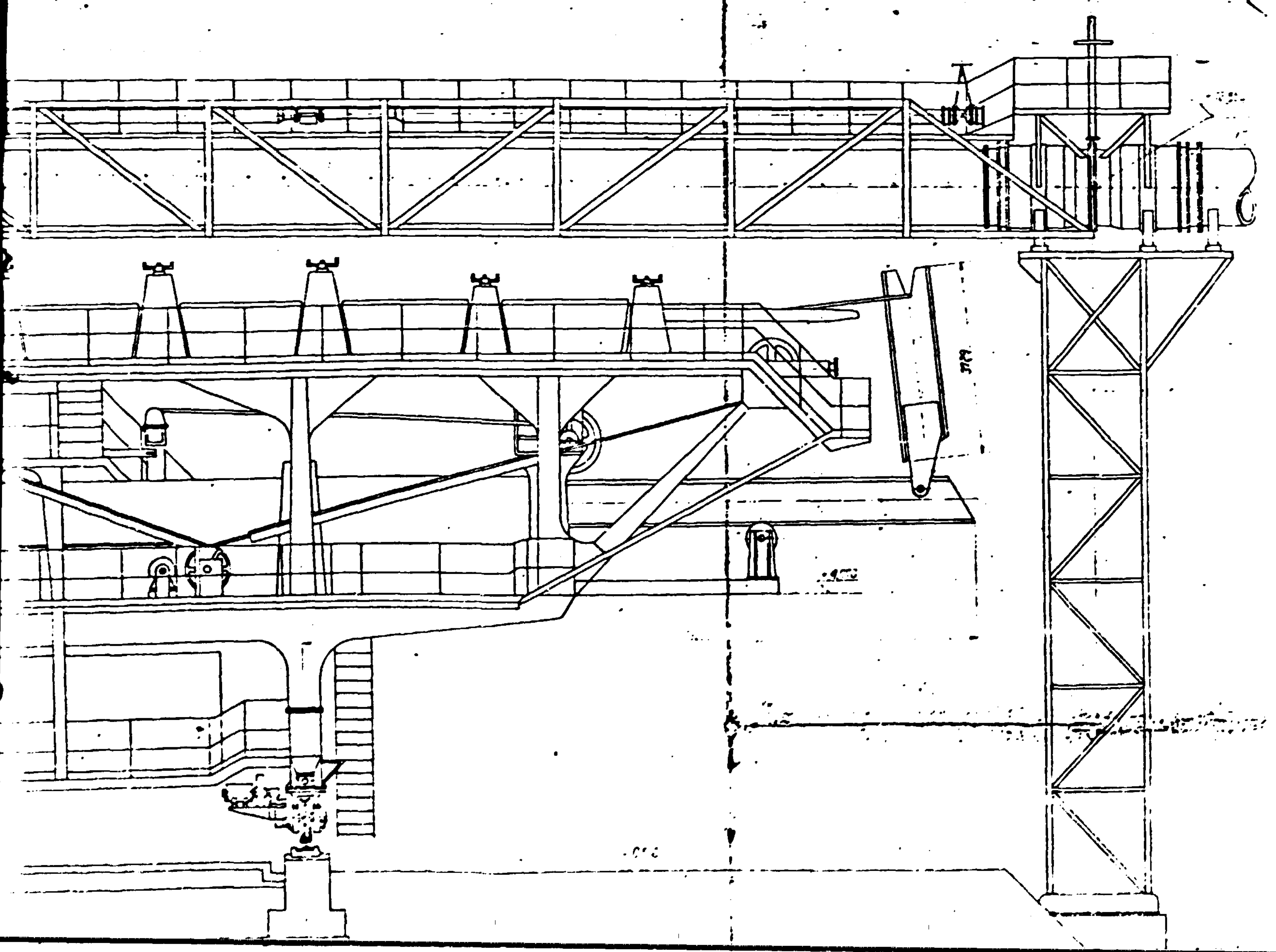


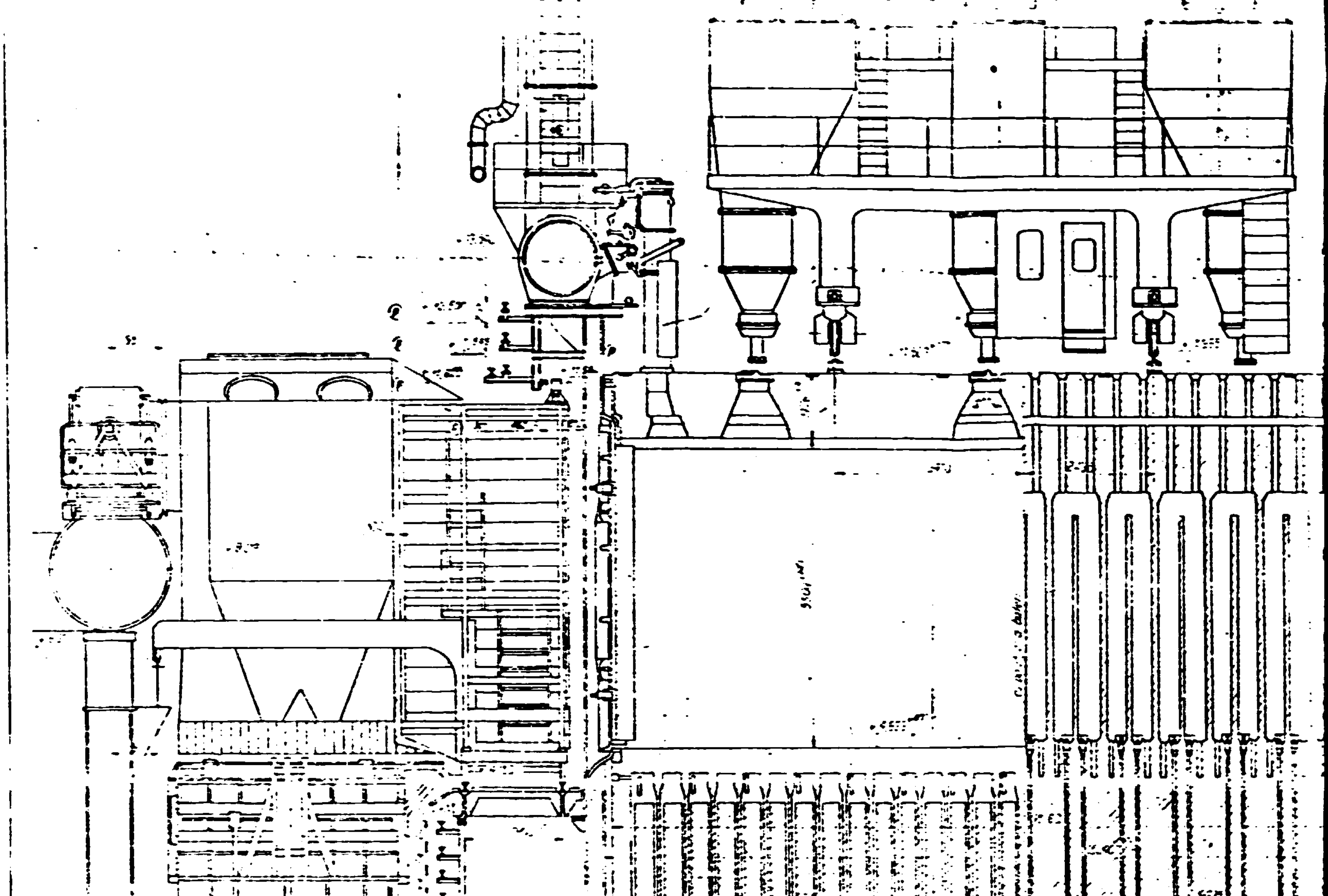
SECTION 1
1085512n-1p



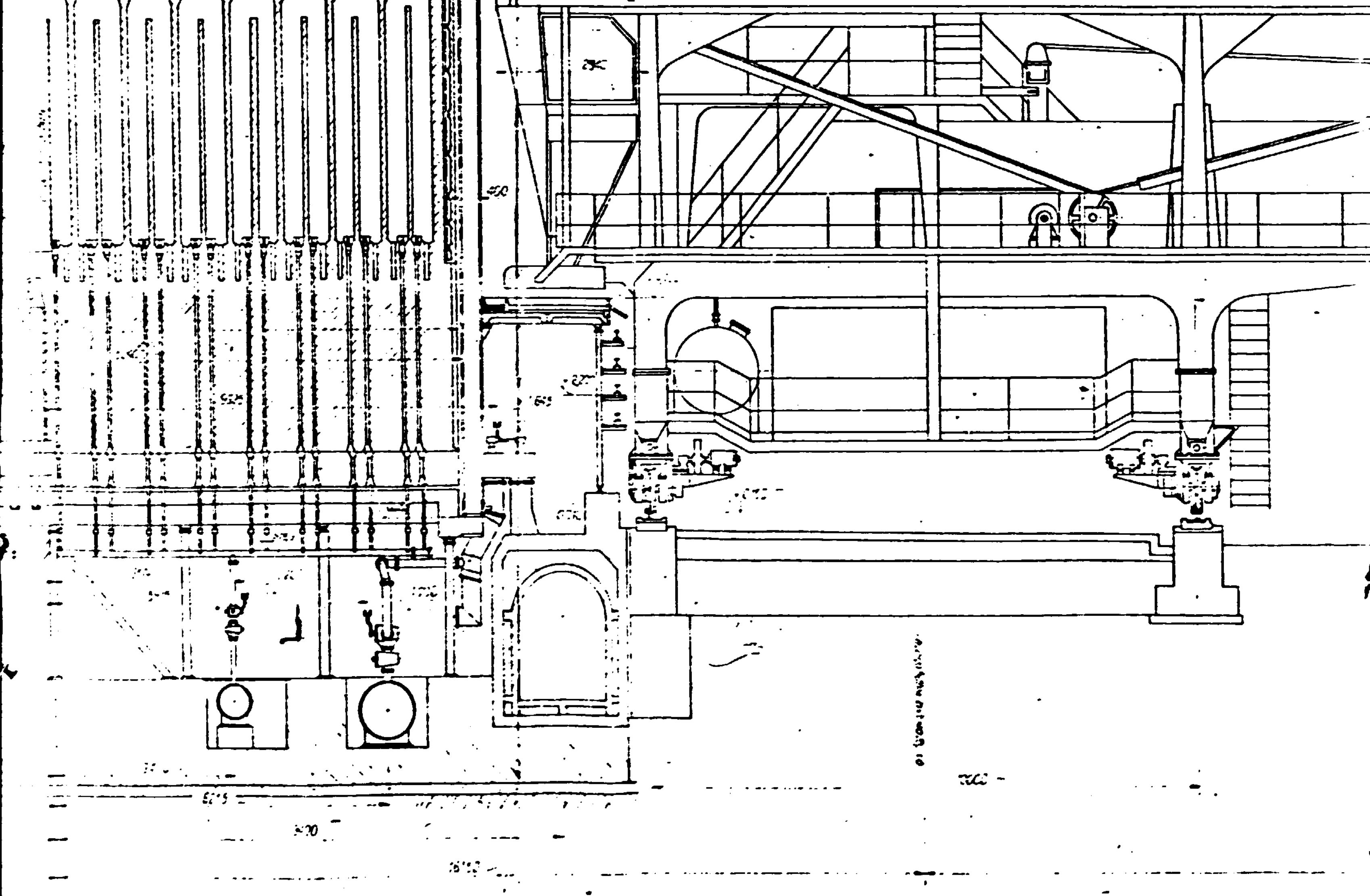
SECTION 2

SECTION 3



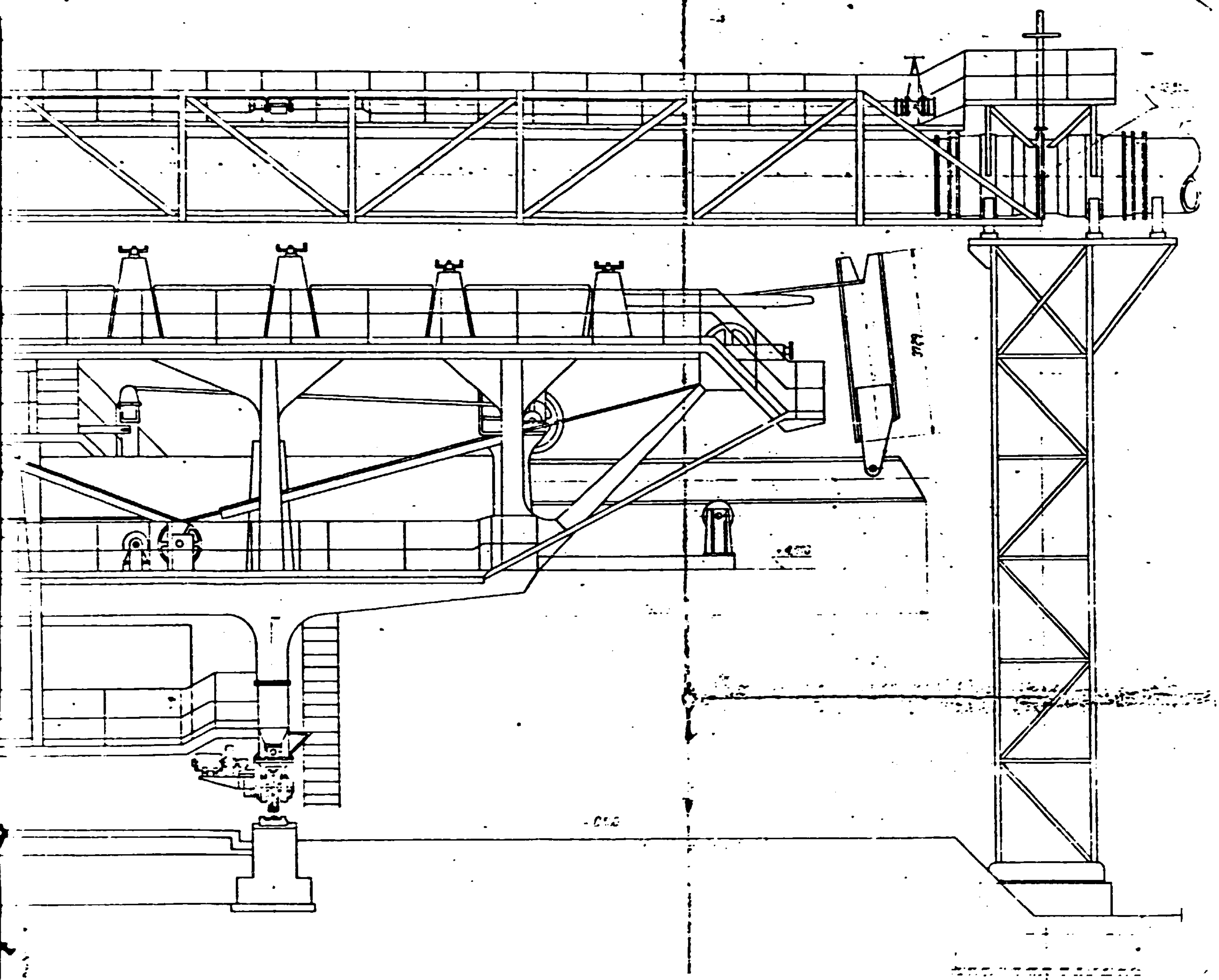


SECTION 4



SECTION 5

DRA



SECTION 6

Uwaga:

Poziom ±0,000 odpowiada główce szyny toru wozu gaszącego i wynosi 347,50 m n.p.m.

FIG.5-6

DRAWING FOR COKE OVEN

Przekrój poprzeczny

1085512n-1

BIURO PROJEKTÓW PRZEMYSŁU KOKSOCHEMICZNEGO - ZABRZE

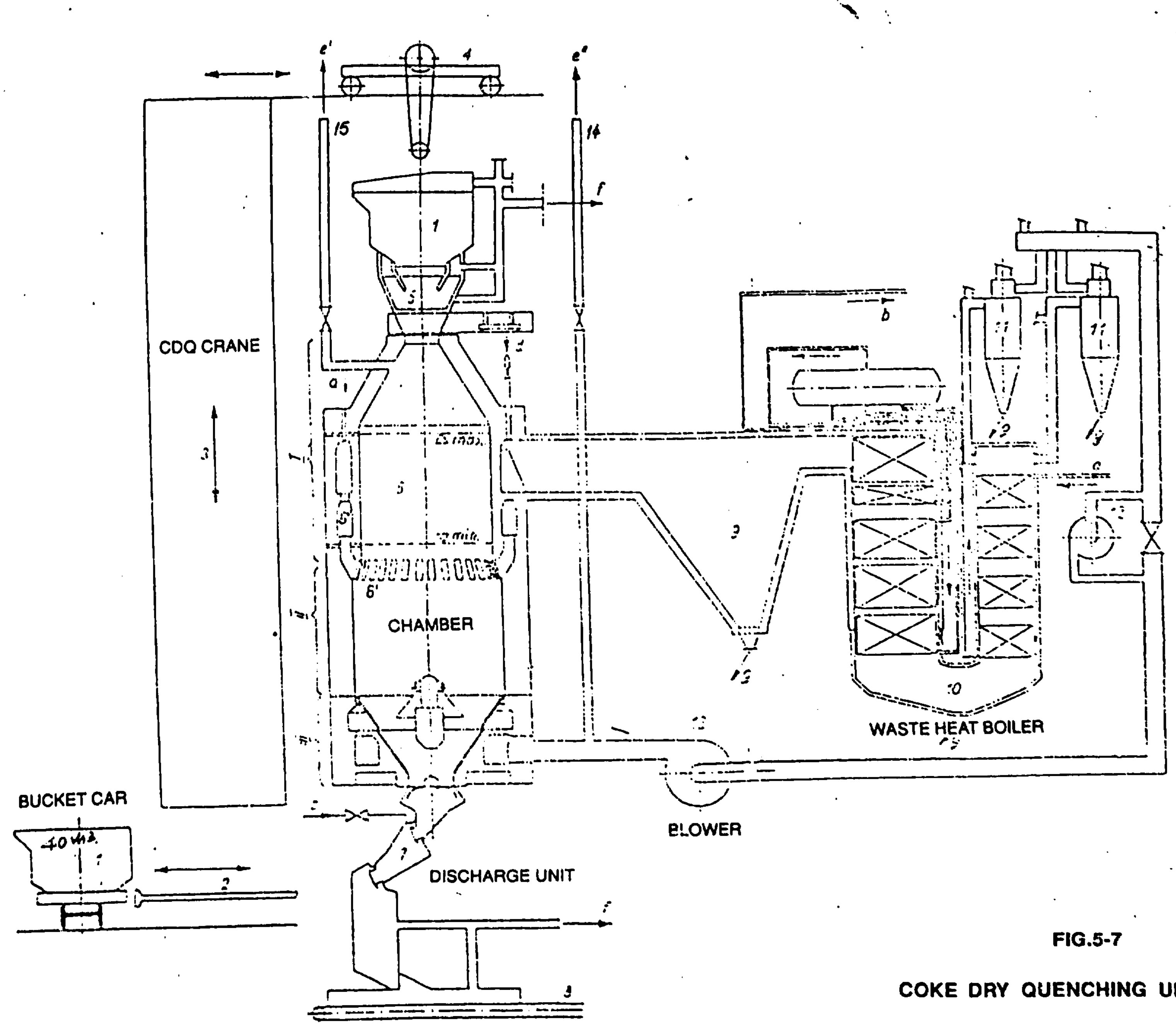
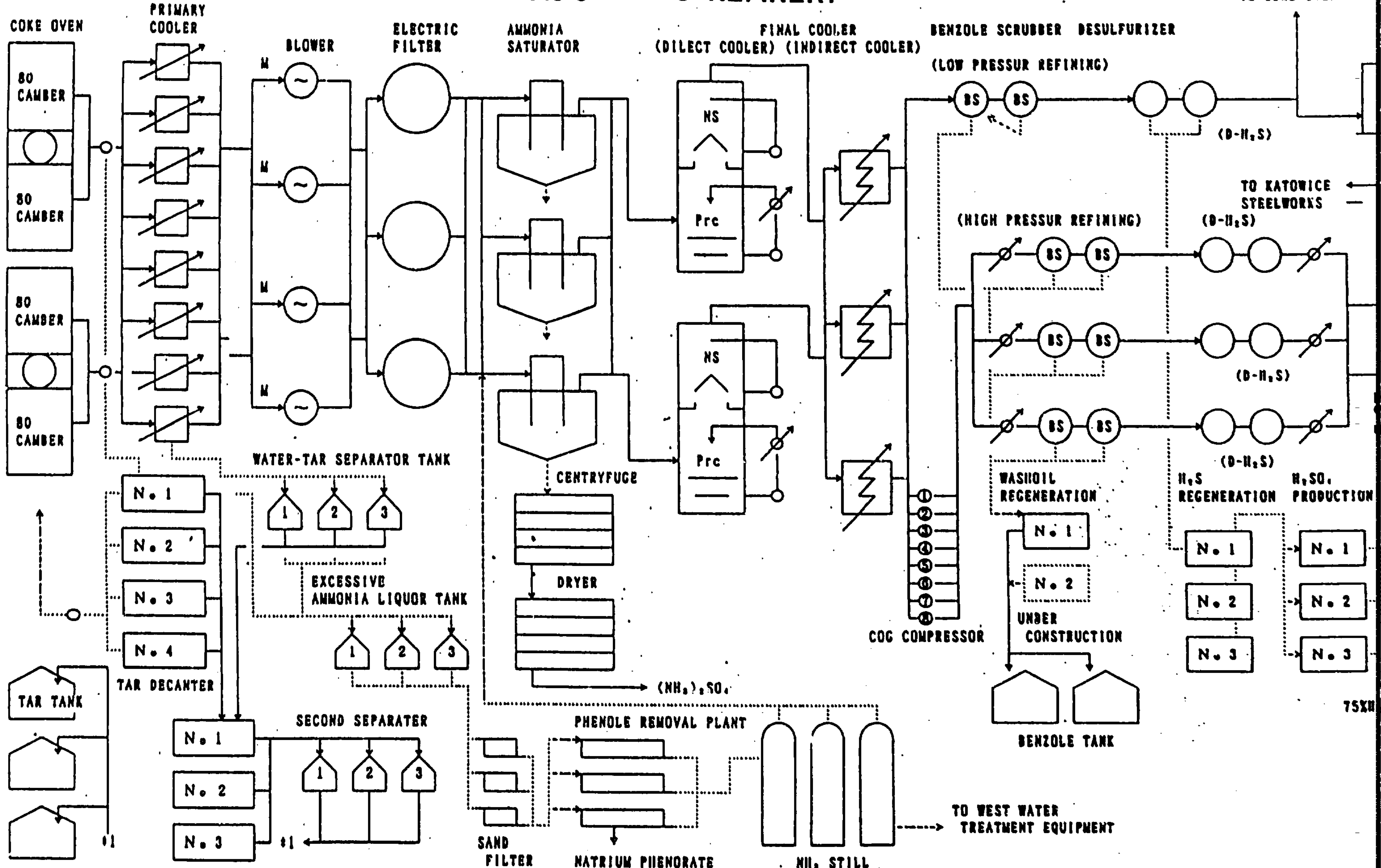
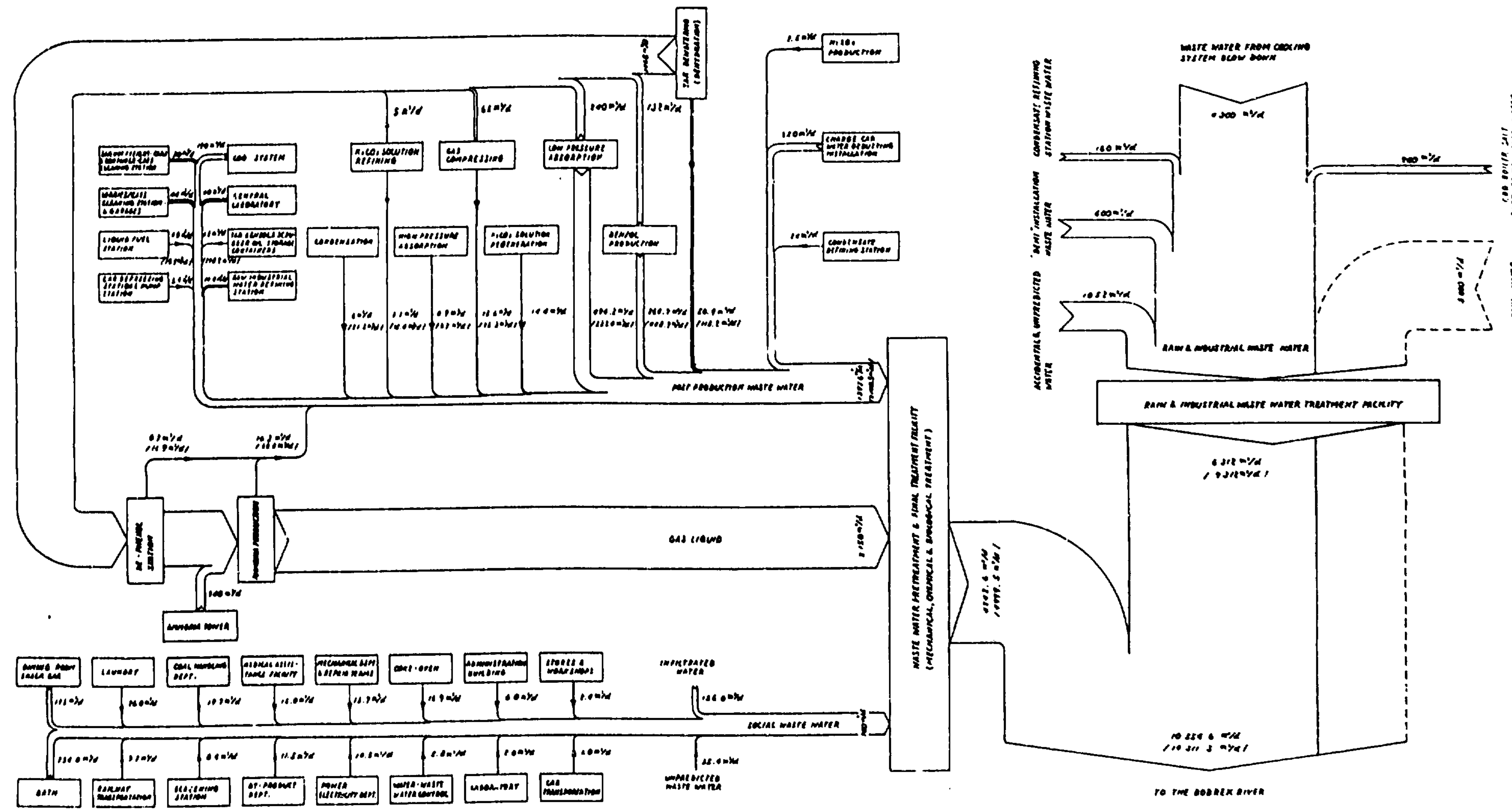


FIG.5-7

COKE DRY QUENCHING UNIT (CDQ)

FIG.5-8 GAS REFINERY

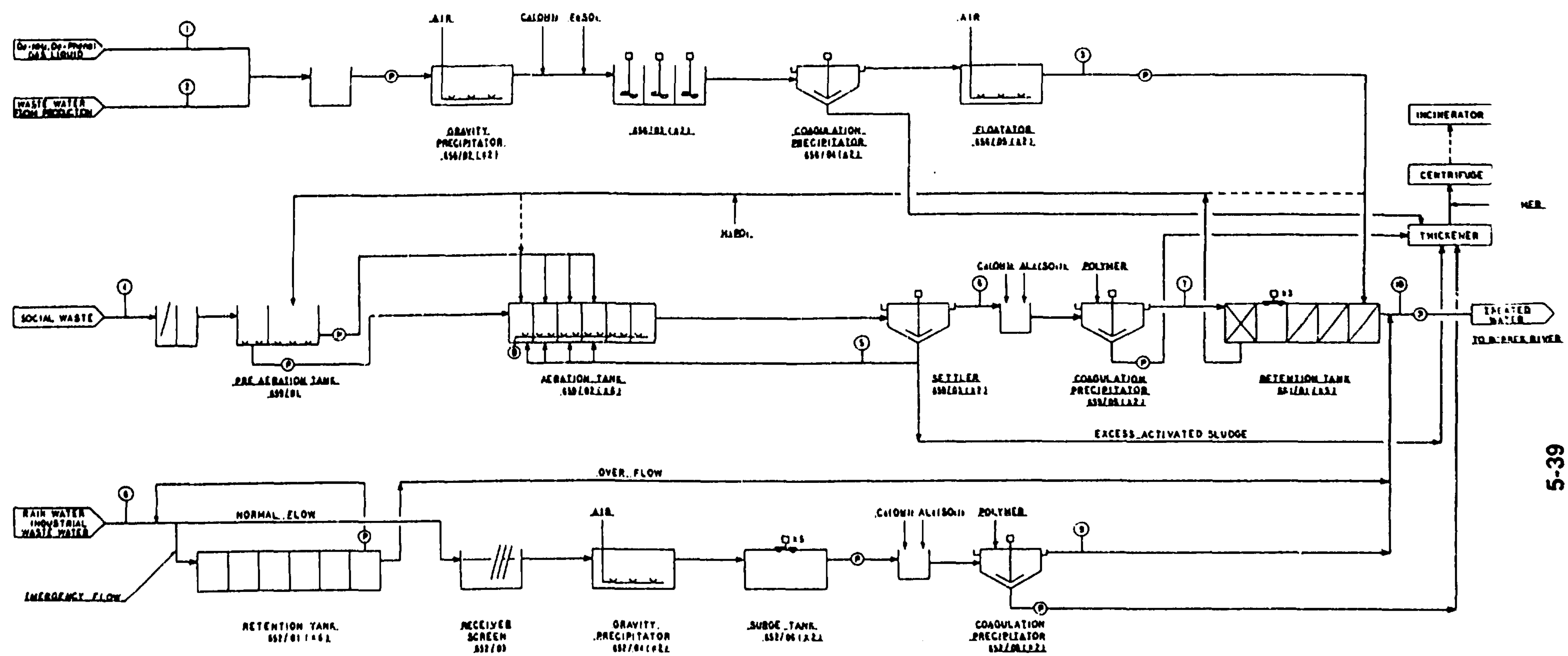




(NOTE)

/ / FLOW QUANTITIES IN HEAVY RAINFALL TIME

FIG.5-9



MATERIAL BALANCE (AVERAGE BASE)

		①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
FLOW RATE	(m^3/d)	1 964	2 232	4 196	1 720	5 916	5 916	5 916	8 764	8 764	14 680
COD	mg/L	5 951	1 620	2 120			680	570	160	20	286
	(kg/d)	(11 691)	(3 616)	(8 896)			(4 023)	(3 372)	(1 402)	(175)	(4 198)
TOTAL·CN^-	mg/L	72	72	40	0.3		2.8	0.7	1.2	0.02	0.64
	(kg/d)	(141)	(161)	(168)	(0.5)		(17)	(4.1)	(11)	(0.2)	(10)
SCN^-	mg/L	463	14	190	1.2		6.3	3.2	3.3	0.7	2.6
	(kg/d)	(909)	(31)	(797)	(2.1)		(37)	(19)	(29)	(6.1)	(38)
FREE·PHENOLS	mg/L	1 135	254	500			1.6	0.57	1.35	0.01	0.1
	(kg/d)	(2 229)	(567)	(2 098)			(9.5)	(3.4)	(12)	(0.1)	(1.5)
NH_4·N	mg/L	334	337	259			208	156			109
	(kg/d)	(656)	(752)	(1 087)			(1 231)	(923)			(1 600)

FIG.5-10

WASTE WATER TREATMENT SYSTEM (EXISTING PLANT) FLOW SHEET & MATERIAL BALANCE

2KBE018-M011 1

5.2 Review for the Existing Plant

5.2.1 Social and Environmental Factors

From an environmental point of view, the plant's inland location is restricted by more severe regulations than coke plants located on the coast. Actually the local regulations in Poland are more severe than those in Japan. Year after year, taxes and fines related to environmental pollution are sharply increased and these greatly affect the production cost. Therefore an environmental protection facility in Przyjazn is needed to improve the reduction of pollution materials in order to meet Polish regulations as much as possible.

On the other hand, the major locational advantages at Przyjazn, are;

- The abundance of high quality coking coal,
- The availability of low cost and highly skilled labourers,

5.2.2 Plant Layout

As the plant area has more than ample space, the following operational problems are evident.

- It takes a substantial amount of time just to move from one unit to another, especially between the Coal Handling Facility, Coke Transportation Facility and the Gas Refining Facility.
- It is difficult to confirm communication between a chief operator and other operators on the site.

As for the gas refining facility, the byproduct COG is produced in the high pressure de-sulphurization unit which is located the furthest away from Huta Katowice to where the COG is sent. This causes a higher operation cost.

As for the waste water treatment facility, this is located in an extremely vast area, and the coagulation precipitators and retention tanks, which are the final processes in the waste water treatment facility, are located at the lowest level in Przyjazn. This causes the operators a lot of unneccessary movement, particularly up and down the stairs.

As for the CDQ and its dust collectors, the equipment is located in a narrow area where operators are again forced to repeatedly climb and descend about 40 meters.

In order to rectify the above problems due to the vast area of floor space, the following two systems should be introduced.

1. Industrial ITV System
2. Individual Communications System

5.2.3 Review for raw material

The following table shows the physical properties of coking coal (Type 34.1, 34.2, 35.1 and 35.2) which were used as raw material for producing coke in 1991, and also the physical properties of slightly coking coal with a high volatile matter content (Type 33) which is about 30% cheaper than coking coal.

Type and Name of Mine	Consumption (T/Y)	Property of Coal (%)				
		H2O	Ash	VM	S	SI
Type 35.1 Zofhiwka Morciek	619,216 (19.4%)	8.5-10.5 (Av.10.0)	5.8-9.2 (6.3)	25.5-28.0 (27.6)	0.6-0.7	8.0
Type 35.1 Pniuwek Borywia	1,112,277 (34.9%)	8.5-10.0 (9.5)	6.4-7.8 (6.7)	28.0-31.0 (29.6)	0.6-0.7	8.0-8.5
Type 35.2 Moszezenica	543,360 (17.0)	8.0-9.5 (8.5)	6.1-7.5 (6.8	22.0-25.0 (23.6)	0.5-0.6	7.0-8.0
Type 4.1	486,643 (15.3)	10.5-12.0 (11.0)	8.3-9.6 (8.9)	22.0-26.0 (25.2)	0.6-0.8	1.5-3.5
Type 34.1 Type 34.2	429,425 (13.4%)	5.0-9.0 (5.5)	7.0-9.5 (7.8)	29.5-36.0 (32.8)	0.5-0.8 (0.65)	3.0-5.0
Total	**3,191,021 (100 %)**	----	----	----	----	----
Type 33	---	7.0-8.0	6.0-9.8	32.6-36.6	0.6-0.8	2.0-4.0

The cost of raw material is 75% of the direct coke production cost. This was the actual data in 1991 at PC. In Japan, the cost of raw material is the same as PC or more. Therefore it is a main target for coke producing companies to reduce the cost of coal as a raw material in order to reduce the coke production cost. Cheap and slightly coking coal or "gas coal" such as non-coking coal with high volatile matter, semi-anthracite and weathered coal have not been blended into the raw material for coke production using traditional coal evaluation technology. However a modern blending technology of coal is possible for blending these cheap coals into coking coal while retaining the quality to meet the stable operation of a blast furnace.

For Przyjazn, we are proposing to use type 33 (slightly coking coal), of which the specification is shown in the above table, by introducing coal blending technology.

Although the detailed blending ratio of type 33 can be determined after evaluation using blending technology, it is safe to say that it would be possible to blend type 33 in coking coal by approximately 5% which would contribute to savings in the coke production cost.

5.2.4 Review of coke oven, CDQ, coke transportation and gas refinery facilities

1) The condition of the coke oven, especially the masonry, is indicative of the quality and maintenance of the plant. It indicates that good maintenance has been kept over the last four or five years at Przyjazn since commencement of commercial operations. Generally the target lifespan of a coke oven in Japan is 35-40 years, maintained using a ceramic welding methods, etc. Therefore the condition of the coke oven and its lifespan, utilizing advanced maintenance technology, can be extended for up to 40 years. In this regard, after the year 2000, it is expected that coke will be exported to Western countries from Przyjazn due to the exhausted lifespans of coke ovens in the US, Western countries and Japan.

2) At Przyjazn, much cleaning of the ascension pipes is performed in their daily maintenance and operation routine for the coke oven. At KC's Kakogawa Plant, a cleaning nozzle is installed at the bent portion of the ascension pipe which reduces a lot of the cleaning work. We are recommending the introduction of this nozzle at Przyjazn.

The following Table shows the effect of introducing this technology.

	Without Modification	Post Modification
Cleaning Cycle	4 days per oven	20 days per oven
Cleaning Time	20 min. x 8 persons	20 min. x1 person
Cleaning Load	20 pipes/day x 8 persons	10 pipes/day x 2 persons
Cleaning Period	6 hr 40 min./day . person	3 hr 20 min./day . person
320 ovens	6 hr 40 min x 32 persons = 213 hr 20 min. person/day	3 hr 20 min x 2 persons = 6 hr 40 min person/day
No.of operators	8 persons x 4 batteries =32	2 persons

3) As for the design philosophy of the coke oven and the CDQ facility,

All hot coke discharged from the coke oven is processed by the CDQ without using CWQ. This system gives PC the triple merits of:

- The ability to produce high quality CDQ coke;
- No atmospheric emission of dust;
- The ability to generate low cost high pressure steam.

However, Przyjazn has enforced keeping two hot standby CDQ chambers and two cold CDQ chambers because there is no way to go to the coke wet quench (CWQ) in case of emergency. This causes a high maintenance cost.

4) Although the maximum design capacity of PC is 2,850,000 tons per year, PC does not produce this amount for long periods because the CDQ has a bottleneck which is insufficient for discharging coke from the bottom of the chamber. Therefore the bottleneck should be removed by modifying the discharging device for the bottom section of the CDQ chamber.

5) The bucket car and CDQ crane are manually operated at PC. For the following reasons, a computerized automatic system should be introduced.

i) As described in **Chapter 5.2.8**, the operating conditions of the coke oven greatly affects the coke strength index after reaction (CSR). In this regard, the coke pushing schedule should be automatically controlled so as to maintain the stable operation of the coke oven.

ii) The automatic combustion control system should be integrated with the system for the bucket car and the CDQ crane so as to be one complete automatic system.

iii) It should be required in order to reduce the labour cost.

6) Complete standby units, except for the coke oven, in the whole of PC are installed. This is advantageous in case of emergency but it also results in expensive maintenance costs.

7) The existing metal removal unit does not operate well which means that the conveyor belts for coal and coke transportaiton are easily damaged. Therefore a new metal removal unit should be installed immediately so as to be stabilize the operation of the conveyor belts.

8) Low efficiency of the H_2S removal unit.
As stated in **5.2.5 B. 2.**, the H_2S content in the outlet gas from the low pressure desulphurization unit is 2.0 g-H_2S/Nm^3 under the present operation data, while the design value is 1.5 g-H_2S/Nm^3. In the case that the coke oven will operate at full capacity after 1996, COG treated in the low pressure desulphurization unit will also increase which will decrease the efficiency of desulphurization to 2.7 g H_2S/Nm^3. Therefore improvement of the low pressure desulphurization unit will be essential.

9) Operation conditions around the tar decanter.
The operation conditions around the tar decanter are very poor due to gas odours such as H2S, HCN, etc., which leak from the open surface of the Decanter. On the other hand, tar sludge, which is separted in the decanter is sent to the coal handling facility via hopper by truck. This operation is done manually high up where the odour accumulates.

In order to improve both the above conditions, namely the odour and the awkward working conditions, we are recommending the tar discharge system and deodorant device as described in chapter 6.

5.2.5 Environmental review

A. Waste water treatment facility

1. Peripheral problems

(1) Strengthened regulations

The quality of the final treated water discharged from this waste water treatment system does not meet the regulation values. Discrepancy between the operation values and the regulation values causes a considerable amount of penalties. The main reason for the discrepancy is that the regulations were strengthened from what they were at the time of planning of the waste water treatment system. The comparison among regulation values, design values and operation values are listed below.

Item	Regulation Value (present)		Design Value	Operation Value	
				Max.	Ave.
pH	(-)	6.5-9.0	7.0	8.3	7.7
SS	(mg/1)	30	30	50	30
BOD	(mg/1)	8	30	5.3	3.8
COD	(mg/1)	60	224	490	286
Total-CN^-	(mg/1)	2.0	3.0	1.45	0.68
Free-CN^-	(mg/1)	0.02	-	0.034	0.014
SCN^-	(mg/1)	0.5	13	9.5	2.6
Free-Phenols	(mg/1)	0.02	0.4	0.64	0.1
NH_4-N	(mg/1)	3.0	143	171	109
Cl^-	(mg/1)	300	955	781	561
$SO_4$2-	(mg/1)	200	770	659	495
Fe	(mg/1)	1.5	-	10	3.7

As is obvious from the above, waste water treatment system design values surpass the regulation values by a wide margin as far as COD, Total-CN^-, SCN^-, Free-Phenols, NH_4-N, Cl^-, $SO_4$2-, etc., are concerned. With all items other than COD, the operation values are within the design values on an average basis. When COD can be controlled to meet the regulation value, this treatment system can be evaluated as "satisfactory." In other words, the system has not been remodeled to meet the strengthened regulations.

(2) Change of inlet waste water

The second reason why final treated water quality does not satisfy the regulation values is explained by the fact that the design values for the waste water treatment system are below the inlet values. The reason for this inconvenience can be traced back to the problems caused at the source of the waste water.

This problem is taken up here, since it is caused by peripheral factors rather than the environment protection section. However, when the problems are evaluated from PC's viewpoint rather than from the section's viewpoint, they are simply the results of insufficient adjustment and coordination among the sections and departments. When such adjustments and coordination are successfully done, improvement can be made to some extent. Such adjustments and coordination have not been made in reality, therefore, the problem has to be discussed here.

The environment protection section which receives waste water holds a passive position; the section is compelled to treat water transferred regardless of the quality of inlet waste water, while sections discharging waste water perform poor maintenance without consideration to subsequent processes. Needless to say, the above reason is not the only one, but should be the main one to be addressed.

A comparison of the design values and maximum operation values are shown below.

a) de-NH_3, de-phenol gas liquid

	Design value		Operation values	
Flow rate	2,150 m^3/d		1,964 m^3/d (average)	
COD	3,600 mg/1	(7,740 kg/d)	9,860 kg/1	(19,365 kg/d)
Total-CN^-	60 mg/1	(129 kg/d)	300 kg/1	(589 kg/d)
SCN^-	450 mg/1	(860 kg/d)	850 kg/1	(1,669 kg/d)
Free-Phenols	150 mg/1	(323 kg/d)	1,350 kg/1	(2,651 kg/d)
NH_4-N	412 mg/1	(886 kg/d)	975 kg/1	(1,915 kg/d)
Cl^-	3,000 mg/1	(6,450 kg/d)	6,390 kg/1	(12,550 kg/d)

b) Waste water from production line

	Design value		Operation values	
Flow rate	3,450 m^3/d		2,232 m^3/d (average)	
COD	3,600 mg/1	(12,420 kg/d)	8,250 kg/1	(18,414 kg/d)
Total-CN^-	20 mg/1	(69 kg/d)	206 kg/1	(460 kg/d)
SCN^-	100 mg/1	(345 kg/d)	318 kg/1	(1,710 kg/d)
Free-Phenols	300 mg/1	(1,035 kg/d)	976 kg/1	(2,178 kg/d)
NH_4-N	247 mg/1	(852 kg/d)	1,271 kg/1	(2,837 kg/d)
Cl^-	1,000 mg/1	(3,450 kg/d)	2,900 kg/1	(6,473 kg/d)

c) Social waste

	Design value	Operation values
Flow rate	1,030 m^3/d	1,720 m^3/d (average)

d) Rain water & industrial waste water

	Design value		Operation values	
Flow rate	19,200 m^3/d		8,764 m^3/d (average)	
COD	150 mg/1	(2,880 kg/d)	160 kg/1	(1,402 kg/d)
Total-CN^-	10 mg/1	(192 kg/d)	1.2 kg/1	(11 kg/d)
SCN^-			3.3 kg/1	(29 kg/d)
Free-Phenols	10 mg/1	(192 kg/d)	4.75 kg/1	(42 kg/d)
NH_4-N			-	
Cl^-	300 mg/1	(5,760 kg/d)	987 kg/1	(8,650 kg/d)

In a) and b) above where the contaminant amounts are high, the maximum operation values greatly surpass the design values as shown above. The high concentration in the inlet waste water is the cause of the excess final treated water values over the regulation values.

2. Problems in the system

1) Automation

All chemical injection in the coagulation system is controlled manually, while pH and ORP are not controlled. Therefore, timely control is not performed due to an over-dependence on the operator's skill, or else countermeasures against changed water quality is delayed. Consequently, coagulation becomes aggravated. As a result, performance of the subsequent equipment is adversely affected.

Moreover, sludge discharge is not periodically performed. Since the flushing process for the discharge line is not automated, the line becomes clogged which creates problems.

2) Rain water and industrial waste water treatment system

The rain water and industrial waste water treatment system is not equipped with an organic matter decomposition unit as is the activated sludge treatment system. If COD, etc., exceeds the regulation values in this system which receives the highest inflow, the final treated water quality naturally exceeds the regulation values, even though other streams are treated satisfactorily. In fact the rain water and industrial waste water at the inlet of the system exceeded the regulation values in 1991.

	Regulation values for final treated water	Inlet rain water & industrial waste water
COD (mg/1)	60	(Max) 160
Free-Phenol (mg/1)	0.02	4.75

3) Denitrification and desalination unit

In the original design for the waste water treatment facility, the denitrification and desalination units were not considered to be installed. Therefore, NH4-N, Cl^- and $SO4^-$ could not be reduced in the final treated water. Although regulation values are set for Cl^- and SO_42-, no unit is installed to remove or decrease salts. Salts will increase as a result of alum and ferrous sulphate injection in the coagulation unit.

3. Problems in operation and maintenance

1) Maintenance of standby unit

Most units in this system are equipped, in principle, with standby units. However the standby units are not in a condition to function properly. The standby units or train are not kept in order; some of them are damaged, disassembled or dismounted. Spare parts for the respective units are not adequate either.

2) Setting of operating conditions

Analysis of water quality has been frequently done and records are well kept. However, the adjustment of the operating conditions based on the analysis or investigation of the cause of abnormal values have not been conducted. In short, daily analysis and records are not kept to improve operation. For example, by carrying out steps a) to c) below, which are easily done, considerable improvement in efficiency will be achieved in pretreatment and in the activated sludge treatment system:

a) Increase of chemical injection when coagulation is unfavourable.
b) Increase of MLSS concentration in the aeration tank.
c) Judgement of activity based on MLVSS concentration and investigation of the cause.

Our comment is that there are no standards available to reflect the analysis data into the actual operation at present.

Considering the above problems, we are recommending methods to improve the waste water treatment facility as described in detail in Chapter 6.

B. Review for emissions control

1. De-dusting

The following countermeasures should be taken for reducing dust to the atmosphere.

- As shown in **Table 5.4**, the current efficiency of the dust collectors is inadequate. This is due to poor sealing for the suction of the dust collectors and also the poor adjustment of the flow rate of the suction blowers because of a low concentration of dust at the dust collector inlet.

In order to increase the efficiency of the dust collectors, minor modification of the dust collectors at site as well as training to improve the operation and maintenance for the dust collectors are required.

- In the places where it is difficult to install a dust collector such as the coal yard and on the top of the coke oven, cleaning and water spraying should be performed more often in order to prevent both the accumulation of dust and dust dispersal into the atmosphere.
- For the machine side of the coke oven, new dust collectors should be installed.

2. SOx

More than 85% of SOx is discharged from the chimneys of the coke oven at PC. This SOx is produced by H2S in the COG which is fired in the coke oven during carbonization. As described in 5.1.5-6), a high H2S content in the COG has been caused by the low efficiency of the low pressure H2S removal unit. This is due to the fact that the first absorber has been operated as an oil mist separator rather than as an H2S absorber as it was originally designed. According to the operation data, the H2S content in COG at the outlet of the low pressure H2S removal unit is 2.0 g-H2S/Nm^3-COG instead of 1.5 g-H2S/Nm^3-COG which is the design value for the H2S removal unit. In Table 5.3, SO2 emitted from the chimney of the coke oven shows 1,502.8 tons/y which is not actually measured but calculated on the basis of 1.5 g-H2S/Nm^3-COG.

The coke production capacity will be increased up to 2,850,000 tons/y at full, COG consumption fired in the coke oven will also increase from 50,900 Nm^3/hr in 1991 to 68,000 Nm^3/hr. In this case the H2S content in COG will also be increased by 2.7 g/Nm^3 so that SO2 will be 3,030 tons/y.

The following Table shows exactly as describe above.

	Calculated SO2 for Tax Purposes in 1991	Actual SO2 in 1991	SO2 at Full Coke Production after 1994 without modification
Coke production Capacity	2,210,000 t/y	2,210,000 t/y	2,850,000 t/y
COG Consumption in Coke Oven	50,900 Nm^3/hr	50,900 Nm^3/hr	68,000 Nm^3/hr
H2S in COG	1.5 g / Nm^3	2.0 g / Nm^3	2.7 g / Nm^3
SO2 emitted from Coke Oven Chimney	**1,502.8 t/y**	**1,680 t/y**	**3,030 t/y**

In order to avoid the above high emission rate of SO2 at full coke production capacity, the following rough case studies have been carried out:

Case-1: Modification of the existing low pressure H_2S removal unit. Installation of a new mist separator and exchange the internai filler in the H_2S absorber, etc. (refer to **ID No.4-2 in Chapter 6.**)

Case-2 : New installation of desulphurization unit which is applied at KC.

	Case-1	Case-2
COG Consumption H2S in COG SO2 emitted	68,000 Nm^3/hr 1.2 g / Nm^3 1,345 tons / year	68,000 Nm^3/hr 0.01 g / Nm^3 11 tons / year
Investment Cost Utility Cost Depreciation/Repair, etc. Tax	$1,151,000 Same as existing $150,000 /y $344,300 /y	$30,770,000 Same as existing $ 4,000,000 /y $ 2,800
Operation Cost	$2494,300 /y	$ 4,002,800 /y

For the moment we recommend Case-1 considering the above rough study.

3. 1) NOx

A low combustion temperature is effective to reduce COG consumption in the coke oven which in turn reduces NOx. In this regard, improvement of energy efficiency as described in **Chapter 5.2.7** contributes to the reduction of NOx by 10 % from the chimney.

2) NOx around the coke oven

In the area around the coke oven, 214.48 tons/year of NOx was measured, while 226.32 tons/year was calculated from the chimney. If this is true, the coke oven was operated without sealing. Therefore the measured amounts around the coke oven should be reconfirmed. In our experience, the NOx is expected to be reduced by more than 50% using a correct measuring method.

4. CO

CO can be reduced by more than 30% from the CDQ and coke oven by improved CDQ operation through operator training. At KC, CO emissions from the CDQ are less than 50% of PC's.

5. Other contaminants

As for the other contaminants, it will be difficult to solve completely. However, due to the fact that these contaminants are emitted from the vicinity of the coke oven, they are expected to be reduced through the following:

1) To reduce leaked gas from the coal charging holes by reinforcement of the sealing method.
2) To reduce leaked gas from the doors of the coke oven by improving the sealing method.

Therefore these contaminants are expected to be reduced by more than 20%.

5.2.6 Review of the mechanization/automation status of PC

According to **Table 5.6** there are not enough mechanization/automation equipment and facilities at PC when compared with KC.

In order to reduce the number of operators as well as engender some environmental improvement and provide for the plant's stable operation, we are recommending the following:

(1) Automatic bucket operation
(2) CDQ automatic crane operation
(3) Auto combustion control system
(4) Cleaning device for ascension pipings
(5) Industrial ITV system
(6) Individual communications system
(7) Tar sludge discharge system
(8) Deodorant device for tar decanter

5.2.7 Review for Energy Efficiency at Przyiazn

The following **Table 5.7** shows the energy consumptic:. at Przyjazn in 1991.

Table 5.7

	Kcal / unit	Consumption	Total Calorie (10^9Kcal/y)	Kcal / coal kg	Ratio(%)
COG	Kcal/Nm[3] 4,220	(x10[3] Nm[3] /Y) 486,610 (For Coke Oven 446,030x10[3])	2053.5 (1,882.2)	689 (632)	87 (80)
Purchased Electric Power	Kcal/Kwh 2,450	Mwh / Y 123,910	303.6	102	13
Total	-	-	2,357.1	791	100%
Recovery of High Pressure Steam from CDQ	795 Kcal/kg	1,117,367 t/y	D888.3	D298	
True Energy Consum-ption			1468.8	493	

It is not easy to evalute the energy efficiency for the cokery plant by one parameter because of the different ratio of the plant's own generated electric power and the byproduct process. However, usually the Heat Consumption (HC) (kcal / coal dry kg) which is the required heat consumption amount for carbonization in the coke oven is sufficient as the index of energy efficiency for the cokery.

The HC for the PRZYJAZN Cokery in 1991 was about 630 kcal / kg which was approximately the level at a Japanese cokery 10 years ago. This means that energy saving technology has not yet been well introduced.

HC shows a tendency to increase in the case where the coke production is increased because it is necessary to increase the coke oven temperature so as to increase the heat loss from the coke oven and the sensitive heat loss from coke. Therefore HC will be increased by more than 630 kcal/ kg if the coke production is increased without introducing energy saving technology.

We are recommending the following two technologies in order to save on energy consumption and reduce environmentally degrading emissions.

1) Automatic Combustion Control System
2) Installation of COG Holder to prevent COG emissions to the flare stack.

The following **Table 5.8** shows the heat consumption figures before and after the introduction of energy saving technology.

Table 5.8 Heat consumption

		1991	1995	1996
Heat Consumption	Kcal / Coal kg	630	645	600
Coke Production	10^3Tons/Year	2,210	2,530	2,850
COG Generated	Nm^3/ H	115,500	132,300	149,000
COG for Heating Oven	Nm^3 / H	50,900	59,600	62,300
COG to Flare	Nm^3 / H	4,600	2,300	0
COG to Huta Katowice	Nm^3 / H	60,000	70,400	86,700
Saved COG	Nm^3 / H	0	10,400	26,700

Note: Heat consumption without automatic combustion control system in 1996 will be 660 Kcal /coal kg.

We have studied the utilization of saved COG after introduction of the above technologies and concluded that Case-1 is the most feasible.

Case-1: All saved COG is sold to Huta Katowice.
Case-2: All save COG is utilized for generation of electricity by installing a Co-generation system with gas turbine, steam turbine and waste heat boiler.
Case-3: 10,000 Nm3/hr from the saved COG is utilized for generation of electricity which corresponds to 168 million KWH/year currently bought from the Polish Electric Authority and the balance of COG is sold to Huta Katowice at the same price.

According to the following comparison **Table 5.9** for each case, Case-1 is the most feasible even if COG is sold to Huta Katowice at a low price. Case-2 requires a high investment cost generating too much power, and therefore this case is out of consideration. Case-3 results in the loss of about one million USD per year in comparison with Case-1. Furthermore, for Cases 2 and 3, the gas turbine generator should be shut down for maintenance for about one month once a year. During this maintenance period electric power must be bought from outside PC and COG should be sold to Huta Katowice. This is impractrical, and therefore one standby generator would be required. As the result, Cases 2 and 3 require higher investment cost and higher electric power consumption.

Table 5.9 Case studies

	Case-1	Case-2	Case-3
COG for Electricity	0	86,700 Nm^3/H	10,000Nm^3/H
Inventment Cost	0	230x10^6USD	27x10^6US$
Generated Electricity	0 (168x10^6kwh/Y) (bought from outside PC)	1,600x10^6kwh/Y	168x10^6kwh/Y
Unit Cost for Electricity	0.0278$/kwh	-	0.0342$/kwh
Cost / Year	4.67x$10^6$$/Y	-	5.75x$10^6$$/Y

5.2.8 Review for the existing quality control system

The following four factors are essential for the quality control of metallurgical coke.

1) Checking the physical properties of the coal at every delivery from each coal mine and prior to charging to the coke oven.
2) Setting the blending ratio of the coal depending on those physical properties.
3) Understanding the relationship between the various operating conditions such as coking time, soaking time, temperature of coke oven, etc., and coke quality.
4) Feedback to the above items 2) and 3) according to the analysis of coke production.

According to **Table 5.10 and Table 5.11,** both the frequency and the items of analysis in Przyjazn are well kept, to the same extent as at a Japanese coke plant.

Table 5.12 shows that the standard quality of coke produced in Przyjazn is better than at Hoogovens (Belgium) and KN due to a coke strength of M40 and the content of ash and sulphur. This good coke quality follows from the good grade of coal used as the raw material.

However a more severe quality control system should still be introduced, considering the following future requirements:

1)The production cost can be reduced through using cheap non-coking coal as one of raw materials.

2) When coke is exported to Western countries in future, the coke strength index after reaction (CSR), which is not yet applied in Poland, should be applied for the quality control of coke.

In this new quality control system, the following is required:

1) In the case of blending non-coking coal with coking coal, new parameters such as maximum fluidity, atomic ratio in coal (C,H,O), etc., should be introduced in order to decide the optimum blending ratio.

2) A grade of coal is distributed in a wide range for non coking coal so that the sampling frequency and sampling volume should be reconsidered.

3) As the operating conditions of the coke oven effects the CSR greatly, it should be studied in detail for the relation between operating conditions such as coke oven temperature, coking time, soaking time, etc , and CSR.

Finally, the present quality control system in PRZYJZAN should be reconsidered including the control method of operation of the coke oven (refer to Automatic Combustion Control System), in the case that non-coking coal is blended as a raw material and coke is exported to a worldwide market.

TABLE - 5.10
Coal sampling and analysis in PC

Coal	Sampling				Analysis
	Point	Frequency	Sample Volume	Method	Item
Receiving Coal	Feeding device under rotary tippler	Each delivery	10 - 15 kg (16 - 25 primary samples of 0.6kg each)	Manual	H_2O A^d (ash, dry) S^d (sulphur total, dry) V^{daf} (volatile matters, dry ash free) RI (Roga Index) Arnou-Audibert dilatations
Coal Blend Components	Storage / Dosing Silo discharge	During dosing (period not shorter than 45min) for each type of coal	15 - 25 kg	Manual	H_2O A^d V^{daf} Size (percentage of grains less then 3 min) SI - Swelling Index
Charging Coal	Mixing Unit (from chute)	same as above	15 - 25 kg	Manual	same as above

TABLE -5.11
Coke sampling and analysis in Przyjazn

	Sampling				Analysis
	Point	Frequency	Sampling volume (kg / time)	Method	Items
for Katowice Steel	BC No. 1135,1136	1 per shift	360 kg (primary samples)	Manual	M30, M40 H_2O VM Ash S P
Others	Loading B / C in No. 210	Each dispatch	360 kg (primary samples)	Manual	Same as above M40

TABLE - 5.12

Comparison table for standard specification of coke

	Strength of Coke			Ash^d (%)	VM^d (%)	S^d (%)	P^d (%)	H_2O (%)
	M10	M40	M30					
Note-1 Hoogovens Standard	(6.5)	(76)	–	10.0±0.5	0.3-0.55	0.6-0.7 (Ave 0.65)	–	4-6 %
PRZYJAZN Export Standard	6.2-6.8 (Ave 6.4)	78-79.8 (Ave 79.2)	88-89.6 (Ave 89.0)	9.5-10.0 (Ave 9.6)	0.5-0.8 (Ave 0.7)	0.55-0.7 (Ave 0.6)	0.058-0.065 (0.06)	–
PRZYJAZN Domestic Standard	6.2-6.8 (6.4)	–	87-89.6 (89.0)	9.5-10.3 (9.8)	0.5-0.8 (0.7)	〃 (〃)	〃 (〃)	–
NOTE-2 KN Standard	–	(75.4-75.5) (Ave 75.6)	–	11.3-11.43 (Ave 11.39)	0.32-0.52 (Ave 0.37)	0.48-0.51 (0.49)	0.03-0.04 (0.035)	–

NOTE-1:M10 is converted from Irsid 10 (French Standard)
NOTE-2:Monthly average record in KC. M40 is converted from JIS standard.
NOTE-3:M10 is DIN standard and smaller value shows more coke strength (high quality).
M40 is also DIN and higher value shows more coke strength.
M30 is Poland standard.

5.2.9 Review for computerization

There are two systems for computerization. One is for the management system and the other is for a process computer control system.

1. Management computer system

At PC, personal computers have been used for the following;

1) Salary and working conditions such as working hours, holidays, etc. for employees
2) Control of the fixed assets
3) Production status

In some cases, the calculation centre at Huta Katowice is utilized for large jobs. However PC is now going to introduce the Super Personal Computer System (COMPAQ SYSTEM PRO 486/33 MHZ) for covering the general accounting system with the establishment of a network system.

As the cokery has a relatively simple array of products, it is possible to modernize the management system such as personal administration, labour cost management and accounting, including distribution management and production control, as well as the fixed asset control system. Such a management system can be established by management at PC, taking into consideration there culture, customs, environmental work conditions and their accounting system.

2. Process computer control system

Przyjazn Cokery was originally designed without a computer control system. Therefore it is impossible to introduce computer control for the whole plant at once.
From an economical and quality control point of view, we are recommending to introduce computer control systems for the following units:

1) Automatic bucket operation
2) CDQ crane automatic operation
3) Automatic combustion control system

CHAPTER 6

RATIONALIZATION AND MODERNIZATION PLAN

CHAPTER 6. RATIONALIZATION AND MODERNIZATION PLAN

6.1 Basic Concept of Rationalization and Modernization

As stated in the previous chapter, there are four main areas that require attention:

1. Production capacity increase by process upgrading and modernization;

2. Labour cost reduction through upgrading the facilities, organizational efficiency and personnel rationalization through technology transfer from a leading firm in the coke industry;

3. Raw material- and energy-saving, and;

4. Improvement of environmental control.

In order to achieve these targets, new equipment for rationalization and modernization of the cokery will be installed, as well as waste water and emission control facilites. In addition, a reorganized organizational structure and training are to be implemented as detailed hereunder.

6.1.1 Rationalization and Modernization: General

1. Increase of production capacity by improving the production system

This can be performed by introducing a modernized system into the CDQ Facility which will ensure an increase of the production capacity as detailed in **Chapter 7.1**.

2. Excess personnel

Personnel reduction can be made with the introduction of automated equipment and organization and a preventive maintenance system.

It is impossible to modernize this plant up to the level of Japanese coke plants in a short period, therefore it is recommended that the plant be modernized in stages as detailed in the following **Chapter 7.2**, through:

1. Automation & upgrading of the production facilities;
2. Increasing the efficiency of the organization and personnel as well as introducing into the function of organization a modernization and rationalization plan through technology transfer from a leading firm in the coke industry.

As mentioned above, an automated system is indispensable for modernizing a production site, but it has no direct effect upon cost-cutting in the production process. Accordingly, application of two (2) items, namely items 2-5 and 2-6 below, from which a valid result can be expected and also where the production site can be automated is proposed.

3. Raw material and energy saving

Through the introduction of a COG holder and an automatic combustion control system for the coke oven in order to save excess COG for outside sales and through the introduction of coal blending technology to take maximum advantage of lower grade coal for coke production by which an effect can be foreseen as mentioned in **Chapter 7.3.**

4. Improvement of gas emissions and waste water treatment facility

(1) Gas emissions

Through installation of new equipment to decrease the dust discharge from the coke ovens and by improving the efficiency of desulphurization to decrease the emitted concentration of H_2S and SO_2, the tax and penalties currently being paid can be minimized as mentioned in **Chapter 7.4**.

(2) Waste water treatment facility

Through the installation of a new denitrification process, automation system, etc., the final treated water quality can meet as closely as possible the local Polish regulations as mentioned in **Chapter 7.4**.

6.1.2 Summary of Recommended Rationalization and Modernization

The following identification numbers and descriptions are constant throughout this feasibility study for ease of reference. Concerning the estimated costs, **Chapter 6.3**, Cost summary of the rationalization and modernization project.

ID No.	Description	Effect	Scheduled startup
1.	**Increase Production Capacity**		
1-1	Modernization of CDQ Facility	Production cap. increase from 2,210,000 t/y to 2,850,000 t/y	Yr-2 (18th Mth)
2.	**Labour Cost Reduction**		
2-1	Automatic bucket operation	Reduction of 16 operators	Yr-3 (28th Mth)
2-2	CDQ automatic crane operation	Reduction of 40 operators	Yr-3 (28th Mth)
2-3	Automatic combustion control system for coke oven	Reduction of 4 operators and COG fuel saving of 54,600,000 Nm^3/yr	Yr-3 (27th Mth)
2-4	Modernized cleaning device for ascension pipings	Reduction of 30 operators	Yr-2 (21st Mth)
2-5	Industrial television (ITV) system	Reduction of 36 operators	Yr-2 (21st Mth)
2-6	Individual communication system	Labour reduction (included in 2-5)	Yr-2 (21st Mth)

2-7	Metal removal units for conveyor belts	Efficient workability	Yr-2 (14th Mth)
2-8	Improved tar sludge discharge system for tar decanter	Reduction of 2 operators	Yr-2 (19th Mth)
2-9	Deodorant device for tar decanter	Labour reduction (included in 2-8)	Yr-2 (19th Mth)
2-10	Technology transfer and and technical assistance	Reduct. of 698 operators - 240 operators - 458 operators	 Yr-3 (32nd Mth) Yr-4 (42nd Mth)

3. Energy and Raw Material Saving

3-1	Analytical equipment for quality control of coal blending	Raw material cost saving of approx.US$ 1920,000./yr	Yr-2 (17th Mth)
3-2	COG Holder	- COG sales increase of 49,670,000 Nm^3/yr; - Reduction of SO_2 emissions by a decrease of 14.5 t/yr and NOx by a decrease of 17.04 t/yr - Tax and penalty reduction: US$8,000.	Yr-2 (18th Mth)

*Attention is also drawn to Item 2-3 above.

4. Improvement of Environment Control

4-1	Dust collector for machine side of coke oven batteries	- Reduction of dust discharge from 89.2 t/y to 12.9 t/yr - Tax and penalty reduction : US$53,000.	Yr-2 (18th Mth)
4-2	Improvement of low pressure desulphurization facility	- Reduction of SO_2 discharge from 3,030 t/y to 1,345 t/y - Tax and penalty reduction : US$432,000.	Yr-2 (13th Mth)
4-3	Improvement of waste water treatment fsacility	- Reduction of taxes and penalties by improving waste water discharge - Tax and Penalty reduction: US$4,061,000.	Yr-3 (36th Mth)

6.2 Scope of Work and Supply of the Rationalization and Modernization Project.

The scope of work and supply of the rationalization and modernization project, which is the basis of this feasibility study, includes the following:

1. Engineering
2. Procurement of equipment and material (including inspection and transportation)
3. Erection & construction at site (including dispatch of engineers to render technical assistance for the erection and start-up operation)
4. Technological transfer through training

The details of the scope of work and supply are described below.

6.2.1 Engineering

Design engineering work of process, equipment, instrument, electrical, piping, building and construction.

6.2.2 Procurement of Equipment

(1) For all items of local supply/procurement in Poland, the local suppliers' scope shall include "design" and supply of materials as well as fabrication/ manufacturing.

(2) Spare parts: 3% of equipment costs are considered.

(3) The site office will be a temporary facility for carrying out erecton and construction as well as commissioning and shall be provided free of charge.

(4) The local cost and expenses required in Poland include:
- General expenses, e.g., support services for maintenance of an office;
- Erection & construction expenses.
- Materials locally available

These expenses are subject to adjustment according to the actual cost. All expenses quoted are on a direct cost basis only.

(5) The cost and expenses for despatching the contractor's engineers and staff members to the site in Poland covered under ID No. 2-10, as well as erection supervisors for each ID No. listed below shall include the cost and expenses for travel, accommodation, living and absence fee.

(6) It shall be understood that the following equipment specifications are meant to be representative only and are subject to adjustment depending upon available supply and actual cost and includes direct cost only.

All new equipment and materials as well as technical services required for the modernization of the cokery are listed below in the order listed in **Chapter 6.1.2** for ease of reference.

1-1. CDQ 1) Rotary seal valve
2) Bell for charging hole of CDQ

2-1. Automatic bucket operation
2-2. Automatic crane operation
2-3. Automatic combustion control system for coke oven
2-4. Cleaning device for ascension pipings
2-5. Industrial television (ITV) system
2-6. Individual communication system
2-7. Metal removal units
2-8. Tar sludge discharge system for tar decanter
2-9. Deodorant device for tar decanter
2-10. Technology transfer and technical assistance
3-1. Analytical equipment for coal blending
3-2. COG holder
4-1. Dust collector for machine side of coke oven batteries
4-2. H_2S absorber in desulphurization facility
4-3. Waste water treatment

1. Increase of Production Capacity

1-1 To increase the coke production capacity through **modernization of the CDQ facility** (8 sets): < ID No. 1-1 >

(1) i) To increase the discharge quantity from 40 t/hr x 2 x 2 batteries = 160 t/hr to (60 t/hr + 40 t/hr) x 2 batteries = 200 t/hr or 60 t/hr x 2 x 2 batteries = 240 t/hr by introducing an updated model of the **rotary seal valve** having a unit discharge capacity of 60 t/hr. Refer to **attachment 1-1-1** Modernization of CDQ Facility Diagram.

ii) Ensure steady and high production rates of operation of the COB by the introduction of a "**Bell**" in the Charging Hole of the CDQ to level out the coke surface in the CDQ chamber resulting in a homogenized circulation gas stream.

(2) Thus a production capacity increase from 2,210,000 t/y to 2,850,000 t/y is expected.

(3) Outline of device & specifications

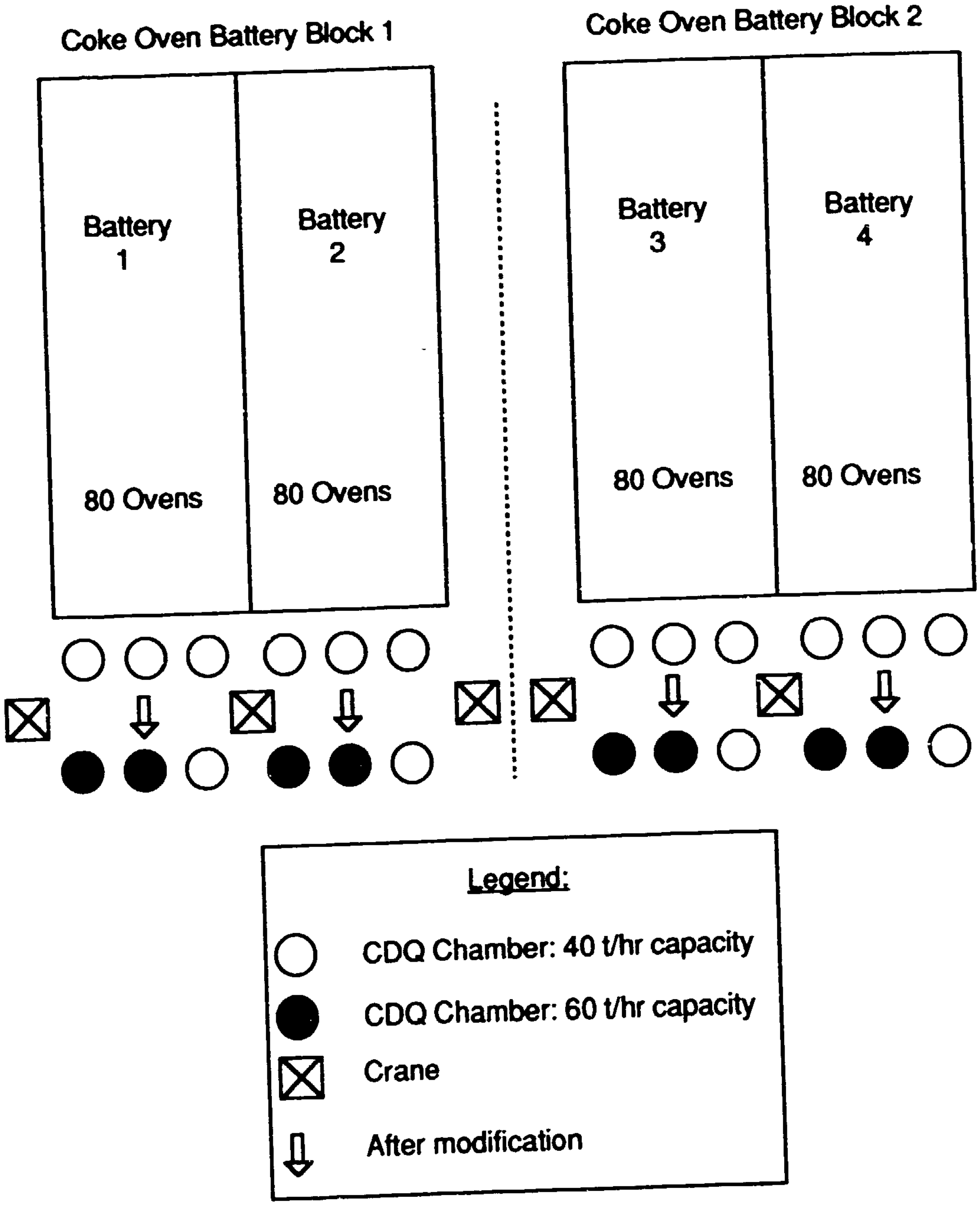
a)	Rotary seal valve; 60 t/hr, electric motor driven	8 pcs
b)	Vibrating feeder; 60 t/hr, electric vibrator	8 pcs
c)	Slide gate valve	8 pcs
d)	Bell for charging hole (Patented item, owned by Nippon Steel Corp.)	8 pcs

Notes:

a), b), and c): To be installed in the discharge equipment of the CDQ. As per **Attachment 1-1-2** CDQ equipment diagram.

d): To be installed in the charge equipment of the CDQ. As per **Attachment 1-1-2** CDQ equipment diagram.

1-1-1 Modernization of CDQ Facility



Modification plans include having two CDQ chambers in operation per battery with the third on standby. Therefore the modified total operational capacity will vary from 200 - 240 t/hr per block against the existing 160 t/hr.

1-1-2 CDQ
Equipment
Diagram

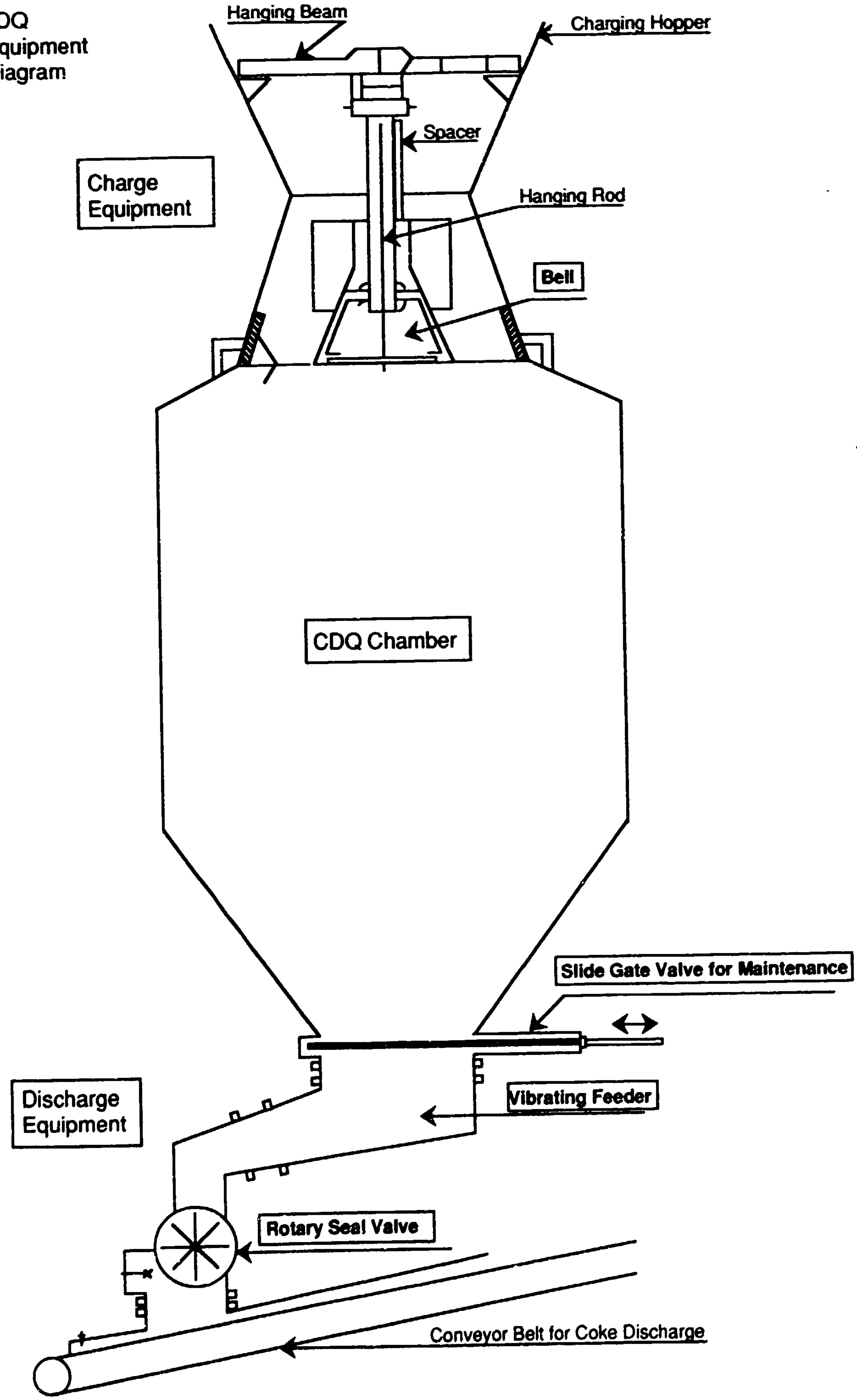


Diagram is representational only: Not to scale

2. Labour Cost Reduction

2-1 To introduce **Automatic Bucket Operation** for the bucket cars (6 sets): < ID No. 2-1 >

(1) To provide 6 sets of automatic bucket operation systems using a programmable logic controller (PLC) and 2 sets of position/speed detectors with inductive radio cables.

(2) Thus automatic operation of the bucket cars is established, reducing the labour requirement by 16 operators.

(3) Outline of device & specifications

For two of the coke oven blocks there are in total 3 sets/block x 2 blocks = 6 sets of Buckets which are currently operated manually.

The bucket cars can be operated automatically according to a programmed schedule by installing an inductive radio system and computer control system.

6 sets of automatic bucket operation systems using a programmable logic controller (PLC) and 2 sets of position/speed detectors with inductive radio cables. As per **Attachments 2-1-1 and 2-1-2.**

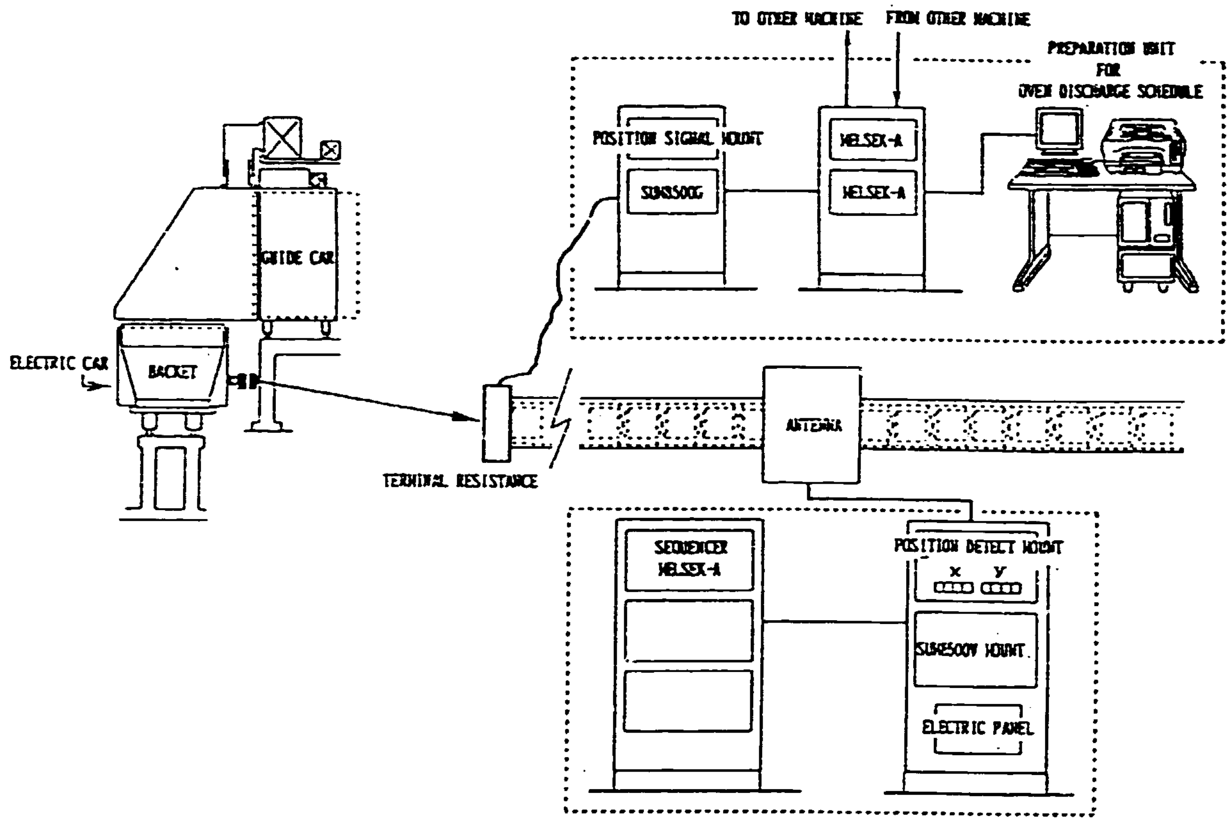
(4) Required equipment

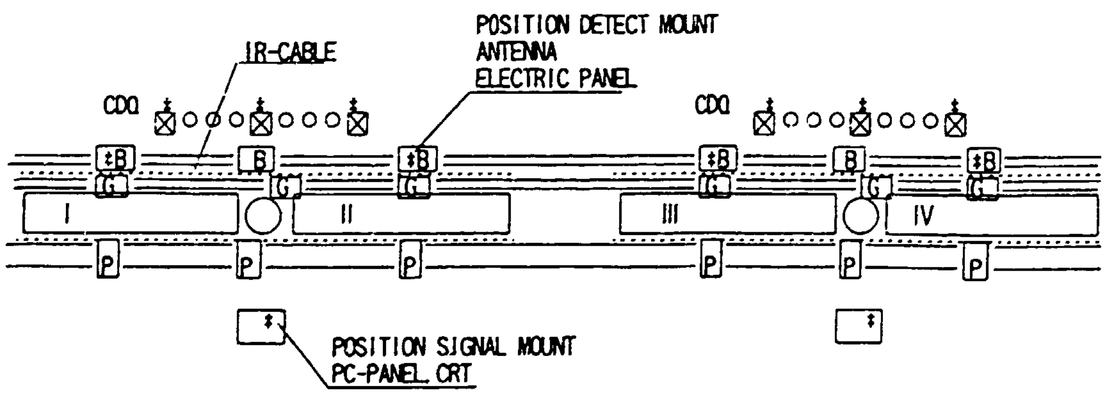
Automation devices, incl. motors, brakes & other necessary accessories for the existing bucket cars	6 sets
Computerized operating system (hardware & software)	6 sets
Programmable logic controllers with CRT display	6 sets
Position detectors incl. IR cable:	2 sets

Note:

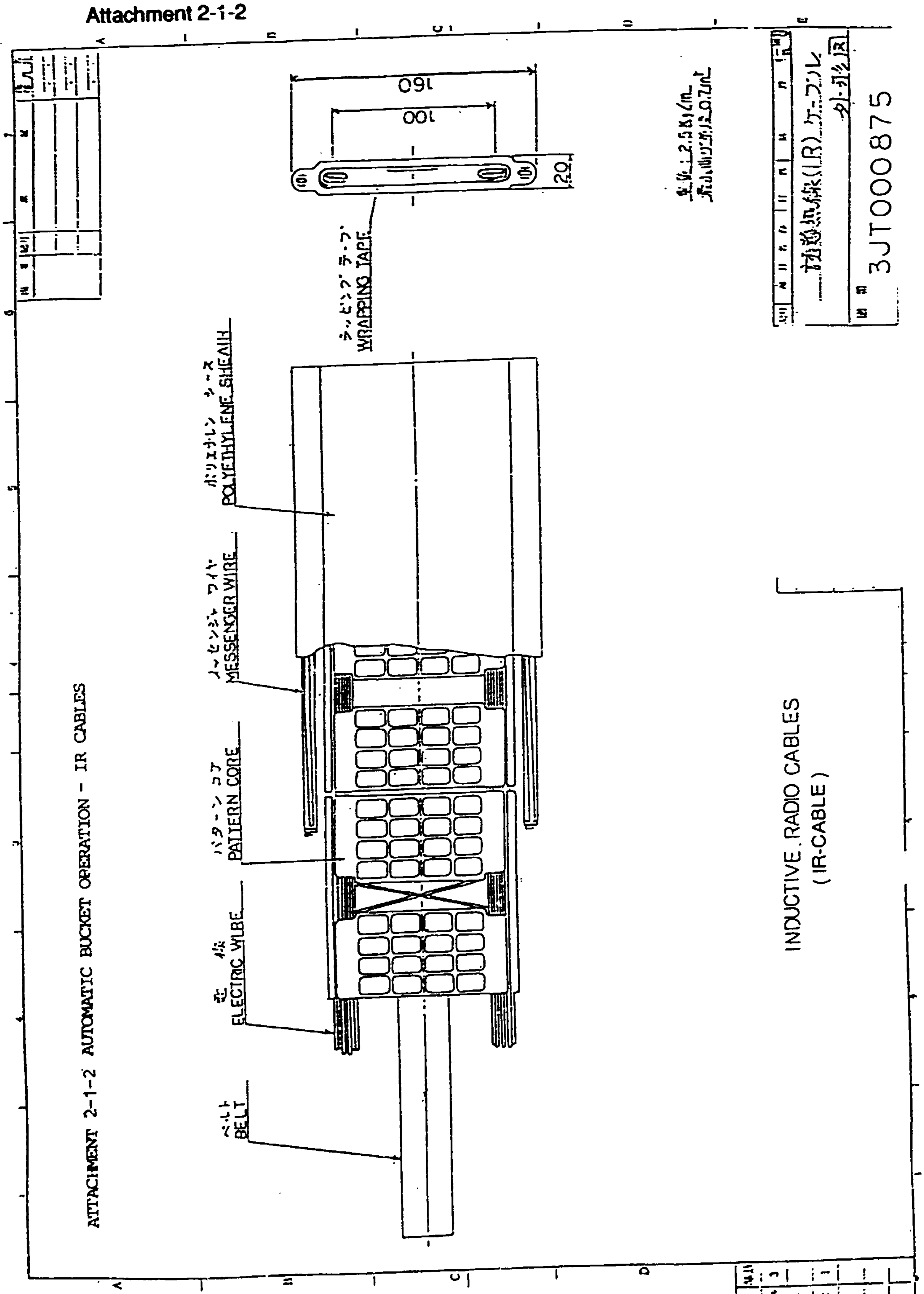
1. The total system is shown in the sketch for 2-2: Automatic crane operation.
2. This system is connected to the same software together with the automatic crane operation as well as the automatic combustion control system.

Attachment 2-1-1





Attachment 2-1-2



2-2 To introduce **automatic crane operation** systems in the CDQ (6 sets): < ID No. 2-2 >

(1) To provide 6 sets of automatic crane operation systems using a PLC and 2 sets of control centres.

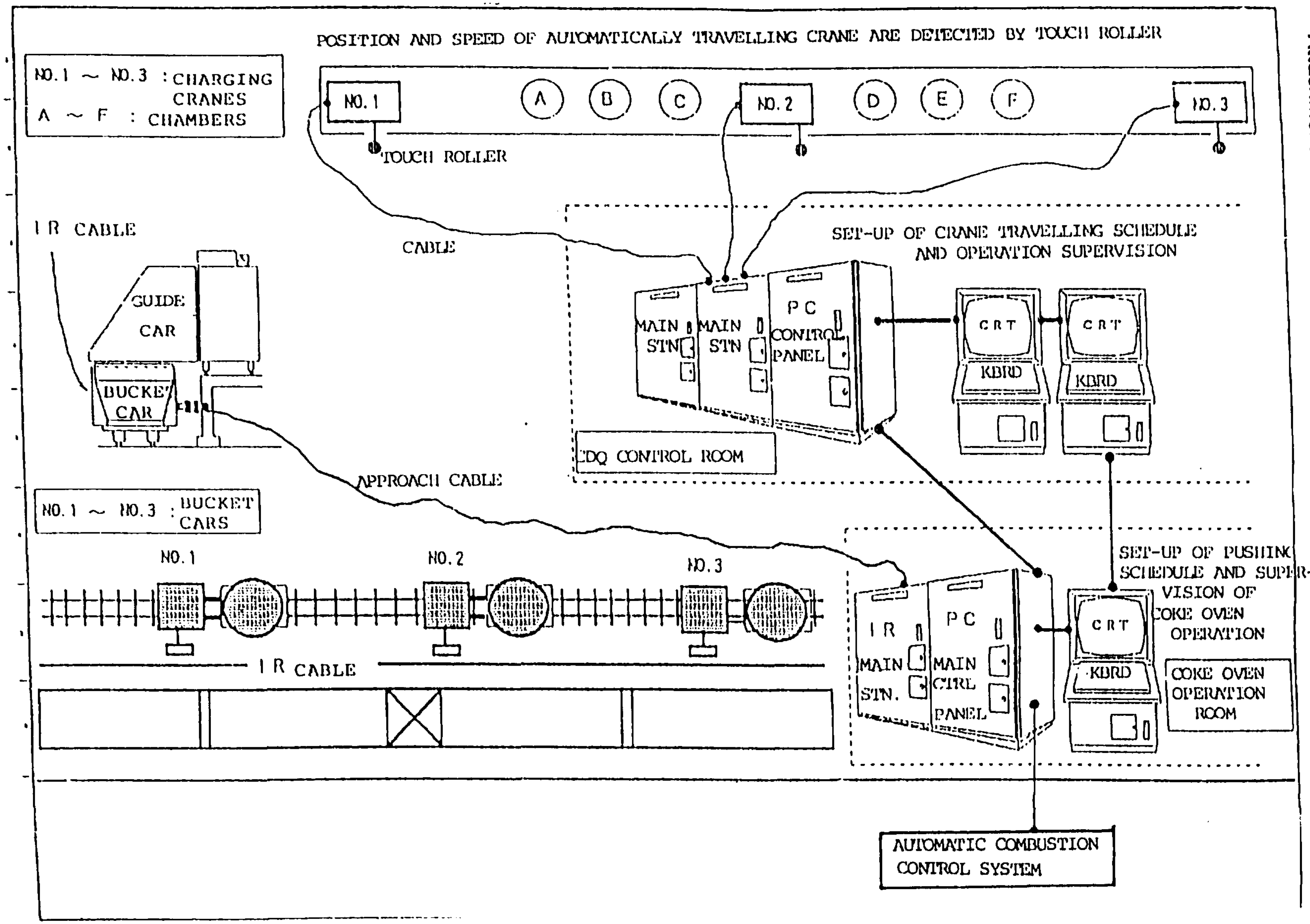
(2) Thus automatic operation of the CDQ Cranes is established, reducing the labour requirement by 40 operators.

(3) Outline of device & specifications

3 sets per coke oven block x 2 blocks = which are currently operated manually, to which 6 sets of automatic crane operation systems using a PLC and 2 sets of control centres will be installed as follows;	6 sets of cranes
PC Panel with CRT display, hardware & software	1 pc
Limit switch	20 pcs x 6
Touch roller type speed and position detector	6 pcs

Note: This system is connected to the same software together with the automatic bucket operation as well as the automatic combustion control system.

Attachment 2-2



2-3 To introduce an **automatic combustion control system** into the coke oven batteries to establish optimum coke oven control by means of automatic measurement of coke oven temperature and automatic determination of coal carbonization completion depending on the target coking time: < ID No. 2-3 >

(1) To provide 2 sets of PLC systems and detective sensors as well as control valves.

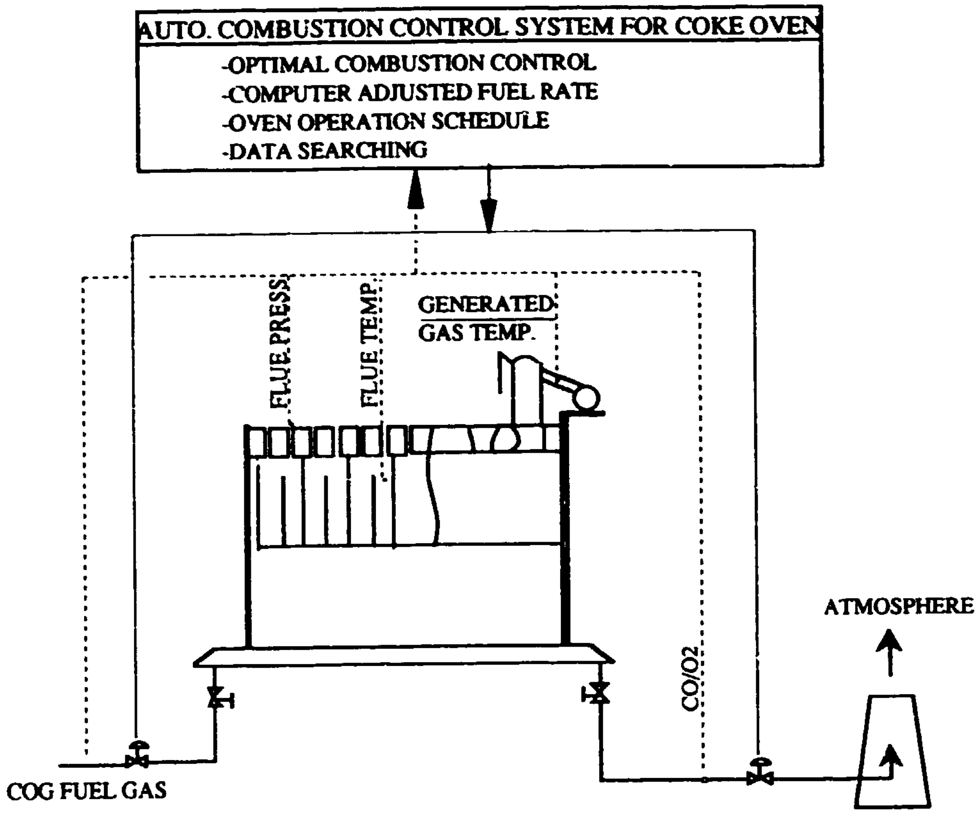
(2) Thus optimum operation of the COB is established, reducing the labour requirement by 4 operators and a 54,600,000 Nm^3/yr COG (6200 Nm^3/yr) fuel saving is expected.

(3) Outline of device & specifications

Fuel gas is automatically controlled by PLC according to a target carbonization time measuring and adjusting the oven temperature and flameout.

In order to attain the targetted time of coking carbonization, the target temperature of the flue will be indexed, determined by the operational conditions and specific coal properties. After the temperature at the head of the flue is measured, the fuel gas flow will be adjusted for minimizing the difference between the indexed temperature and the actual measured temperature, and the flue draft as well as the oxygen content in the flue gas will be controlled for optimal combustion.

In addition, operational guidance will be given through a computer readout giving the indexed figures for fuel gas adjustment in the event that the actual coal carbonization time exceeds the preset values.



PLC	2 sets
CPU panel	
CRT console	
Remote I/O panel with software	
Combustion control and measuring equipment	
Thermocouple	160 pcs
Gas pressure gauge	4 pcs
Flow meter	4 pcs
Calorimeter	1 pc
Oxygen meter	8 pcs
Damper and control unit	4 pcs

Note: 1. This system is connected to the same software together with the automatic crane operation as well as the automatic bucket operaton system. The total system is shown in the sketch for 2-2: Automatic Crane Operation.

2-4 To introduce a modernized **cleaning device for ascension pipings**:
< ID No. 2-4 >

(1) i) To change from the existing ammonia liquor seal liquid system mounted on the upper part of the ascension piping, to the industrial Water circulating system by providing with vessels, pumps and pipings.

ii) To improve the present cleaning device for the Ascension Pipings by relocating 640 pcs. of a new type of special nozzles. Refer to Attachment 2-4.

(2) Thus a minimization of cleaning frequencies is expected and the labour requirement can be reduced by 30 operators.

(3) Outline of device & specifications

i) Industrial water circulation system

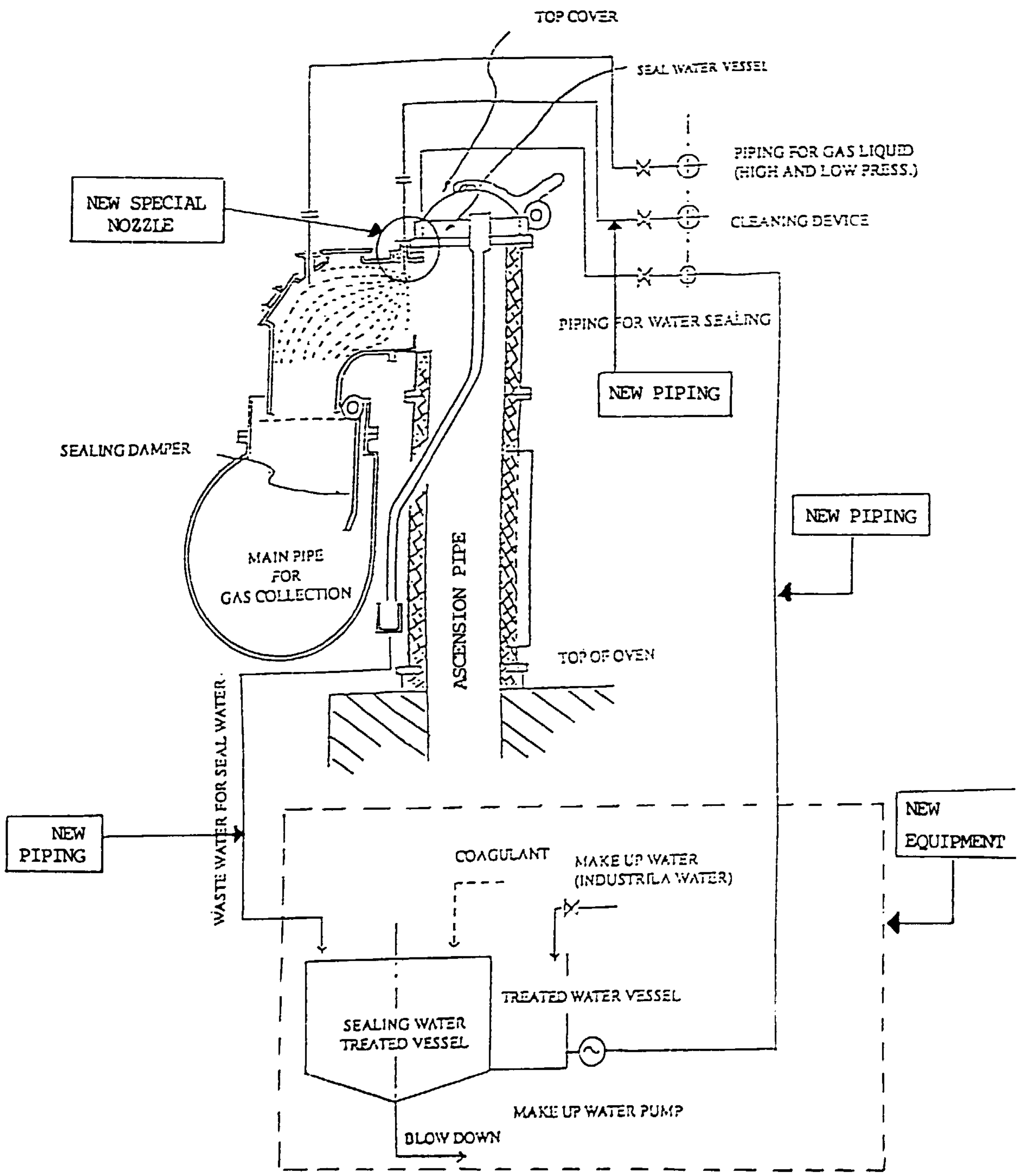
Pumps: 40m^3/h x 30m Head (Motor: 7.5kw)	6 sets
Water tank	2 sets

ii) Improved cleaning system

Specia' ozzle and piping	640 pcs

Attachment 2-4

CLEANING DEVICE FOR BENT PORTION
AND
WATER CIRCULATION SYSTEM
FOR
TOP COVER WATER SEALING



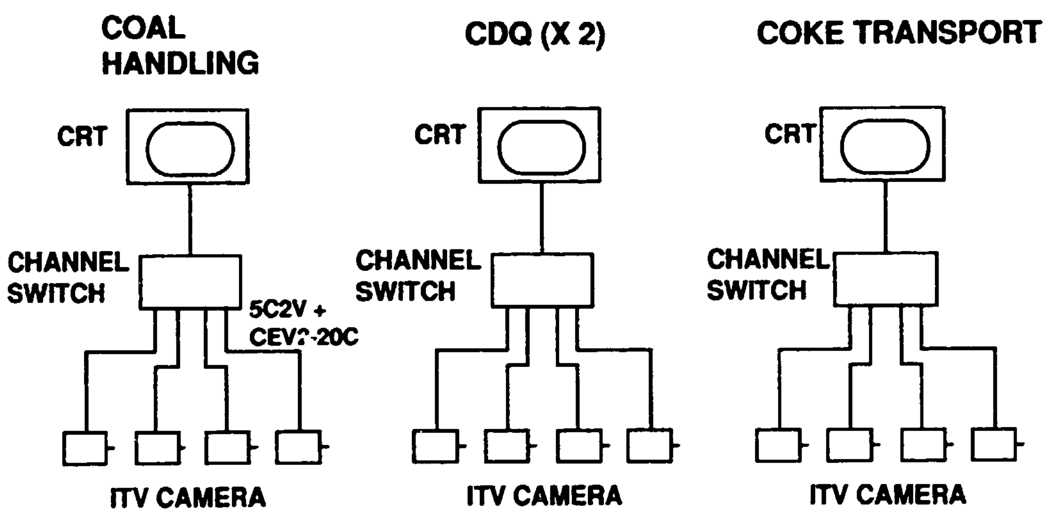
2-5 To introduce an **industrial television (ITV) system** for the four major work sites of the plant: < ID No. 2-5 >

(1) To provide 16 ITV cameras at the major work sites and 4 monitors in the control rooms.

(2) Thus the existing operators for supervising the major work sites are expected to be cut completely. Together with item 2-6 below, a labour reduction of 36 operators is expected in total.

(3) Outline of device & specifications

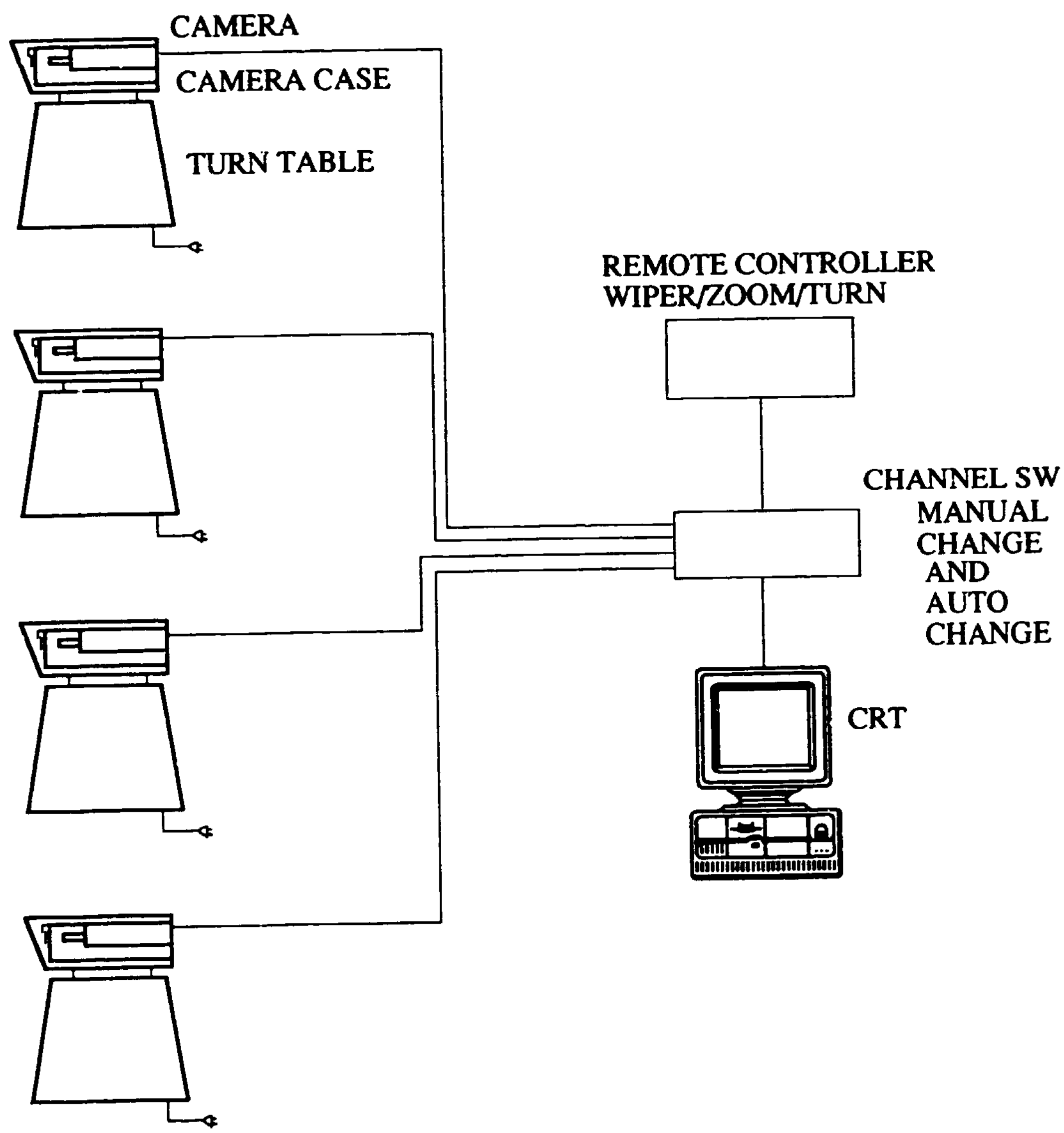
Four sets of ITVs have been newly installed to monitor and supervise the coal handling, CDQ, and coke transport sections from a remote location for ensuring smooth operation in each area. The ITV will reduce the necessity for operators currently employed for this function. Refer to the system configuration attached.



ITV System	4 systems
ITV camera with automatic zoom lens:	4 units
Channel switch:	1 unit
Monitor:	1 unit

ATTACHMENT - 2-5

ITV-SYSTEM CONFIGURATION



2-6 To introduce an **individual communication system** between the local work sites and the control rooms: < ID No. 2-6 >

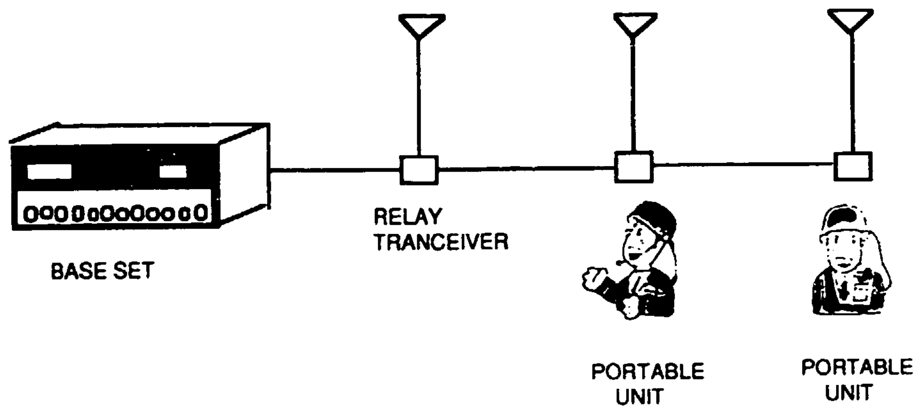
(1) To provide with 3 radio stations and in total 100 portable radio sets.

(2) Thus the existing operators allocated for each local work site can be reduced by introducing a flexible allocation method thereby reducing 36 operators in total as included in item 2-5 above.

(3) Outline of device & specifications

Outline of the system configuration is as below:

Equipment	Coal handling	Gas refinery	CDQ & Coke transport
Remote controller	1 set	2 sets	3 sets
Base set	3 sets	3 sets	3 sets
Relay transceiver	14 sets	14 sets	20 sets
Portable unit	30 sets	30 sets	40 sets



The base set is installed in a central control room. Relay transceivers are placed 100 to 200 meters apart on the site to cover the required service area.

2-7 To introduce a conveyor belt protective device, i.e., **metal removal units**: < ID No. 2-7 >

(1) To provide with metal removal units for both the coal and coke conveyor belts.

(2) Thus smooth operation is expected and repair and maintenance work can be reduced.

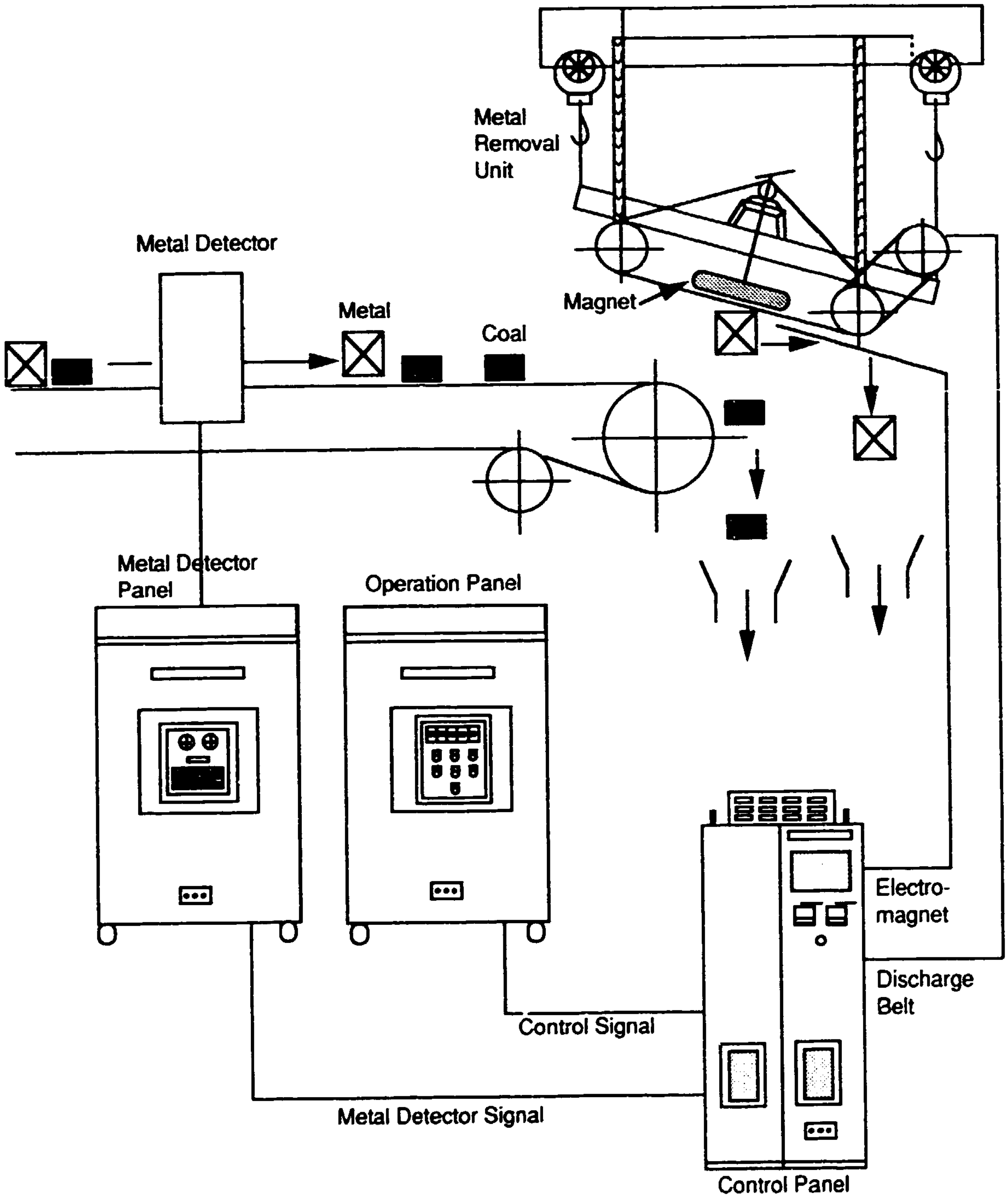
(3) Outline of device and specifications

The following conveyor belt protective devices are newly installed for the existing conveyor belt system for the coal handling and coke transportation sections:

Metal removal units:	2 sets
Metal detector	2 sets
Local switch stand:	2 sets

One metal removal unit is to be used for two conveyor belts on manual setting over the operating conveyor while the other conveyor is on standby status.

Attachment 2-7 Metal Removal Unit



2-8 To introduce an improved **tar sludge discharge system for the tar decanter**: < ID No. 2-8 >

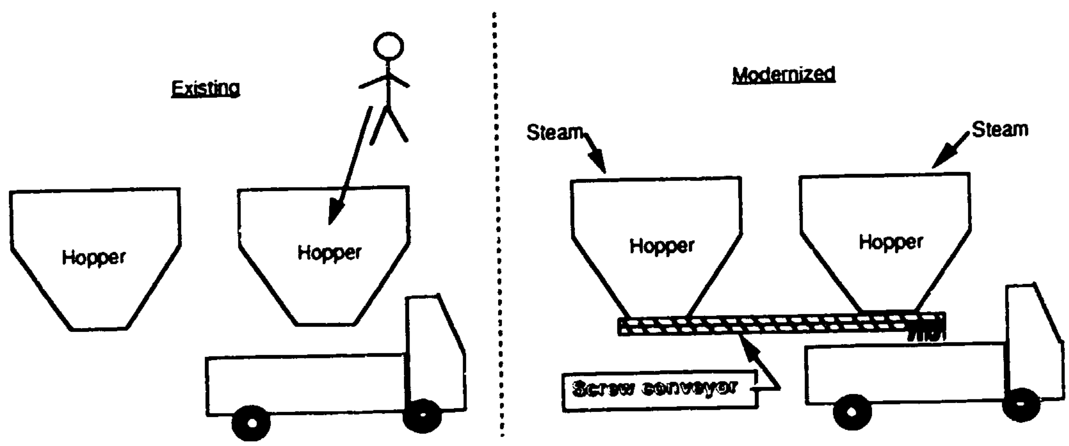
(1) To change from the existing manual tar discharge from the tar sludge hopper of the decanter to an updated hopper, and to provide discharge equipment including 4 Screw Conveyors.

(2) Thus the number of operators for tar sludge discharge can be reduced in total by two together with 2-9 below.

(3) Outline of device & Specifications

Presently, tar sludge accumulated on the decanter floor is scraped and stored in the tar sludge hopper. Manually loading the tar sludge from the hopper to a truck is inconvenient due to the height, location and odour emanating from the hopper. Therefore tar sludge discharge equipment consisting of four rotating boring screws are to be provided.

Screw conveyors	4 sets
Hopper (modification)	4 sets
Steam piping	4 sets



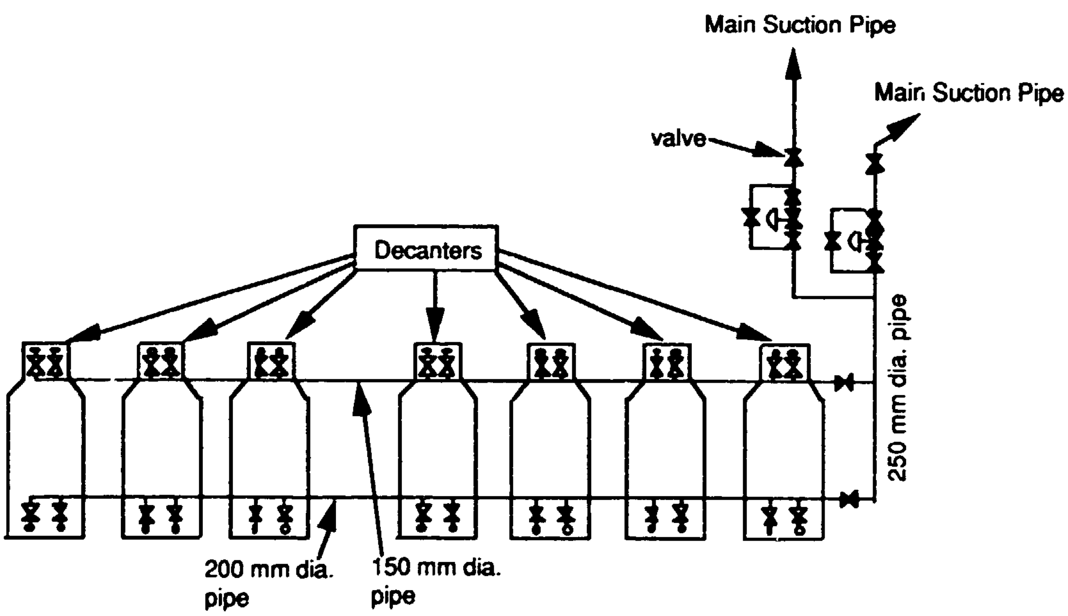
2-9 To introduce a **deodorant device for the tar decanter**:
< ID No. 2-9 >

(1) To change the decanter to a closed type and to provide tar vapor piping for connection to the COB main suction pipe.

(2) Thus deodorization at the decanter work site and comfortable working conditions will be established.

(3) Outline of device & specifications

To close the decanter by blinding it with steel plates and provide tar vapor piping from the decanter to the COB main suction pipe as shown in the diagram below, since the existing decanter is open, thus releasing undesirable gas and odour.



2-10 To provide **technology transfer and technical assistance**:
< ID No. 2-10 >

(1) i) For the purpose of improvement of plant control, the contractor will transfer its updated technology with regard to plant control and its maintenance and plant organization concepts, where PC engineers including those at management level are invited to the contractor's as in Step1, to dispatch the Contractor's engineers to the PC as Step 2-1 and Step 2-2, and again to invite PC engineers to the contractor's as Step 3. < ID No. 2-10 (1) >

ii) For the purpose of improvement of plant operation, the contractor will transfer its updated technology with regard to plant operation as well as raw material control, where PC engineers are invited to the contractor's as Step 1, to dispatch the contractor's engineers to PC as Step 2-1 and Step 2-2 and again to invite PC engineers to the contractor's as in Step 3-1 and Step 3-2. < ID No 2-10 (2) >

iii) For the purpose of assisting the personnel of PC to practice the above i) and ii) on the modernization project, the contractor's are to dispatch their engineers to PC after start-up of the modernization Project. This forms a part of the on the job training cost. < ID No. 2-10 (3) >

(2) Thus, mainly as the result of the technology transfers through the above (i) (ii) and (iii), the present organization of PC will be reduced by 698 personnel.

(3) Time Schedule

Please refer to time schedule, **Attach. 2-10-1**.

(4) The new organizational chart is shown in Fig. 7.2.2 which is to be expected and established during/after the technology transfer.

(5) Detailed Scheduie/Plan

(A) plant control

The organizational system and allottment of personnel in PC are arranged as shown in **Attach. 2-10-2**. Similarly and through reference to the organizational structure of PC, the organizational structure of the Kansai Coke and Chemicals Co., Ltd., (hereafter referred to as KC), is shown in **Attach 2-10-3**.

Note: general affairs and administration departments cannot be compared due to the fact that national circumstances and the sales organization system in Poland differs substantially from Japan's. Therefore, a counter plan for the production and maintenance departments has been the object of this technology transfer.

The distinct difference in the allottment of personnel at both PC and KC is due to the organization of the Maintenance Department. At KC, the Operations Department does not hold maintenance personnel for maintaining stable operation at each facility. KC has adopted a PM (Preventive Maintenance) system and/or TBM (Time Based Maintenance) system which enables low cost maintenance and requires few personnel.

The TBM and/or PM system is based on the prediction of frequency of trouble for each of the equipment through operational experience. According to these predictions, the interval of inspection for each equipment can be set. Therefore, effective maintenance work can take place based on the result of inspections.

Recently, further advanced maintenance systems have been adopted aiming for more careful maintenance and a reduction of labor which are called CBM (Condition Based Maintenance) and TPM (Total Preventive Maintenance). CBM is a ranking sytem where attention is given based according to the level of importance of the function for each of the equipment to the continued operation of the plant, as well as the equipment's record of dependability. TPM is based on the premise of increased communication between the operations and maintenance departments. In the operations department, operators are well-versed in the mechanisms of the machinery. Should a problem arise, they have the ability to take emergency measures and subsequently inform the maintenance department the nature of the problem.

At PC, they already have kept up good record-keeping practices and have accumulated a lot of data on the equipment, such as the points to be repaired, the frequency of repair work, the points to be lubricated and the frequency of lubrication, etc. Therefore, through their operational experience and record-keeping system already in place, it is not necessary to continuously monitor equipment nor have a maintenance crew on standby for the entire twenty-four hour shift on the off-chance that a problem might arise. However, this is the situation at present. As mentioned, the basic system is already in place, and after an initial transition period as outlined in the following schedule, either a TBM, CBM or TPM system can be easily transferred and adopted.

In order to lessen the potential for problems arising, we intend to introduce the system by conducting a plant tour and by giving practical experience at a modernized plant, mainly through the following stages:

Step 1: To establish the actual condition of operation through observing the modernized plant.

Number of persons:	Five (5) engineers including management level, from the principal members of PC and from PC's Production Department.
Period:	Ten (10) days
Place:	Contractor's

Step 2-1 and 2-2: Improvement plan and training at PC

No. of trainers:	Five (5)
Period:	Thirty (30) days
Place:	PC, Poland

Step 3: Study & training at Contractor's plant

Number of persons:	Six (6) manangers and/or engineers from PC's Production Department.
Period:	Fifteen (15) days
Place:	Contractor's

(B) Improvement of Plant Operation

The operation system at PC has been handled by allotting operators to each equipment station. In order to rationalize by decreasing the number of personnel, the operation system should be mechanized, automated and finally, centralized. In short, a system should be adopted whereby operators periodically patrol the equipment stations.

Basically, this system operates optimally when the currently decentralized equipment, such as the coal and gas refinery facilities, are concentrated in one area in order to carry out efficient and effective operation. Such steps toward modernization of the production process may seem radical, but they are necessary for the plant's modernization up to the standard level of efficiency.

Therefore, when the above mentioned system is introduced, its implementation will depend on the receptivity of those who will be operating within such a system. We intend to promote this introduction by conducting a plant tour and through practical experience at a modernized plant, as follows:

Step 1: To establish the actual conditions of operation through observing the modernized plant

Number of people:	Nine (9) engineers from the Production Dept. of PC
Period:	Ten (10) days
Place:	Contractor's

Step 2-1
and 2-2: Improvement and Training at the plant site of PC

No. of trainers:	Six (6)
Period:	Twenty (20) days
Place:	PC, Poland

Step 3-1
and 3-2: Training at the Contractor's plant for the engineers and foremen of PC.

No. of trainees from PC:	Eighteen (18)
Period:	Fifteen (15) days
Place:	Contractor's

(C) On the Job Training at the Modernization Project.

Six (6) engineers x 2, in total 12 engineers, will be dispatched to train PC personnel at the plant site.

This training will cover the improvement of environmental protection through the proper operation and maintenance of the facilities such as the Waste Water Treatment Facility, Coal Handling Area, Coke Oven Area, etc.

TIME SCHEDULE

Attach. 2-10-1

For Technology Transfer and Technical Assistance

ID NO	ITEM	1												2												3											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
2-10	Technology Transfer and Technical Assistance																																				
2-10 (1)	For the Purpose of Improvement of Plant Control									STEP-1 ←-→ (5)						STEP 2-1 ←→ (2)				STEP 2-2 ←→ (3)						STEP 3 ←-→ (3)											
2-10 (2)	For the Purpose of Improvement of Plant Operation							STEP 1 ←-→ (3)				STEP 2-1 ←→ (3)			STEP 3-1 ←-→ (6)						STEP 2-2 ←→ (6)			STEP 3-2 ←-→ (6)													
2-10 (3)	On the Job Training																													←→ (6)		←→ (6)					

NOTES
- ←→ : Engineers to be dispatched to PRZYJAZN
- ←-→ : Engineers to be dispatched from PRZYJAZN

Attach. 2-10-2 Organization at Przyjazn Coke Plant (White / Blue = 470 / 2,810 = 3,280)

General Manager

— (Direct Control Dept.) (56 / 136=192)
President's Office, Lawyer, Unit of Internal Control,
Div. of Work Organization, Military Unit, Worker's Board

— (Administration Dept.) (50 / 5=55)
Admin. Office, Financial Unit, Salary Acct'g. Unit (Payroll),
Social Service, Vice-Main Accountant, Materials Acct'g. Unit,
Main Acct'g. Unit, Cost Acct'g. Unit, Quantity Survey Team

— Ecconomics & Trade Dept. (88 / 447=535)
Admin. Office, Div. of Planning Materlals, Trade Office,
Div. of Economics & Work Motivation, Office of Supplies, Dept.
of Railway Transport, Car Transport, Dept. of Storerooms

— (Production & Technical Dept.) (276 / 2, 222=2,498)
Vice-President of Production & Technical Dept.

Section name		Operation		Maintenance		Total
		Day	Shift	Day	Shift	
Head of Production Adimin. Office Operator	W					7
Coal Handling	W	17				17
	B	2	35 x 4=140	M 36 E 18	3 x 4=12 3 x 4=12	220
		(Total : 142)		(Total : 78)		
Coke Oven	W	24				24
	B	77	60x4=240	M 74 E 28	6 x 4=24 4 x 4=16	459
		(Total : 317)		(Total : 142)		
CDQ	W	33				33
	B	4	44 x 4=176	M 73 E 31	5 x 4=20 5 x 4=20	324
		(Total : 180)		(Total : 144)		

Vice-President of Production & Technical Dept.

Section Name		Opration		Maintenance		Total
		Day	Shft	Day	Shift	
Gas Refinery	W	23				23
	B		42x4=168 (Total 168)	M 64 E 18	3x4=12 3x4=12 (Total 106)	274
Environmental Unit	W	5				5
	B		(Total 25)		(Total 89[illegible])	114
Quality Control						67
Mech. Maint.	W					65
	B					281
Energy (Elec.) Maint.	W					53
	B					446
Others ②						85
Total ③	W					275
	B					2,222

① Including Analitical Div.
② Safety & Hygiene Div., Fire Brigade Div. and Technology & Progress Eng'g Div.
③ Excluding vice-President of Production & Technical Dept.

Attach. 2-10-3 Organization at KN Plant (Plant: White / Blue = 87 / 612 = Approx. 700)

Organization of Head Office = (Head Office + Laboratory) = (Approx. 90 / 15)

General Manager 87 / 319 (+300)
- Administration Dept. (22 / 4) — (General Affairs, Sales, Purchasing, Labour)
- Safety & Development Dept. (15 / 3)
- Production Dept. and Construction & Maintenance Dept. (50 / 312 (+300))

Section name		Operation: Shift duty	Operation: Normal duty	Maintenance: Shift duty	Maintenance: Normal duty	Total
Equipment maintenance	W				10 + 12	85
	B			2 x 4	52 + 3 (Total : 63)	
Maintenance, construction, transportation & fire-fighting by cooperative companies			(Abt. 70)		(Abt. 230)	(300)
* Coal Handling	W		3			41
	B	7 x 4	10 (Total : 38)			
* Coke Oven and CDQ	W		6			119
	B	20 x 4	33 (Total : 113)			
* Gas Refinery	W		5			66
	B	13 x 4	9 (Total : 61)			
Production Control * Analysis	W		12 + 7			43
	B	3 x 4	24 (Total : 36)			
Total 4 Production Sections		43 x 4 + 76 = 248			0	—

3. Energy and Raw Material saving

3-1 To introduce **analytical equipment for quality control of coal blending**: < ID No. 3-1 >

(1) In order to enable the use of cheap and slightly coking coal as a raw material by means of modern technology for coal blending, the project will introduce analytical equipment, i.e., a coal analyzer at PC to analyze the components of H, C, and O in the coal, and present the data to determine the optimum blending ratio of the coal as raw material. The contractor is to transfer its technologies for this purpose as per ID No. 2-10 (2) above.

(2) Thus about US$1,900,000.-/yr of raw material cost saving will be realized.

(3) Outline of device & specifications

The coking cost is largely occupied with the coal as approx. 75% of the total production cost for coke-making. In Japan the coking cost can be greatly reduced by applying a method of calculating the blend for satisfying the target strength and property of the coke, and also the method of using the cheapest, slightly coking coal as much as possible, taking into account the required quantity of coke to be used for BF, which is absolutely required for constant and steady operation.

As the various situations of coal for coke-making and its price system in Japan are different from those in Poland, it may be impossible to settle this problem unconditionally. However, it is estimated that the coking cost in Poland can be discounted by increasing the amount of weak or non-coking coal with a high content of volatile matter, usually called "Gas Coal," to a certain extent. In the case of a modern cokery, it is estimated that 4-10% of cheaper non-coking coal can be used by applying an established and developed coal evaluation system which evaluates the concentration of O, H and C contained in the reactives in coal.

To increase the accuracy of predicting coke strength when a large amount of non-coking coal is used, new coal characterization indices have been developed. The characteristics of H/C and O/C of reactives to coke strength, including other properties of coke, were examined using 33 kinds of coal ranging from semi-anthracite to sub-bituminous. The results were that H/C and O/C of coal reactives were appropriate for representing the coking properties of coal blended with non-coking coal. For applying the new indices to a commercial plant, the error of coke strength prediction decreases to 0.17% compared with 0.33% using the conventional method.

This technology is far beyond the traditional evaluation technique of coal for a cokery, therefore, this modern evaluation method and the coal blending technology as well as the management, operation, and control of the plant are more than adequate to determine a competitive level for the cokery.

- Thermogravimetric analyzer and gas chromatographer	1 set
- Data processor with software	1 set

3-2 To install a **COG holder**: < ID No. 3-2 >

(1) In order to avoid the discharge of COG during the interval when the COG flow direction is reversed, a COG holder with the required pipe connection will be installed.

(2) Thus 49,670,000 Nm^3/yr of additional COG can be sold as a result of such a pressurized transfer system, and at the same time 14.5 t/yr of SO_2 and 17.04 t/yr of NOx will be decreased from the gas effluent, thereby reducing the corresponding tax and penalty.

(3) Outline of device & specifications

Approximately half of the generated COG at PC is used internally and the remaining is compressed and delivered to Huta Katowice, a steel company.

When the heating direction of the coke oven is switched over to the reverse direction, the supply of COB heating is blocked and this blocked gas is released through the flare stack. The COG holder is used to save and discharge gas and also to control the COG pressure balance.

Recovered gas to be saved:

- Amount of heating gas: approx. 62,300 Nm^3/hr/4 batteries
- Excess gas per one battery changeover (If changeover period is 100 seconds):

$$\frac{62{,}300 \times 100 \text{ seconds}}{4 \text{ batteries} \times 60 \times 60} = 472 \text{ Nm}^3\text{/one changeover}$$

- Recovered gas amount (Each battery has 20 minutes interval for one changeover):

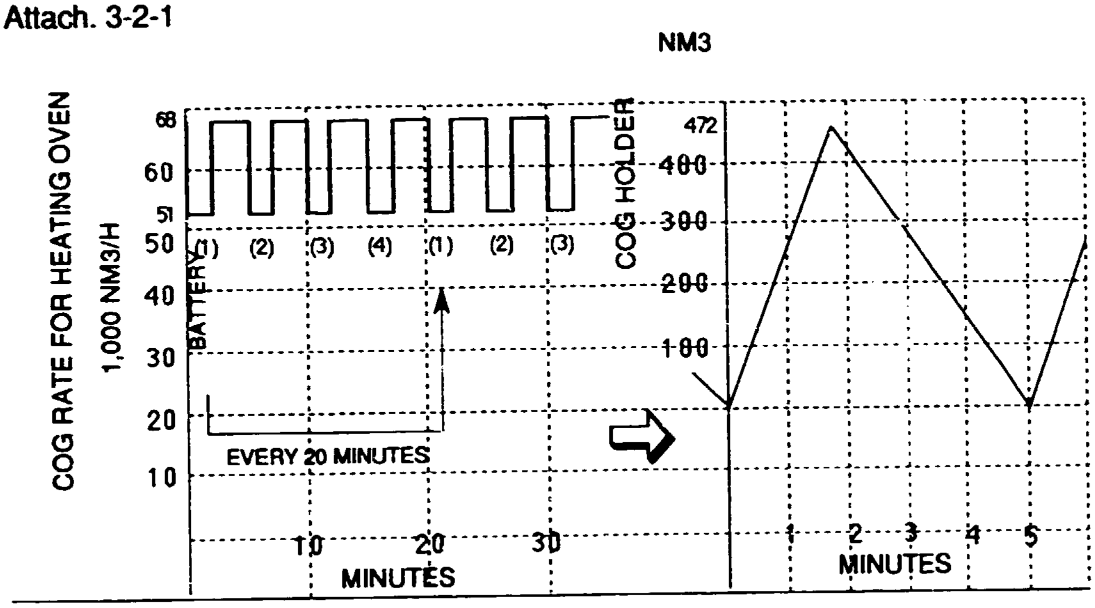
$$472 \text{ Nm}^3 \times (60/20) \times 4 \text{ batteries} = 5{,}670 \text{ Nm}^3\text{/hr} = 49{,}670{,}000 \text{ Nm}^3\text{/year}$$

<Equipment and specification>

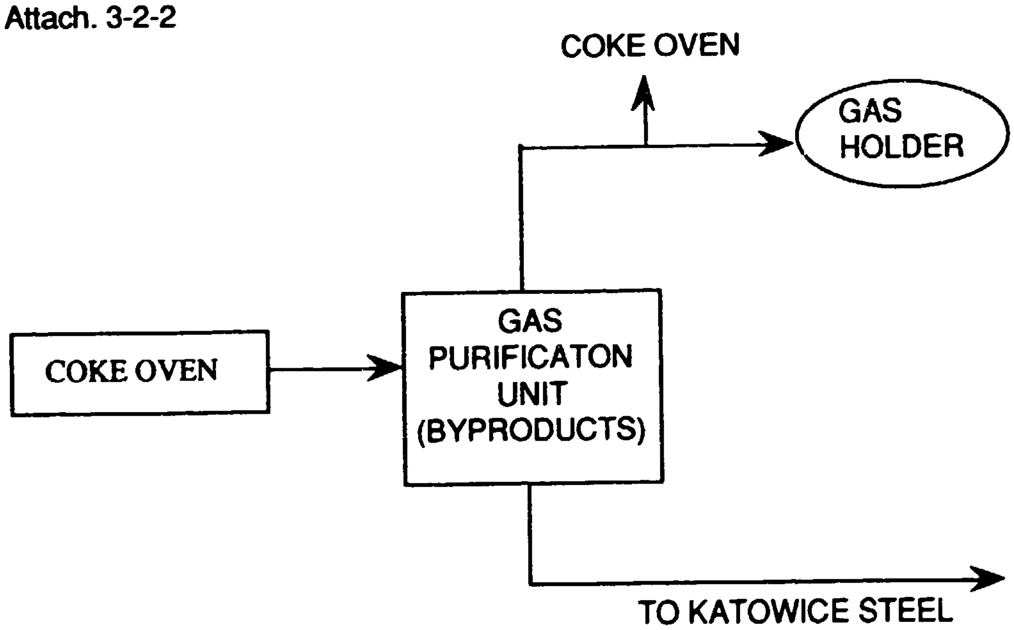
COG Holder		1 pc
- Holder capacity:		5,000 m^3
- Inside diameter:		20,000 mm
- Effective height:		16,000 mm
- Material:		C.S.
- Storage gas:		Coke Oven Gas
- Impurity of COG		
- H_2S:	1.2g/Nm^3	
- HCN:	0.4g/Nm^3	
- Benzol:	2 g/Nm^3	
- COG Flow fluctuation		
- In:	472 Nm^3/100 sec.	
- Out:	470 Nm^3/200 sec.	

- Design Pressure: 400 mm H2O
- Design Temperature: 25°C - 28°C
- Seal Type: Wet

Attach. 3-2-1



Attach. 3-2-2



4. Improvement of environmental control

4-1 To install a **dust collector for the machine side of the coke oven batteries**: < ID No. 4-1 >

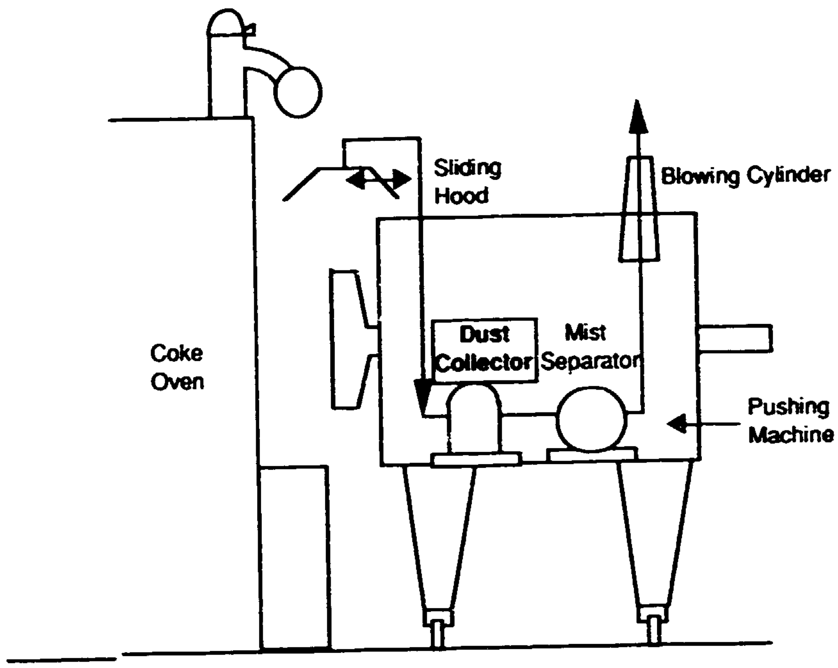
(1) To provide with a new dust collector at the machine side of the coke oven batteries using a dust collector mounted on four pushing machines.

(2) Thus the total quantity of dust discharged from the coke oven batteries will be decreased from 89.2 t/yr to 12.9 t/yr.

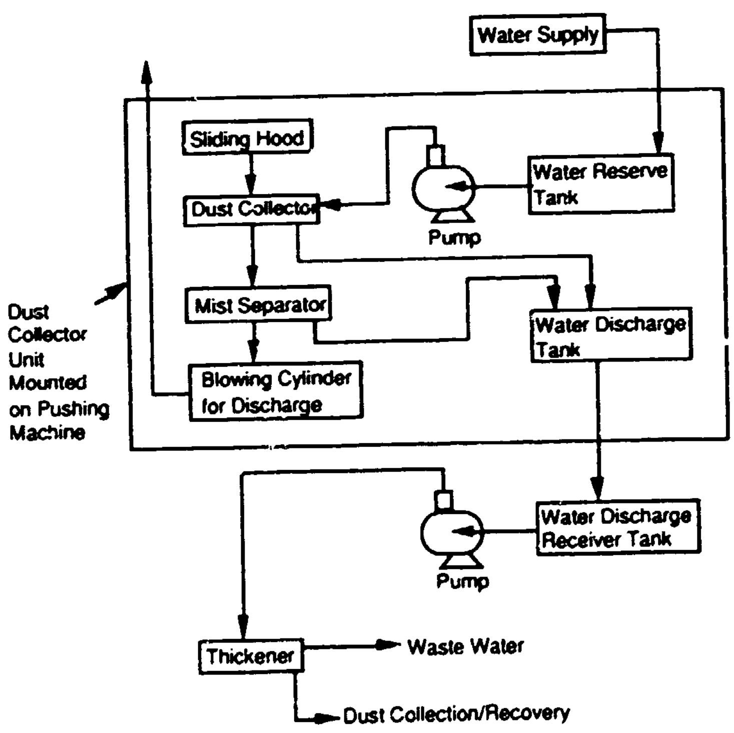
(3) Outline of device & specifications

Dust collector mounted on pushing machine, including mist separator, silencer & damper	4 units
Hood unit, including hydraulic system	4 sets
Water supply and discharge facility, including pumps, tanks and piping	12 units
Thickener	1 set

4-1 Graphic for Dust Collector Unit



4-1 Block Flow Diagram for Dust Collector Unit



4-2 To introduce an **improvement on the low pressure desulphurization Facility**: < ID No. 4-2 >

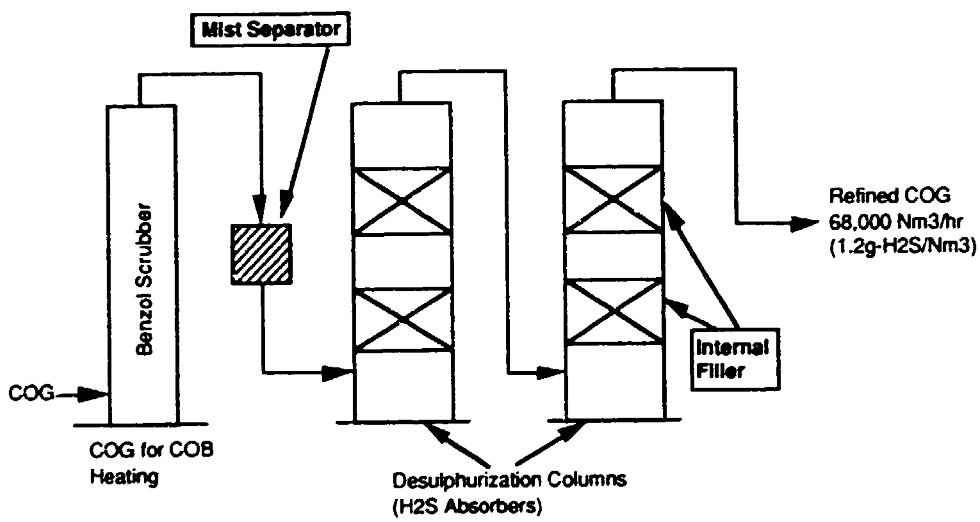
(1) To increase the capacity of the gas flow-rate of the low pressure desulpherization facility from 56,000 Nm^3/hr to 68,000 Nm^3/hr, and to improve the efficiency of desulpherization by introducing a more efficient internal filler in the H_2S absorber. This will decrease the outlet concentration of H_2S from 2.7 gr/Nm^3 to 1.2 gr/Nm^3.

(2) Thus the discharge of SO_2 in the effluent will be reduced from 3,030 t/yr to 1,345 t/yr.

(3) Outline of device & specifications

Mist separator	1 set
Internal filler for H_2S absorber	2 sets
Piping material	1 set
SOx and NOx meter	4 pcs

4-2 Desulphurization facility diagram



4-3 To introduce an **improvement for the waste water treatment facility**: < ID No. 4-3 >

1. Outline of Modernization

(1) i) To install a new **denitrification process**.

In order to reduce the content of NH4-N in the final treatment water by a regulation value of 3mg/l, a new denitrification unit should be installed to reduce COD, CN^-, SCN^-, Phenol, etc. Refer to attached Flow Sheet & Material Balance and Plot Plan.

ii) **Retention tank rearrangement** (661/01)

In the existing flow, the gas liquid and waste water from production, after being treated at the pretreatment equipment, flows into the pre-aeration tank (659/01) where the activated sludge treatment and coagulation treatment are added. The effluent from the activated sludge and coagulation treatments is then retained in the retention tank (661/01) for discharge outside the plant as final treated water. In this case, the fluctuation in water quantity and quality of the effluent to the pretreatment is not fully absorbed at pretreatment and causes lowered treatment performance of the equipment after activated sludge treatment.

To remedy the existing disadvantage, the retention tank is arranged to receive the effluent from pretreatment as a buffer to absorb the quantitative and qualitative fluctuation of pretreatment effluent. As a result, the subsequent equipment following the activated sludge treatment will stabilize the operation.

iii) Automation

An **automatic chemical injection system** is introduced for all chemical injection points in order to control PH and ORP automatically. **The automatic discharge and cleaning system** are introduced for the coagulation precipitators and thickener. These automation systems will contribute to the steady and stabilized operation of the waste water treatment facility.

(2) Thus the tax and penalty currently being paid will be decreased from US$5,751,000 to $1,690,000.

2. Points critical to modernization

The main points of this modernization are summarized based on the problems with the existing plant stated in **Chapter 5**.

Meeting regulation values

The final treated water quality must satisfy or must be as approximate as close as possible to the regulation values under the following preconditions:

Premises

a) Large scale modernization will not be done for the rain water and industrial waste water stream line.

If the water quality remains the same as it is at present, in which no retrofit is being done, the final water quality in future will exceed the regulation values by a great margin. However, some information has been obtained from the site survey, such as:

i) Although maximum operating values exceed the regulation values, the usual values are almost within the regulation values.

ii) The cause of maximum operating values can be precisely traced back in many cases. Therefore, appropriate diagnostic measures can be taken to avoid the cause.

Based on the above information, the water quality meeting the regulation values will be constantly secured (provided Cl^- and $SO_4 2-$ are excluded).

b) A treatment system is not specifically installed to remove or reduce Cl^- and $SO_4 2-$.

The operating values exceed the regulation values by a great margin in all discharge lines except for social waste where no data isavailable. In the coagulation process conducted in this waste water treatment system, coagulant which includes $SO_4 2-$ is injected. Unless some equipment is installed to reduce or remove Cl^- and $SO_4 2-$, operating values will exceed the regulation values. There are two methods available, if it is required to to be installed:

Ion-exchange method
Reverse osmosis method

However these two methods are not practical for the following reasons:

High construction & operation costs
High concentrated salts disposal method
Technically uncertain results.

It is wiser to pay the penalty rather than installing these removal or reduction units.

3. Improvement after modernization

(1) Final treated water

Target values for final treated water are set as follows:

Item	Unit	Target value
Temperature	(°C)	less than 26
pH	(-)	6.5 - 9.0
SS	(mg/1)	30
BOD	(mg/1)	8.0
COD	(mg/1)	60
Total-CN^-	(mg/1)	2.0
Free-CN^-	(mg/1)	0.02
SCN^-	(mg/1)	0.5
Free-Phenols	(mg/1)	0.02
NH_4-N	(mg/1)	3.0
Fe	(mg/1)	1.5

(2) Flow sheet & material balance

Flow sheet & material balance after completion of the modernization is attached in the flow sheet & material balance **(Attach. 4-3-1).**

(3) Plot plan

The plot plan after completion of the modernization is shown in the attached plot plan **(Attach. 4-3-2)**.

4. Specifications

a) Pretreatment

pH Meter of reaction tank (656/03) 2 units

ORP Meter of reaction tank (656/03) 2 units

Automatic discharge and cleaning system for bottom sludge provided to coagulation precipitator (656/04) 2 sets

b) Activated sludge treatment

1st Denitrification tank (RC) 3 units
Volume: 1250m3

1st Denitrification tank aerator (CS + TE) 3 units
Type: mechanical surface aerator
Motor power: 55kW

2nd Denitrification tank (RC) 2 units
Volume: 1300m3
(The standby tank attached to the existing aeration tank will be used as 2nd denitrification Tank. Being open structure at present, it will be covered with slab).

2nd Denitrification tank mixing blower (FC) 3 units
Type: Roots
Motor power: 37kW

Re-aeration tank (RC) 1 unit
Volume: 1250m3

Re-aeration tank aerator (CS + TE) 1 unit
Type: Mechanical surface aerator
Volume: 45kW

Transfer pump (FC) 3 units
Type: Centrifugal
Motor power: 15kW

Caustic soda tank (CS) 1 unit
Type: Cylindrical
Volume: 10m3

Caustic soda dosing pump (SS/PTFE) 2 units
Type: Diaphragm
Motor power: 1.5kW

Methanol tank (CS) 1 unit
Type: Cylindrical
Volume: 10m3

Methanol dosing pump (SS/PTFE) 2 units
Type: Diaphragm
Motor power: 1.5kW

Recycle pump (FC) 3 units
Type: Centrifugal
Motor power: 30kW

pH Meter of 1st denitrification tank
pH Meter of aeration tank
pH Meter of 2nd denitrification tank Total 3 units

D.O Meter of 1st denitrification tank
D.O Meter of aeration tank
D.O Meter of 2nd denitrification tank
D.O Meter of re-aeration tank Total 4 units

ORP Meter of 1st denitrification tank
ORP Meter of aeration tank
ORP Meter of 2nd denitrification tank Total 3 units

pH Meter of the reaction tank 2 units

Automatic discharge and cleaning system
for bottom sludge provided to coagulation
precipitator (659/05) 2 sets

c) Rain water & industrial waste water treatment

pH Meter of reaction tank 2 units
Automatic discharge and cleaning system
for bottom sludge provided to the coagulation
pricipitator (659/08) 2 sets

d) Sludge treatment

Automatic discharge and cleaning system
for bottom sludge provided to thickener 1 set

Notes:

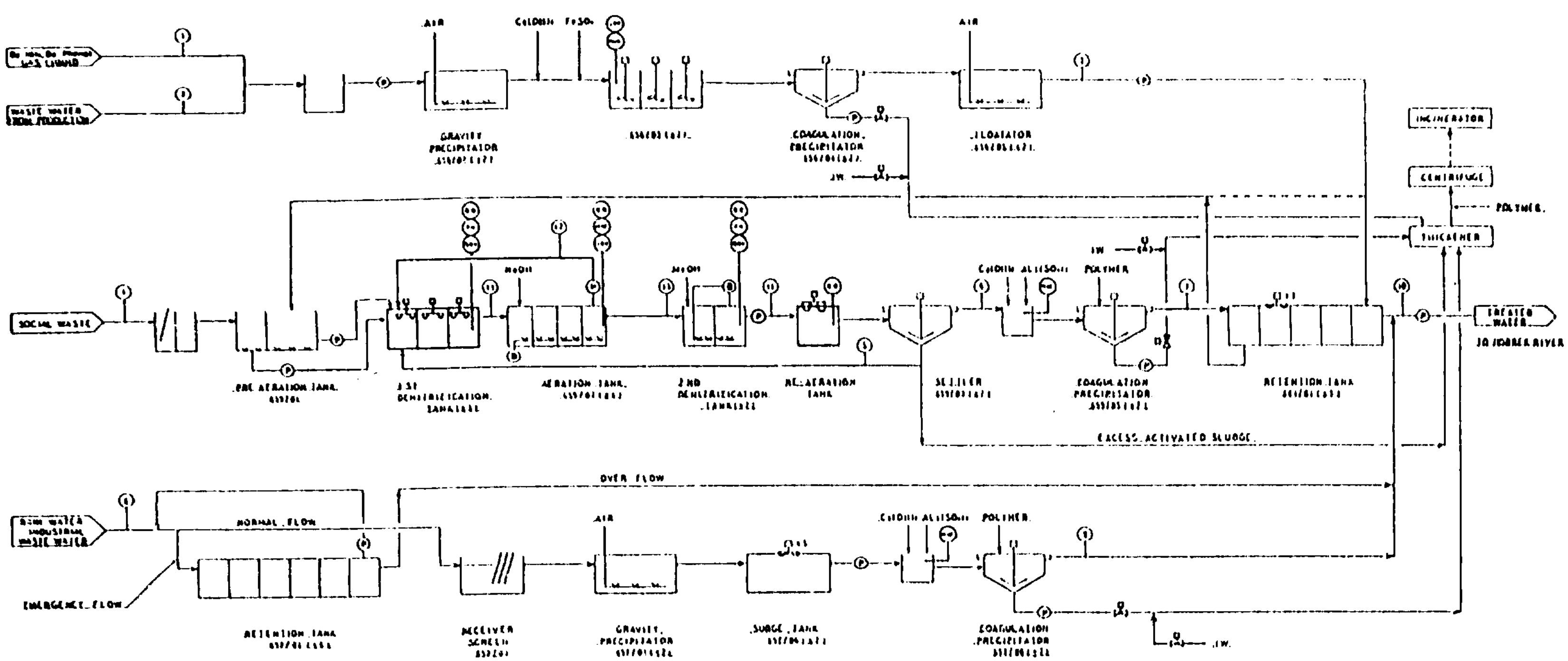
Water treated in pretreatment is first transferred to the retention tank (661/01) for steady treatment at the subsequent activated sludge treatment.

The standby tank to the existing aeration tank (659/02) will be used as the 2nd denitrification tank. As a result, the standby tank will no longer be available as standby, but the requirement will decrease due to improved pretreatment.

Except for the newly installed equipment listed above, all the existing equipment will be reused. The existing units must be placed in good order for ready usage by making proper repairs or replacement.

Placement of slabs to 2nd denitrification tank must be included in civil work.

Attach. 4-3-1

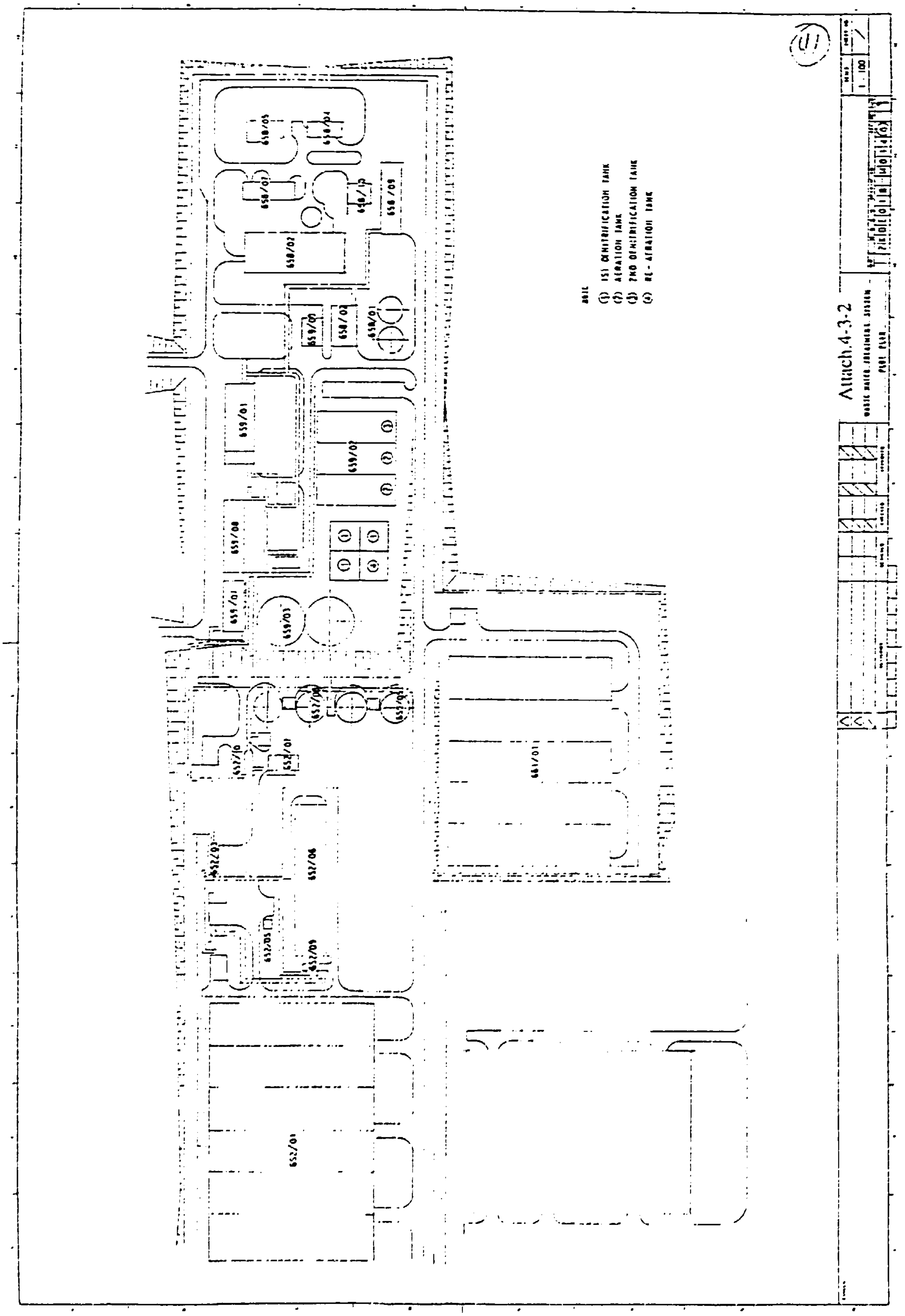


MATERIAL BALANCE (AVERAGE BASE)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
FLOW RATE	(m^3/d)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
COD	mg/L	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	—	—
	(kg/d)	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
TOTAL-CN⁻	mg/L	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	—	—
	(kg/d)	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
SCN⁻	mg/L	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	—	—
	(kg/d)	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
FREE-PHENOLS	mg/L	[illegible]	[illegible]	[illegible]	—	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	—	—	—
	(kg/d)	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
NH_4-N	mg/L	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	(kg/d)	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NO_3-N	mg/L	—	—	—	—	—	—	—	—	—	—	—	[illegible]	[illegible]	—
	(kg/d)												[illegible]	[illegible]	—

Attach.4-3-1
WASTE WATER TREATMENT SYSTEM

Attach. 4-3-2



1ST DENITRIFICATION TANK
AERATION TANK
2ND DENITRIFICATION TANK
RE-AERATION TANK
Attach.4-3-2

6.3 Cost Summary of the Rationalization and Modernization Project

(1) Costs consist of: -

- Foreign currency portion, and
- Local currency portion.

(2) In order to facilitate a simplified and correct comparison/evaluation, both the foreign currency portion and the local currency portion are shown in US dollars herein.

(3) Cost levels shown herein are those available in August, 1992, and therefore an adequate escallation is to be applied at the time of actual cost.

6.3.1 Estimated Cost of Modernization and Improvements: Summary

Unit: US$1,000

I.D.	IMPROVEMENTS AND EQUIPMENT (Method)	EQUIP CIF	ENG'G.*	CONSTR. & MAT.**	TOTAL
1-1	Modernization of CDQ	4,254	264	244	4,762
2-1	Automatic bucket operation	5,282	906	162	6,350
2-2	CDQ Automatic crane operation	2,292	424	86	2,802
2-3	Auto combustion control system for coke oven	4,590	314	75	4,979
2-4	Cleaning device for ascension piping	77	60	767	904
2-5	Industrial (ITV) system	364	6	74	444
2-6	Individual communication system	869	36	43	948
2-7	Metal removal units	269	12	58	339
2-8	Tar sludge discharge system	266	6	65	337
2-9	Deodorant device for tar decanter	29	36	176	241
2-10	Supervisor & operator training (technology transfer & technical assistance)	-	2,415	-	2,415
3-1	Analytical equipment for coal blending	217	121	3	341
3-2	COG Holder	-	-	1,091	1,091
4-1	Dust catcher for M/S of coke oven batteries	1,269	132	1,068	2,469
4-2	Low pressure desulphurization facility	738	36	377	1,151
4-3	Waste water treatment facility	2,913	1,329	2,445	6,687
	Total	**23,429**	**6,097**	**6,734**	**36,260**

Notes:
* Engineering and dispatch of contractor's engineers.
** Construction & material cost: local

CHAPTER 7

PLANT OPERATION

CHAPTER 7 PLANT OPERATION

As previously stated, the main purposes of this modernization project are to:

1. Increase production;
2. Reduce labour;
3. Reduce energy consumption and reduce raw material costs, and;
4. Meet environmental requirements thereby reducing tax and penalties.

The point 4 above will be covered in **Chapter 9**. This chapter mainly covers the first three aspects of rationalization.

7.1 Production Capacity

The production plan has been drawn up considering the above objectives and after careful review of market penetration possibilities in new foreign market such as Western Europe and the American continent. The plan is outlined in the following tables.

7.1.1 Production Schedule

Table 7.1

Item	Year 1	Year 2	Year 3 +
1. Main Product			
(1) Stabilized Coke	1,947,000 t/y	2,229,000 t/y	2,510,000 t/y
(2) Pea Coke	121,000	139,000	157,000
(3) Breeze Coke	142,000	162,000	183,000
* Coke excluding Dust	(2,210,000)	(2,530,000)	(2,850,000)
(4) Dust	54,000	62,000	69,000
Total Coke	2,264,000	2,592,000	2,919,000
2. Byproducts			
Tar	123,300	141,200	158,900
Crude Benzol	28,425	32,540	36,630
$(NH_4)_2 SO_4$	31,890	36,510	41,090
Sodium Phenolate	841	960	1,080
COG (10^3 Nm^3/y)	525,740	616,390	759,630

Unit: tons per year

Note: * Nominal production capacity

7.1.2 Production Capacity and Specification of the Cokery

The following chart is an outline of the production capacity for 1991 and the proposed capacity after modernization.

Production Outline

	1991 & year 1	After modif.	Remarks
Coke production capacity (10^3 t/y)	2,210	2,850	Full cap. basis
Coal consumption 10^3 dry t/y (10^3 wet t/y)	2,980 (3,270)	3,840 (4,220)	Coal to coke 74% prod. efficiency
Pushing no. per day/COB 80 ovens	90	120	
Hours per cycle	21	16.5	
Coke oven temperatures (°C) oven #s 1 - 4	1,2 = 1,225 3,4 = 1,230	1,270 1,275	95°C increase as above
HC (Kcal/kg)	633	600	
COG quantity for heating COB (x10^3 Nm^3/yr)	446,030 (50,900 Nm^3/hr)	545,970 (62,300 Nm^3/hr)	difference of 99.94×10^6
Calorie of COG Kcal/Nm^3	4,220	4,220	

7.2 Number of Personnel Required for PC

7.2.1 PC Organizational Chart: Current

The current organization of PC is shown on the attached chart (Fig. 7-2-1). The organization is largely divided into three Departments under the respective vice presidents.; production & technical, economics and trade and administration. The production & technical depatment employs 2,498 staffs, 76% of the total employment of 3,280.

7.2.2 Economics & Trade Department, Administration Departments (including Presidential Room)

Functions of departments of each division are as follows:

(W=White color means mental wokers, B=Blue color meas physical workers.)

D:President
DA:President's Office:Secretary and his assistant
DO:Division of Work Organization:W9 B3
  Organization of management, Analysis of work
  Management of library
DZ:Worker's Board:W34 B133
  Security Guard
  Social Service (Recreation programme, Cultural event)
  Accommodation service for company flats having 100 rooms
DW:Miritary Unit:W3
  Division made by order of government. Its task is secret.
DK:Unit of Internal Control:W4
  Mainly auditing of accounting
DL:Lawyer:2 Lawyers and 1 assistant
  Collection of legal information, Checking of contracts

DE:Vice President in Economics and Trade
EA:Administration Office:1 Secretary
EH:Trade Office:W15,B12
  Trade promotion, Preparation of documents of trade, Trade marketting, Advertisement, Transport
EI:Office of Supply:W14, B1
  Purchase of coal, spare parts, stationaries
EM:Division of Planning of Materials:W9
  Control and sales of old spare parts in cooperation with WM and EZ
  Number of staff is decreasing because stock of spare parts is decreasing.
EE:Division of Economics and Work Motivation:W10, B1
  Analysis of price, production cost, salary
WTK:Department of Railway Transport
  W16:Supervise, control
  B194:3 shifts (4 groups)
  Transport of coal by rail from national railway station to stockyard of the factory and unloading.
  Loading of coak on freight train
  Loading and unloading of chemical products on wagon of railway.
BTS:Car Transport:W11, B170
  Transport of workers (3 shifts) from near towns to the factory.
  Transport by truck of side materials for production, spareparts, chemical products

WM:Department ot Storeroom:W13, B67

All works in connection with warehouses of spareparts, chemical materials

DR:Main Accountant

RA:Administration Office:1 secretary

RF:Fincancial unit:W7, B1

Payment by cash, check, note. Contact with banks

Payment of salary

RP:Social Service:W1

Management of funds for loan to employees

RW:Unit of Salary Accounting:W16

Calcuration of monthly salary.

RG:Division of Main Accounting:W10

Accounting

Making B/S, P/L. Keeping accounting vouchers.

In-put of accounting date into computer is done by PTR Division (Engineer in Technology and Progress)

RI:Quantity Survey Team:W1, B4

Management of inventory such as coal, materials, office equipments

Preparing inventory report twice a year.

RM:Division of Material Accounting:W7

Keeping evidences of materials of production,

Control of purchased/used quantity and value.

RK:Division of Cost Accounting:W5

Keeping evidences of cost according to divisions/items.

7.2.3 PC Personnel Reduction Schedule

As the following table shows, the proposed labour rationalization and reduction is to take place in all departments.

Personnel (by Dept.)	Year 1	Year 2	Year 3	Year 4 +
Economics & Trade: Total	535	519	451	352
White	88			
Blue	447			
Administration: Total	247	238	207	162
White	106			
Blue	141			
Prod. & Technical: Total	**2,498**	**2,430**	**2,130**	**1,672**
White	**276**	**276**	**261**	**250**
Blue	**2,222**	**2,154**	**1,869**	**1,422**
PC: Total	3,280	3,187	2,788	2,186
White	470			
Blue	2,810			

7.2.4 Production & Technical Dept. Personnel Reduction Breakdown by Section

A) The following table indicates the labour reduction schedule by section within the Production & Technical Department. Figures in parentheses indicate the number of employees reduced for that year and job classification. It is proposed that initially the Maintenance employees from Coal Handling, Coke Oven, CDQ, Gas Refinery and Environment Sections will be re-organized into the Mechanical Maintenance and Energy Maintenance Departments which will in turn be reduced in Years 3 and 4.

Section	Personnel: Year 2	Personnel: Year 3	Personnel: Year 4
Coal Handling	1+146	1+144	1+142
Oper.	142 to 130 (-12)	130	130
Maint.	78 to 0 (-78)	0	0
Aux.	16	16 to 14 (-2)	14 to 12 (-2)
Coke Oven	**1+310**	**1+286**	**1+284**
Oper.	**317 to 287 (-30)**	**287 to 267 (-20)**	**267**
Maint.	**142 to 0 (-142)**	**0**	**0**
Aux.	**23**	**23 to 19 (-4)**	**19 to 17 (-2)**
CDQ	1+200	1+155	1+151
Oper.	180 to 168 (-12)	168 to 128 (-40)	128
Maint.	144 to 0 (-144)	0	0
Aux.	32	32 to 27 (-5)	23 (-4)
Gas Refinery	**1+176**	**1+173**	**1+170**
Oper.	**168 to 154 (- 14)**	**154**	**154**
Maint.	**106 to 0 (-106)**	**0**	**0**
Aux.	**22**	**22 to 19 (-3)**	**19 to 16 (-3)**
Mech. Maint.	346 to 728 (+382)	728 to 591 (-137)	591 to 316 (-275)
Energy Maintenance	**499 to 676 (+177)**	**676 to 594 (-82)**	**594 to 430 (-164)**
Environment	1+29	1+28	1+28
Oper.	25	25	25
Maint.	89 to 0 (-89)	0	0
Aux.	4	4 to 3 (-1)	3
QC	**1+68**	**1+61**	**1+52**
	67	**67 to 62 (-5)**	**62 to 53 (-9)**

B) The following table shows the Production & Technical Department rationalization schedule according to the number of employees reduced through the modifications made. The figures to the right of the modification indicate the breakdown of the number of employees reduced for that specific modification, the total of which appears in the reduction column. The figures in parentheses for years 3 and 4 indicate the percentage of the total amount of employees to be reduced for that year.

Year	White(W)	Blue(B)	Total(T)	Reduct.	Modifications
1	276	2,222	2,498	Base	Base
2	276	2,154	2,430	B - 68	- Ascension pipe: - 30 - ITV and, - Cmns system: - 36 (Coal, CDQ, Byproducts Sections are reduced by 12 ea.) - Decanter - 2
3	261	1,869	2,130	T - 368 W - 15 B - 353	- Auto. combustion - 4 - Unmanned bucket car - 16 - Auto.crane oper. - 40 - Post. tech. assistance & training: (1/3 decr.) B - 225 (1/2 decr.) W - 15
4	250	1,422	1,672	T - 826 W - 26 B - 800	- Post. technical assistance & training: (2/3 decr.) B - 447 (1/2 decr.) W - 11

7.2.5 Personnel Reduction of Economics & Trade Departments and Administration Departments.

This study is mainly focused on rationalization and modernization of the production & technical department which currently shares 76% of the total employment. So the number of workers of these departments is reduced simply in proportion to that of production departments, and the new orgenization will not be very different from the present organization.

7.2.6 Management of J/V Company

The proposed joint-venture company will take the form of the joint stock company based on the polish commercial code. The company will have a board of directors and a board of supervisors. The board of directors which will be in charge of management consists of a president, vice president and a few directors from foreign partner(s). The supervisory board consists of a minimum of five members, in charge of auditing the company, selected outside of the board of directors and employees of the company.

7.2.7 Labour Cost

As is shown on the Table 9.5, PC will enjoy the reduction of the number of employees in total from 3,280 to 2,186. The monetary term for their reduction amounts 7.3 million US dollars during 4 years from1994 to1997. It is a substantial amount compared with the production cost.

7.2.8 Plan of New Organization

Please refer to Fig. 7.2.2
Organization based on the content of the report supposing that 1,094 workers will be reduced during the period from 1994 to 1997.

7.2.9 Recommended Organization

1) The following organizational alternatives can be considered to effectively reduce redundant employment. (Figures in parenthesis are number of workers.)

   a) Separation of divisions ••• DZ (167), WTK (210), BTS (181)
   Those units can be separated from PC and incorporated as independent companies providing services to other clients utilizing their experience, technical expertise and facility. (Among sections of Production & Technical Department TZ(51), TM(346), TE(499) can be categorized in this group.) This operation has to be done one by one taking account of economic development of Poland, above all economic infrastructure, and at the present stage it is difficult to judge when such separation would be possible.

   b) Consolidation ••• EE (11), DO (12) and RK (5) can be consolidated into one unit in charge of labour and cost management. On the other hand, EZ (19), WM (80), RI (9) and RM (7) can be put together for procurement and storing so that a substantial number of redundant labour can be depleted by reducing over-lapping functions.

   c) Elimination •••
   DK (4):The new joint-venture company will be born as a joint-stock company with a supervisory board which will carry out an auditing function.
   EM (9): This unit is in charge of stocking old spare parts. In the new regime, due to a change to the market economy, the flow of merchandise including spare parts will be liberalized. The specialized unit for old spare parts stock will not be needed anymore.

   d) Merchandalization ••• RF (8), RW (16),RG (10)
   Computerization of process in payment and development of computerization of banks will enable dramatically reduce the numer of staff in those units.

2) A) In consideration of the above factors a plan of Recommended Organization Chart is given in Figure 7.2.3.
   This plan is a rough framework which does not give details of sections under each department, number of staff needed etc because organization depends upon such factors as ability of employees, financial situation of PC, change of economic infrastructure of Poland and situation of these of several years later cannot be foreseen now.

   B) Function of Each Division (Except Production/Technology Divisions)

   a) Presidential Room
   To help the Board of Directors plan important corporate strategy. Control of subsidiary companies.

b) Sales/Purchase Division
In order to survive very hard competition in the market economy, it will be very important to find the best way to make procurement of materials of best quality and most economic price and to sell products to clients on the conditions as advantageous as possible. So this division has to be strengthened to meet this requirement.

c) Finance/Accounting Division
—Finance Department
Most important function is to find the source of finance as favorable as possible not only in the domestic market but in the international market.
—Accounting Department
To accomplish rapid and accurate procedure of accounting and prepare materials showing financial situation of the company (Balance Sheet, Profit and Loss Statement etc) which are necessary for management to plan financial strategy.

d) Personnel Department
To maintain growth of company in the market economy such system is required as able employees can be promoted smoothly. For this purpose to elaborate policy of pay, promotion, recruitement is important functions of this division.

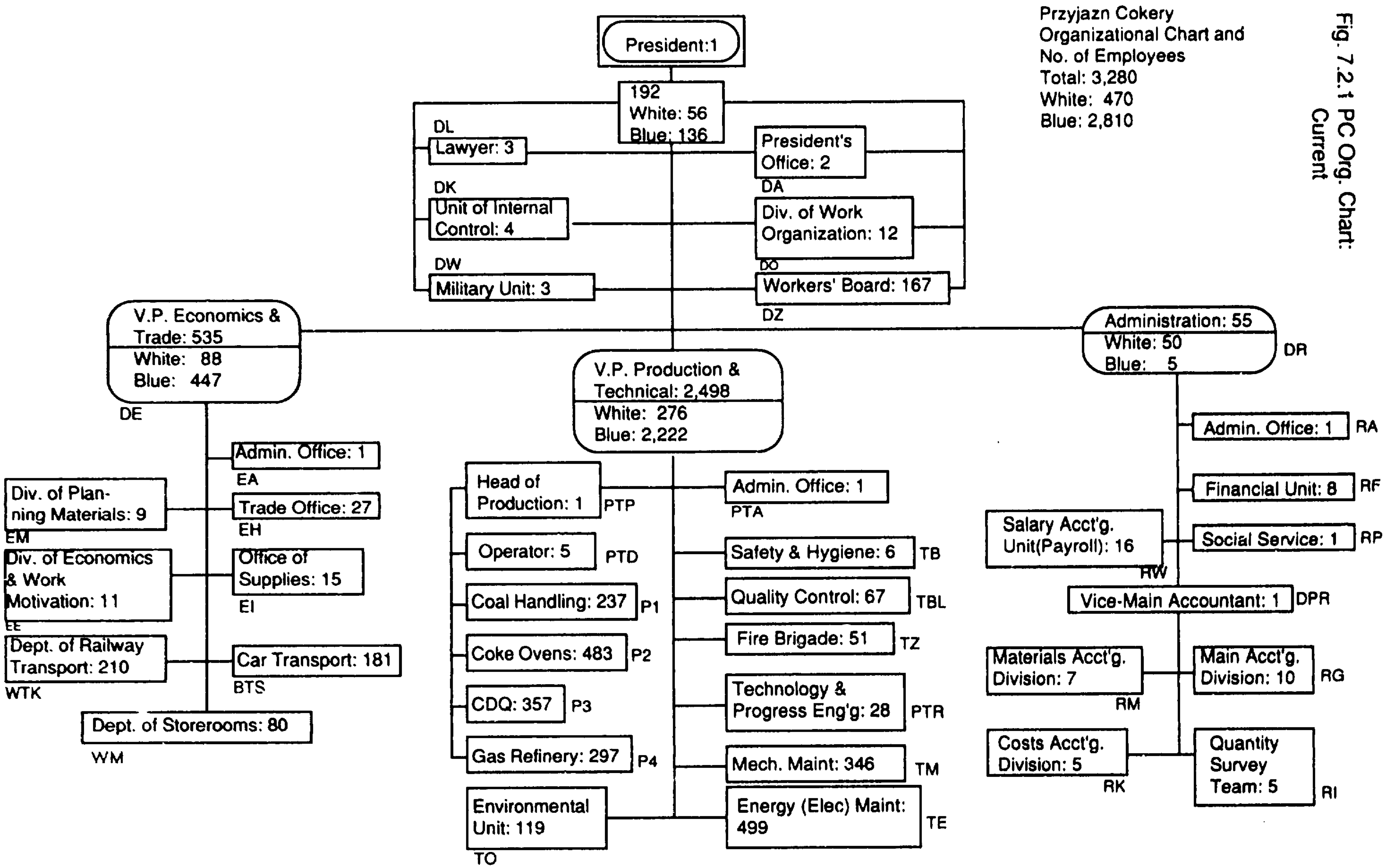


Fig. 7.2.1 PC Org. Chart: Current

Fig. 7.2.2
Plan of New Organization Chart.

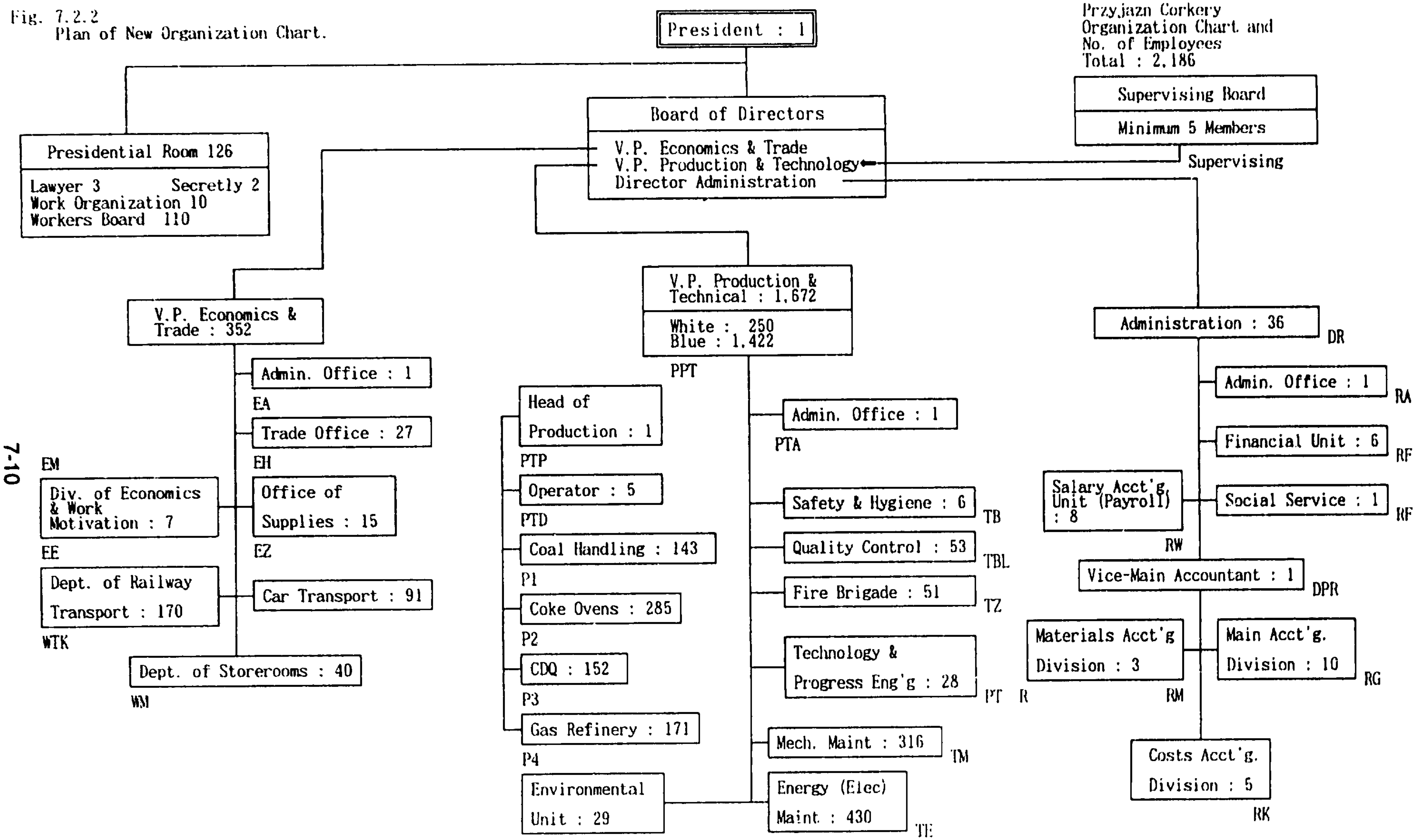
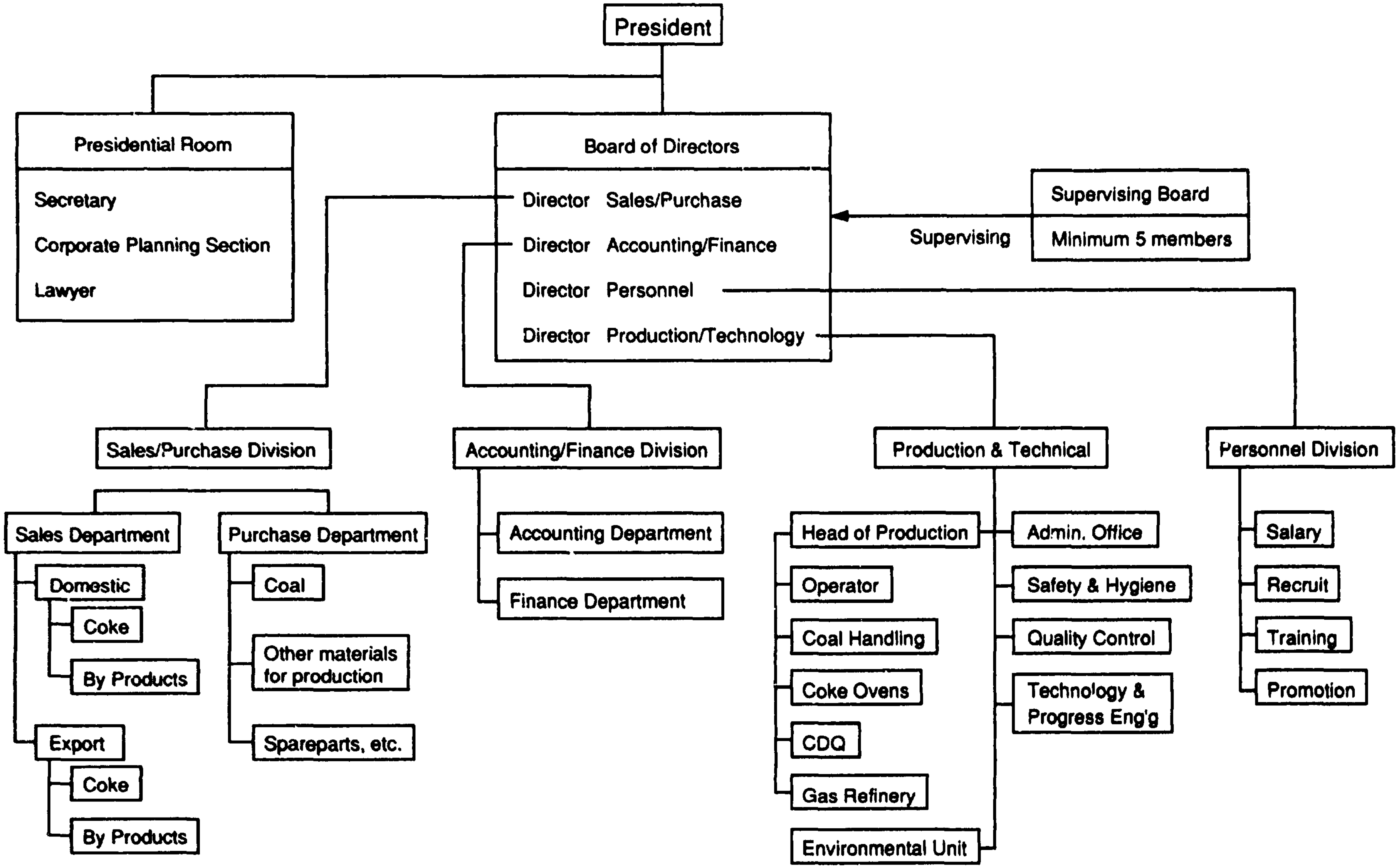


Fig. 7-2-3 Plan of Recommended Organization Chart



7.3 Raw Material and Other Inputs

The following Table 7.3 shows consumption of raw material, energy and utilities for Years 1 - 3 as well as their cost.

Table 7.3

		Year 1		Year 2		Year 3		Year 4
		Quantity	Value*4	Quantity	Value*4	Quantity	Value*4	Value*4
1.	Raw Material	KT/Y	(US$1,000)	KT/Y	(US$1,000)	KT/Y	(US$1,000)	
	(1) Coking Coal*1, *2	2,980 (3,270)	127,752	3,325 (3,654)	142,530	3,650 (4,010)	156,388	
	(2) Slightly Coking Coal*3	0		85 (93)	2,717	190 (210)	6,121	
	Total	2,980 (3,270)	127,752	3,410 (3,747)	145,247	3,840 (4,220)	162,509	

		Year 1		Year 2		Year 3		Year 4
		Quantity	Value*4	Quantity	Value*4	Quantity	Value*4	Value*4
2.	Other raw materials	T/Y	(mil ZL)	T/Y	(mil ZL)	T/Y	(mil ZL)	
	(1) Wash oil	(4,032)	12,500	4,614	14,304	5,196	16,107	
	(2) Sodium hydrate	(2,852)	7,700	3,264	8,811	9,375	25,312	
	(3) Sulphuric Acid	(16,333)	4,900	18,690	5,607	21,030	6,309	
	(4) Potassium carbonate	(151.5)	1,600	173.4	1,830	195.2	2,062	
	(5) Other		59		68		*5 15,327	
	Total		26,759		30,620		65,117	Same as Year 3
3.	Utility							
	Drinking water		1,527		1,495		1,356	1,142
	Industrial water	6,138	7,856	7,024	8,990		10,123	10,123
	Total		9,383		10,485		11,479	11,265
4.	Energy							
	Fuels	$\times 10^3$ Nm^3		$\times 10^3$ Nm^3				
	(1) Nitrogen	(7,717)	3,056	8,831	3,497	9,944	3,938	
	(2) Liquid Fuel		1,220		1,396		1,572	
	(3) Gasoline		890		1,018		1,147	
	(4) Boiler coal		876		1,002		1,129	
	(5) Coke gas		100		114		129	
	Fuel total		6,142		7,027		7,915	
	Electric energy	Mwh 123,910	44,781	142,101	51,355	161,231	58,269	
	Heat Energy		5,260		6,019		6,778	
	Total		56,183		64,401		72,962	Same as Year 3

Notes:

*1) ( ): Wet base

*2) Coking Coal: type 35.1, 35.2B, 34.1, 34.2

*3) Slightly coking coal: type 33

*4) Value is calculated on 1991 price base.
In order to get values in dollar shown in Table 9.3, values in ZL are converted into dollar (Exchange Rate $1 = ZL 11,107) and annual increase of 5% for 3 years (1992-1994) is added.
For example : Other raw material $26{,}759 \div 11{,}107 \times 1.05^3 = 2.789$ (Thous. dollars)

*5) $FeSO_4$ 1,460 t/y, $Al\ 2(SO_4)^3$ 1,800 t/y,
$CaCO_3$ 700 t/y, MeOH 700 t/y

7.4 Improvement for Environmental Requirements

Tables 7.4.1 and 7.4.2 show improvements of waste water and air pollution after modification (year 3).

As described in Chapter **5.1.1** and **5.2.1**, recently the tax and penalties related to environmental pollution have been sharply increased year by year. In actual fact it is very difficult to estimate tax and penalties after 1994. Therefore we have assumed that the tax and penalties for year 1 (1994) are based on those of 1992 plus an inflation factor of 5% per year, although the 1992 base figure is PC's estimate.

7.4.1 Tax and Penalty for Sludge Disposal

Sludge disposal originates from the following:

1) Excess sludge from the activated sludge process;
2) Others such as residual sludge from tanks, vessels and heat exchangers during maintenance.

As stated in Chapter **5.1.5 - (5)**, the incinerator's operation has be delayed. However in 1993, it will begin operation so that excess sludge will be greatly reduced for disposal. Considering the other residual sludge, we assume the following tax and penalties for sludge disposal after 1993 taking into consideration a 5% inflation factor:

	1992	1993	Year 1	Year 2	Year 3
Tax & penalties Sludge disposal ($ 10^3)	373.8	118	124	124	124

TABLE - 7.4.1
Tax and Penalty for Air Pollution

	Year 1		Year 2		Year 3		Without Modification		Difference
	Discharge t/y	Tax 10^3 \$/y	Discharge t/y	Tax 10^3 \$/y	Discharge t/y	Tax 10^3 \$/y	Discharge t/y	Tax 10^3 \$/y	10^3 \$/y
Total Dust	1,086	758	1,026	717	966	675	1,312	917	242
SO_2	1,761	451	1,680	430	1,599	410	3,121	799	389
Co	2,787	195	2,464	172	2,239	157	3,037	212	55
NOx	671	172	693	178	556	142	733	188	46
Benzene	3.15	733	3.0	716	2.5	587	3.8	885	298
NH_3	302	211	306	214	310	217	379	265	48
H_2S	25.3	18	25.3	18	25.2	18	25.4	18	0
HCN	24.5	17	24.7	17	25	17	28.7	20	3
Cl_2	5.6	4	5.7	4	5.8	4	7.2	5	1
Phenol	14.5	17	14.6	17	14.9	17	18.2	21	4
Benzpyrene	0.24	56	0.24	55	0.23	54	0.3	68	14
Tar	32.9	67	31.8	66	30.5	65	37.4	82	17
Hydro Carbon	1,216	25	1,229	26	1,243	27	1,502	33	6
H_2SO_4	11.6	24	11.6	24	11.6	24	11.6	24	0
Total		2,748		2,654		2,414		3,537	1,123

TABLE - 7.4.2
Tax and Penalty for Waste Water

		Year 1		Year 2		Year 3		Year 3 without Modification		Difference $10^3\$$
		Discharge t/y	Tax/Penalty $10^3\$$	Discharge t/y	Tax/Penalty $10^3\$$	Discharge t/y	Tax/Penalty $10^3\$$	Discharge t/y	Tax/Penalty $10^3\$$	
1.	Tax									
	COD	1,285	2,899	1,470	3,317	376	848	1,656	3,735	2,887
	Fe	16.2	263	18.5	301	9.4	153	20.8	339	186
	Free Phenol	2.3	15	2.7	17	0.1	1	3.0	20	19
	Sub Total		3,117		3,635		1,002		4,094	3,092
2.	Penalty									
	Free CN	2.6	264	3.0	298	* *	* *	3.4	335	335
	SCN	24.9	399	399	451	* *	* *	32.0	507	507
	Cl	2,200	441	2,517	498	1,635	323	2,835	561	238
	SO_4	725	147	830	184	1,850	365	935	185	△180
	NH_4 - N	90	54	103	61	* *	* *	116	69	69
	Sub Total		1,305		1,493		688		1,657	969
	Total		4,485		5,128		1,690		5,751	4,061

* * : Less than penalty.

CHAPTER 8

PROJECT IMPLEMENTATION PLAN

CHAPTER 8. PROJECT IMPLEMENTATION PLAN

8.1 Implementation System for the Project

In order to handle the project implementation including the period from the new joint venture company establishment to the start of commercial production, the implementation team should be appropriately organized within the new joint venture company as a task force.

The major activities of this team are as follows:

1) Preparation of tender documents
2) Tendering
3) Opening of bids
4) Evaluation of bids
5) Negotiation and award of contract
6) Executing the project with contractor under the contract

8.2 Type of Contract for the Project

The type of contract for this project is assumed to be on a CIF + supervisor basis.

The construction work on site, including procurement of locally available materials such as carbon steel piping materials, ordinary cables, materials for civil, building and structure, etc., will be performed by the new joint venture company using their own manpower from the maintenance department. The site construction work is very complicated and sophisticated being that the main work is the modification of the existing plant. In addition, the operation of the plant cannot be shut down at a moment's notice. Therefore, it will be most appropriate to carry out this site construction work utilizing the new joint venture company's own skilled manpower who are well acquainted with the existing plant, as well as the maintenance shop with construction equipment and tools already at hand.

8.3 Training and Technology Transfer

The training of key personnel will be performed to master the technology and related operating methods in a foreign country as well as in Przyjazn on an on-the-job-training basis. The detailed schedule and training plan are described in Chapter 6.

8.4 Project Schedule

The project schedule, especially for the construction work on site, has to be well planned in advance so that interruption of the production process is minimized. Please refer to the attached time schedule.

Major milestones of the project are as follows:

Mile stone	Planned date
Effective date of the contract for this project	January 1st, 1994
Start of the construction work at site	October 1st, 1994
Mechanical completion	September 30th, 1995
Commencement of the commercial operation	March 1st, 1996

TIME SCHEDULE

General Time Schedule for Modernization of PRZYJAZN Cokery Plant

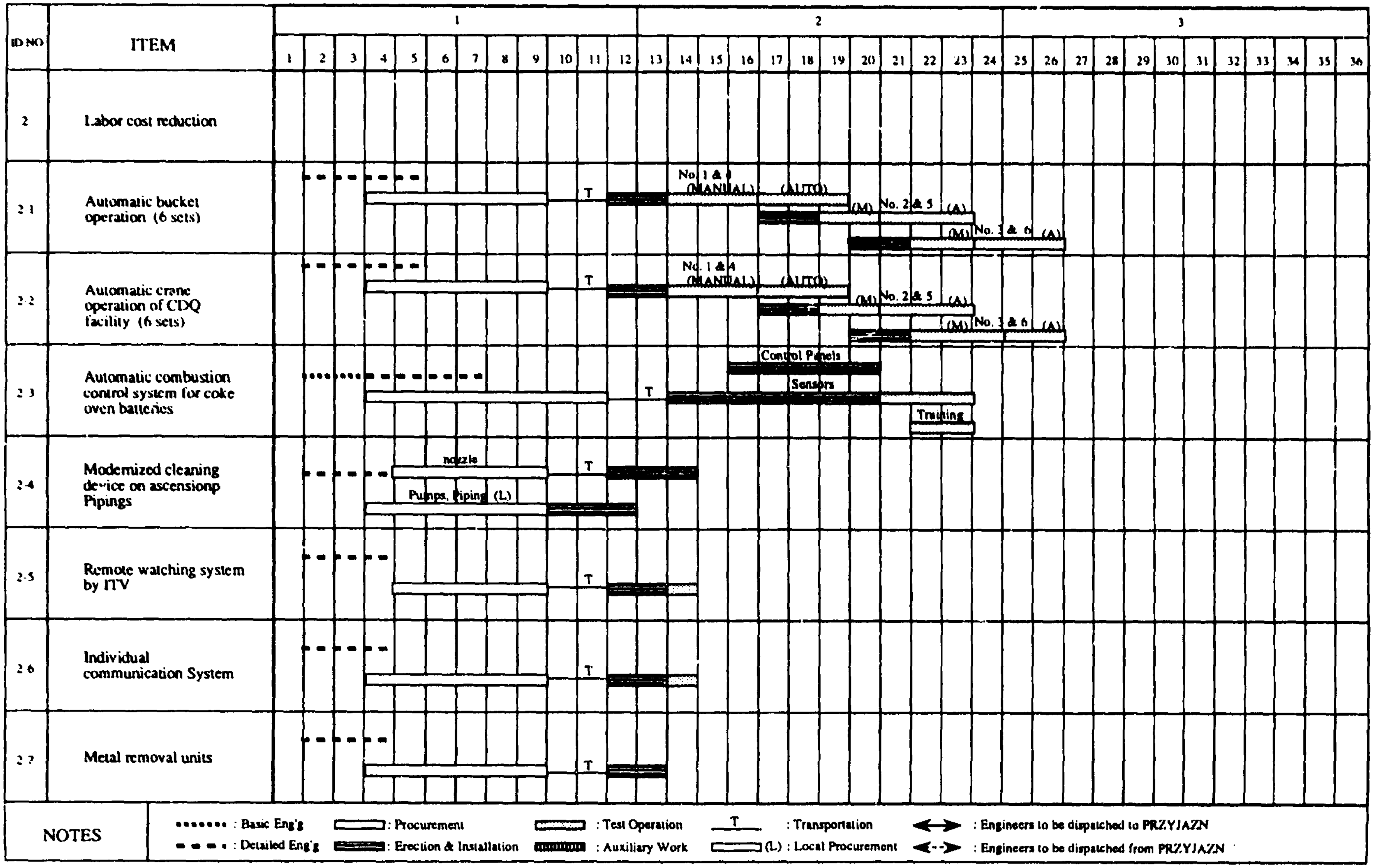
ID NO	ITEM	1												2												3											
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	for increase of production capacity																																				
1-1	modernization of CDQ facility (8 sets)													T		No. 1 & 2 No. 3 & 4																					

NOTES

- ••••••• : Basic Eng'g
- ▬ ▬ ▬ : Detailed Eng'g
- : Procurement
- : Erection & Installation
- : Test Operation
- : Auxiliary Work
- T : Transportation
- (L) : Local Procurement
- ←→ : Engineers to be dispatched to PRZYJAZN
- ←--→ : Engineers to be dispatched from PRZYJAZN

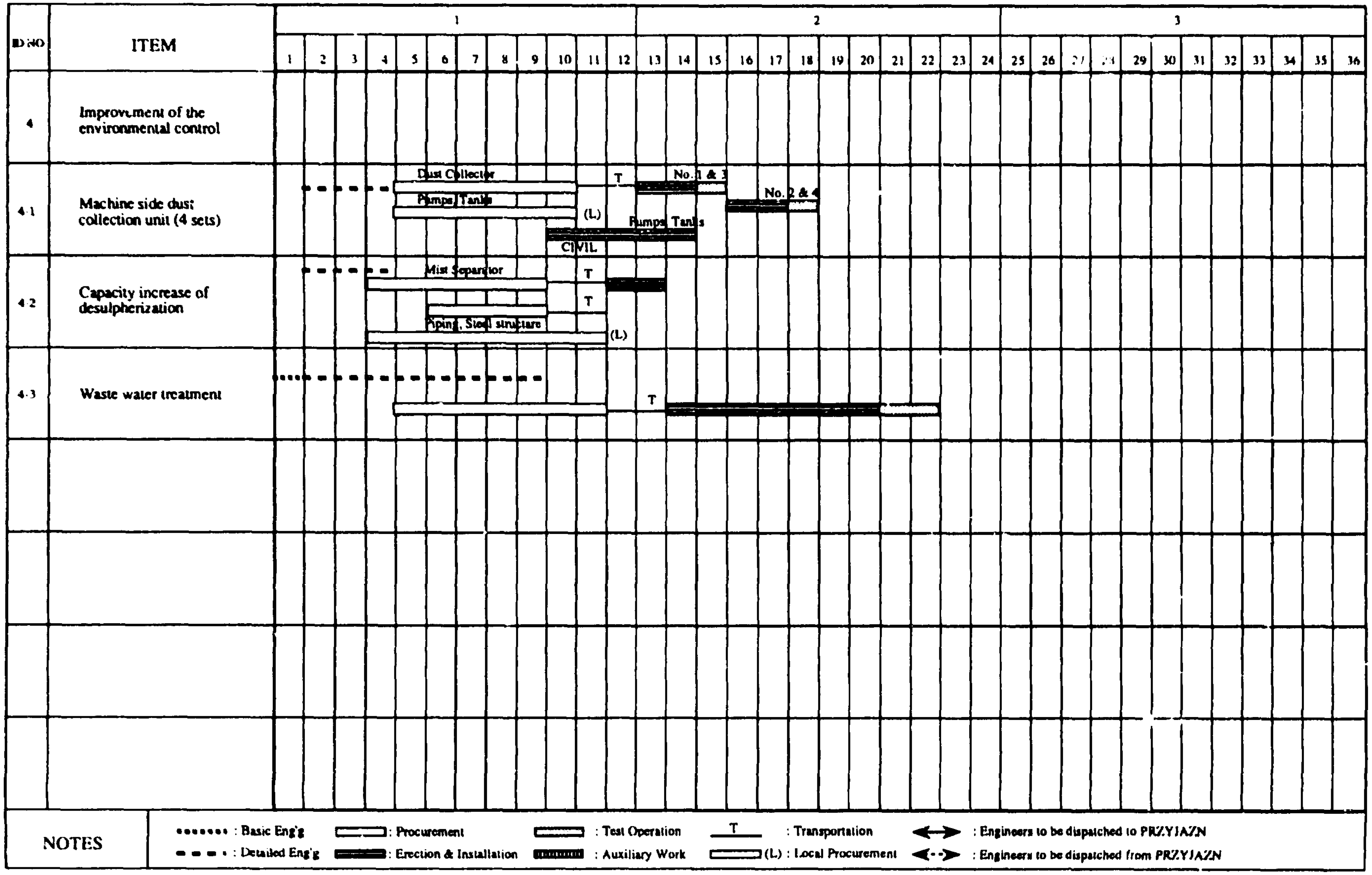
TIME SCHEDULE

General Time Schedule for Modernization of PRZYJAZN Cokery Plant



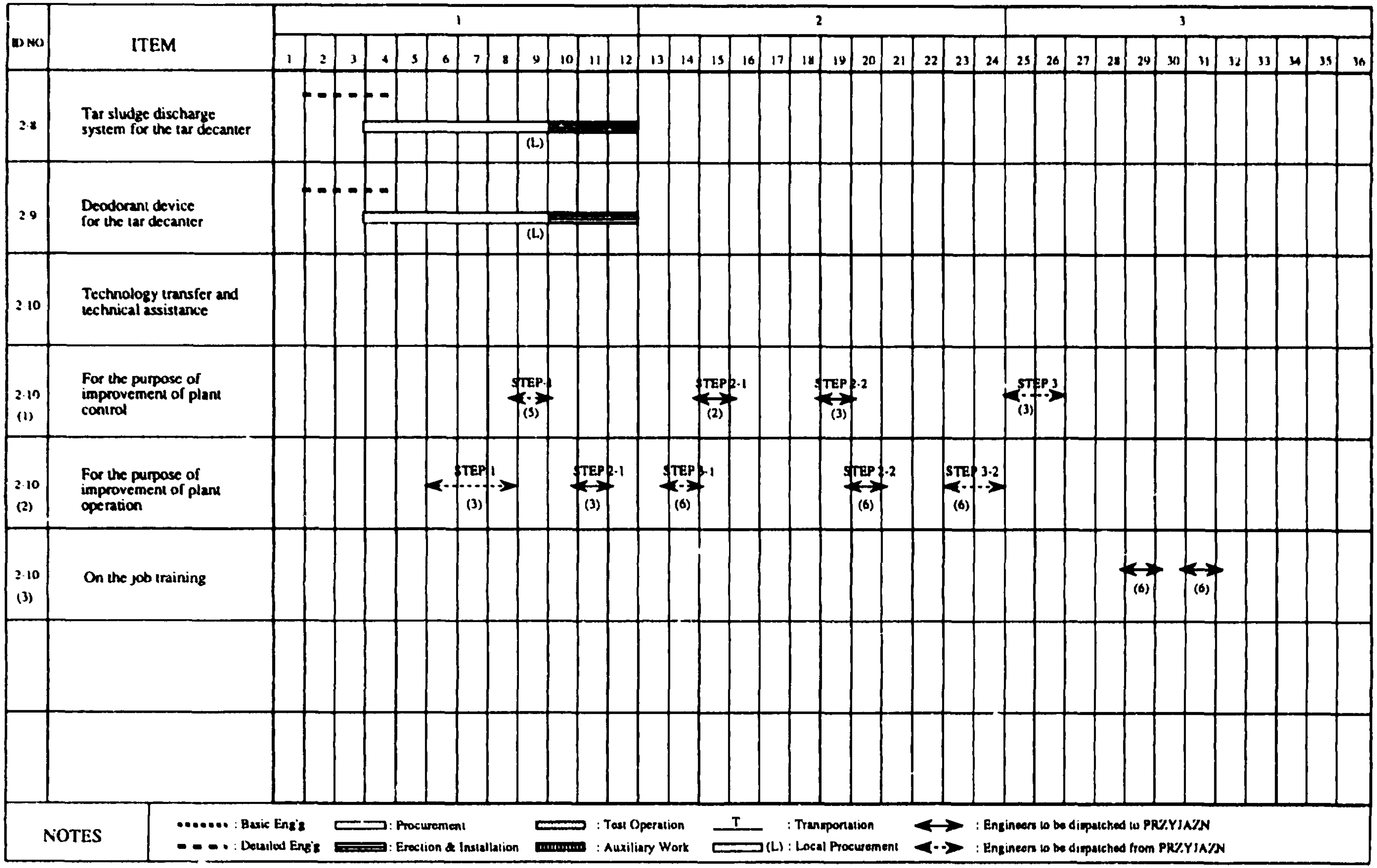
TIME SCHEDULE

General Time Schedule for Modernization of PRZYJAZN Cokery Plant



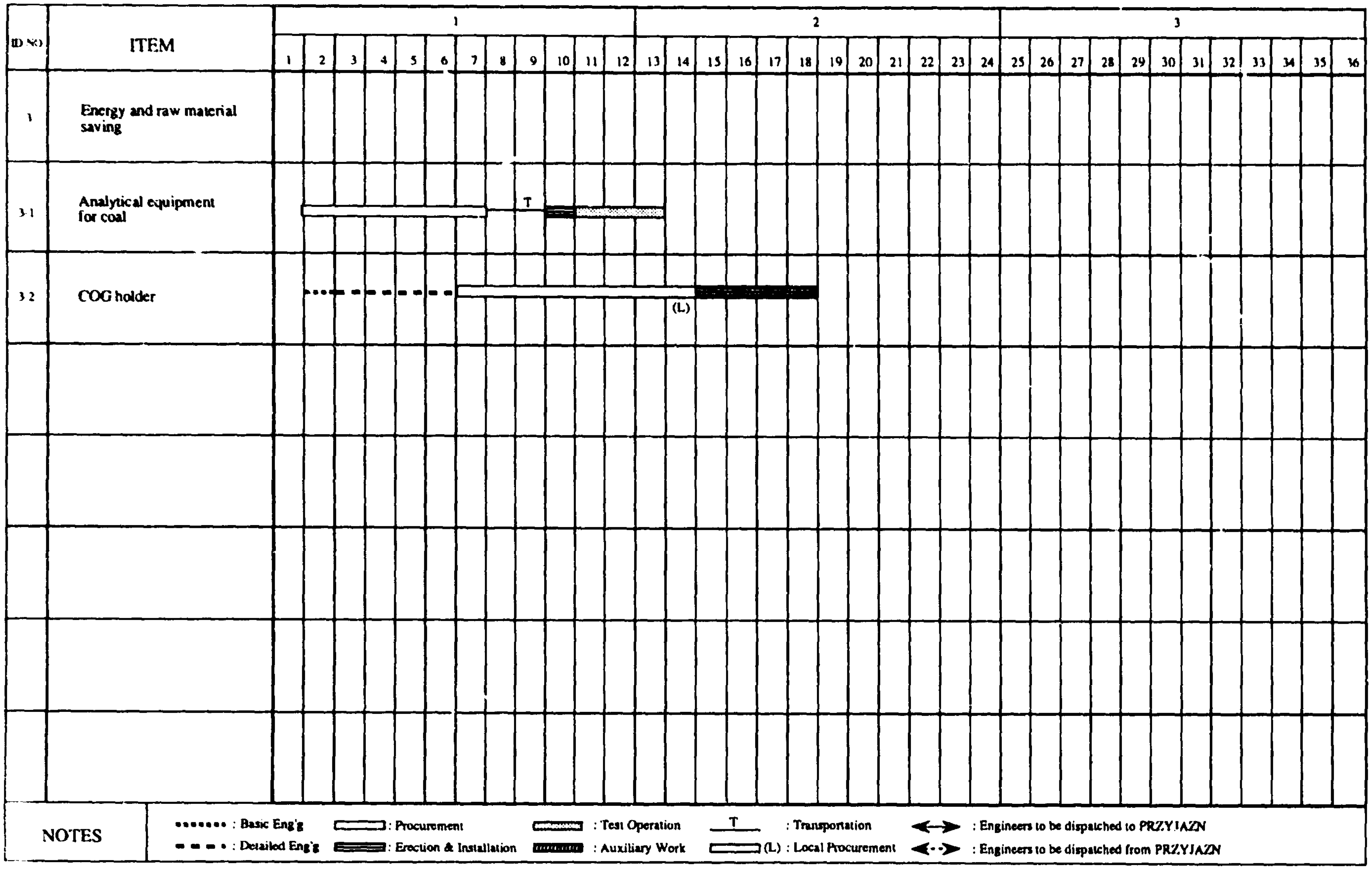
TIME SCHEDULE

General Time Schedule for Modernization of PRZYJAZN Cokery Plant



TIME SCHEDULE

General Time Schedule for Modernization of PRZYJAZN Cokery Plant



CHAPTER 9

FINANCIAL AND ECONOMIC EVALUATION

CHAPTER 9. FINANCIAL AND ECONOMIC EVALUATION

9.1 Review of the PC's past financial performance

During the site survey in April, investigation and analysis were performed on the financial status, sales, and profitability of the PC under cooperations of PROXIMA, a Polish management consultant company. After rearranging the PC's balance sheets and profit and loss statements as of 1990 and 1991, which had been of the Polish standard, into those of the international standard, their contents were analyzed. The results of such analysis are shown on Annex C to this report.

As for the evaluation of fixed assets, it was considered very difficult and impractical to estimate the exact current value about all of a large number of buildings, machines and items of equipment (152 buildings, 401 structures and so on), taking into consideration enormous money and time supposed to be necessary for this estimation. Accordingly, investigation of book values was mainly performed at this time with calculations of the current value performed on four samples of buildings and land (though it is leased).

This investigation has revealed the following.

In the aspect of financial status:

a) The book value of fixed assets at the end of 1991 was 260 million dollars; however, according to the investigation on samples of land and buildings by a real estate appraiser, the estimated current value of buildings is between 0.56 and 1.95 times that of the book value. The current value of land, which is leased from the government, is evaluated as 11.3 million dollars.

b) Irregular payment of account receivable by Huta Katowaice, one of the main customers in the country, and a large loss during 1991 are suppressing the PC's working capital.

In the aspect of sales and profitability:

a) It is difficult to forecast the domestic demand in Poland because restructuring of the steel making industry is now in process, so overseas sales are mainly sought.

b) Among the production cost items, the price of coal, which is main raw material, personnel expenses, railway transportation costs, taxes for environmental protection, etc. are increasing remarkably by reflecting the price liberalization policy and environmental protection policy of the government. Thus the operating loss during 1991 amounted to 11.6 million dollars.

c) Dividends imposed solely on national enterprises (taxes imposed on the amount equivalent to the capital at a rate of 22%) and those taxes imposed on the amount in excess of the standard base-up level amounted to 30.6 million dollars in 1991 resulting in the total loss of 42.2 million dollars in 1991. As far as the PC remains as a national enterprise, these large amount of taxes will be imposed and they will endanger the existence of the PC through suppression of its financial status and profitability.

These taxes are not imposed on those enterprises in which the shareholding ratio of the government is 50% or less, so it is necessary to reform the PC into a private enterprise, in which the contribution from private sectors is the majority of the capital, as soon as possible if its existence is to be assured.

9.2 General

1) This financial evaluation is made by assuming a coke plant which has the maximum annual coke production capacity of 2,919,000 tons.

2) This plant shall be operated by a joint venture between Polish partners and foreign partners, where the Polish partner shall contribute the PC's fixed assets and the foreign partner shall contribute the foreign hard currency to purchase the equipment and technology required for modernization of the plant.

   The capital structure on the basic case is as follows:

Polish capital:	US$221,549,000
Foreign capital:	US$ 29,526,000
Total:	US$251,075,000

   The shareholding ratio of the Polish government shall be 50% or less (i.e., US$125,537,500 or less) and the reminder shall be held by employees and common shareholders at the time when the joint venture is established.

   When the PC has been liquidated, the new joint venture shall take over the PC's fixed assets but all other credits and liabilities shall be left to the disposal by the PC.

   All employment agreements between individual employees and the PC shall be cancelled and various settlements in association with such canceling shall be left to the PC, then the joint venture shall enter into new employment contracts with individual workers.

3) The following common premises and assumptions will apply to the basic case and sensitivity analysis.

   a) Currency: US dollars
      Polish Zloty has been remarkably devaluated against the US dollar since 1989 as shown below and it is still undergoing a monthly devaluation of 1.8%. If the financial analysis is performed on the basis of the Zloty currency under these circumstances, work of feasibility study will become complicated and thus the output data will also be complicated and difficult to understand because of the necessity of considering a large rate of inflation and devaluation of the currency, so the US dollar is used for the analysis to avoid such complexity.

      However sales prices and various costs are calculated in the Zloty currency on the basis of the PC's results as of 1990 and 1991 and estimations for the PC project as of 1992 in assumption that the rate of Zloty against the US dollar was 9,500 in 1990, 11,107 in 1991, and 13,543 in 1992.

Transition of the rate of Zloty against the US dollar is as shown below:

Zloty/US dollar	Year
503	1989 (January)
6,500	1989 (December)
9,500	1990
11,072	1991
13,618	1992 (July)

b) Commencement of modernization: Jan. 1994

c) Commercial operation: The joint venture will take over the plant in operation as it is, so commercial operation is assumed to be commenced in 1994.

d) Project life: 15 years

f) Depreciation

Straight-line method, no salvage value

Term of depreciation

1. Structure, Civil Engineer	40 years
2. Civil Engineering	25 years
3. Transportation	10 years
4. Technology	10 years
5. Tools, Office Equipment	5 years
6. Machinery	10 years
7. Energy Machine	20 years

Transport and tools, other equipments are of consumable nature, so new items will be purchased every year in the amount corresponding to that of depreciation; the amounts will be 340 and 220 respectively.

g) Taxes and duties

Import tax and turnover tax

These taxes are not imposed on those equipment and machinery for production use.

Corporate income tax = 40%

It is premised that a permit for exemption of this tax will be obtained according to Article 23 of the Joint Venture Act.

The limit of exemption of the tax is the same as the amount of foreign investment (= US$29,525,000). As the amount of tax corresponding to this amount of contribution is estimated as for 9 years, so no tax for 9 years is premised.

Salary increase tax, dividend*

It is premised that this tax is not imposed on assumption that the final share holding ration of the Polish government in the joint venture will become 50% or less after part of shares have been sold to private sectors.

9.3 Investment Cost

a) The fixed assets, which the new joint venture takes over from the PC as investments in kind by the Polish partner, are assumed as the initial investment as of 1993. (See Table 9-1)

b) New investments in equipment for modernization are assumed as current investment and are allocated to the 3 years from 1994. Inflation during the period of 1992 to 1994 is not taken in consideration. Details of these investments are stated in Chapter 1.5 (See Table 9-2)

*Note: Under the laws of Poland, when the government holds the majority of an enterprise, the government imposes a tax called "dividend" in the amount corresponding to 22% of the capital invested by the government. Further, taxes are also imposed on salary increases in excess of government regulation.

9.4 Conditions Applied for Cost Estimate Calculations (Table 9-3 and 9-3-2)

1. Price Escalation
   All costs are calculated on the basis of actual costs of 1991 and are subject to 5% annual increase in 1992, 1993 and 1994 except for coal which takes 1% annual increase. This price escalation is applied only in those three years.

2. Raw Material
   Coal: Estimated price as of 1992: $33.98/ton
   Coal rail transport: Estimated price as of 1992 : $3.947/ton
   Other Raw Material: See Table 9.3

3. Utility and Energy: See Table 9.3

4. Labor Cost
   Based on actual payment as of January 1992, Social insurance cost of 45% of the gross payment and worker's fund (2%) are added. For details see attached Table 9-5.
   Dismissal payment is also included in initial four years when the new company has to decrease its employees due to rationalization.

5. Cost for Maintenance, Repair, Spare parts, Factory overheads and Administration-Non Labor Cost are based on 1991 actual cost with 5% price escalation up to 1994.

6. "Marketing Non labor costs" appeared in COMFAR tables includes cost for environmental penalty fee for sludge, air pollution and waste water. (Item No. 35,36,37 of Table 9-4)

7 Sales and distribution costs are given in Sales Plan (Table 9-6A-F) in the name of Inland Transport, Port Charge, Agent Commission, Transport Charge.

9.5 Sales Plans

Sales plans are based on the demand forecast and sales prices as stated in Chapter 3.1.2 (Refer to Table 9-6 A~F).

9.6 Working Capital

a) Accounts receivable and accounts payable

Domestic sales: Eighty percent of accounts receivable are those to be paid from the Huta Katowice Steelworks (H.K.) and, although such payment within 14 days after each delivery is provided in the contract, actually very irregular payments are made such as that each payment is made after the H.K. has received the payment from its customers.

However, because the payment to the coal supplier also delays accordingly, the joint venture will have no burden of funds as related to transactions.

Export: According to the sales conditions as to the Benglo Cokes, the main customer, each payment is made within 14 days after the delivery and the same conditions apply to the coal supplier, the joint venture will have no burden of funds in export transactions also.

The aging list of accounts receivable and accounts payable as of the end of 1991 is as shown below. Although most of accounts receivable and accounts payable are left unpaid for more than 3 months, payments to suppliers are made after receiving the payments from customers in any case and no burden of funds occurs (as the cost of coal occupies 55% of the total cost), the days of coverage of 30 days are assumed for both accounts receivable and accounts payable in this feasibility study.

Aging List (Unit US$1,000, as of end 1991)

	Notes and Account Receivable	Account Payable
less than 1 month	9,620	1,108
2	4,588	485
3		356
above 3	23,240	53,461
Total	37,448	55,410

b) Inventory

According to the result of interviews made in the plant, the inventory period for coal, which is the main material for production, is 7 days with 7 days for materials for chemical products.

As to work in progress, a coverage day of 1 day applies to coke, which can be produced within a few hours.

c) Finished products

Produced cokes are in principle not stored more than one day at PC. They will be delivered by rail to clients in Poland and CISs and other European countries or by ship to North America.

As to the products to be exported by ship to North American and Brazilian markets, products are stored in the stockyard at the port - not at the factory while waiting for a vessel which come 2-3 times a month. It is difficult to estimate how many days the final products stay at the port. It depends on the shipping arrangement such as the volume of one time shipment and size of the vessel. The average days could be guessed approximately 10~20 days. The above mentioned (9.6. a) 30 days of coverage thus includes the portion of days in which the finished goods stays at the port.

In light of this calculation of working capital requirement, the report assumes that only one day coverage of finished product as current assets is appropriate.

9.7 Financing

a) Investment cost: The PC's assets taken over by the joint venture will be represented by the investment in kind by the Polish partner and the equipment imported from foreign countries and the expenses for technical transfer as part of the new investment for modernization will be represented by the investment by the foreign partner.

The fund by domestic currency as part of the new investment will be represented by the loan from any international finance organization or foreign bank, of which conditions are as follows:

Interest rate	: 6%
Repayment term	: 10 years by equal installments
Grace period	: 2 years

b) Working capital

Loans from banks in Poland is available at the annual interest rate of about 60% and the fund procurement through such loans result in too much burden, so funds are assumed to be covered by over drafts from foreign banks at the interest rate of 15%.

9.8 Financial Evaluation

The following schedules are set out in Annex B.

Total Initial Investment
Total Investment During Production
Total Production Costs
Working Capital Requirements
Cash Flow Tables
Projected Balance Sheet

Net Income Statement
Source of Finance
Sensitivity Analysis
Economic Analysis

9.9 Main Conclusions Obtained from Financial Evaluation

1) Although net profit will be in negative figures for the first 2 years it will turn into black figures from the third year when production by the full capacity will be commenced, and the deficit accumulated during the first 2 years surplus offset in the fourth year with some profit to be carried over.

2) Profit after tax for a single term will be about 14 million dollars even in the 14th year where it is estimated to reach the maximum and if 50% of such profit is paid as dividends, the dividend rate will be only less than 3%.

3) IRR is calculated as 5.31% which is not a sufficient rate to attract interest of foreign investors.

4) As stated on the attached sheet, the break even point will be 77.8% in 1998, the 5th year when the full production capacity will be achieved with the cost on the standard production cost level. (following the next page)

<u>Break - Even Point</u>

(Unit:Value US$1,000, Quantity 1,000 tons)

(5th year = 1998)

p : Average Price = $ 95/tons (277,551÷ 2,919)

f : Fixed Cost = $ 47,835

v : Variable Cost = $215,807/2,919 tons

x : Annual Production

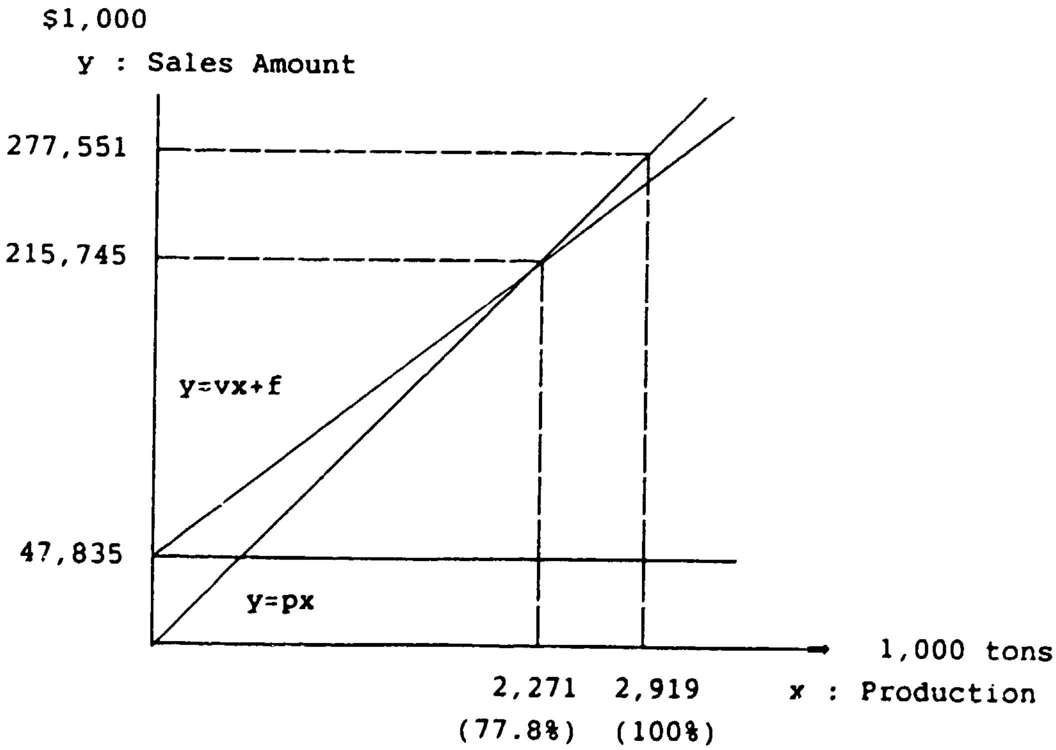
y : Annual Sales

$$\begin{cases} y = px : y = 95x \\ y = vx + f : y = \dfrac{215,807}{2,919} x + 47,835 \end{cases}$$

$$95x = 73.9318x + 47,835$$

$$21.068x = 47,835$$

$$x = 2,271 \ (77.8\%) \qquad y = 215,745$$



9.10 Sensitivity Analysis

As described in the previous section, IRR of the basic case is 5.31%. However, a sensitivity analysis was performed on the following premises to pursue the possibility to make a project now attractive.

1) Sales price of coke

If the sales price of coke is raised by 10%, IRR will be raised by 6.9% to 14.98% indicating a high sensitivity of IRR to the sales price. However, no remarkable increase in the demand for coke within a short period can be expected under the present conditions where the demand for iron and steel is cooling down.

On the other hand, the demand for coke will gradually increase over a long period because of the shutdown of existing coke plants as mentioned in Chapter 3 and the difficulty in constructing new plants due to the rise in environmental countermeasure and construction costs. Nevertheless it is not realistic to consider that the price will be maintained at a level 10% higher than that of the basic case.

2) Initial investment cost

This financial evaluation was performed on the premise that the new joint venture would take over the PC's existing fixed assets represented by the estimated book values as of the end of 1993 as the investment in kind by the Polish partner.

During the site survey of the feasibility study, investigation of the book values of assets and evaluation of the current values of land (leased) and some buildings in a simplified manner by a Polish expert were performed. (Precise evaluation of all fixed assets including machinery and equipment is not performed at this time because it requires immense expenses and a long time, but it is reasonable to leave such evaluation to the parties who actually make investments in the joint venture.)

Although the current value of the buildings based on these evaluations is 1.3 to 1.9 times that of the book value, IRR as calculated based on the book value was only 5.31%, In order to make the project attractive to foreign investores, further reduction of the book value of assets must be taken into consideration.

Therefore, a sensitivity analysis was performed here on the premises that fixed assets would be evaluated at the cost equal to 1/2 and 1/3 of the book value. As the result, IRR was 12.21% and 17.08% for cases of 1/2 and 1/3 of the book value respectively. It was found that the manner of evaluating fixed assets is a very large factor for improving IRR.

At present, a criterion for international financial institutions to justify an investment or loan to a project is an IRR between 15 to 20%.

Therefore, how to decide the assessed amount of fixed assets that the new joint venture will take over from the PC becomes an important point to be negotiated between foreign investors and the Polish partner.

9.11 Economic analysis

1) As a result of calculation of the economic IRR made on the assumption below, IRR is 8.64%.

A) Tax

a) Income tax

The proportion of the income tax to the labor cost including the social security cost and the workers fund is 14%, and the amount of income tax of each year is as follows and it is excluded from the base case. Dismissal pay is not included in labor cost because income tax is not levied on this part.

(US$ 1,000)	1994	1995	1996	1997 onward
Labor Cost	21,888	21,194	18,547	14,552
Income Tax	3,064	2,967	2,597	2,037

b) Corporate tax

40% of the corporate tax are imposed on the profit. According to the base case, this tax is imposed in and after the year 2003 (the 10th year) so that the corporate tax in and after the year 2003 is excluded.

c) Other taxes

There are three types of taxes as shown below.

The amount of payment in 1991

Tax on Property	22,025	mil ZL
" Land	468	
" Land use	2,943	
Total	25,463	
	= US$ 2,290	mil

According to the base case, the amount of payment in 1994 is US$ 2,651 million which is calculated by adding the amount caused by an inflation of 5% from 1992 to 1994 to the US$ 2,290 million, which is excluded.

d) The chemical products are imported as raw material of which quantity is so small that it is omitted.

e) The import duty and the turn-over tax are not imposed on the import of machinery for the new investment.

f) The penalty for air pollution, waste water and dump is not excluded from production cost, because this penalty is considered to be expensed again by the government for the countermeasures against the pollution of the country.

B) Shadow exchange rate

The shadow exchange rate does not exist because the exchange of foreign currencies has been liberalized excluding the capital transactions since January 1990 in Poland and the foreign exchange rate is also unified. This matter has been already confirmed in the World Bank.

C) Subsidy

Neither government subsidies are granted for coal, the primary material of coke, energy to be used for manufacture, and the railway transport, etc. nor government subsidies to PC is granted.

D) Shadow wage

According to the minimum monthly wages of PC in December, 1991, the wage as low as 800,000 to 900,000 ZL is paid to the workers in the lower category and it can be considered that the shadow wage does not exist.

2) Expected effect and gain after completing the rationalization and modernization of the project and other contribution

A) The purpose of the project and the most important effect are to privatize PC through a participation of the foreign capital, purchase facilities and machinery necessary to modernize the plant with that foreign capital, introduce the technology, and help the plant to survive in the market economy.

B) The effect expressed in the concrete figures are the energy saving amounting to US$ 4,944,000 and the environmental tax saving amounting to US$ 5,184,000, total US$ 10,128,000 annually as shown 9-7. Also, if the production increase is exported, approx. US$ 53 million of the foreign currency can be acquired annually.

C) It is possible to reduce the environmental contamination such as air pollution, waste water, dump, etc...

D) The employment of PC will decrease by labor saving, but the employment of the people who engage in the distribution (transportation, foreign freight forwarder, insurance, etc.) will increase by increasing the production.

E) If this project starts smoothly, it will attract foreign investors' interest because it is a large scale project as a privatized enterprise in which the foreign capitals participate so that it will stimulate investments in Poland.

Initial Investment

(Table 9-1)

($1 = 11,107 ZL)

COMFAR category (Depreciation year/rate)	PC category		① Purchased value end 91 [1]		② Net book value end 91 [2]		③ Depreciation 92/93 (① × rate× 2)	④ Book value end 93 (② - ③)
	item	Name	Mil ZL	$1,000	Mil ZL	$1,000	$1,000	$1,000
Structure, Civil engineering (a) (40 years/2.5%)	1	Building	814,402	73,323	753,853	67,873	3,666	64,207
Structure, Civil engineering (a) (25 years/4.0%)	2	Civil engineering	1,216,167	109,496	1,024,162	92,209	8,760	83,449
Transport (10 years/10.0%)	7	Transport	37,083	3,339	20,368	1,834	668	1,166 (Purchase 92/93) 668
Technology (10 years/10.0%)	0	Technology Documents	107,843	9,709	80,040	7,206	1,942	5,264
Other assets (5 years/20.0%)	8	Tools, Office equipment	5,911	532	2,888	260	213	47 (Purchase 92/93) 213
Machinery equipment (a) (10 years/10.0%)	4	General application machines	528,966	47,625	358,130	32,243	9,525	22,718
	5	Batteries machines	236,091	21,256	160,402	14,441	4,251	10,190
	6	Technical machines	596,763	53,729	394,135	35,485	10,745	24,740
								Total 57,648
Machinery equipment (b) (20 years/5.0%)	3	Energy machines	131,689	11,856	111,882	10,073	1,186	8,887
Total			3,674,915	330,865	2,905,860	261,624	40,956	220,668 (Purchase 92/93) 881

Note: 1) Refer Table 9-1A (List of PC fixed assets)
2) Refer Table 9-1A and 9-1B (Net Book Value = Purchased Value – Accumulated Depreciation)

List of Fix Assets from 1991.01.01 to 1991.12.31 (Purchased Value)

(Table 9-1A)

(ZL)

Name	Category	Beginning 1991	Increase during 1991	decrease during 1991	end 1991
technologies and documents	0	97,873,753,935	9,969,451,506	0	107,843,205,441
buildings	1	793,855,419,000	20,546,146,135	0	814,401,565,135
civil engineering work	2	1,213,667,441,000	2,499,224,000	0	1,216,166,665,000
energy machines	3	131,684,790,000	3,968,472	0	131,688,758,472
general application machines pumps, drills	4	528,588,913,000	502,919,927	125,183,000	528,966,649,927
batteries-machines typical for cokery	5	236,247,323,000	452,671,556	608,922,000	236,091,072,556
technical machines, e.g. water, gas treating machines	6	595,051,844,000	1,710,896,000	0	596,762,740,000
means of tansort / railways, cars	7	37,895,477,000	449,510,000	1,262,405,000	37,082,582,000
tools, office equipment	8	5,514,758,000	396,199,155	0	5,910,957,155
total 1-8		3,542,505,965,000	26,561,533,245	1,996,510,000	3,567,070,990,245
total		3,640,379,718,935	36,530,986,751	1,996,510,000	3,674,914,195,686

List of fixed assets from 1991.01.01 to 1991.12.31. (Depreciation)

(Table 9-1B)

(ZL)

Name	Category	Balance sheet / the biginning of the year / (Accumulated Depreciation)	Increase during 1991	Decrease during 1991	Changes within a year – amortisation	Bilance sheet at the end of a year (Accumulated Depreciation)
technologies and documents	0	18,016,387,589	0	0	9,787,375,404	27,803,762,993
buildings	1	40,846,610,361	0	0	19,702,512,751	60;549,123,112
civil engineering work	2	146,211,530,710	0	0	45,792,191,517	192,003,722,227
energy machines	3	13,222,853,007	0	0	6,584,375,050	19,807,228,057
general application machines pumps, drills	4	121,505,433,912	0	43,913,722	49,374,952,263	170,836,472,453
batteries-machines typical for cocery	5	55,147,619,580	0	266,138,443	20,807,258,518	75,688,739,855
technical machines e.g. water, gas treating machines	6	143,653,626,065	0	0	58,973,274,629	202,626,900,694
means of tranport / railway, cars/	7	13,650,293,483	0	1,082,034,646	4,143,976,403	16,715,171,312
tools, office equipment	8	1,956,432,247	0	0	1,066,311,795	3,022,744,042
Total 1 - 8		536,194,399,365	0	1,392,086,811	206,444,852,926	741,250,101,752
Total		554,210,786,954	0	1,392,086,811	216,232,228,330	769,053,864,745

New Investment (Current Investment)

(Table 9-2)

(US$ 1,000)

PC category	COMFAR category (Depreciation year)	Chapter 5-1 I.D. No.	1st year		2nd year		3rd year		Total		
			Local [1]	Foreign [2]	Local	Foreign	Local	Foreign	Local	Foreign	Total
1	Structure, Civil engineering (a) (40 years)										
2	Structure, Civil engineering (b) (25 years)	2-4 / 3-2 / 4-1, 2, 3	1,022		269				1,291		1,291
7	Transport (10 years)	1-2 / 2-1, 2	49	13,059	442	362			491	13,421	13,912
0	Technology (10 years)	2-10		724		1,208		483		2,415	2,415
8	Other assets (5 years)										
4 5 6	Machinery equipment (a) (10 years)	2-3, 4, 5, 6, 7, 8, 9/ 3-1/ 4-1, 2, 3	1,425	13,255	2,628	435			4,053	13,690	17,743
3	Machinery equipment (b) (20 years)	3-2	431		468				899		899
Total			2,927	27,038	3,807	2,005		483	6,734	29,526	36,260

(Foreign portion : Import duty and turnover tax are exempted)

1) Bank loan
2) Foreign equity

Operation Cost

(Table 9-3)

($1,000)

COMFAR Line No.		1991 *1) (Actual)	1994 (Modernization Year 1)	1995 (Year 2)	1996 (Year 3)	1997 and after (Year 4)
94	Raw material (a) (Coal) (2)	131,842	127,752	145,247	162,509	162,509
96	Raw material (b)	2,409	2,789	3,191	6,786	6,786
98	Utilities	845	978	1,093	1,196	1,174
99	Energy	5,058	6,497	7,049	7,604	7,604
100	Direct labor cost	15,349	16,921	16,537	14,768	11,844
104	Administration labor cost	1,338	1,472	1,427	1,266	1,016
106	Marketing labor cost	3,101	3,418	3,333	2,954	2,356
101	Maintenance / repair	7,741	8,960	8,960	8,960	8,960
102	Spare parts	330	382	382	382	382
103	Factory overhead	883	1,023	994	870	682
105	Administration Non labour	6,488	7,531	7,531	7,531	7,531
107	Marketing non labour (Environment pollution penalty)	2,599	7,357	7,906	4,228	4,228
Total		177,983	185,080	203,650	219,054	215,072

* 1) See Table 9-4 for details. (Exchange Rate $1=ZL 11,107)

Note: Figures can slightly differs with COMFAR tables due to calculation and rounding process.

2) Railway transport charge is included.

3) For detail of Raw material (a), (b), Ulitities, Energer of years 1994 onward, see Table 7-3.

(Table 9-3-2)

Detail of Operation Cost of 1991

(Exchange Rate $1 = 11,107 ZL)

Comfar No.		Item No. of Table 9-4		Cost (Million ZL) ($1,000)
101	Maintenance Repair	5	Materials for Renovation	46,929
		13	Machining Service	1,103
		17	Other Transport Service (Lease of crane used for maintenance of ccke oven)	2,265
		18	Renovation Works	35,680
			Total	85,977 ($=7,741)
102	Spare Parts	4	Production of Workshop	3,664 ($= 330)
103	Factory Overhead	7	Unstable Materials	3,136
		16	Workers Transport	3,166
		21	Meal	3,512
			Total	9,814 ($= 883)
105	Administration Non Labor Cost	6	Other Material	13,447
		19	Computer Service	538
		22	Canteen Maintenance	1,596
		23	Road Cleaning	1,796
		24	Recultivation of Land	451
		25	Other Material Service	5,385
		30	Special Fund	1,099
		31-34	Taxes	25,483
		38	Business Trip	273
		40	Non Material Service	21,993
			Total	72,061 ($=6,488)

(Table 9-4) Actual Costs of 1991

Costs -			1991 Actual Cost in milion PZL
1.	Coal for Production		1326486
2.	Other Raw Materials		
		wash oil	12500
		sodium hydrate	7700
		sulphuric acid	4900
		potassium carbonate	1600
		other	59
		TOTAL	26759
3.	Fuels		
		nitrogen	3056
		liquid fuels, oxigene and acetylene	1220
		gasoline	890
		boiler coal	876
		coke gas	100
		TOTAL	6142
4.	Production of Workshop		3664
	These are parts for the needs of other production divisions		
	made by Mechanical and Construction Division M-1, e.g.;		
	housings and covers of bearings, pivost, shats for pumps and		
	engines, distance rings, pins sleeve packings		
5.	Materials for Renovation		
		Running Maintenance	29642
		Minor Renovations	15186
		General Overhauls	2100
		TOTAL	46928
6.	Other Materials		
		Materials for Workshop Production	3044
		Oils and Grease (except fuel)	2207
		Materials for Construction, Assembly	
		and Maintenance Works	620
		Tyres	431
		Office Materials	623
		Books and Periodice	336
		Entertainment and Advertising	167
		Minor Tools	437
		Other (Means of Hygiene, Soap,	
		Towels, Sand, etc.)	2491
		Protective Clothing	3001

			Other				90
			TOTAL				13447
7.	Unstable Materials						
			(Tools and Office Equipment				
			up to 5,000,000 PZL par unit)				3136
8.	Materials in the Storehouse						
	These are figures resulting from change in the manner of						
	calculating the inner production of spare parts.						
	Formerly, these parts value was placed at the item "Materials"						
9.	Electric Energy						44781
10.	Drinking Water						1527
11.	Industrial Water						7856
12.	Heat Energy						5260
13.	Machining Service out of the Plant						1103
14.	Freight Cars Lease						659
15.	Use of Side Track						
			(Fees paid to PKP Polish Railways)				58
16.	Workers Transport						
			(Formerly, mainly outside services;				
			presently own sevices)				3166
17.	Other Transport Services						2255
18.	Renovation Works						
			(Services of specialized companies)				
			Anti-Corrosion Protection				12000
			Electric Devices				15000
			Other				8680
			TOTAL				35680
19.	Computer Services						
			(Purchased from an outside				
			computer centre)				538
20.	Comissions and Margins						
			(For agents selling coke)				29616
21.	Meals		(9,000 PZL per person/day)				3512
22.	Canteen Maintenance						
			(Outside company service)				1596
23.	Road Cleaning						1796
24.	Recultivation of Land						451
25.	Other Material Services						
			Design				954
			Telecommunication & Mail				987
			Tools Regeneration				400
			Warranty Inspections				218
			Claims				27
			Laundry				202

			Measures & Weights				187
			Technical Progress		(Implementation		
					of projects)		76
			Hire of Machinery and Tools				35
			Other				2299
			TOTAL				5385
26.	Wages						90010
27.	Tax on Wages		20%				17997
28.	Social Insurance		45%				38054
29.	ZFM & ZFS Funds for Workers						1764
	ZFS - 25% of medium wages						
	ZFM - 12,5% of medium wages						

In the above table following costs are omitted from PC's original cost table(between 12 and 13).

Railway transport	261,529
(of which for coke	114,026)
(for coal	137,887)
(for others	9,616)
Other Means of Transport	487

30	**Special Funds**			
	Excluded from the costs of obtaining			
	income for calculation of income taxes.			
	There must be 6 disabled persons			
	in every 100 persons employed.			
	Employing fewer disabled persons, a firm			
	will be charged with this fund.			
	Calculation of the amount is complicated			
	for it additionally considers value of			
	services by companies which employ			
	disabled persons statutorily.			1.099
31	**Tax on Property**			22.025
32	**Tax on Land**			468
33	**Tax on Vehicles**			47
34	**Tax on Land Use**			2.943
35	**Tax on Air**			5.825
36	**Tax on Used Water**			19.777
37	**Tax on Dump**			3.268
38	**Business Trips**			273
39	**Costs of Financial Operations**			37
40	**Other Non-material Services**			
		Hotel accomodation fees		6.312
		Rewards of projects of invention		7.269
		trust administration		1.904
		vehicle registration		196
		other		6.312
				21.993

(Table 9-5) Labor Cost

	1992			1994			1995			1996			1997			Comparison 1997-1994	
	Number	Cost/Head	Cost ($1,000)	Number	Cost/Head	Cost ($1,000)	Number	Cost/Head	Cost ($1,000)	Number	Cost/Head	Cost ($1,000)	Number	Cost Head	Cost ($1,000)	Number	※ Cost ($1,000)
Presidential Room																	
President	1	24,000	24	1	25,000	25	1	25,000	25	1	25,000	25	1	25,000	25	0	0
Office Staff	24	5,733	138	24	6,321	151	23	6,321	145	20	6,321	126	16	6,321	101	-8	-50
Workers Board	167	4,686	783	167	5,166	863	161	5,166	831	140	5,166	723	109	5,166	563	-58	-300
Dismissal Pay									6			21			30		
Total	192		945	192		1,039	185		1,007	161		895	126		719	-66	-350
Economic Trade																	
V. President	1	10,000	10	1	11,000	11	1	11,000	11	1	11,090	11	1	11,000	11	0	0
Office Staff	63	4,914	310	63	5,418	341	61	5,418	330	53	5,418	287	41	5,418	222	-22	-119
Transport	471	5,904	2,781	471	6,509	3,066	457	6,509	2,975	397	6,509	2,584	310	6,509	2,018	-161	-1,048
Dismissal Pay									17			72			105		
Total	535		3,101	535		3,418	519		3,333	451		2,954	352		2,356	-183	-1,167
Production Technology																	
V. President	1	10,000	10	1	11,000	11	1	11,000	11	1	11,000	11	1	11,000	11	0	0
Staff	2,497	6,143	15,339	2,497	6,772	16,910	2,429	6,772	16,449	2,129	6,772	14,418	1,671	6,772	11,316	-826	-5,594
Dismissal Pay									77			339			517		
Total	2,498		15,349	2,498		16,921	2,430		16,537	2,130		14,768	1,672		11,844	-826	-5,594
Accounting Finance																	
Director	1	10,000	10	1	11,000	11	1	11,000	11	1	11,000	11	1	11,000	11	0	0
Staff	54	7,084	383	54	7,810	422	52	7,810	406	45	7,810	351	35	7,810	273	-19	-149
Dismissal Pay									3			9			13		
Total	55		393	55		433	53		420	46		371	36		297	-19	-149
Grand Total	3,280		19,783	3,280		21,811	3,187		21,297	2,788		18,988	2,186		15,216	-1,094	-7,260

Cost of Presidential Room & Accounting/Finance is included in Administration Labor Cost of COMFAR.
Cost of Economic Trade is included in Marketing Labor Cost of COMFAR.
Cost of Production/Technology is included in Direct Labor Cost of COMFAR.

※ Dismissal Pay not included

(Table 9-6A)

Sales Plan : Cokes　　　　Year 1994　　　　Production 2,264千 ton

(Unit : 1,000 tons)

(Amount US$ 1,000.-)

	Domestic 516 tons			Export 1,748 tons									Total Amount
				CIS 800 tons			Europe 948 tons			others 0 tons			
	tons	Unit Price	Amount	tons	Unit Price	Amount	tons	Unit Price	Amount	tons	Unit Price	Amount	
Stabilized Coke (1,947 tons)	389	76.83	29,887	800	94.00	75,200	758	89.37	67,742	—	—	—	172,829
Other Coke (317 tons)	127	53.10	6,744		—	—	190	64.50	12,255	—	—	—	18,999
Total	516		36,631	800		75,200	948		79,997				191,828
Inland Transport		0			11.03	8,824		10.73	10,172	—	11.50	—	18,996
Port Charge		0			0			0			0		
Insurance		0			0			0			0		
Agent Commossion		0			2.00	1,600		2.00	1,896		1.50		3,496
Remarks													

(Table 9-6B)

Sales Plan : Cokes　　　　Year 1995　　　　Production 2,592千 ton

(Unit : 1,000 tons)

(Amount US$ 1,000.-)

	Domestic 534 tons			Export 2,058 tons									Total Amount
				CIS 800 tons			Europe 976 tons			others 282 tons			
	tons	Unit Price	Amount	tons	Unit Price	Amount	tons	Unit Price	Amount	tons	Unit Price	Amount	
Stabilized Coke (2,229 tons)	389	76.83	29,887	800	94.00	75,200	758	89.37	67,742	282	89.37	25,202	198,031
Other Coke (363 tons)	145	53.10	7,700		—	—	218	64.50	14,061	—	—	—	21,761
Total	534		37,587	800		75,200	976		81,803	282		25,202	219,792
Inland Transport		0			11.03	8,824		10.73	10,473	—	11.50	3,243	22,540
Port Charge		0			0			0			3.00	846	846
Insurance		0			0			0			0		
Agent Commossion		0			2.00	1,600		2.00	1,952		1.50	423	3,975
Remarks													

(Table 9-6C)

Sales Plan : Cokes   Year 1996

Production 2,919千 ton
(Unit : 1,000 tons)
(Amount US$ 1,000.-)

	Domestic 553 tons			Export 2,366 tons									Total Amount
				CIS 800 tons			Europe 1,003 tons			others 563 tons			
	tons	Unit Price	Amount	tons	Unit Price	Amount	tons	Unit Price	Amount	tons	Unit Price	Amount	
Stabilized Coke (2,510 tons)	389	76.83	29,887	800	94.00	75,200	758	89.37	67,742	563	89.37	50,315	223,144
Other Coke (409 tons)	164	53.10	8,708		—	—	245	64.50	15,803	—	--	—	24,511
Total	553		38,595	800		75,200	1,003		83,545	563		50,315	247,655
Inland Transport		0			11.03	8,824		10.73	10,762	—	11.50	6,475	26,061
Port Charge		0			0			0			3.00	1,689	1,689
Insurance		0			0			0			0		
Agent Commossion		0			2.00	1,600		2.00	2,006		1.50	845	4,451
Remarks													

(Table 9-5D)

Sales Plan : By-Product   Year 1994   Coke Production 2,264,000 ton

(Amount US$ 1,000.-)

	Domestic			Export			Total	
	Quantity (tons)	Unit	Amount	Quantity (tons)	Unit	Amount	Quantity (tons)	Amount
Tar	49,320	37.57×1.01^2 38.33	1,890	73,980	47.94×1.01^2 48.90	3,618	123,300	5,508
Benzol	11,370	121.14×1.01^2 123.57	1,405	17,055	132.57×1.01^2 135.23	2,306	28,425	3,711
Ammonium	12,756	11.07×1.01^2 11.29	144	19,134	8.50×1.01^2 8.67	165	31,890	309
Chemical Products Total			3,439			6,089		9,528
COG	525,740 $\times 10^3$ Nm^3	22.73×1.01^2 23.19	12,191	—	—	—	525,740	12,191
CHARGE								1,012

Transport Charge : 1991 $909,000 = $0.405/1 ton of Coke Production
$0.405 \times 1.05^2 = \$0.447$

Unit Price : Price of 1992 × Two Yers Inflation, each 1%

(Table 9-6E)

Sales Plan : By-Product　　Year 1995　　Coke Production 2,592,000 ton

(Amount US$ 1,000.-)

	Domestic			Export			Total	
	Quantity (tons)	Unit	Amount	Quantity (tons)	Unit	Amount	Quantity (tons)	Amount
Tar	56,480	38.33	2,165	84,720	48.90	4,143	141,200	6,308
Benzol	13,016	123.57	1,608	19,524	135.23	2,640	32,540	4,248
Ammonium	11,880	11.29	134	21,906	8.67	190	36,510	324
Chemical Products Total			3,907			6,973		10,880
COG	616,390 $\times 10^3$ Nm^3	23.19	14,294	—	—	—	616,390	14,294
Transport Charge								1,159

(Table 9-6F)

Sales Plan : By-Product　　　　Year 1996　　Coke Production 2,919,000 ton

(Amount US$ 1,000.-)

	Domestic			Export			Total	
	Quantity (tons)	Unit	Amount	Quantity (tons)	Unit	Amount	Quantity (tons)	Amount
Tar	63,560	38.33	2,436	95,340	48.90	4,662	158,900	7,098
Benzol	14,652	123.57	1,811	21,978	135.23	2,972	36,630	4,783
Ammonium	16,436	11.29	186	24,654	8.67	214	41,090	400
Chemical Products Total			4,433			7,848		12,281
COG	759,630 $\times 10^3$ Nm^3	23.19	17,616	—	—	—	759,630	17,616
Transport Charge								1,305

Table 9-7 Financial Effects: Expected Effect and Gain after completing the Rationalization and Modernization Project

I.D.	IMPROVEMENTS AND EQUIPMENT (Method)	LABOUR SAVING ($)	ENERGY SAVING ($)	ENV. TAX SAVING ($)	INCREASED PRODUCTION CAP. (EARNING) ($)
1-1*	Modernization of CDQ	-	-	-	53,367,000
2-1	Automatic Bucket Operation	108,000	-	-	-
2-2	CDQ Automatic Crane Operation	271,000	-	-	-
2-3	Auto combustion Control System for Coke Oven	27,000	1,721,000	-	-
2-4	Cleaning Device for Ascension Pipings	203,000	-	-	-
2-5	Industrial (ITV) System	244,000	-	-	-
2-6	Industrial Communication System	incl. in 2-5	-	-	-
2-7	Metal Removal Units	-	-	-	-
2-8	Tar Sludge Discharge System	14,000	-	-	-
2-9	Deodorant Device for Tar Decanter	incl. in 2-8	-	-	-
2-10	Supervisors & Operator Training (Technology Tfr. & Tech. Assistance)	4,727,000	-	630,000	-
3-1*	Analytical Equip. for Coal Blending	-	1,920,000	-	-
3-2	COG Holder	-	1,303,000	8,000	-
4-1	Dust Collector for M/S of Coke Oven Batteries	-	-	53,000	-
4-2	Low Pressure Desulphurization Facility	-	-	432,000	-
4-3	Waste Water Treatment	-	-	4,061,000	-

Note:

*1-1: This is the increased sales amount. For the actual financial effects refer to Chapter 9.

*3-1: A $10. per ton difference, i.e., cost savings, between coking coal and slightly coking coal is assumed.

Restricted

ORIGINAL: ENGLISH

Industrial Cooperation for Promotion of Investment Project
in Developing Countries US/GLO/90/292
Technical Report:

FEASIBILITY STUDY ON RATIONALIZATION & MODERNIZATION FOR PRZYJAZN COKERY IN REPUBLIC OF POLAND

- ANNEX -

Prepared for the Government of the Republic of Poland
by UNIDO Based on the Work by the Team of:

NICHIMEN CORPORATION
KOBE STEEL, LTD
THE KANSAI COKE AND CHEMICALS CO., LTD.

OCTOBER, 1992

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
(UNIDO)
VIENNA, AUSTRIA

ANNEX A

Terms of Reference

28/1/92

Feasibility Study on Modernization of
"PRZYJAZN" Coke Plant

TERMS OF REFERENCE

ANNEX C

1. BACKGROUND

In February 1991, the Friendship Cokeries (PRZYJAZN) in Poland propsed the follcwing:

(1) to conclude partnership with Japanese companies who can participate as equity partners;

(2) to give exclusive right for the export of the product (coke) if guaranteed to sell;

(3) to modernize their coking plant such as automation, computerization and environmental protection in order to have a competitive edge in the world market for cokes in the future.

In September 1991, a fact-finding mission consisting of potential Japanese investors visited and surveyd PRZYJAZN. The following were the conclusions of the preliminary survey:

(a) PRZYJAZN is a state-owned enterprise under the control of the Ministry of Industry of Poland and the privatization is now under study for application to the competent authorities.

(b) Present assets: about US$ 331 million

(c) Turn over/1990: about US$ 204 million; export share 77%

(d) Production of coke in 1990: 2.35 million tons

(e) Maximum capacity of coke production: 2.8 million t/y

(f) Initial start-up of plant: In 1986 with USSR technology, after 10 years construction period.

(g) Design concept: 15 years behind that of Japanese coke plant. This means that a lot of operations are manual without automation and computerization of production process.

(h) Number of employees: approx. 3,200 persons. This is more than 4 times compared with Kansai Coke and Chemical plant which has almost the same capacity.

(i) Environmental protection: Treated waste water is out of specification limits set for Katowice area which are two times more severe than the regulations in other parts of Poland. Therefore PRZYJZAN must pay a large sum as special taxes and fines to the authorities.

(j) Under these circumstances, the following are required:

- automation of operation and saving on labour cost;
- computerization of marketing, administration, planning and management;
- solving of environmental problems;
- investigate long term export prospects and financial viability of the venture.

2. OBJECTIVE

For the successful realization of the joint venture, it is planned to introduce entirely the technology and expertise of Japanese manufacturers as well as marketing know-how and fiancial ability of Japanese trading company(ies). In order to assess the technical and financial viability of the project outlined above, a comprehensive and amply detailed feasibility study should be prepared which would facilitate rational investment decision by the potential investors.

3. SCOPE OF CONSULTANCY SERVICES

In order to achieve the above objective, the contractor shall produce a feasibility study report containing the following chapters:

1. Executive Summary
2. Introduction and Enterprise Background, including detailed description of the internal analysis already carried out.
3. Market study
4. General Management and long term Objectives
5. Technical examination of the existing plant
6. Renovation plan
7. Operation of Plant
8. Implementation Schedule
9. Financial and Economic Evaluation

Specifically, the study will focus on the following:

(1) Market Study:

(a) Survey and analyse the present world market for coke.

(b) Assess the demand for coke on a long term basis.

(c) Determine the most likely markets and distribution arrangements.

(d) Investigate government incentives and protection measures which influence the pricing of the proposed product.

(e) Determine the competitive F.O.B. price for coke, indicating the price structure (price build-up).

(f) Survey and analyse the raw material (coal) market on a long term basis.

(2) Raw Materials and Utilities:

Determine the annual requirements of raw materials and utilities, indicating the quantities, specifications and sources of raw materials as well as utilities required.

(3) Technical Examination of the existing plant:

Review the existing plant design, production planning, quality control, energy and equipment efficiency.

(4) Renovation Plan:

Describe the proposed renovation plan and justify the introduction of new technology. Explain how the chosen technology would contribute to operational efficiency of the enterprise and abatement of environmental problems. Formulate recommendations for installing new and scrapping old equipment within the frame-work of the physical rehabilitation programme, safety and environmental protection. Also explain how the structure of the existing management will be affected by the rehabilitation programme and propose an appropriate organizational structure for the enterprise.

(5) Environmental Impact Assessment; in conjunction with the Technical Examination of the existing plant.

(6) Operation of Plant:

(a) Describe the production process and proposed improvements.

(b) Describe the production and sales plans as well as levels of inventories.

(c) Indicate required number of employees and training requirements

(d) Variable costs

(e) Management aspects

(7) Implementation Schedule:

(a) Organisation of project implementation

(b) Construction schedule

(8) Financial Evaluation:

(a) Review the past financial performance of the enterprise with a view to identifying bottlenecks, if any, in accounting and management information systems. Recommend appropriate accounting and management information systems for the plant.

(b) Provide investment cost estimates for the rehabilitation, broken down into foreign and local cost components.

(c) Estimate the working capital requirements. State specifically the criteria for its estimation.

(d) Estimate operating and production costs on annual basis.

(e) Estimate sales revenue for each year.

(f) Prepare cash-flow analysis for 10-15 years of project life.

(g) Calculate the Internal Rate of Return on total invested capital and the Net Present Value of the project.

(h) Prepare and analyse projected balance sheets and income statements for future operations.

(i) Carry out break-even analysis.

(j) Undertake sensitivity and risk analyses.

(k) Present required financial ratios.

(8) Economic Evaluation:

Calculate Economic Internal Rate of Return and the Net Present Value of the project.

4. GENERAL TIME REQUIREMENT

The implementation schedule of the feasibility study preparationn and its follow-up is as follows:

(1) Award of contract	A
(2) Initiation of field survey	A + 3 weeks
(3) Submission of draft final report	A + 5 months

UNIDO HQ will finalize the comments within 20 days after submission of the draft final feasibility study report by the contractor. The final report will be submitted within 15 days after receipt of UNIDO comments.

5. REPORTS

Five copies of the draft feasibility study report and 20 copies of the Final Report, in English, will be submitted by the contractor to UNIDO.

ANNEX B

COMFAR Tables

Date Date

COMFAR 2.1 - TOKYO, JAPAN

Modernization of Przyjazn Coke Plant
September 1992

1 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: US Dollars 1000

Total initial investment during construction phase

fixed assets:	221549.00	0.000 % foreign
current assets:	0.00	0.000 % foreign
total assets:	221549.00	0.000 % foreign

Source of funds during construction phase

equity & grants:	221549.00	0.000 % foreign
foreign loans :	0.00	
local loans :	0.00	
total funds :	221549.00	0.000 % foreign

Cashflow from operations

Year:	1	3	5
operating costs:	208477.40	252561.00	247913.00
depreciation :	11914.08	15525.37	15729.67
interest :	426.56	403.80	345.84
production costs	220818.00	268490.20	263988.50
thereof foreign	10.84 %	13.71 %	13.94 %
total sales :	213546.30	277551.60	277551.60
gross income :	-7271.57	9061.39	13563.05
net income :	-7271.57	9061.39	13553.05
cash balance :	-23.61	23241.36	29098.38
net cashflow :	-34080.55	23455.16	29117.22

Net Present Value at: 15.00 % = -127497.10
Internal Rate of Return: 5.31 %
Return on equity1: -4.72 %
Return on equity2: 5.26 %

Index of Schedules produced by COMFAR

Total initial investment
Total investment during production
Total production costs
Working Capital requirements
Cashflow Tables
Projected Balance
Net income statement
Source of finance

Total Initial Investment in US Dollars 1000

Year	1993
Fixed investment costs	
Land, site preparation, development	0.000
Buildings and civil works	[illegible]
Auxiliary and service facilities	0.000
Incorporated fixed assets	7358.000
Plant machinery and equipment	65535.000
Total fixed investment costs	221549.000
Pre-production capital expenditures.	0.000
Net working capital	0.000
Total initial investment costs	221549.000
Of it foreign, in %	0.000

Total Current Investment in US Dollars 1000

Year	1994	1995	1996	1997
Fixed investment costs				
Land, site preparation, development	0.000	0.000	0.000	0.000
Buildings and civil works	1022.000	269.000	0.000	0.000
Auxiliary and service facilities	0.000	0.000	0.000	0.000
Incorporated fixed assets	14392.000	2572.000	1043.000	550.000
Plant, machinery and equipment	15111.000	3531.000	0.000	0.000
Total fixed investment costs	30525.000	6372.000	1043.000	550.000
Preproduction capitals expenditures.	0.000	0.000	0.000	0.000
Working capital	8624.515	880.648	492.402	-229.986
Total current investment costs	39149.520	7252.647	1535.402	331.014
Of it foreign, %	74.065	33.352	58.519	0.000

Total Current Investment in US Dollars 1000

Year	1998	1999-2007	2008
Fixed investment costs			
Land, site preparation, development	0.000	0.000	0.000
Buildings and civil works	0.000	0.000	0.000
Auxiliary and service facilities	0.000	0.000	0.000
Incorporated fixed assets	560.000	560.000	220.000
Plant, machinery and equipment	0.000	0.000	0.000
Total fixed investment costs	560.000	560.000	220.000
Preproduction capitals expenditures.	0.000	0.000	0.000
Working capital	-38.656	0.000	0.000
Total current investment costs	521.344	560.000	220.000
Of it foreign, %	0.000	0.000	0.000

Total Production Costs in US Dollars 1000

Year	1994	1995	1996	1997
% of nom. capacity (single product).	77.570	93.305	100.000	100.000
Raw material 1	127702.300	145254.300	152509.000	152509.000
Other raw materials	3784.381	5191.092	5786.000	5786.000
Utilities	977.555	1090.553	1195.000	1174.000
Energy	5495.402	7049.715	7504.000	7504.000
Labour, direct	15921.000	16537.000	14758.000	11844.000
Repair, maintenance	3960.000	3960.000	3960.000	3960.000
Spares	392.000	382.000	382.000	382.000
Factory overheads	1023.000	994.000	870.000	582.000
Factory costs	165246.700	183451.300	203075.000	199941.300
Administrative overheads	8953.000	8953.000	8755.000	8547.000
Indir. costs, sales and distribution	10773.550	11239.570	7182.000	5534.000
Direct costs, sales and distribution	23504.000	29520.000	33506.000	33506.000
Depreciation	11914.080	14905.710	15525.370	15651.670
Financial costs	426.552	967.123	403.800	386.220
Total production costs	220818.000	248051.900	268490.200	264515.900
Costs per unit (single product)	113.415	111.284	106.953	105.425
Of it foreign, %	10.337	12.977	13.712	13.924
Of it variable,%	74.583	76.753	80.378	81.555
Total labour	21751.000	21297.000	19989.000	15216.000

Total Production Costs in US Dollars 1000

Year	1998	1999	2000	2001
% of nom. capacity (single product).	100.000	100.000	100.000	100.000
Raw material 1	152509.000	152509.000	152509.000	152509.000
Other raw materials	5786.000	5786.000	5786.000	5786.000
Utilities	1174.000	1174.000	1174.000	1174.000
Energy	7504.000	7504.000	7504.000	7504.000
Labour, direct	11327.000	11327.000	11327.000	11327.000
Repair, maintenance	3960.000	3960.000	3960.000	3960.000
Spares	392.000	382.000	382.000	382.000
Factory overheads	582.000	582.000	582.000	582.000
Factory costs	199424.000	199424.000	199424.000	199424.000
Administrative overheads	8504.000	8504.000	8504.000	8504.000
Indir. costs, sales and distribution	5479.000	5479.000	5479.000	5479.000
Direct costs, sales and distribution	33506.000	33506.000	33506.000	33506.000
Depreciation	15729.570	15755.570	15783.570	15803.570
Financial costs	345.340	305.450	265.080	224.700
Total production costs	263938.300	263974.200	263957.300	263981.400
Costs per unit (single product)	105.175	105.169	105.155	105.151
Of it foreign, %	13.340	13.327	13.312	13.297
Of it variable,%	81.749	81.753	81.755	81.757
Total labour	14551.000	14551.000	14551.000	14551.000

Total Production Costs in US Dollars 1000

Year	2002	2003	2004	2005
% of nom. capacity (single product).	100.000	100.000	100.000	100.000
Raw material 1	152509.000	152509.000	152509.000	152509.000
Other raw materials	5786.000	5786.000	5786.000	5785.000
Utilities	1174.000	1174.000	1174.000	1174.000
Energy	7604.000	7604.000	7604.000	7604.000
Labour, direct	11327.000	11327.000	11327.000	11327.000
Repair, maintenance	3960.000	9960.000	3960.000	8950.000
Spares	352.000	382.000	382.000	362.000
Factory overheads	582.000	582.000	562.000	532.000
Factory costs	199424.000	199424.000	199424.000	199424.000
Administrative overheads	8504.000	8504.000	8504.000	8504.000
Indir. costs, sales and distribution	6479.000	6479.000	6479.000	6479.000
Direct costs, sales and distribution	33506.000	33506.000	33506.000	33506.000
Depreciation	15857.570	15891.570	9451.372	5599.374
Financial costs	184.320	143.940	103.560	45.600
Total production costs	263955.000	263943.600	257457.600	254553.500
Costs per unit (single product)	105.161	105.159	102.577	101.418
Of it foreign, %	13.382	13.357	14.201	13.278
Of it variable,%	81.759	81.751	83.319	84.777
Total labour	14551.000	14551.000	14551.000	14551.000

Total Production Costs in US Dollars 1000

Year	2006	2007	2008
% of nom. capacity (single product).	100.000	100.000	100.000
Raw material 1	152509.000	152509.000	152509.000
Other raw materials	5786.000	5786.000	5786.000
Utilities	1174.000	1174.000	1174.000
Energy	7604.000	7604.000	7604.000
Labour, direct	11327.000	11327.000	11327.000
Repair, maintenance	3960.000	3960.000	9960.000
Spares	382.000	382.000	382.000
Factory overheads	582.000	582.000	582.000
Factory costs	199424.000	199424.000	199424.000
Administrative overheads	8504.000	9504.000	9504.000
Indir. costs, sales and distribution	6479.000	5479.000	6479.000
Direct costs, sales and distribution	33506.000	33506.000	33506.000
Depreciation	5092.374	5044.074	5044.047
Financial costs	0.000	0.000	0.000
Total production costs	254005.400	253957.100	253957.000
Costs per unit (single product)	101.197	101.178	101.178
Of it foreign, %	13.210	13.194	13.194
Of it variable,%	84.350	84.373	84.373
Total labour	14551.000	14551.000	14551.000

Net Working Capital in US Dollars 1000

Year	mdc	coto	1994	1995	1996	1997
Coverage	mdc	coto				
Current assets &						
Accounts receivable	30	12.0	17373.120	19348.250	21045.750	20714.830
Inventory and materials	7	51.4	2537.250	2856.451	3291.847	3291.847
Energy	0	—	0.000	0.000	0.000	0.000
Spares	30	12.0	31.833	31.833	31.833	31.833
Work in progress	1	360.0	459.019	509.515	554.097	555.392
Finished products	1	360.0	483.898	534.496	588.536	579.133
Cash in hand	15	24.0	1509.958	1492.959	1407.417	1257.292
Total current assets			22395.070	24803.610	26930.480	26440.330
Current liabilities and						
Accounts payable	30	12.0	13770.560	15293.450	16922.920	16661.750
Net working capital			8624.513	9515.162	10007.570	9778.580
Increase in working capital			8624.513	890.649	492.404	-228.986
Net working capital, local			6665.849	7138.496	7215.398	6986.412
Net working capital, foreign			1958.667	2376.667	2792.167	2792.167

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .

Net Working Capital in US Dollars 1000

Year	mdc	coto	1998	1999-2008
Coverage	mdc	coto		
Current assets &				
Accounts receivable	30	12.0	20659.420	20659.420
Inventory and materials	7	51.4	3291.847	3291.847
Energy	0	—	0.000	0.000
Spares	30	12.0	31.833	31.833
Work in progress	1	360.0	553.956	553.956
Finished products	1	360.0	577.573	577.578
Cash in hand	15	24.0	1243.958	1243.958
Total current assets			26358.590	26358.590
Current liabilities and				
Accounts payable	30	12.0	16518.670	16518.670
Net working capital			9739.924	9739.924
Increase in working capital			-38.656	0.000
Net working capital, local			6947.756	6947.756
Net working capital, foreign			2792.167	2792.167

Note: mdc = minimum days of coverage ; coto = coefficient of turnover .

Source of Finance, construction in US Dollars 1000

Year	1993
Equity, ordinary ..	221549.000
Equity, preference.	0.000
Subsidies, grants .	0.000
Loan A, foreign .	0.000
Loan B, foreign..	0.000
Loan C, foreign .	0.000
Loan A, local....	0.000
Loan B, local....	0.000
Loan C, local....	0.000
Total loan	0.000
Current liabilities	0.000
Bank overdraft	0.000
Total funds	221549.000

Source of Finance, production in US Dollars 1000

Year	1994	1995	1996	1997	1998
Equity, ordinary ..	22038.000	2215.000	483.000	0.000	0.000
Equity, preference.	0.000	0.000	0.000	0.000	0.000
Subsidies, grants .	0.000	0.000	0.000	0.000	0.000
Loan A, foreign .	2930.000	0.000	-293.000	-293.000	-293.000
Loan B, foreign..	0.000	3600.000	0.000	-380.000	-380.000
Loan C, foreign .	0.000	0.000	0.000	0.000	0.000
Loan A, local....	0.000	0.000	0.000	0.000	0.000
Loan B, local....	0.000	0.000	0.000	0.000	0.000
Loan C, local....	0.000	0.000	0.000	0.000	0.000
Total loan	2930.000	3600.000	-293.000	-673.000	-673.000
Current liabilities	13770.560	1517.884	1634.471	-261.166	-43.084
Bank overdraft	4539.114	-4539.115	0.000	0.000	0.000
Total funds	43277.680	2793.759	1824.471	-934.166	-716.084

Source of Finance, production in US Dollars 1000

Year	1999-2005	2006
Equity, ordinary ..	0.000	0.000
Equity, preference.	0.000	0.000
Subsidies, grants .	0.000	0.000
Loan A, foreign .	-293.000	0.000
Loan B, foreign..	-380.000	-380.000
Loan C, foreign .	0.000	0.000
Loan A, local....	0.000	0.000
Loan B, local....	0.000	0.000
Loan C, local....	0.000	0.000
Total loan	-673.000	-380.000
Current liabilities	0.000	0.000
Bank overdraft	0.000	0.000
Total funds	-673.000	-380.000

Cashflow Tables, construction in US Dollars 1000

Year	1992
Total cash inflow . .	221549.000
Financial resources .	221549.000
Sales, net of tax . .	0.000
Total cash outflow . .	221549.000
Total assets	221549.000
Operating costs . . .	0.000
Cost of finance . . .	0.000
Repayment	0.000
Corporate tax . . .	0.000
Dividends paid . . .	0.000
Surplus (deficit) .	0.000
Cumulated cash balance	0.000
Inflow, local	221549.000
Outflow, local	221549.000
Surplus (deficit) .	0.000
Inflow, foreign . . .	0.000
Outflow, foreign . . .	0.000
Surplus (deficit) .	0.000
Net cashflow	-221549.000
Cumulated net cashflow	-221549.000

Cashflow tables, production in US Dollars 1000

Year	1994	1995	1996	1997	1998
Total cash inflow . .	251800.400	252289.000	279669.100	277551.500	277551.500
Financial resources .	43254.250	7322.384	2117.471	0.000	0.000
Sales, net of tax . .	208546.200	244966.700	277551.500	277551.500	277551.600
Total cash outflow . .	251824.000	246442.200	256427.700	249968.200	249453.200
Total assets	52920.070	8780.533	3163.875	59.349	476.259
Operating costs . . .	208477.400	232179.000	252561.000	248578.000	247913.000
Cost of finance . . .	426.562	967.123	403.800	385.220	345.840
Repayment	0.000	4515.490	293.000	934.165	716.084
Corporate tax . . .	0.000	0.000	0.000	0.000	0.000
Dividends paid . . .	0.000	0.000	0.000	0.000	0.000
Surplus (deficit) .	-23.594	5846.375	23241.350	27583.330	28098.390
Cumulated cash balance	-23.594	5823.281	29064.640	56647.970	84746.340
Inflow, local	56031.020	57305.360	62278.590	60644.120	60644.120
Outflow, local	208896.800	210016.500	221326.400	215403.000	214928.300
Surplus (deficit) .	-142865.800	-152711.200	-159047.800	-154758.900	-154284.200
Inflow, foreign . . .	195769.400	194983.700	217390.520	216907.500	216907.500
Outflow, foreign . . .	52927.230	36425.620	35101.300	34565.220	34524.840
Surplus (deficit) .	142842.200	158558.000	182289.200	182342.200	182382.600
Net cashflow	-34080.530	5524.478	23455.160	28542.550	29117.230
Cumulated net cashflow	-255629.500	-250105.000	-226649.900	-198007.300	-168890.100

Cashflow tables, production in US Dollars 1000

Year	1999	2000	2001	2002	2003
Total cash inflow . .	277551.500	277551.500	277551.500	277551.500	277551.500
Financial resources .	0.000	0.000	0.000	0.000	0.000
Sales, net of tax . .	277551.500	277551.500	277551.500	277551.500	277551.500
Total cash outflow . .	249451.500	249411.100	249370.700	249330.300	254731.100
Total assets	560.000	560.000	560.000	560.000	560.000
Operating costs . . .	247913.000	247913.000	247913.000	247913.000	247913.000
Cost of finance . . .	305.450	255.080	224.700	184.320	143.940
Repayment	673.000	673.000	673.000	673.000	5441.181
Corporate tax . . .	0.000	0.000	0.000	0.000	0.000
Dividends paid . . .	0.000	0.000	0.000	0.000	0.000
Surplus (deficit) .	28100.110	28140.430	28180.850	28221.250	22820.440
Cumulated cash balance	112845.500	140985.900	169167.800	197389.000	220209.500
Inflow, local	60644.120	60644.120	60644.120	60644.120	60644.120
Outflow, local	214967.000	214967.000	214967.000	214967.000	220408.200
Surplus (deficit) .	-154322.900	-154322.900	-154322.900	-154322.900	-159764.100
Inflow, foreign . . .	216907.500	216907.500	216907.500	216907.500	216907.500
Outflow, foreign . . .	34484.460	34444.080	34403.700	34363.320	34322.940
Surplus (deficit) .	182423.000	182463.400	182503.800	182544.100	182584.500
Net cashflow	29078.560	29078.560	29078.560	29078.560	23637.380
Cumulated net cashflow	-139811.500	-110733.000	-81654.420	-52575.860	-28938.480

Cashflow tables, production in US Dollars 1000

Year	2004	2005	2006	2007	2008
Total cash inflow	277551.500	277551.500	277551.500	277551.500	277551.500
Financial resources	0.000	0.000	0.000	0.000	0.000
Sales, net of tax	277551.500	277551.500	277551.500	277551.600	277551.500
Total cash outflow	257283.100	258398.300	258271.500	257910.800	257570.800
Total assets	560.000	560.000	560.000	560.000	220.000
Operating costs	247913.000	247913.000	247913.000	247913.000	247913.000
Cost of finance	103.560	45.600	0.000	0.000	0.000
Repayment	673.000	673.000	380.000	0.000	0.000
Corporate tax	8033.575	9197.231	9418.475	9437.794	9437.807
Dividends paid	0.000	0.000	0.000	0.000	0.000
Surplus (deficit)	20268.420	19162.730	19280.090	19640.770	19980.750
Cumulated cash balance	240477.900	259640.600	278920.800	298561.500	318542.300
Inflow, local	60644.120	60644.120	60644.120	60644.120	60644.120
Outflow, local	223000.600	224164.200	224385.500	224404.800	224064.800
Surplus (deficit)	-162355.500	-163520.100	-163741.300	-163760.700	-163420.700
Inflow, foreign	216907.500	216907.500	216907.500	216907.500	216907.500
Outflow, foreign	34282.550	34224.600	33886.000	33506.000	33506.000
Surplus (deficit)	182624.900	182682.800	183021.500	183401.500	183401.500
Net cashflow	21044.990	19881.330	19660.090	19640.770	19980.760
Cumulated net cashflow	-7393.430	11997.840	31647.930	51288.700	71259.450

Cashflow Discounting:

a) Equity paid versus Net income flow:

Net present value ....-222945.10 at 15.00 %

Internal Rate of Return (IRRE) .. -4.72 %

b) Net Worth versus Net cash return:

Net present value ....-126134.00 at 15.00 %

Internal Rate of Return (IRSE) .. 5.25 %

c) Internal Rate of Return on total investment:

Net present value ....-127487.10 at 15.00 %

Internal Rate of Return (IRR) .. 5.31 %

Net Worth = Equity paid plus reserves

Net Income Statement in US Dollars 1000

Year	1994	1995	1996	1997
Total sales, incl. sales tax	213545.300	244956.100	277551.500	277551.500
Less: variable costs, incl. sales tax.	169914.400	190410.000	215807.000	215807.000
Variable margin	43531.970	54554.130	61744.550	61744.550
As % of total sales	20.773	22.273	22.246	22.246
Non-variable costs, incl. depreciation	55477.080	56672.720	52279.370	48422.670
Operational margin	-6345.109	-2118.594	9465.191	13321.890
As % of total sales	-3.205	-0.865	3.410	4.800
Cost of finance	426.552	967.123	403.800	386.220
Gross profit	-7271.672	-3085.719	9061.391	12935.670
Allowances	0.000	0.000	0.000	0.000
Taxable profit	-7271.672	-3085.719	9061.391	12935.670
Tax	0.000	0.000	0.000	0.000
Net profit	-7271.672	-3085.719	9061.391	12935.670
Dividends paid	0.000	0.000	0.000	0.000
Undistributed profit	-7271.672	-3085.719	9061.391	12935.670
Accumulated undistributed profit	-7271.672	-10357.390	-1296.000	11639.670
Gross profit, % of total sales	-3.405	-1.260	3.265	4.661
Net profit, % of total sales	-3.405	-1.260	3.265	4.661
ROE, Net profit, % of equity	-2.925	-1.231	3.609	5.152
ROI, Net profit+interest, % of invest.	-2.626	-0.791	3.512	4.937

Modernization of Przyjazn Coke Plant — September 1992

Net Income Statement in US Dollars 1000

Year	1998	1999	2000	2001
Total sales, incl. sales tax	277551.600	277551.600	277551.500	277551.600
Less: variable costs, incl. sales tax	215807.000	215807.000	215807.000	215807.000
Variable margin	61744.550	61744.550	61744.560	61744.550
As % of total sales	22.245	22.245	22.246	22.245
Non-variable costs, incl. depreciation	47835.680	47851.680	47895.690	47929.580
Operational margin	13909.890	13882.930	13848.880	13814.890
As % of total sales	5.011	5.002	4.990	4.977
Cost of finance	345.840	305.450	265.080	224.700
Gross profit	13563.050	13577.420	13583.800	13590.190
Allowances	0.000	0.000	0.000	0.000
Taxable profit	13563.050	13577.420	13583.800	13590.190
Tax	0.000	0.000	0.000	0.000
Net profit	13563.050	13577.420	13583.800	13590.190
Dividends paid	0.000	0.000	0.000	0.000
Undistributed profit	13563.050	13577.420	13583.800	13590.190
Accumulated undistributed profit	25202.720	38780.140	52363.940	65954.130
Gross profit, % of total sales	4.887	4.892	4.894	4.896
Net profit, % of total sales	4.887	4.892	4.894	4.896
ROE, Net profit, % of equity	5.402	5.408	5.410	5.413
ROI, Net profit+interest, % of invest.	5.145	5.125	5.101	5.078

Net Income Statement in US Dollars '000

Year	2002	2003	2004	2005
Total sales, incl. sales tax	277551.500	277551.500	277551.500	277551.500
Less: variable costs, incl. sales tax	215807.000	215807.000	215807.000	215807.000
Variable margin	61744.560	61744.560	61744.560	61744.560
As % of total sales	22.246	22.245	22.245	22.245
Non-variable costs, incl. depreciation	47963.680	47997.670	41557.070	38705.880
Operational margin	13780.880	13746.890	20187.500	23038.680
As % of total sales	4.965	4.953	7.273	8.301
Cost of finance	184.320	143.940	103.550	45.600
Gross profit	13596.560	13602.950	20083.940	22993.080
Allowances	0.000	0.000	0.000	0.000
Taxable profit	13596.560	13602.950	20083.940	22993.080
Tax	0.000	5441.181	8033.575	9197.231
Net profit	13596.560	8161.772	12050.360	13795.850
Dividends paid	0.000	0.000	0.000	0.000
Undistributed profit	13596.560	8161.772	12050.360	13795.850
Accumulated undistributed profit	79550.690	87712.460	99762.820	113558.700
Gross profit, % of total sales	4.899	4.901	7.236	8.284
Net profit, % of total sales	4.899	2.941	4.342	4.971
ROE, Net profit, % of equity	5.415	3.251	4.800	5.495
ROI, Net profit+interest, % of invest.	5.056	3.041	4.440	5.047

Net Income Statement in US Dollars 1000

Year	2006	2007	2008
Total sales, incl. sales tax	277551.500	277551.500	277551.500
Less: variable costs, incl. sales tax.	215807.000	215807.000	215807.000
Variable margin	61744.550	61744.550	61744.560
As % of total sales	22.245	22.245	22.245
Non-variable costs, incl. depreciation	38199.380	38150.060	38150.050
Operational margin	23545.190	23594.490	23594.520
As % of total sales	8.484	8.501	8.501
Cost of finance	0.000	0.000	0.000
Gross profit	23545.190	23594.480	23594.520
Allowances	0.000	0.000	0.000
Taxable profit	23545.190	23594.480	23594.520
Tax	9418.475	9437.794	9437.807
Net profit	14127.710	14156.690	14156.710
Dividends paid	0.000	0.000	0.000
Undistributed profit	14127.710	14156.690	14156.710
Accumulated undistributed profit	127686.400	141843.100	155999.800
Gross profit, % of total sales	8.484	8.501	8.501
Net profit, % of total sales	5.090	5.101	5.101
ROE, Net profit, % of equity	5.627	5.638	5.638
ROI, Net profit+interest, % of invest.	5.141	5.141	5.137

Projected Balance Sheets, construction in US Dollars 1000

Year	1993
Total assets	221549.000
Fixed assets, net of depreciation	0.000
Construction in progress	221549.000
Current assets	0.000
Cash, bank	0.000
Cash surplus, finance available	0.000
Loss carried forward	0.000
Loss	0.000
Total liabilities	221549.000
Equity capital	221549.000
Reserves, retained profit	0.000
Profit	0.000
Long and medium term debt	0.000
Current liabilities	0.000
Bank overdraft, finance required	0.000
Total debt	0.000
Equity, % of liabilities	100.000

Projected Balance Sheets, Production in US Dollars 1000

Year	1994	1995	1996	1997
Total assets	253825.700	272510.400	283496.300	285435.400
Fixed assets, net of depreciation	209534.900	235254.200	216100.300	201492.200
Construction in progress	30525.000	5372.000	1043.000	550.000
Current assets	20895.110	23310.650	25523.060	25173.040
Cash, bank	1503.958	1492.959	1407.417	1257.292
Cash surplus, finance available	0.000	5823.250	29064.580	56647.950
Loss carried forward	0.000	7271.572	10357.390	1295.000
Loss	7271.572	3085.719	0.000	0.000
Total liabilities	253825.700	272510.400	283496.300	285435.400
Equity capital	248537.000	250592.000	251075.000	251075.000
Reserves, retained profit	0.000	0.000	0.000	0.000
Profit	0.000	0.000	9061.391	12935.570
Long and medium term debt	2930.000	6730.000	5437.000	5764.000
Current liabilities	13773.560	15288.450	16922.920	16661.750
Bank overdraft, finance required.	4539.114	-0.001	-0.001	-0.001
Total debt	21239.680	22018.450	23359.910	22425.750
Equity, % of liabilities	92.128	91.923	88.564	87.655

Projected Balance Sheets, Production in US Dollars 1000

Year	1998	1999	2000	2001
Total assets	297987.400	310891.800	323802.500	336719.800
Fixed assets, net of depreciation	186322.500	171126.800	155897.100	140633.500
Construction in progress	560.000	550.000	550.000	550.000
Current assets	25114.530	25114.530	25114.530	25114.530
Cash, bank	1243.958	1243.959	1243.959	1243.959
Cash surplus, finance available	84745.340	112346.400	140985.900	159167.700
Loss carried forward	0.000	0.000	0.000	0.000
Loss	0.000	0.000	0.000	0.000
Total liabilities	297987.400	310891.800	323802.600	335719.800
Equity capital	251075.000	251075.000	251075.000	251075.000
Reserves, retained profit	11639.570	25202.720	38780.140	52363.940
Profit	13563.050	13577.420	13583.800	13590.190
Long and medium term debt	5091.000	4413.000	3745.000	3072.000
Current liabilities	16618.570	16618.570	16618.570	16618.570
Bank overdraft, finance required.	-0.001	-0.001	-0.001	-0.001
Total debt	21709.560	21035.630	20363.630	19690.630
Equity, % of liabilities	84.257	80.760	77.540	74.565

Projected Balance Sheets, Production in US Dollars 1000

Year	2002	2003	2004	2005
Total assets	349543.300	357132.100	363509.500	381632.300
Fixed assets, net of depreciation	125335.800	110004.100	101113.100	95073.160
Construction in progress	550.000	550.000	560.000	560.000
Current assets	25114.530	25114.530	25114.530	25114.530
Cash, bank	1243.958	1243.958	1243.958	1243.958
Cash surplus, finance available	197369.000	220209.400	240477.800	259640.500
Loss carried forward	0.000	0.000	0.000	0.000
Loss	0.000	0.000	0.000	0.000
Total liabilities	349543.300	357132.100	363509.500	381632.300
Equity capital	251075.000	251075.000	251075.000	251075.000
Reserves, retained profit	65954.130	79550.690	87712.460	99762.820
Profit	13595.560	8151.772	12050.360	13795.850
Long and medium term debt	2399.000	1725.000	1053.000	380.000
Current liabilities	16518.670	15519.570	16618.570	16619.670
Bank overdraft, finance required.	-0.001	-0.001	-0.001	-0.001
Total debt	19017.550	18344.660	17671.660	16998.660
Equity, % of liabilities	71.809	70.303	68.133	65.790

COMFAR 2.1 - TOKYO, JAPAN

Projected Balance Sheets, Production in US Dollars 1000

Year	2006	2007	2008
Total assets	395380.000	409536.700	423593.400
Fixed assets, net of depreciation	89540.800	84055.730	73572.690
Construction in progress	560.000	550.000	220.000
Current assets	25114.530	25114.530	25114.530
Cash, bank	1243.958	1243.958	1243.958
Cash surplus, finance available	278920.600	298551.400	318542.200
Loss carried forward	0.000	0.000	0.000
Loss	0.000	0.000	0.000
Total liabilities	395380.000	409535.700	423593.400
Equity capital	251075.000	251075.000	251075.000
Reserves, retained profit	113558.700	127685.400	141843.100
Profit	14127.710	14156.590	14155.710
Long and medium term debt	0.000	0.000	0.000
Current liabilities	16518.570	16518.570	16618.570
Bank overdraft, finance required.	-0.001	-0.001	-0.001
Total debt	16618.560	15618.560	16618.560
Equity, % of liabilities	63.502	61.307	59.259

Modernization of Przyjazn Coke Plant
September 1990

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1 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: US Dollars 1000

Total initial investment during construction phase

fixed assets:	221549.00	0.000 % foreign
current assets:	0.00	0.000 % foreign
total assets:	221549.00	0.000 % foreign

Source of funds during construction phase

equity & grants:	221549.00	0.000 % foreign
foreign loans :	0.00	
local loans :	0.00	
total funds :	221549.00	0.000 % foreign

Cashflow from operations

Year:	1	3	5
operating costs:	208477.40	252561.00	247913.00
depreciation :	11914.09	15525.37	15729.57
interest :	87.90	403.80	345.84
production costs	220479.40	268490.20	263988.50
thereof foreign	10.70 %	13.71 %	13.94 %
total sales :	232729.50	302317.90	302317.90
gross income :	12250.17	33827.73	38329.39
net income :	12250.17	33827.73	38329.39
cash balance :	14980.73	48007.70	52854.72
net cashflow :	-14397.35	48221.50	53383.56

Net Present Value at: 15.00 % = -239.22
Internal Rate of Return: 14.98 %
Return on equity1: 3.50 %
Return on equity2: 15.10 %

Index of Schedules produced by COMFAR

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance

COMFAR 2.1 - TOKYO, JAPAN

Modernization of [illegible] Coke Plant
September 199[illegible]

1 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: US Dollars 1000

Total initial investment during construction phase

fixed assets:	110774.00	0.000 % foreign
current assets:	0.00	0.000 % foreign
total assets:	110774.00	0.000 % foreign

Source of funds during construction phase

equity & grants:	110776.00	0.000 % foreign
foreign loans :	0.00	
local loans :	0.00	
total funds :	110775.00	0.000 % foreign

Cashflow from operations

Year:	1	3	5
operating costs:	208477.40	252561.00	247913.00
depreciation :	5957.05	9558.34	9772.64
interest :	425.55	403.80	345.84
production costs	214851.00	252533.10	258031.50
thereof foreign	11.14 %	14.02 %	14.25 %
total sales :	213546.30	277551.60	277551.60
gross income :	-1314.64	15018.44	19520.08
net income :	-1314.64	15018.44	19520.08
cash balance :	-23.61	23241.35	28093.38
net cashflow :	-34060.55	23455.16	29[illegible]7.22

Net Present Value at: 15.00 % = -22237.84
Internal Rate of Return: 12.21 %
Return on equity1: 5.79 %
Return on equity2: 12.31 %

Index of Schedules produced by COMFAR

COMFAR 2.1 - TOKYO, JAPAN

Modernization of Przyjazn Coke Plant
September 1992

1 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: US Dollars 1000

Total initial investment during construction phase

fixed assets:	73849.00	0.000 % foreign
current assets:	0.00	0.000 % foreign
total assets:	73849.00	0.000 % foreign

Source of funds during construction phase

equity & grants:	73849.00	0.000 % foreign
foreign loans :	0.00	
local loans :	0.00	
total funds :	73849.00	0.000 % foreign

Cashflow from operations

Year:	1	3	5
operating costs:	208477.40	252551.00	247913.00
depreciation :	3971.39	7582.62	7786.98
interest :	426.56	403.80	345.84
production costs	212875.30	260547.50	256045.80
thereof foreign	11.24 %	14.13 %	14.37 %
total sales :	213546.30	277551.60	277551.50
gross income :	671.02	17004.09	21505.75
net income :	671.02	17004.09	21505.75
cash balance :	-23.51	23241.35	28093.38
net cashflow :	-34080.55	23455.16	29117.22

Net Present Value at: 15.00 % = 12845.27
Internal Rate of Return: 17.08 %
Return on equity1: 12.25 %
Return on equity2: 17.39 %

Index of Schedules produced by COMFAR

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance

Modernization of Przyjazn Coke Plant
September 1990

1 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency, 1 unit = 1.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: US Dollars 1000

Total initial investment during construction phase

fixed assets:	221549.00	0.000 % foreign
current assets:	0.00	0.000 % foreign
total assets:	221549.00	0.000 % foreign

Source of funds during construction phase

equity & grants:	221549.00	0.000 % foreign
foreign loans :	0.00	
local loans :	0.00	
total funds :	221549.00	0.000 % foreign

Cashflow from operations

Year:	1	3	5
operating costs:	202772.40	247313.00	243225.00
depreciation :	11914.09	15525.37	15729.67
interest :	87.90	403.80	345.84
production costs	214774.40	263242.20	259300.50
thereof foreign	10.93 %	13.98 %	14.19 %
total sales :	213545.30	277551.60	277551.60
gross income :	-1228.02	14309.39	18251.05
net income :	-1228.02	14309.39	18251.05
cash balance :	2021.41	29457.59	32785.38
net cashflow :	-27853.59	29681.39	32805.22

Net Present Value at: 15.00 % = -89939.97
Internal Rate of Return: 9.63 %
Return on equity1: 1.18 %
Return on equity2: 8.56 %

Index of Schedules produced by COMFAR

ANNEX C

Preliminary Analysis of Balance Sheet and Valuation of Land and Building owned by PC

PRELIMINARY ANALYSIS OF FINANCIAL AND ECONOMIC DATA OF THE BALANCE SHEET AND THE INCOME STATEMENT TOGETHER WITH TRANSLATION OF DATA TO UNIDO STANDARD AND THE VALUATION OF LAND AND BUILDINGS OWNED BY THE ENTERPRISE ©

in

Koksownia "PRZYJAŹŃ"
Dąbrowa Górnicza
POLAND

Contractors:

Dariusz Pelc
Andrzej Podszywałow
Marek Górniak - expert in estate valuation
Krystyna Paradowska - expert in land valuation

Poland
Warsaw, April 1992
PROXIMA ® Ltd.
YOHO Co.,Ltd.

Contents

I. Preface.

The subject of the following work is the accomplishment of contract signed with YOHO Co.,Ltd. comprising:

- analysis of financial data stated in the annual reports of the coke plant "Przyjaźń" together with translating them into standards accepted by UNIDO.
- the estimation of market value of land, buildings and machinery.
- estimation of appreciation and inflation factors.

The above mentioned work is accomplished under supervision of UNIDO at the stage of conducting .n investment possibilities analysis of the Nichimen Tokyo Co., Japan.

Our valuation is valid only for the purpose for which it is stated herein. We will maintain the confidentiality of all conversations, documents provided to us and our report.

- To the best our knowledge, all data set forth in this report are true and accurate. Although gathered from reliable sources, no guarantee is made nor liability assumed for the accuracy of any data, opinions, or estimates identified as being furnished by others which have been used in formulating this analysis.
- The services provided by PROXIMA Sp. z.oo. are performed in accordance with recognised professional appraisal standarts. We act as an independent adviser. Our compensation is not contingent in any way upon our conclusions of value.

II. Financial reports.

The following reports are analysed:

- F04, F05, F01 of 1990
- F02, F05, F01 of 1991 (before verification of an chartered accountant)

copies of reports enclosed. During the studies in the coke plant the members of and accountancy staff have been interviewed together with the analysis of the following documents:

- internal clearing of funds and fixed assets revaluation
- loan contract signed with Węglokoks enterprise
- computers outputs of fixed assets statements
- distribution of profits for 1989, 1990
- estimation of overdue payments and commitments

II.1.Balance sheet

Balance sheet of 1990 was examined by a chartered accountant. F02 statement contains data before the verification by the chartered accountant, as he is just examining documents. Data accomplished in years 1990, 1991 was examined from the point of their economic sense. Figures are given in million zł and th. USD (1 USD = 11107 zł).

"Huta Katowice" is the main customer whose payments are about 80% of the total receivable. Currently coke plant is export oriented. Overdue payments are as follows:

Year	beg 1990	end 1990	end 1991	end 1991
	in mln zł	in mln zł	in mln zł	in th. USD
Total assets	1439174	3614486	4030719	362899
Fixed assets, net of depreciation	1370103	3234927	2905860	261624
Property,plant and equipment	1282258	3145100	2825820	254418
Intangibles	87845	89827	80040	7206
Construction in progress	2003	64763	81202	7311
Current assets	52273	304485	557085	50156
Notes and accounts receivable	35418	202975	415933	37448
Inventories	14227	87100	129041	11618
Materials	13254	75852	115859	10431
Work-in-process	576	7107	9036	814
Finished Goods	397	4141	4146	373
Prepaid expenses, taxes and other c. assets	2628	14410	12111	1090
Cash	14795	10311	17175	1546
Loss carried forward				
Loss			469397	42261
Total liabilities	1439174	3614486	4030719	362899
Equity capital	1201249	3139665	3000236	270121
Reserves, retained profit	1494	1494	8021	722
Profit		30478		
Long and medium term debt	170950	223274	52500	4727
Current liabilities	62900	212075	950062	85537
Notes payable	776	25000	15500	1396
Accounts payable	44706	169173	615450	55411
Income taxes payable	6938	2672	196478	17690
Other current liabilities	10480	15230	122634	11041
Bank overdraft, finance required	2581	7500	19900	1792

Some of items are stated in detail below:

	beg 1990	end 1990	end 1991	end 1991
	in mln zł	in mln zł	in mln zł	in th. USD
Property,plant and equipment	1282258	3145100	2825820	254418
Buildings		1903293	1778015	160080
Machinery		1211852	1024550	92244
Transportation		25191	20367	1834
Other Fixed assets		4764	2888	260
Land				

	beg 1990	end 1990	end 1991	end 1991
	in mln zł	in mln zł	in mln zł	in th. USD
Notes and accounts receivable	35418	202975	415933	37448
less than 1 month		105324	106852	9620
less than 2 months		9340	50960	4588
less than 3 months		33956		
above 3 months		54356	258121	23240

The remaining items of the current assets are shown below:

	beg 1990	end 1990	end 1991	end 1991
	in mln zł	in mln zł	in mln zł	in th. USD
Prepaid expenses, taxes and other c. assets	2628	14410	12111	1090
Insurance receivable			1702	153
Loans for employees		1353	4904	442
Legal cases			321	29
Pre-payments		201		
Letters of credit		2064		
Discounted bills		697		
Budget receivable		945	525	47
Bonuses on the basis of anticipated profit		8900		
Deferred charges			4438	400
Other current assets		250	221	20

Coke plant has got a small loan for investment purposes, received from trading company Węglokoks.

	beg 1990	end 1990	end 1991	end 1991
	in mln zł	in mln zł	in mln zł	in th. USD
Long and medium term debt	170950	223274	52500	4727
Loan from Węglokoks		40000	52500	
Investment loan	170950	183274		

The loan agreement states 52000 million zł loan, which must be paid before 30.12.1993. Instalments are in the form of monthly payments. Interest rate will be estimated at the end of each year on the basis of the lowest of the National Bank of Poland interest rate. The loan can be paid in the form of decreasing receivable created by coke supply. Węglokoks received exclusive rights to buy and sell coke abroad.

Main suppliers are coal mining enterprises but at the moment the biggest payable are due to the Budget. Overdue payments are as follows:

	beg 1990	end 1990	end 1991	end 1991
	in mln zł	in mln zł	in mln zł	in th. USD
Accounts payable	44706	169173	615450	55411
less than 1 month		10316	12309	1108
less than 2 months		2005	5388	485
less than 3 months		218	3959	356
above 3 months		156634	593794	53461

The remaining items of the payable and current liabilities are shown below.

	beg 1990	end 1990	end 1991	end 1991
	in mln zł	in mln zł	in mln zł	in th. USD
Other current liabilities		15230	122634	11041
Protection of the environment payable		7397	18170	1636
Retirements, insurance company			1099	99
Salary payable		4723	5049	455
Special funds		1919	8061	726
Unearned revenues - extraordinary profit			89163	8028
Reserves for uncollectible receivable		12	166	15
Other current liabilities		1179	926	83

II.2. Income statement

Data comes from the financial reports F01 of 1990, 1991 years.

Year	1990	1991	1991
	in mln zł	in mln zł	in th. USD
Total sales, incl. sales tax	1935540	2387432	214948
Operational costs incl. depreciation	1402152	2276859	204993
Operational margin incl. depreciation	533388	110573	9955
As % of total sales	28%	5%	0
Other income	-4272	7633	687
Extraordinary loss	31570	167202	15054
Extraordinary profit	58243	3728	336
~~Depreciation~~	~~86950~~	~~216145~~	~~19460~~
Cost of finance	248876	83608	7528
Gross profit	306913	-128876	-11603
Allowances			
Taxable profit	306913	-128876	-11603
Tax	276435	340521	30658
Net profit	30478	-469397	-42261
Dividends paid			
Undistributed profit	6527		
Accumulated undistributed profit	1494	8021	722

Some of items:

	1990	1991	1991
	in mln zł	in mln zł	in th. USD
Other income	-4272	7633	687
Income on bill operations	-5909	1501	135
Selling of equipment, materials	844	3216	290
Profit on changes in the exchange rate	793	2916	263

	1990	1991	1991
	in mln zł	in mln zł	in th. USD
Extraordinary loss	31570	167202	15054
Interests - overdue dividend payment	28783	135668	12215
Overdue instalments - investment debt		18390	1656
Court charges		5474	49[illegible]
Interests - overdue budget payable	2412		
Other loss	375	7670	691

	1990	1991	1991
	in mln zł	in mln zł	in th. USD
Extraordinary profit	58243	3728	336
Interests on receivable	28529	3544	319
Revaluation of the coal inventory	18077		
Not billed supply	11503		
Fines	134	184	17
Donations	27		

	1989	1990	1991	1991
	in mln zł	in mln zł	in mln zł	in th. USD
Tax	13299	276435	340521	30658
Corporate tax	5374	118644		
PPWW - on the overdrawn salaries basis	2451	1203	70068	6308
Other taxes		11943	1624	146
Dividend due to budget	3325	155395	268829	24204

Distribution of net income achieved in 1989 and 1990 years was as follows:

Year	1989	1990	1991	1991
	in mln zł	in mln zł	in mln zł	in th. USD
Net profit	2149	30478		
Special funds	930	16044		
Bonuses (employees and management)	1434	6905		
Retained income	1494	6527		
Received subventions	1850			
Given subventions		1000		
Other deductions payable	141	2		

The enterprise can establish two special funds named: social fund and house fund for purposes of employees. Special funds are increasing by charge to the operation cost or distribution of the net income.

Spending of these funds are stated below.

Year	1989	1990	1991	1991
	in mln zł	in mln zł	in mln zł	in th. USD
Beginning amount	4313	1919	8061	726
Inflow charged to costs		540	1764	159
Inflow from net profit		930	16044	1444
Spending		3864	11666	1050

II.3.Revaluation of the assets and funds

The following reports are the main source of data for the statement.: F02, F05 (1991) and F04 i F05 (1990). Accountants prepared also a calculation of the assets and funds revaluation for the 1990 year. There was not any revaluation during 1991 year.

II.3.1Revaluation of the fixed assets

Revaluation of the tangible and intangibles assets are done after publication of the appreciation factors by Government institution and enterprise can not change these factors. There is also obligation to using straight line depreciation method.

Year	beg 1990	end 1990	end 1991	end 1991
	in mln zł	in mln zł	in mln zł	in th. USD
Net fixed assets before appreciation	1282258	1207824	2965300	266976
Gross fixed assets - FA	1409465	1412640	3736153	336378
Accumulated depreciation of fixed assets - DFA	127207	204816	770853	69402
Gross intangibles - IN	91576	91576	107843	9709
Accumulated amortisation of intangibles - AIN	3731	13474	27803	2503
FA appreciation		2297553		
DFA appreciation		360277		
IN appreciation		16267		
AIN appreciation		4542		
Cumulative adjustment of FA appreciation		-15424	-169084	-15223
Cumulative adjustment of DFA appreciation		402	-29603	-2665
New FA (from investment)		18978	26548	2390
Liquidated FA		378	588	53
FA Depreciation expense		77207	205760	18525
IN Amortisation expense		9743	10385	935
Net fixed assets after appreciation, depr. and adjust.	1282258	3145100	2825820	254418
Gross fixed assets - FA	1409465	3710193	3567070	321155
Accumulated depreciation of fixed assets - DFA	127207	565093	741250	66737
Gross intangibles - IN	91576	107843	107843	9709
Accumulated amortisation of intangibles - AIN	3731	18016	27803	2503

II.3.2 Calculation of the main funds

Coke plant "Przyjaźń" was founded as a subsidiary of the HUTA KATOWICE enterprise from the central investment funds and Government subventions. In formal terms investment loan was repaid by HUTA KATOWICE but in real life, from the moment of establishing the independent enterprise (1989), loan was repaid in the form of coke supply. At the beginning of 1990 the amount of debt was 206000 milion zł and it was repaid to the end of 1991 together with interest in the amount of: 232000 milions (1990 r.) . 51000 milion zł (1991 r.).

During 1989 the idea of two main funds (symulation of the equity) entered our economy.

Establishing fund was created as a 75% of fixed assets fund and 25% of the working capital fund. Enterprise fund was equal to the difference between total asset value, establishing fund, debts and payable. The new tax was also introduced as a 22% of the establishing funds (paid in equal monthly instalments) Retained earnings increases enterprise fund in next year, in the case of loss the enterprise fund is decreasing.

Both funds are increased in historical proportion after assets revaluation.

Revaluation of funds:

Year	beg 1990	end 1990	end 1991	end 1991
	in mln zł	in mln zł	in mln zł	in th. USD
Funds before appreciation	1202743	1202743	3141159	282809
Establishing fund - ESF	481656	481656	1284247	115625
Enterprise fund - ENF	721087	721087	1856912	167184
ENF/(ESF+ENF)	60%	60%	59%	59%
Appreciation of Establishing fund		731984		
Appreciation of Enterprise fund		1134331		
Total appreciation		1866315		
ENF/(ESF+ENF)		61%		
Cumulative adjustment of both of funds			-112432	-10123
Additional adjustment of Establishing fund			4166	375
Additional adjustment of Enterprise fund			-10666	-960
Funds after appreciation and adjustments	1202743	3141159	3008257	270843
Establishing fund	481656	1284247	1221948	110016
Enterprise fund	721087	1856912	1786308	160827
ENF/(ESF+ENF)	60%	59%	59%	59%
Retained earnings	1494	6527		

In next chapters we will show that the revaluation of assets underestimates from 1.3 to 1.9 times a market value (estimated by replacement method).

III. Estimation of the land value.

I. The aim of valuation:

The Initial valuation of the land to investigate the investement in the coke plant "Przyjaźń" in Dąbrowa Górnicza. The above mentioned valuation cannot be used as a basis for valuating of the suitability qualities of the plant for privatization purposes.

II. The subject of the valuation:

The subject of the valuation is the land owned by the Treasury situated in Dąbrowa Górnicza which is registered on the records in the area:

Łosień - 220.7418 ha
Okradzionów - 18.4564 ha
Strzemieszyce Małe - 32.2532 ha
Strzemieszyce Małe - 0.1673 ha - lands owned by the plant
of total area - 271.6187 ha.

The land under the valuation comprises 1800 lets.

III. Legal basis of the valuation.

The 29 April 1985 act of law on land administration and expropriation of real estate.

IV. Technical settlements.

The coke plant "Przyjaźń" is equiped with modern technology and technical means which provide full protection for the enviroment.
The plant is conveniently situated. It is close to one of the biggest reloading stations and is easily reached by car. The plant is supplied with electric and gas power. The area is outside the reach of mining damage.

V. Methods of valuation.

The valuation has been accomplished on the basis of real estate value obtained as a result of:

1. Estimation of real estate value with book-value method.
2. Local information obtained from Depantament of Finance and Attorney Office.

The output value of land obtained on the basis of market value prise and localization is 45,000 zł (3.36 $ USD) per 1m² after taking into consideration all adjustment factors the value of 1m² is established at 55,800 zł (4.16 $ USD) per 1m².

Real estate value:

271.6187 ha x 55,800 zł/m² = 151,563,234,600 zł
271.6187 ha x 4.1642 $/m² = 11,310,689 $ USD

in round figures 151,563,000,000 zł.
say: one hundred fifty one milliard five thousand sixty three million złoty.

IV.Estimation of the buildings value.

I. The aim of valuation:

Preliminary valuation of the buildings and structures in the coke plant "Przyjaźń" in Dąbrowa Górnicza in order to examine the investment possibilities. The above mentioned valuation cannot be used as a basis for valuating for privatisation purposes.

II. The subject of the valuation:

The subject of the valuation are the buildings and structures in Dąbrowa Górnicza show in the enclosures.

III. Legal basis of the valuation.

Computer data of fixed assets obtained from the accountancy of the enterprise.

IV. Technical settlements.

The coke plant "Przyjaźń" consists of production social and administration units. The survey has carried out on the spot.

V. Methods of valuation.

Valuation of buildings and structures has accomplished with book method based on the adjusted net book value. The following accounts are enclosed:

- the gross value of buildings and structures for 31.12.1991
- accumulated depreciation
- adjusted net book value

Table of book value buildings and structures (in th. $ USD)			
Group	Gross value	Accumulated depreciation	Current net value
Buildings	73 047	5 451	67 596
Structures	109 362	17 287	92 079
Total	182 409	22 738	159 675

Table of book value buildings and structures (in mln. złoty)			
Group	Gross value	Accumulated depreciation	Current net value
Buildings	611 338	60 549	750 788
Structures	1 214 682	192 004	1 022 725
Total	2 026 020	252 553	1 773 514

It follows from the consolidated chart that in the enterprise under the analysis, in round figures:

- the gross value of buildings and structures for 31.12.1991 equals 2026020 millions zł (182409 th. USD)
- accumulated depreciation equals 252553 millions zł (22738 th. USD)
- adjusted net book value equals 1773514 millions zł (159675 th. USD)

The actual net book value buildings and structures equals 1773514 millions zł (159675 th. USD).

Table of price ratios in $ USD per cubic meter (examples)
(for buildings and structures)

No	Object	Book value method	Replacement method	Repl./ Book
1	poz. 31 Hala stalowa	26	50	1,95
2	poz. 61 Hala żelbet.	50	65	1,30
3	poz. 123 Bud.adm.-soc. "Ziębiec"	78	43	0,56
4	poz. 134 Bud.mieszkalny	28	44	1,55

Table of price ratios in złoty per cubic meter (examples)
(for buildings and structures)

No	Object	Book value method	Replacement method	Repl./ Book
1	poz. 31 Hala stalowa	285 990	558 472	1,95
2	poz. 61 Hala żelbet.	556 375	726 376	1,30
3	poz. 123 Bud.adm.-soc. "Ziębiec"	865 451	481 332	0,56
4	poz. 134 Bud.mieszkalny	315 389	487 878	1,55

We enclose an example of comparison of 4 chosen buildings valuated with two methods: the book value method and replacement method.

Estimation market value of buildings and structures in Coke Co.,"PRZYJAŹŃ"			
Example			
	Gross value	Accumulated depreciation	Current net value
in th. $ USD	1 $ USD=11107 zł		
Book value	182 409	22 738	159 675
Ratio 1.3	237 132	29 560	207 578
Ratio 1.9	450 551	56 163	394 398
in mln. zł			
Book value	2 026 020	252 553	1 773 514
Ratio 1.3	2 633 826	328 319	2 305 568
Ratio 1.9	5 004 269	623 806	4 380 579

Conclusions:

In our opinion the factors achieved with the accounting method cannot be fully trusted (see examples below).

- more reliable results have been achieved with the replacement method
- the divergence of factors in the above mentioned methods is the result of incidental value of appreciation factors (difference between predicted and real rate of inflation.
- in the most cases book values are lower than values established with replacement method.

V.Book value of the basic machinery and equipment.

Preliminary valuation of the machinery and equipment in the main workshops of coke plant "Przyjaźń" in Dąbrowa Górnicza.

I. The aim of valuation:

Preliminary valuation of machinery and equipment in the main workshops P-1,P-2,P-3,P-4,TO in the coke plant "Przyjaźń" in Dąbrowa Górnicza for investment purposes. The above mentioned valuation cannot be used as a basis for estimating the value of the enterprise for privatisation purposes.

II. The subject of the valuation:

The subject of the valuation are the machinery and equipment in the main workshops P-1,P-2,P-3,P-4,TO in the coke plant "Przyjaźń" in Dąbrowa Górnicza show in the charts e.g. P-1,P-2,P-3,P-4,TO workshops when started operating from 1984-1991.

III. Legal basis of the valuation.

Computer data of fixed assets obtained from the accountancy of the enterprise.

IV. Technical settlements.

The coke plant "Przyjaźń" is equipped with modern machinery and tool stock as well as with modern technical solutions to provide a full protection for the environment. The survey and the establishing of the market price is up to the customer.

V. Methods of valuation.

The valuation has been done with the book value method. The results of the valuation are show in the following charts.

Conclusions:

From the consolidated chart it follows that in round figures in P-1,P-2,P-3,P-4,TO workshops:

-depreciation over a year of machinery and tools is 93915 mln złotych (8456 th. $)
-the value of accumulated depreciation is 384242 mln. zł (34595 th. $)
-actual net value is 755636 mln zł. (68032 th. $)

The actual net book value (for 01.01.1992) of the machinery and the equipment in the above mentioned workshops is 755636 mln zł, say: seven hundred fifty five milliard six hundred thirty six milion złotych.

The book values presented above underwent the revaluation according to the cperative rules. This factors were different from inflation factors. In order to get the estimated market value a similar valuation of each piece of machinery and equipment should be done. Underestimation can be specified by the factors from 1.3 to 1.9. The results in the chart below.

Estimation market value of machine tools and equipment in subsidiary P-1,P-2,P-3,P-4,TO in Coke Co., "PRZYJAŹŃ"

1 $ USD = 11 107 zł
date 31.12.1991

	in mln. złotych			in th. $ USD		
	Depreciation	Accum. depr.	Current value	Depreciation	Accum. depr.	Current value
Book value	93 915	384 242	755 636	8 456	34 595	68 032
Ratio = 1.3	122 089	499 515	982 327	10 993	44 974	88 442
Ratio = 1.9	178 439	730 060	1 435 708	16 066	65 731	129 261

Remaining divisions of the coke "Przyjaźń" plant are equipped as follows:

division	current net book value in mln zł
mechanics	1 387
energetic	219 180
electricity	44504
gas	40
railway	16 682
transportation	5 547
computers	1 361
others	3 466

Consolidated book value of machine tools and equipment in subsidiary P-1,P-2,P-3,P-4,TO in Coke Co., "PRZYJAŹŃ"						
(data 31.12.1991)				1 $ USD = 11 107 zł		
	in mln. złotych			in th. $ USD		
Group	Depreciation	Accum. depr.	Current value	Depreciation	Accum. depr.	Current value
Stock of machine tools	163	421	922	15	38	83
Coke oven battery	33 351	116 728	304 748	3003	10509	27437
repair equipement	155	409	1 387	14	37	125
charging device						
coke pusher	3 418	12 445	27 762	308	1120	2499
combustion gas chamber	547	2 040	4 398	49	184	396
gas heater	28	89	465	2	8	42
Road transport	1 512	6 280	11 164	136	565	1005
Rail transport	5 072	18 200	40 445	457	1639	3641
Belt conveyor line	13 176	50 815	26 937	1186	4575	242[illegible]
Pneumatic conveying	3 670	8 911	15 829	330	802	1425
Crane, overhead crane, lift	3 641	10 729	31 093	328	966	2799
bloc	215	851	1 555	19	77	140
car puller	274	714	2 636	25	64	237
Monitoring system	592	1 536	1 242	53	138	112
Breaker	320	1 245	2 467	29	112	222
Screen, sorting machine, separator	995	4 806	13 448	90	433	1211
Fan	1 001	5 861	9 844	90	528	886
mechanical ventilation	408	1 160	3 640	37	104	328
Mixer		130	299		12	27
Tippler	1 987	6 489	18 049	179	564	1625
Scales						
Vibrating conveyor, drum conveyor	53	287	310	5	26	28
Railway, turn bridge	1 403	4 810	11 694	126	433	1053
Tank	222	3 536	6 494	20	318	585
Rectifier set	145	549	946	13	49	85
Transformer	231	1 792	3 345	21	161	301
Dispatch instalation	487	3 091	5 523	44	278	497
Switching station,cubicle	3 190	10 903	28 173	287	982	2537
Larry	268	1 098	2 086	24	99	188
Filter equipment	4 877	17 810	37 591	439	1603	3384
Gas installation	2 807	33 833	26 283	253	3046	2366
Water installation	2 318	7 258	20 523	209	653	1848
Pump station	328	3 794	9 243	30	342	832
Air installation	315	3 067	6 318	28	276	569
Other installation	1 779	14 119	25 583	160	1271	2303
Loading device, unloader	3 193	13 123	26 976	287	1181	2429
Feeder	316	1 508	2 468	28	136	222
Coke stabilizer	11	39	87	1	4	8
Atypical equipment	377	5 913	10 323	34	532	929
Tank clasure	40	165	281	4	15	25
Interdepartment installation	670	6 843	10 280	60	616	926
Hydraulic installation	361	842	2 776	32	76	250
TOTAL	93 915	384 242	755 636	8456	34595	68032

Machine tools and equipment (book value)						
			1 $ USD=	11107	zlotych	
Subsidiary P - 1						
		in zlotych			in $ USD	
	Depreciation	Accum. depr.	Current value	Depreciation	Accum. depr.	Current value
Stock of machine tools	26 212 392	57 579 853	184 237 147	2360	518[illegible]	16587
Coke oven battery						
repair equipement						
charging device						
coke pusher						
combustion gas chamber	547 220 880	2 040 219 672	4 397 672 328	49268	183688	395937
gas heater						
Road transport	1 439 493 636	6 071 863 660	10 823 676 340	129602	546370	974491
Rail transport						
Belt conveyor line	5 403 345 296	21 506 885 545	10 459 379 455	486481	1936336	941693
Pneumatic conveying						
Crane, overhead crane, lift	56 871 624	174 194 805	494 838 195	5120	15683	44552
bloc	96 887 292	394 299 525	335 598 275	8723	35500	30215
car puller						
Monitoring system	1 342 320	3 437 021	591 259	121	309	53
Breaker	305 850 564	1 222 415 262	2 375 826 738	27537	110058	2[illegible]3904
Screen, sorting machine, separator	48 451 032	205 466 218	346 545 782	4362	18499	31201
Fan						
mechanical ventilation						
Mixer						
Tippler	1 920 808 248	6 154 408 520	16 443 335 480	172937	554102	1480448
Scales						
Vibrating conveyor, drum conveyor	53 179 488	287 342 160	310 023 840	4788	25870	27912
Railway, turn bridge	64 450 824	218 009 118	540 235 882	5803	19628	48639
Tank						
Rectifier set						
Transformer						
Dispatch instalation	145 513 704	539 965 032	1 171 960 968	13101	48615	105516
Switching station,cubicle	353 827 454	1 486 661 054	3 671 938 946	31856	133849	330597
Larry	184 422 316	761 392 894	1 474 569 506	16604	68551	132760
Filter equipment	41 541 396	179 173 699	236 240 301	3740	16132	21269
Gas installation						
Water installation						
Pump station						
Air installation						
Other installation						
Loading device, unloader						
Feeder	284 748 372	1 310 603 786	2 039 376 214	25637	117998	183612
Coke stabilizer						
Atypical equipment						
Tank clasure	40 039 092	164 881 047	281 282 253	3605	14845	25325
Interdepartment installation						
Hydraulic installation						
TOTAL	11 014 205 930	42 778 798 871	55 587 328 909	991645	3851517	5004711

Machine tools and equipment (book value)						
			1 $ USD=	11107	złotych	
Subsidiary	P - 2					
		in złotych			in $ USD	
	Depreciation	Accum. depr.	Current value	Depreciation	Accum. depr.	Current value
Stock of machine tools	45 360 006	99 898 473	261 236 624	4084	8994	23520
Coke oven battery	32 529 202 184	104 472 210 452	278 322 868 548	2928712	9405979	25058330
repair egurpement	154 646 492	408 670 091	1 387 170 909	13923	36794	124892
charging device						
coke pusher	3 417 555 204	12 444 900 724	27 761 631 276	307694	1120456	2499472
combustion gas chamber						
gas heater	27 690 000	88 901 628	464 898 372	2493	8004	41856
Road transport	32 056 908	79 332 684	177 122 316	2886	7143	15947
Rail transport	4 579 710 780	16 478 822 182	37 437 757 818	412327	1483643	3370645
Belt conveyor line	1 182 840	4 648 786	24 922 214	106	419	2244
Pneumatic conveying						
Crane, overhead crane, lift	142 811 848	358 670 692	1 170 364 306	12858	32292	105372
bloc	5 489 400	20 757 957	18 452 043	494	1869	1661
car puller	235 109 496	527 760 481	2 238 233 516	21168	47516	201516
Monitoring system	8 606 760	17 274 565	33 353 435	775	1555	3003
Breaker						
Screen, sorting machine, separator						
Fan						
mechanical ventilation						
Mixer						
Tippler						
Scales						
Vibrating conveyor, drum conveyor						
Railway, turn bridge	1 338 378 288	4 592 161 814	11 153 465 186	120499	413448	1004183
Tank						
Rectifier set						
Transformer						
Dispatch instalation						
Switching station,cubicle	129 411 144	332 633 416	1 189 855 584	11651	29948	107127
Larry						
Filter equipment						
Gas installation	102 063 744	299 002 640	901 747 360	9189	26920	81187
Water installation	20 845 224	55 773 448	189 464 552	1877	5021	17058
Pump station						
Air installation						
Other installation						
Loading device, unloader						
Feeder						
Coke stabilizer						
Atypical equipment						
Tank clasure						
interdepartment installation						
Hydraulic installation	360 809 052	842 356 176	2 775 525 824	32485	75840	249890
TOTAL	43 130 929 370	141 123 776 209	365 508 069 883	3883220	12705841	32907902

Machine tools and equipment (book value)						
			1 $ USD=	11107	złotych	
Subsidiary P - 3						
		in złotych			in $ USD	
	Depreciation	Accum. depr.	Current value	Depreciation	Accum. depr.	Current value
Stock of machine tools	61 244 964	160 135 682	333 269 318	5514	14418	30005
Coke oven battery						
repair equipement						
charging device						
coke pusher						
combustion gas chamber						
gas heater						
Road transport	25 371 108	79 937 070	129 247 930	2284	7197	11637
Rail transport	492 388 620	1 720 886 523	3 007 581 477	44331	154937	270783
Belt conveyor line	7 771 950 659	29 303 465 949	16 452 629 051	699734	2638288	1481285
Pneumatic conveying	3 670 025 712	8 911 098 871	15 828 876 130	330425	802296	1425126
Crane, overhead crane, lift	3 166 374 180	9 588 144 810	27 668 912 190	285079	863252	2491124
bloc	112 374 146	436 114 962	1 200 770 338	10117	39265	108109
car puller	39 198 672	186 733 407	397 660 593	3529	16812	35803
Monitoring system	245 094 450	1 041 182 070	184 494 930	22067	93741	16611
Breaker	14 178 744	22 449 678	90 980 322	1277	2021	8191
Screen, sorting machine, separator	369 097 044	1 436 248 746	2 906 090 254	33231	129310	261645
Fan	794 630 298	3 723 903 753	3 983 405 632	71543	335275	358639
mechanical ventilation	407 928 174	1 159 659 234	3 640 317 766	36727	104408	327750
Mixer						
Tippler	25 433 544	74 328 110	561 509 890	2290	6692	50555
Scales						
Vibrating conveyor, drum conveyor						
Railway, turn bridge						
Tank						
Rectifier set	145 122 408	544 818 026	942 531 096	13066	49052	84868
Transformer	10 802 752	28 588 687	104 178 313	973	2574	9380
Dispatch instalation	95 714 436	332 458 187	793 593 813	8617	29932	71450
Switching station,cubicle	1 832 521 162	6 053 338 621	15 624 811 379	164988	545002	1406754
Larry	83 296 776	336 785 692	611 426 718	7499	30322	55049
Filter equipment	4 623 881 226	15 905 300 395	34 650 148 449	416303	1432007	3119668
Gas installation	403 001 160	1 198 857 287	3 542 332 713	36284	107937	318928
Water installation	68 019 216	199 484 425	600 741 575	6124	17960	54087
Pump station						
Air installation	141 216 360	507 006 308	1 076 420 140	12714	45647	96914
Other installation	10 847 364	33 579 550	91 036 450	977	3023	8196
Loading device, unloader	3 175 002 320	13 003 668 522	26 197 609 942	285856	1170763	2358658
Feeder	2 075			0		
Coke stabilizer	10 765 584	39 233 168	87 420 832	969	3532	7871
Atypical equipment	42 268 800	106 915 200	390 364 800	3806	9626	35146
Tank clasure						
Interdepartment installation	407 534 544	1 791 868 678	3 002 655 322	36692	161328	270339
Hydraulic installation						
TOTAL	28 245 286 498	97 926 191 611	164 101 117 363	2543017	8816619	14774567

Machine tools and equipment (book value)						
			1 $ USD=	11107	złotych	
Subsidiary P - 4						
		in złotych			in $ USD	
	Depreciation	Accum. depr.	Current value	Depreciation	Accum. depr.	Current value
Stock of machine tools	21 779 787	79 599 778	100 654 222	1961	7167	9062
Coke oven battery	821 759 565	12 256 056 000	26 424 944 000	73986	1103453	2379125
repair eguipement						
charging device						
coke pusher						
combustion gas chamber						
gas heater						
Road transport	14 619 268	48 399 876	33 374 124	1316	4358	3005
Rail transport						
Belt conveyor line						
Pneumatic conveying						
Crane, overhead crane, lift	273 672 321	606 300 000	1 756 039 000	24640	54587	158102
bloc						
car puller						
Monitoring system	327 137 389	454 533 000	994 275 000	29453	40923	89518
Breaker						
Screen, sorting machine, seperator	577 074 907	3 164 699 000	10 195 736 000	51956	284928	917956
Fan	206 144 647	2 137 048 000	5 860 737 000	18560	192406	527662
mechanical ventilation						
Mixer		130 108 000	[illegible]98 968 000		11714	26917
Tippler	40 781 262	260 725 000	1 044 275 000	3672	23474	94020
Scales						
Vibrating conveyor, drum conveyor						
Railway, turn bridge						
Tank	210 041 188	3 493 506 000	6 390 782 000	18911	314532	575383
Rectifier set	192 129	4 114 000	3 763 000	17	370	339
Transformer	196 929 189	1 687 825 000	3 047 009 000	17730	151960	274332
Dispatch instalation	245 474 320	2 218 079 000	3 557 787 000	22101	199701	320319
Switching station,cubicle	675 611 082	2 363 612 000	6 006 535 000	60828	212804	540788
Larry						
Filter eguipment	212 054 076	1 725 335 000	2 704 882 000	19092	155338	243529
Gas installation	2 302 401 846	32 335 067 000	21 839 095 000	207293	2911233	1966246
Water installation	164 823 688	800 424 000	1 780 253 000	14840	72065	160282
Pump station	325 249 040	3 783 186 689	9 226 813 311	29283	340613	830721
Air installation	173 948 912	2 559 980 000	5 241 816 000	15661	230483	471938
Other installation	1 634 956 144	13 726 969 000	24 285 031 000	147201	1235884	2186462
Loading device, unloader	18 169 310	118 907 000	778 428 000	1636	10706	70084
Feeder	26 928 154	181 772 000	400 458 000	2424	16366	36055
Coke stabilizer						
Atypical equipment	334 453 750	5 806 000 000	9 933 000 000	30112	522733	894301
Tank clasure						
Interdepartment installation	261 985 281	5 051 511 000	7 277 208 000	23587	454804	655191
Hydraulic installation						
TOTAL	9 066 187 256	94 993 756 343	149 181 862 657	816259	8552603	13431337

Machine tools and equipment (book value)						
			1 $ USD=	11107	złotych	
Subsidiery TO						
		in złotych			in $ USD	
	Depreciation	Accum. depr.	Current value	Depreciation	Accum. depr.	Current value
Stock of machine tools	8 342 544	23 588 609	43 053 391	751	2124	3876
Coke oven battery						
repair equipement						
charging device						
coke pusher						
combustion gas chamber						
gas heater						
Road transport	400 500	801 000	243 000	36	72	22
Rail transport						
Belt conveyor line						
Pneumatic conveying						
Crane, overhead crane, lift	993 996	1 987 985	2 982 015	89	179	268
bloc						
car puller						
Monitoring system	9 917 988	19 835 758	29 754 242	893	1786	2679
Breaker						
Screen, sorting machine separator						
Fan						
mechanical ventilation						
Mixer						
Tippler						
Scales						
Vibrating conveyor, drum conveyor						
Railway, turn bridge						
Tank	12 410 004	42 766 159	103 233 841	1117	3850	9294
Rectifier set						
Transformer	22 930 632	75 688 546	194 083 454	2065	6814	17474
Dispatch instalation						
Switching station,cubicle	198 903 588	666 778 779	1 680 322 221	17908	60032	151285
Larry						
Filter equipment						
Gas installation						
Water installation	2 064 618 984	6 202 355 897	17 952 698 103	185884	558419	1616341
Pump station	2 710 992	11 066 774	16 043 226	244	996	1444
Air installation						
Other installation	133 040 892	358 542 601	1 206 644 399	11978	32281	108638
Loading device, unloader						
Feeder	4 400 004	15 730 757	28 269 243	396	1416	2545
Coke stabilizer						
Atypical equipment						
Tank clasure						
Interdepartment installation						
Hydraulic installation						
TOTAL	2 458 670 124	7 419 142 865	21 257 327 135	221362	667970	1913868

Table of book value buildings and structures (in th. $ USD)			
Group	Gross value	Accumulated depreciation	Current net value
Buildings	73 047	5 451	67 596
Structures	109 362	17 287	92 079
Total	182 409	22 738	159 675

Table of book value buildings and structures (in mln. złoty)			
Group	Gross value	Accumulated depreciation	Current net value
Buildings	811 338	60 549	750 788
Structures	1 214 682	192 004	1 022 725
Total	2 026 020	252 553	1 773 514

It follows from the consolidated chart that in the enterprise under the analysis, in round figures:

- the gross value of buildings and structures for 31.12.1991 equals 2026020 millions zł (182409 th. USD)
- accumulated depreciation equals 252553 millions zł (22738 th. USD)
- adjusted net book value equals 1773514 millions zł (159675 th. USD)

The actual net book value buildings and structures equals 1773514 millions zł (159675 th. USD).

Table of price ratios in $ USD per cubic meter (examples)
(for buildings and structures)

No	Object	Book value method	Replacement method	Repl./ Book
1	poz. 31 Hala stalowa	26	50	1,95
2	poz. 61 Hala żelbet.	50	65	1,30
3	poz. 123 Bud.adm.-soc. "Ziębiec"	78	43	0,56
4	poz. 134 Bud.mieszkalny	28	44	1,55

C O M P A R A T O R Y   A N A L Y S I S

VALU

and BY RECONSTRUCTION METHOD

1. Item 31. **Steel hall**
   (repair post of coke cars)

2. Item 61. **Ferroconcrete hall**
   (air compressor station)

3. Item 123. **Administration building - social building "ZIĘBIEC"**
   (mixed construction)

4. Item 134. **Apartment building**
   (constructed with W-70 technology)

REPAIR POST of COKE CARS

STEEL HALL

Item 31 (inventory No 102 / 0110)

The object is a steel hall, where railway "coke cars" are repaired. Rooms for electric and mechanic workoshops and for foremen are separated inside the hall.

Dimensions	18.0 x 51.0 x 19.20
Area	977 m^2
Cubage	18,400 m^3

Steel openwork carrying posts are supported on ferroconcrete monolithic block foundaticns. Vertical protective walls and roof are made of trapezoidal plates, heat insulated.
Roof supporting structure is constructed of lattice girders. The hall contains overhead crane of 32/8 T lifting capacity.

1. The technical value of the object determined by method of reconstruction, taking into account the mean technical rate of wear, calculated as for the date of 31 December 1991, is:

   18,400 x 585,400 x 0.954 = <u>10,275,877,440 zlotys</u>

2. Net book value of the object (item 31 102/0110) is as for the date of 31 December 1991:

   <u>5,262,219,926 zlotys</u>

STATION of AIR COMPRESSORS

F E R R O C O N C R E T E H A L L

Item 61 (inventory No 109/0055)

The object comprises air turbocompressors and equipment for air purification.

Dimensions	**15.0 x 54.0 x 12.0**
Area	**846 m^2**
Cubage	**10,152 m^3**

Supporting structure is made of openwork ferroconcrete poles. Roof trusses are made of prestressed concrete. The block foundations with stays are made of ferroconcrete. Roof covering is of tray plates. Internal walls of separated rooms are made of bricks. Ferroconcrete floors are supported by steel beams.

1. The technical value of the object determined by method of reconstruction, taking into account the mean technical rate of wear, calculated as for the date of 31 December 1991, is:

   10,152 x 763,000 x 0.952 = 7,374,169,152 zlotys

2. Net book value of the object (item 61 inventory No 109/0055) is as for the date of 31 December 1991:

   5,668,628,360 zlotys

ADMINISTRATION BUILDING

" Z I E B I E C "

(inventory No 149/0103)

The evaluated object is constructed as typical social-office building of "Ziębiec" type designed by Biuro Projektów Budownictwa Przemysłowego i Kopalnictwa Rud (Design Office for Industrial and Ore Mining Building) "Biprorud" - Częstochowa.

A modification against typical documentation consists in building founding on a basement what resulted in an additional third storey. The foundations are monolithic ferroconcrete. The basement is made of bricks. Two another storeys are of steel structure. The lateral carrying frames comprise lengthwise bracings. Ceilings - steel structure. The carrying beams are of rolled shapes. Carrying plate is of trapezoidal steel sheets. Acoustic and thermal insulation is made of mineral wool. External walls are in layers: corrugated sheet, plate of "Acekol" type, thermal insulation, anti-damp insulation, plaster board. Internal walls - crosswise wooden grid with fixed from two sides plaster boards.

The object comrises:

- water supply and sewerage system,
- central heating,
- electric wiring system,
- telephone wiring system,
- ventilation system,
- lightning protection system.

Dimensions

length	58.10 m
width	12.45 m
height	9.25 m
area	723.0 m^2
cubage	6,691.9 m^3

1. Technical value of the building according to valuation (own method) performed by detailed reconstruction method, taking into account the mean technical rate of wear, which amunted to 9.4%, for the date of 27 December 1991, is:

   3,220,592,247 zlotys

2. Net book value of the building (item 123 inventory No 149/0103) is as for the date of 31 December 1991:

   5,790,732,680 zlotys

APARTMENT BUILDING No 5

(item 134, inventory No 161/0033)

Apartment building is localized at 4, Kosynierów St. in Olkusz. It is composed of 6 three-storeys segments, and has been constructed using W-70 technology. It comrises a cellar and attic, where laundries and driers are placed. Continuous footing is monolithic ferroconcrete, cellar walls are of poured ferro-concrete of 25 cm (30 cm) thickness.

Protective and internal walls are made using W-70 SG technology; they have ready external surface quality. External "layers" walls are made of brick and mineral wool. Partition walls are made of full and cavity bricks. The ceilings are of channel boards. At corners the floors are monolithic poured. The gable roof is covered with corrugated sheets supported by steel purlins. The typical windows are made of wood. Board doors are full. Floors in rooms, kitchens and anterooms are made of polyvinyl chloride boards, in bathes - terazzo. Cement and lime plasters are painted with lime paint, glue colours and partially with oil and emulsion paints.

The building is provided with:

- central heating,
- central warm water system,
- water supply and sewerage system,
- electric wiring system,
- azart system,
- channel gravitaion ventilation of flats.

The house was constructed (accepted) 31 March 1987.

Usable floor area **4,504.45 m^2**

Cubage **25,004.00 m^3**

Number of separate apartments **63**

Technical value of the building, according to valuation performed 12 October 1991 with reconstruction method by "Inbud", is

11,191,651,376 zlotys.

Mean technical rate of wear amounts to 3.47%.

Mean cost of 1 m^2 of usable floor area is 2,484,577 zlotys.

1. The technical value of the building updated to 31 December 1991 is:

   11,191,651,376 x 1.09 = <u>12,198,900,000 zlotys</u>

2. Net book value of the building (item 134, inventory No 161/0033) is as for the date of 31 December 1991:

   <u>7,886,002,418 zlotys</u>

SPECIFICATION of BUILDING VALUES

No	Object	Book value method	Reconstruction method
1.	item 31 Steel Hall (18,400 m^3)	5,262,219,926.-	10,275,877,440.-
2.	item 61 Ferroconcrete hall (10,152 m^3)	5,668,628,360.-	7,374,169,152.-
3.	item 123 Administration building "Ziębiec" - mixed construction (6,691 m^3)	5,790,732,680.-	3,220,392,247.-
4.	item 134 Apartment building (63 apartments) W-70 (25,004 m^3)	7,886,002,418.-	12,198,900,000.-

Four typical objects have been chosen for analysis:

1. Steel hall
2. Ferroconcrete hall
3. Administration building (social) of mixed construction: basement - traditional bricks construction, two another storeys - steel construction.
4. Apartment building (63 apartments) - W-70 technology.

When analysing the object values obtained with book value method one should notice typical indexes of value when 1 m^3 of the building is considered, thus:

item 1. 5,262,219,926 : 18,400 = 285,990 zlotys per 1 m^3

item 2. 5,668,628,360 : 10,152 = 558,375 zlotys per 1 m^3

item 3. 5,790,732,680 : 6,691 = 865,451 zlotys per 1 m^3

item 4. 7,886,002,418 : 25,004 = 315,389 zlotys per 1 m^3

When the reconstruction method is utilised the following indexes are obtained:

item 1. 10,275,877,440 : 18,400 = 558,472 zlotys per 1 m^3

item 2. 7,374,169,152 : 10,152 = 726,376 zlotys per 1 m^3

item 3. 3,220,592,247 : 6,691 = 481,332 zlotys per 1 m^3

item 4. 12,198,900,000 : 25,004 = 487,878 zlotys per 1 m^3

LISTING of VALUE INDEXES

No	Object	Cost index of 1 m^3 based on book value method (zlotys/m^3)	Cost index of 1 m^3 based on reconstruction method (zlotys/m^3)
1.	Item 31 Steel hall	285,990	558,472
2.	Item 61 Feroconcrete hall	558,375	726,376
3.	Item 123 Administration building "Ziębiec"	865,451	481,332
4.	Item 134 Apartment building	315,389	487,878

Analysing the obtained indexes one can easily see very "random" and unrealistic values of indexes received with book value method. A striking example is the cost of 1 m^3 of apartment building amounting approximately to 315 thousand zlotys, while that of administration building (having considerably worse standard and material consupti
sand zlotys.

The values closest to actual "market" values (December 1991) are obtained when indexes based on reconstruction method are used.

The discrepancy of book value, and relative indexes, in relation to actual value, results from quite random scaling coefficients of fixed assets updating and depreciation rates which are divergent in relation to mean technical rates of wear and technical values of valuated objects.
Therefore, if one wants to determine likely actual technical value of an object, he will not be able to do that basing on book value. The discrepancy augments still more when some special structures are considered, which features and functions result from technological process.

Another factor impacting on the a/m discrepancy, which is very typical in our economical situation, is the value of infation. Unfortunately, during one year the inflation value is higher than book reassessment of fixed assets.

Summarizing, one can state that in major part of cases (especially for bigger objects) the book values are lower than the values obtained with reconstruction method.

Another problem, exceeding the range of this study, is value analysis considering income value of the a/m buildings and structures.

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ANNEX D

Interview Report of Potential Customers in Europe, US and Brazil

1. About Coke and PCI

Coke is indispensable as a reducing agent for iron ore while it is used as the heat source for melting iron ore and limestone in the blast furnace. It plays an important role as an agent to assure good ventilation of gas in the furnace. Although there are many types of coke according to their uses, essential conditions for the coke for use in blast furnaces are that this coke: (1) is hard and rigid, (2) has grain sizes within a certain range, and (3) has low contents of ash, water, or other foreign matter (sulfur, in particular). To produce coke that has these characteristics, coal with high caking property (such as coking coal/hard coal) must be used as the raw material.

The following materials are required to produce 1 ton of steel in a blast furnace:

Iron ore:	213 kgs
Sintered ore:	1223 kgs
Pellets:	178 kgs
Other iron materials:	7.4 kgs
Manganese ore:	2.9 kgs
Coke:	480 kgs
Limestone:	2.6 kgs
Electric power:	47.3 kWh
Water:	172.0 m^3

PCI (pulverized coal injection) is injection of dust coal and is a fuel injection method for the blast furnace. Dust coal with particle sizes of less than 0.7 mm in ordinary cases is injected from the tuyere as a substitute for coke for use with blast furnaces. Although heavy oil has conventionally been injected, the use of PCI has become wide spread, especially since the oil crisis, for stabilization of conditions in the furnace, cost reduction, and as a countermeasure against the aging of coke ovens, and is used in more than 60% of the furnaces now in operation in Japan. In normal cases, 50 to 120 kgs of dust coal is injected to produce 1 ton of molten iron.

2. Hoogovens Jimuiden, The Netherlands.

In order to maintain a productions of 5 million tons of new steel with operation of 2 blast furnaces, it is necessary to use 1.8 million tons of metallurgical coke. This coke is now being supplied by their own coke oven, the normal yearly production of which is 2 million tons of coke, giving a surplus 200,000 tons. The surplus is to be exported to neighboring countries such as Finland, Germany, Italy, and Algeria at an inexpensive price of US$ 100/mt on a CF basis. Hoogovens imported coke breeze from Poland in 1991. They imported Polish coal 15 years ago but because there were problems such as non-delivery and unequal quality they have no further intention of importing coal from Poland in future. They also have stable suppliers in the U.S. and Australia from which cheap, high quality coal is easily imported because the Blast Furnace (F.B.) plants are located in good positions in harbors.

However, as far as coke is concerned, Hoogovens has 2 coke factories, a one-million ton plant started 1983 and another (older) one started 1972. They obviously have to consider what to do with the old one, that is, either to rebuild it or to shut it down and import coke in the near future (1996-1997).

Hoogovens must know quite well that current installation of a new coke oven requires a large amount of investment with huge costs of environmental protection.

Even now, Hoogovens is very worried about being able to maintain pollution levels below that required by the severe regulations. They must renovate measuring methods and pollution control, and they are hurt by the large problems caused by regulations, which forces some companies to stop operation and/or pay big penalties for environmental protection. They are seriously thinking of increasing the PCI portion (now used at 140 kgs/ton) in order to reduce the proportional consumption of coke.

However, if they decide to shutdown the old coke oven, they would be forced to seek new stable suppliers of coke for at least 400,000 to 500,000 tons/year, in this respect, they would be very interested in negotiations with a Polish supplier at that stage.

3. CTC MINEMET (Coke trader in France)

The surveyor contacted the biggest blast furnace mills in France "Usinor Sacilor", however the mill refused to talk with him, because they do not need to buy imported coke at all. Their own coke production and domestic supply sources are sufficient.

According to CTC Minemet, all mills in France do not need to buy from other countries for following reasons.

Charbounage De France has a coke factory in the northern part of France which import coking coal from the U.S. and Australia and sells the coke produced to domestic mills. Furthermore, if extra quantities are produced sometimes, they export their coke through CTC Minemet, 25% of which is owned by Charbounage De France.

4. Ruhrkohle Aktiengesellschaft = RAG
   (biggest trader of coal/coke in Germany)

The technical capacity for coke production, which was 13.2 million tons in 1986, was cut back to 9 million tons by 1990, but actual coke production was cut back further to 8.4 million tons 1991.

Because of the unfavorable sale situation, the coke stocks rose by 0.5 million tons. RAG accounted for 52 percent of the total German coke production. The remaining 48% of the coke is produced by steel mills and there is no need to import coke from outside countries.

Coal production in Germany is approximately 70 million tons out of which 53 million tons was produced by RAG 1990. Domestic users must use coal produced in Germany.

Domestic price of ex coal mine is DM 260/t, however the price of imported coal is DM 100/t, the difference, DM 170, is to be subsidized by the German government. This subsidiary on coal is to be continued until the year 2005, then coal production will be up to 50 million tons/year with 15 to 20% of coal being imported.

The regulations concerning ash dust are to become more strict in April 1993. The present allowed ash content of 150 grams will become 50 grams, making control of ash dust much more important. According to information from RAG, the present spot market price of Metallurgical coke is US$75/ton C&F Europe and cheapest prices are for coal from China at FOB $65/ton .

In general, the situation of German coke is as follows : (see attached list *)

Raw steel production in Germany is around 40 million tons per year.

Consumption of coke for German blast furnace mills is about 16 million tons/year, while production is seen as only decreasing.

Production of coke was 17.6 million tons in 1990, out of which about 7.2 million tons was produced by the steel mills themselves. Germany has the largest share of EC production, about 35% of the total coke produced in the EC.

Production of coal in Germany was about 70 million tons in 1990 with government-subsidized help; expensive coal mines will be cut back and their production of coal will likely decrease to 35 million tons/year towards the year 2005.

Energy / Federal Republic of Germany (Old Federal States): Consumption during production in the iron - making industry

Year	Production		Energy consumption					Coke consumption in the blast furnace		Fuel oil consumption in the blast furnace	
	Crude iron	Raw steel	Stone coal, stone coal coke	Brown coal	Fuel oil	Gas	Electricity				
	1000 t	1000 t	1000 t	1000 t	1000 t	Mill. M3	Mill. kWh	1000 t	kg/	1000 t	kg/
1951	10 697	13 506	13 342	324	-	6 738	4 417	10 538	963	-	-
1952	12 877	15 506	16 298	954	-	7 917	4 538	13 276	1 031		
1953	11 654	15 420	14 531	388	110	7 454	4 584	11 754	1 009	-	-
1954	12 512	17 434	14 788	945	245	7 686	5 196	11 899	935		
1955	16 482	21 336	18 596	915	328	9 087	6 305	15 600	933	-	-
1956	17 577	23 189	19 659	841	491	9 609	7 150	16 681	938	-	-
1957	18 358	24 507	20 531	368	622	9 827	7 796	17 507	941	-	-
1958	16 659	22 785	18 132	857	720	8 728	7 981	15 501	896	-	-
1959	18 393	23 822	22 388	841	984	8 799	8 625	15 635	839	-	-
1960	25 739	34 100	25 675	846	1 286	11 529	11 020	21 471	826	0	0
1961	25 431	33 458	24 593	778	1 484	10 976	11 271	20 419	797	3	0
1962	24 251	32 563	22 383	560	1 804	9 863	11 285	18 264	748	46	2
1963	22 909	31 597	20 375	525	1 896	8 977	11 421	16 626	719	74	3
1964	27 182	37 339	22 785	587	2 458	9 624	13 107	18 932	619	119	4
1965	26 990	36 821	21 962	386	2 690	9 340	13 637	18 127	668	218	8
1966	25 413	35 316	20 069	279	2 902	8 805	13 549	15 796	617	569	22
1967	27 366	34 744	20 545	228	2 913	9 130	13 879	16 516	599	780	28
1968	30 305	41 159	21 461	144	3 244	10 264	13 326	17 546	577	1 087	36
1969	33 764	45 316	23 019	106	3 384	11 682	16 769	19 038	563	1 386	41
1970	33 627	45 041	22 640	100	3 672	12 510	17 331	18 787	558	1 690	30
1971	29 990	40 313	19 126	113	3 604	11 560	16 315	15 638	520	1 955	65
1972	32 003	43 705	19 023	126	4 324	11 832	17 501	15 598	486	2 523	79
1973	36 828	49 521	21 819	126	4 350	12 913	19 749	18 221	494	2 611	71
1974	40 221	53 232	24 792	183	3 792	13 948	20 632	20 806	517	2 232	56
1975	30 074	40 415	18 584	68	3 083	11 448	17 588	14 965	497	1 876	62
1976	31 849	42 415	18 870	10	3 124	11 604	18 526	15 366	482	1 995	63
1977	28 959	38 985	17 221	1	2 473	10 697	17 964	14 014	484	1 485	51
1978	30 148	41 263	17 587	-	2 377	10 857	18 381	14 644	486	1 453	48
1979	35 167	46 040	20 552		2 417	12 043	20 447	17 501	497	1 525	43
1980	38 873	43 838	20 468	-	1 444	11 436	19 773	17 447	515	794	23
1981	31 876	40 610	19 997	-	726	10 385	18 998	17 223	540	309	10
1982	27 621	35 880	16 946	-	531	8 359	17 236	14 577	528d	260	9
1983	26 598	35 729	16 152	-	522	8 225	17 145	13 977	525d	330	12
1984	30 203	39 389	18 439	-	482	8 936	18 354	16 039	531d	328	11
1985	31 531	40 497	19 015	-	331	9 206	18 629	16 747	531d	195	6
1986	29 018	37 134	16 268	-	895	8 860	17 671	14 043	484d	733	26
1987	28 517	36 248	15 609	-	827	8 781	17 190	13 068	458d	676	24
1988	32 453	41 023	17 559	-	905	9 594	18 339	14 412	441	752	23
1989	32 777	41 073	17 707	-	923	9 381	18 407	14 498	442	802	24
1990	30 097	38 431	16 115	-	843	8 723	17 884	12 672	421	721	24

a) Until 1959 without Searland

b) Blast furnace, coke furnace gas, generator gas, natural gas and liquid petroleum gas -. 7692 kWh/cm

c) Specific consumption in kg/t crude iron including unmolten crude iron

d) Including iron sponge production

Source: Federal Bureau of Statistics, Outpost Dusseldorf

Stone coal-Federal Republic of Germany (Old Federal States)

Coke Production (1000 t)

Year	Mine coke production					Blast-furnace coke production	Gas coke production	Total coke production
	Ruhr	Sar*	Aachen	Ibbenbüren	Federal Republic of Germany			
1957	39 777	1 020	1 373	136	42 306	7 476	6 121	
1958	37 751	926	1 706	123	40 506	7 361	5 551	
1959	32 793	1 205	1 812	120	35 930	7 036	5 597	
1960	33 695	1 533	1 924	69	37 221	7 533	5 824	
1961	33 681	1 557	1 806	–	37 044	7 490	5 556	
1962	32 659	1 468	1 927	–	36 054	7 144	5 590	
1963	31 796	1 496	1 921	–	35 213	6 682	5 534	
1964	33 997	1 448	1 949	–	37 394	5 955	4 912	
1965	34 719	1 211	1 973	–	37 903	5 391	4 153	
1966	31 884	1 132	1 974	–	34 990	4 901	3 576	
1967	27 306	1 402	1 944	–	30 652	4 592	2 882	
1968	28 171	1 741	1 960	–	31 872	4 370	2 327	
1969	29 256	1 917	2 151	–	33 324	5 686	2 406	
1970	27 909	1 900	2 285	–	32 194	7 721	2 565	
1971	26 142	1 499	2 279	–	29 920	7 617	2 014	
1972	23 272	1 198	2 110	–	26 580	7 870	1 719	
1973	22 919	1 599	2 123	–	26 441	7 556	1 547	
1974	23 420	1 476	2 089	–	26 984	7 938	1 544	
1975	22 995	1 458	2 040	–	26 493	8 324	1 250	
1976	20 473	1 439	1 946	–	23 858	8 093	971	
1977	17 000	1 297	1 756	–	20 053	7 446	809	
1978	15 133	1 298	1 684	–	18 115	7 478	782	
1979	15 607	1 446	1 823	–	18 881	7 816	937	
1980	17 423	1 430	1 350	–	20 705	7 964	678	
1981	17 176	1 444	1 722	–	20 342	7 818	84	
1982	16 441	1 357	1 664	–	19 462	6 978	–	
1983	13 170	1 183	1 401	–	15 754	7 018	–	
1984	11 443	1 444	1 264	–	14 151	6 939	–	
1985	12 268	1 410	1 322	–	15 030	7 797	–	
1986	12 718	1 375	1 296	–	15 389	7 305	–	
1987	10 211	1 151	1 299	–	12 661	7 159	–	
1988	8 906	1 082	1 094	–	11 084	7 337	–	
1989	8 892	1 292	803	–	10 992	7 380	–	
1990	8 426	1 069	814	–	10 309	7 271	–	

* Since 1974 including job coking for blast - furnace plant

Source: Statistics of the Coal Economy

EC: Coke production (1000 t)

Year	Countries of EC							Total
	Belgium	Federal Republic of Germany	France	Great Britain	Italy	Nether-lanc	Greece, Portugal, Spain	
1976	6 216	31 951	11 313	15 753	7 970	2 813	4 961	
1977	5 569	27 499	10 769	14 194	7 676	2 501	4 801	
197P	5 747	25 593	10 682	12 394	7 315	2 401	4 290	
1979	6 451	26 697	11 613	12 511	7 501	2 530	4 321	
1980	6 048	28 669	11 118	10 058	8 283	2 455	4 616	
1981	6 004	28 160	10 723	9 060	8 071	2 242	4 443	
1982	5 217	26 440	9 934	8 718	7 466	2 427	4 326	
1983	5 106	22 772	8 457	8 533	6 492	2 206	3 664	
1984	5 926	21 140	8 999	6 983	6 943	2 725	3 529	
1985	5 961	22 827	8 690	9 277	7 411	2 957	3 671	
1986	5 130	22 694	8 257	8 870	7 209	2 872	3 364	
1987	5 226	19 819	7 463	8 682	6 753	2 735	3 150	
1988	5 547	18 421	7 417	8 584	6 723	2 905	3 255	
1989 *	5 457	18 372	7 323	8 444	6 743	2 897	3 426	
1990 *	5 420	17 580	7 197	8 055	6 626	2 736	3 463	

* 1989 temporary: 1990 evaluated
Source: Eurostat.

1. MINING· FEDERAL REPUBLIC OF GERMANY

FEDERAL REPUBLIC OF GERMANY

1. Stone coal

Society of Stone Coal Mining : Production and Personal in 1990

District/Society	Quantity transported		Coke production		Briquette manufacture		Gas yield				Generation of electricity		Personnel			
							Coke furnace gas recovery	Production and purchase of other gases	Total				Workers	Clerks	Total	
	1	%	1	%	1	%	1000 m³	1000 m³	1000 m³	%	MWh	%				%
Ruhrhohle																
Ruhrhohle Niederhein AG ·······	24174757	44.31	8425638	100.00	360553	100.00	2021432	146469	2167941	100.00	–	–	34091	6617	40708	41.25
Ruhrhohle Westfalen AG ·······	25221273	46.23	–	–	–	–	–	–	–	–	96236	0.66	38892	8433	47325	47.96
Ruhrhohle AG insgesant ·······	49396030	90.54	8425638	100.00	360553	100.00	2021472	146469	2163941	100.00	96236	0.66	73146*	16628*	89774*	90.98
Gewerkschaft Auguste Victoria·····	2930114	5.37	–	–	–	–	–	–	–	–	–	–	4261	988	5249	5.32
Eschweiler Bergwerks-Verein AG··	2229612	4.09	–	–	–	–	–	–	–	–	–	–	2907	499	3406	3.45
Steag AG ·······················	–	–	–	..	–	–	–	–	–	–	14476672	99.34	.	.	.	.
Saarrevier ························																
Saarbergwerke AG ··············	9718651	100.00	1069071	100.00	–	–	281485	183362	464847	100.00	6000425	100.00	15536	4073	19609	100.00
Aacbene Revier																
Eschweiler Bergwerks-Verein AG	1843114	53.52	813969	100.00	–	–	171454	14097	185.551	100.00	853710	100.00	3207	943	4150	51.00
Sophia-Jacoba GmbH ·············	1600411	46.48	–	–	395470	100.00	–	–	–	–	–	–	3209	779	3988	49.00
Ibbenbüreuer Revier																
Preustag Authrazit GmbH ········	2044367	100.00	–	–	–	–	–	60220	60220	100.00	107646	100.00	3113	720	3833	100.00
Ruhrrevier ······················	54555756	78.20	8425638	81.73	360553	47.69	2021472	146469	2167941	75.31	14572908	67.67	80421	18254	98675	75.76
Saatrevier ······················	9718651	13.93	1069071	10.37	–	–	281485	183362	464847	16.15	6000425	27.86	15536	4073	19609	15.05
Aachener Revier ················	3443525	4.94	813969	7.90	395470	52.31	171454	14097	185551	6.45	853710	3.96	6416	1722	8138	6.25
Ibbeubürener Revier ············	2044367	2.93	–	–	–	–	–	60220	60220	2.09	107646	0.51	3113	720	3833	2.94

D-7

Metallurgical coking plant

Metallurgical coking plant : Produktion und Beschäftigte

Metallurgical coking plant	Operating enterprise	Production of coke by steelmakers in Germany		Production Robret		Gas		Personnel	
		1989 t	1990 t	1989 t	1990 t	1989 (1000) m3	1990 (1000) m3	1989	1990
Kokerei Rheinhausen	Krupp Stahl AG	444670		19206	18041			191	170
Kokerei Huckingen	Krupp Mannesmann GmbH	1146440		36737	39403			167	167
Kokerei Lübeck	Neuc Metallhüffenwerke Lübeck GmbH	395327	-	14790		180478	-	226	
Kokerei Usade	Stahlwerke Peine-Salzgiffer AG		433140	14561				124	128
Kokerei Salzgitter	Stahlwerke Peine-Salzgiffer AG	1346193	1331870	44482	48319		661139	216	216
Kokerei August Thyssen	Thyssen Stahl Aktiene-gesellschaft	2460936	2404951	107718	104304	613342	628089	865	868
ZKS - Zentral-kokerei Saar GmbH	Saarbrcwerks AG Sarstahl Volklingen GmbH. AG der Dillinger Hüffeniserke	1,431,766	1409053	67753	65326	686334		333	333

5. COCKERILL Sambre S.A. (Belgium)

Total steel production from their four blast furnaces is 4.3 to 4.5 million tons, they also use PCI at a ratio of 150 kgs per ton of raw steel. Coke production is 900,000 tons at Liege Works and 700,000 tons at Charleoi Works, the total of 1,600,000 ton is used in their own blast furnaces.

They produce an additional 1 million tons of coke, 200,000 tons of which is used in their own mills and 800,000 tons is exported to Clabecq and Arbed, France and Scandinavia. They are planning to increase the PCI portion from the present usage of 150 kgs/ton, and have no need to buy coke from other countries in the future. Polish coke breeze of 80,000 to 85,000 tons/year was contracted on a long term basis with Weglokoks in 1987.

As far as coking coal is concerned, they are importing from the U.S. (75%), Australia (20%), and Germany, South Africa, and Poland (5%).

Two years ago they bought Polish coke, on a one time basis, which had low water content and they added water before using the coke in their blast furnaces.

Raw steel production in all of Belgium is 4.5 million tons by Cockerill, 4 million tons by Sidmar mill (with a coke oven capacity of 1.3 million tons), 1.5 million tons by Boel (with a coke oven capacity 900,000 tons), and 1 million tons by Clabecq which does not have a coke factory.

6. ILVA S.P.A. (Italy)

The total steel production is about 11 million tons, using PCI ratio of 150 kgf per ton of raw steel.

Production of coke in two factories (11 batteries) is 4.4 million tons (3.8 and 0.6 million tons at each factory) and the whole coke production in Italy is about 5.7 million tons/year which includes 900,000 tons of foundry coke. A new factory with a metallurgical coke oven capacity of 300,000 tons/year was installed at Trieste in 1991. Even if their coke ovens are rather old (one factory is already more than 30 years old), ILVA does not need to buy outside coke so far, and they say they may maintain their current production ratio in the future. However if the old coke oven might be shutdown, they would obviously need to buy outside coke.

They maintain a high quality of steel such as low phosphorous (<0.025), low VM (<95), but they are facing environment problems which must be solved by 1993. They are planning somehow to increase the percentage of PCI. ILVA imports coking coal from the U.S., Australia, etc.

7. Alto Hornos de Vizcaya S.A.

Production of raw steel is about 2 million tons/year, using three blast furnaces. Coke production is maintained at about 750,000 tons/year by operating 5 coke batteries. So it is not necessary to import any coke so far.

Coal is always imported from the U.S. (75 to 80%), Australia (20%) and Poland (5 %).

Their steel plant and coke oven are too old with high maintenance costs and they are considering changing to electric furnaces if they can obtain investment funds.

In case of ENSIDESA, the biggest mill in Spain, their own production of coke is now 2.8 million tons, sufficient for their own use in blast furnace mills.

8. U.S Steel, a unit of USX Corporation

The supply and demand in the near future is unclear, because the U.S. steel industry is stagnant, however the following facts must be taken into consideration:

1) The Air Clean Act regulations are more severe in American steel mills

2) Coke ovens are now getting old in almost all American steel mills, causing such big problems as expensive repair costs for environmental protection and forcing mandatory shutdowns of old coke ovens.

3) Even if the percentage of PCI is increased, PCI coal cannot substitute 100% and its use is limited. Drastic conversion to PCI cannot be realized very soon.

4) There are questions how and when the reconstruction of steel industry will be realized. For example, changing into mini-mills.

USS is now operating two coke ovens: -

1) Gary works 2.5 million tons

2) Clairton (Mon Valley works) 4.5 million tons and Fairless works was shutdown

Present blast furnaces factories are as follows.-

Fairless works	:	1
Fairfield works	:	0
Lorain works	:	2 (J/V with KSL 50%)
Clairton works	:	2
Gary works	:	4

Total steel production capacity of USX : 12 million tons

USS coke production now exceeds their own consumption, thus they are now selling their coke to domestic mills such as Lorain works and Inland steel.

They are also importing from Mitsubishi Chemical and Mitsui mining, 400,000 ton respectively, because imported coke is cheaper than their own coke due to the fact that their produced coke has the disadvantage of requiring inland transportation in comparison with imported coke from Alabama or Detroit at a cost of approximately US$30/ton. USS Pittsburgh has a stockpile of 500,000 mt which is bigger than its normal inventory of about 100,000 mt.

U.S. Steel expects to have a close relationship with the surveyor for mutual information from now on, and is ready to study purchasing Przjyazn coke if prices and quality is competitive on the basis of a long term contract for 0.5 million tons/year, thus they are asking for a quotation on CF Mobile for their perusal.

9. National Steel Corporation, Pittsburgh

Total consumption of all American steel by BF : 50-53 million ton

Total Production : abt 76 million ton (60-65% for BF) (30-35% electric arc furnace)

Present coke production of National Steel : capacity 500,000-600,000 tons

A new coke oven with a 1.5 - to 1.6-million ton capacity was installed at Detroit and started mid/Nov '92, plant cost of which was $400 million. (Davy Macky, an engineering company, sold refractory 3 times more expensive than in the past.) (This plant does not use CDQ and conventional quenching system will be used.) Five blast furnace plants with 2.5 million tons of steel production capacity and the following plants are buying coke for approximately 900,000 tons/year.

1) Granite city . . . mainly from domestic suppliers

2) Great lake . . . 1 BF only operating (old 1 BF was shutdown) imported by panamax vessel.

Comments for Polish coke:
They once bought Polish coke (maybe Zdzieszowice) of 100,000 tons

- The specifications were very bad and the coal should not be used in their blast furnaces. It remains useless as deadstock.
- It seemed to have bad quality as coking coal (VM is much lower than American/Aust)
- Hardness: very weak
- Loading conditions at Gdansk was poor.

Conclusion : If Polish coal were continued to be used, there would be considerable damage to their blast furnaces. Anyhow with the operation of the new coke oven, a 900,000 to 1,000,000-ton surplus could be produced, and there would be no need to import from 1993 onwards at all.

10. Phibro Energy, inc. Pittsburgh

Phibro Energy is one of the world's largest crude oil trading houses and is also a comprehensive coal and coke trader as well.
Its parent company is Solomon Inc. and sister company is Solomon Brothers.

Present situation and forecast for coke in the U.S. and the world:

1) The world demand of coke market is now decreasing and there seems to be an over inventory. Coke prices are also on a down trend and it is now very difficult to sell. The future prospects of the coke market is unknown, because the steel industry itself, the consumer of coke, has ambiguous prospects in the future.

2) Such crucial regulation as the Clean Air Act in the U.S. are becoming more severe year by year, and the environment protection measures required in the regulations always are a worry for steel mills, because large investment for the installation for new rehabilitation is obviously needed.
   Coke oven factories of steel mills are being forced to shutdown year by year and because of this, imports of coke for U.S. blast furnaces will theoretically have to increase.

3) Conversion to PCI (pulverized coke injection) as a substitute for coke, is still not rapid due to the big investment required for new equipment, but might increase slowly.

4) American domestic consumption of coke is normally 22 to 24 million tons and 22 mt this year. Present production is 22 mt (85% of the production capacity in the U.S.) and there is a sufficient inventory.

5) Regarding investment in a J/V with a Polish coke factory, Phibro gave their opinion that they can't foresee a rosy picture for the coke industry because their actual trading of coke is now decreasing. Conservative steel mills consider Polish coke to have inferior quality and not reliable for their use. Even though Phibro has this opinion, they are ready to cooperate to sell Polish coke through their channels.

6) Even though Bethlehem recently bought US$105/ton from Japan, present market price is an average CF of US$99/ton.

7) Bethlehem has shutdown all its coke ovens and buys as follows. -

   320,000 tons from Mitsubishi Chemical
   240,000 tons from Mitsui Mining
   320,000 tons from BHP
   160,000 tons KCC (Muroran)

   USX imports 800,000 tons from Japan (Mitsubishi and Mitsui).
   inland steel is looking for a new supply source, due to the shutdown of all its coke factories recently.

Note; USX: If they deliver coke from Mobile, Alabama to the Gary Works, inland transportation cost is approximately US$30/ton. (Even if delivered from Clairton to Birmingham, the cost of inland transportation is about US$25/ton).

Bethlehem: Unloading port is S. Point.

Market price in 1986 was around US$63/ton.

Phibro's record in the past was 2 million ton/year, and now is below half.

11. Bethlehem Steel

They have four coke factories as follows. -

Bethlehem:	production 1,100,000 tons	consumption	5-600,000 tons (1*)
Buffalo Works:	production 700,000 tons	consumption	100,000 tons
Burns Habor:	production 1,600,000 tons	consumption	2,100,000 tons (2*)
Sparrows Point:	production closed		1,500,000 tons (3*)

Note:

(*1) The coke ovens of Bethlehem could be used until the year 2,000, however repair costs of US$40 million must be invested every year in order to pass environment regulations.

(2*) Shortage of this works is made up by surpluses from No. 1 factory together with 200,000 tons from domestic suppliers.
Burns Habor, due to the age of the oven, will be renovated or shutdown in the near future. PCI equipment is planned to be installed at the blast furnace of Burns Habor at a cost of US$80 million.

(3*) Sparrows Point needs 1.5 million tons/year and imports 900,000 tons from Mitsubishi Chemical, Mitsui Mining, KCC and BHP. This volume will continue for an additional 4 to 5 years.
Sparrows Point is now studying whether to rebuild this works and will decide within this year, however, it is unclear if it will build new plant due to lack of investment funds.

Their opinion is that the quality of imported coke is inferior to their own coke:

	Bethlehem coke	imported coke
Size (2" oven)	over 67%	less than 48%
Ash	less than 7.5%	more than 10.5%
P205	0.25	more than 0.6
CSR	62-67	60
Sulphar	0.65	0.4-0.7 (this is a merit)

12. Inland Steel

Present situation of their coke factory is as follows.

No. 8 battery closed Dec '91 (capacity was 500,000 tons)
No. 11 battery closed Jan '92 (capacity was 700,000 tons)
No. 6/7/9/10 (4 batteries) is now under operation, but will be closed in 1994. Production and consumption of coke is 1 million tons and 2.2 million tons respectively, with a present shortage of 1.2 million tons/year.
All coke ovens of Inland Steel will be shutdown by 1994 but PCI installation shall be finished by 1994. The necessary quantity of purchased coke will be about 1.7 million tons until 1994, out of which they are planning to procure 1.2 million tons with long term contracts and 0.5 million tons on spot basis.
They have a long-term contract for 360,000 tons with Koppers until the end of 1993 and are now negotiating a long term contract for 800,000 tons per year with USX. The procurement schedule for purchases on a spot basis for 1993 is 125,000 tons at this moment. Forecasts of crude steel production in USA are 95.5 million tons in 1992 and the U.S. had a record of 99 million tons in 1989 which was peak of recent years. Inland Steel is confident of a high production level for 1992.

13. COSIPA-Companhia Siderurgica Pilista

- Full capacity of steel production: 3.9 million ton/year by 2 blast furnaces
  Actual production: 3 m. t. this year and 3.4 m. t. in 1991
  Sales of steel: 50% export 50% domestic

- Import/contracted quantity of coking coal in 1992: 2.1 million tons
  Note: Total imported coking coal in Brasil: Normal about 11 m. t., out of which the share of Polish coal was 2 m. t. in the past, but is now decreased to less than 1 m. t.

- Total coke made by their own production: about 1.5 m. t.
  Imports of coke: about 150,000 tons/year, including 15% of cokes breeze
  Imports this year: 40,000 tons x 4 pamamax vessel from Mitsubishi, BHP. Poland, China = about 160,000 tons. Payment conditions by D/A 180 days without L/C, non bank guarantee
  (note: this time is a trial case for using China coke)

- Installation of PCI: Use of PCI starting in 1994/5 is now under study, and if implemented, consumption of coke will be decreased accordingly.

- Forecast for coke: If steel production maintains at the same and/or increased level, imports of coke will be continued until PCI is started.

- Coke oven: 5 batteries
  Numbers 1, 2, and 3 were installed 23 - 25 years ago and Numbers 4 and 5 are rather new, 8 - 10 years old. 70% of their total production are by Numbers 4 and 5.

- Normal specs of coke

moisture	6%	
ash	12%	
VM	max. 1.5 % dry base	
s	0.8 %	
p	0.045 %	
cri	30 % (Hirohata method)	
csr	56 min.	
size	aver. 50 mm (25-75 mm)	
	below 25 mm	5 % max.
	over 75 mm	10 % max.
Drum index	150/15	83.5 %

note: hardness of coking coal by JIS .... drum index 150/15 = 83.5 %
150/30 = 93 %

- Cosipa's comments on Polish coke:
  The size, after production at the factory, seems to be OK, however too much of the coke is undersized when the cargo arrives at Cosipa's factory, because of damage by too many handling processes such as inland transport in Poland and loading/unloading the vessel.
  They bought Polish coke from Phibro this time, and they would like to buy through many trading channels (not only Weglokok).

- Others: draft capacity of unloading for Cosipa .... 10.97 m
  (cubic feet of coke is 70CF = 1 MT)

14. CSN Companhia Siderurgica Nacional

- Present coke production (5 batteries) : 190,000 tons/year (using no. 1/2/4/5)

- Present consumption of coke for own use : 2.2 - 2.3 million tons/year

- Required quantity of imported coke : approx. 220 - 230,000 tons
  ('91.300,000 tons imported)
  1992 ..... 500,000 tons contracted with Mitsubishi (200,000 tons), Mitsui (120,000 tons), BHP (40,000 tons/one vessel), China (60,000 tons/2 vessels) and Poland (40,000 tons) on C&F basis Brasilian port D/A180 d/s at a average price of US$100/ton
  Note : this is the 1st time to buy Polish coke, so its performance results are not known yet.
  1994/5 ... No. 3 battery to be renovated
  No. 2 to be repaired in the near future
  PCI installation to be planned, thus less procurement of coke is to be expected from 1996.

- Number of blast furnaces: 3 (Number 1, 2, 3 but Number 1 was shutdown) Number 2 and 3 blast furnaces under operation with 11,000 tons /day 4.1 million tons/year - pig iron - crude steel base, 50% of steel to be exported (1992 was a good operation)

- Brasil's total imports of coking coal : about 11 million tons CSN total purchasing coal : 2.6 million tons/year

- Privatisation of steel mills : Usiminas .... already started
  CSN .... to be started Sept '92
  CST .... to be started within this year

- PCI installation: Usiminas already decided and now under installation

- Other opinions:

  - Quality of operation result
    Japanese (Mitsubishi) ..... very good
    BHP .... good
    China .... 1st lot of 20,000 t was used and got good results

  - The reason why they buy from various coke suppliers is for payment schedule to get different armature dates in order to divide payments on the basis of d/a 180 d/s.

  - P/N should be signed by 2 directors, of which signatures should be recognized by the corresponding bank (it is not bank aval)

  - Polish coke through Phibro is 1st time to import and cargo has not arrived yet

  - 3 shipments imported from Mitsui this year, 1st shipment by Feb and remaining shipments have been recently bought.

15. CST Cia Siderugica de Tubarao (established 1983 by KSC)

- Demand and supply of coke:
  consumption of coal : 2.4 million tons/year (BF capacity: 3.3-m. t.)
  consumption of coke : 1.6 million tons/year
  production of coke : 1.65 million tons/year
  (2.4 m. t. × 92% = 2.2 m. t. (dry basis) of coal
  2.2 m. dry tons × 75% = 1.65 m. tons of dry coke
  size of coke : 25-75 mm/1.4-m. t. and 15-25 mm for coke breeze/0.14 m. t.)

- Since the supply is balanced with the demand of coke in CST, it is not necessary to import coke for the short term even this year. They have 300,000-ton of coke in stock.
  They have a plan for installation of PCI after the privatisation of the company in the near future. They have a plan for rebundling of the blast furnace refractory in 1994, at that time they are considering installing PCI. The new owner of the company after privatisation might make the decision.

- Their coke battery was built by Italian partner with German technology.

- General information:

a) Brasil was importing Polish coal almost 2 million tons (about 20% of total coal import in Brasil) on G-G basis, however imports of Polish coal was decreased to less than 75,000 tons last year, due to changes in the Polish economy and the recession in Brasil caused drastic decline in trading of coke.
Payment conditions-Poland insists L/C base and Brasil insists D/A 180 days, and there are sometimes labor strikes by either side.
Thus trading between both countries is now based on a commercial basis and there are imports of about 1 million tons of Polish coal this year, out of which CST imported Polish coal by 230,000 tons this year.

b) U. S. Steel Mills's anti-dumping suit on steel prices against exporters
Since the object of the suit is limited to steel coil, CTS's main item (slab steel) is exempted and there are no problem to export to the U. S.; however, the slab market is not good, thus they are seeking for new buyers to sell their main product to.

c) They had a recent tender for procurement of low-grade coking coal with:
Drum index : 86 to 81.8
Ash : 10.5 to 11%
CST can use low-quality coal (soft coal, semi-soft coal, high ash coal) and they decided to purchase low-quality coal at US$ 40 or below.
If low quality coal is used, it is imperative to be washed.
CST is using 28 kinds of coal for blending and in practice uses 8 kinds to blend.

d) Information from Kawasaki steel, Belo Horizonte office (partner of CST)
For rebundling of BF refractory, Ishikawajima has got the order for this job.

16. ACOMINAS, Aco Minas Gerais S.A.

- Blast furnace × 1, Coke batteries × 2 under operation

	1991	1992	1993
Steel production	2-m. t.	2.2-m. t.	2.2-2.4-m. t.
Coke consumption	1-m. t.	1-m. t.	1.0-1.1-m. t.

- Coke production : yearly 1.2 m. t. (= 29.4 tons × 106 × 138% × 77% × 360 days)
84% .. 1 m. t. (25-75 mm)
16% .. 0.2 m. t. (under 25 mm) coke breeze
Coke consumption : ...... 980,000 tons (unit 490 kgs/1 mt of pig iron)

- Rebundling of blast furnace
It is planned to rebundle in March 1994. (delayed from 1993) in order to increase capacity by 27-30%, therefore thev are preparing to rebundle in 1993, depending on the furnace condition. They do not have plans to increase the capacity of the coke oven, so after completion of rebundling of the blast furnace, there might be a necessity of importing coke but the quantity would be unknown. The procurement of the refractory for blast furnace has been already decided on Japanese made (NDK).
After privatisation of the company, it is planned to do as follows :

1) Installation of PCI
2) New production of profile (rail etc)
3) Continuous casting method

- Privatisation

  1) Appraisal of Asominas assets is now under evaluation by a certain group and will be finished in a few months, thus upon getting approval of the appraisal by the authority, the auction of the company will be announced December 15 or at the end of 1992. It is expected that Mendes Junior, Belgo Mineira and CVRD, Petrobras, White Martin will participate as joint owners.
     White Martin as an oxygen producer, to whom Asominas is selling oxygen, is considering to buy 10-15% of shares of Asominas.

  2) As far as privatisation of Acesita (one of biggest producer for stainless steel, in addition to normal CRC) is concerned, Usiminas and Belgo Mineira are considering buying shares of Acesita.
     When the auction of CST's privatisation is announced (this month), CVRD is also quite interested in acquiring a share.

  3) Transportation cost of Acominas located at Ourd Blanco (Belo Horizonte),
     port of Vitoria to Ouro Blanco (rail way of CVRD) : coal US$7/mt
     Mine of iron ore (Minas state) to Ouro Blanco : iron ore US$2/mt

- There is a plan for installing new coke factory in Minas State by Cemig (Minas state-owned electric company) and Belgo Mineira in order to protect the forest environment (to save charcoal by wood products), but it would be difficult to implement.

- Specs of Acominas coke
  S : 0.58-0.68, Drum index : 84 %, Size : 25-75 m

17. Belgo Mineira

- Steel production capacity: 1.2 million tons, actual production is 1 m.t.
  BF × 5 units: No. 1-250 t/d
  Nos. 2/3/4-400 t/d
  No. 5-850 t/d
  (No. 6 blast furnace is now planning to start using coke instead of charcoal)
  Nos. 1/2/3 blast furnace can use charcoal only
  No. 5 blast furnace is now using 100% coke
  No. 3 blast furnace will use coke starting from July 13 as a trial.

- Use of coke was started 2 years ago (1990) and they imported 200,000 tons of coke this year, and are planning to import the same quantity in 1993 (monthly consumption of 17,000 tons)
  Origin country of imported coke: Poland 1 shipment (40,000 tons)
  Mitsubishi 4 shipments (160,000 tons)
  Main source of coke: BHP (Australia), Mitsubishi Kasei (Japan), Poland, and they are now studying China coke.

There are 2 big producers of Polish coke, and the one imported through Phibro Energy is PRZYJAZN, the same company which is now studying renovation of its plant. Conditions of this purchase was CF US$106/tons on the basis of D/A 180 days including financing costs. Recent offer of spot base is US$98/mt CF base. The quality of PRZYJAZN coke is good with a moisture contents about 1% only. The other large Polish coke producer (Zdzieszowice cokery) is expected to send samples from Phibro soon. Sample of Mitsui's coke will be submitted soon from Hunsen. Chinese coke has been offered by various traders.

- Charcoal
  Own production by Belgo Mineira: 50%
  Outside: 50%
  Price level of charcoal: US$18-20/cubic meter (breakeven point against coke price is US$25/c.m.)
  Units weight for blast furnace: ..... charcoalabout 800 kgs/ton)
  coke about 550 kgs/ton
  Transportation of charcoal: charcoal plants are located 200 - 1000 km from them, so coke is at a disadvantage cost-wise

- Others
  There might have a plan to install new coke oven in Minas State and its initiation is made by CEMIG under expected Japanese government.

18. USIMINAS

- BF×3 is under operation
  No. 1/2: each 885 cubic meter
  No. 3: 2,700 cubic meter
  Total steel production capacity: 3.5-m.t. actually 4.2-4.5-m.t. of crude base.

- Coke oven×4: producing 1.8-million ton/year
  No. 1/2: installed 1962 (each 50 chamber, 13.4 t/oven)
  No. 3/4: installed 1974 (each 55 chamber, 27.3 t/oven)
  Total capacity: 1.8-million ton for covering 3.5-m.t. of steel making.
  92-93 % for stabilized coke
  17-18 % for cokes breeze
  crude steel production of last year was 4.2-m.t. thus it was necessary to import 240,000 t.

- Import of cokes:
  Import started since 1988 and are this year as follows: -
  Mitsubishi .... 4 shipments + option 1 shipment (4 or 5-cargo)
  Phibro ...... 1 shipment (Poland) + 1 shipment (= Mitsubishi) (2-cargo)
  Total import .. 6 or 7 shipments (= 24 or 280,000-ton)
  Note: The shipment by Mitsubishi was scheduled to be made for U.S.A. but it was canceled and resold to Usiminas with the previous consent of Mitsubishi. Polish coke was bought this year, but from another company other than PRZYJAZN, because this coke was not made by CDQ treatment at all.

- Forecast of coke import after installation of PCI:
  Usiminas may start operation PCI this November which has already installed. Design capacity of this PCI is 150 kgs/1 ton of hot metal but it is not cleared how many kgs could be injected. They are aiming to get the ratio of 80 -100 kgs/ton, but will accept 40 kgs/t at first stage.
  Anyway if the ratio of PCI is to get under 60 kgs/t, they must import coke. If PCI works well, it is not necessary to import coke. Therefore, their demand for import coke depends on ability of injection of PCI, and Usiminas is considering a negative need for coke imports in the near future. Investment for PCI installation: US$ 20-million × 3 BF = US$ 60 million

- Coal for PCI
  If Usiminas can use PCI ratio up to 100 kgs/mt, they must buy PCI coal about 350-400,000 t/year, so they are seeking for new supplier of good coal. Usiminas has already contacted with supply sources in South Africa (optimum coal) and Australia as well. Specifications required are low sulfur, ash 10 % max., high VM 30-33 %.

- General information
  Polish coal: Brasil was importing Polish coal about 2.4-m.t. on G-G base and was decreased to 1.1 m.t. this year. Usiminas imported 280,000 t this year, so the door is always opened to everybody offering a competitive price.
  As for high fluidity coal, their long term contract with 5-6 suppliers will be terminated in the next few years, so if anybody can offer with good conditions, they are ready to study it seriously.
  They have contracted with Canada for Canadian coal 200,000 tons/1992 but is very anxious for stable supply owing to happening sometimes Canadian strike. They imported Hongey coal 100,000 tons through a Japanese trader.

Transition of the export of coal coke during the period of 1985 to 1991

(Unit: Million tons)

Destination \ year	1985	1986	1987	1983	1989	1990	1991
Korea	94,414	86,517	132,235	107,866	102,888	110,839	112,008
North Korea	24,432	22,490	32,207	7,000	-	3,500	-
Taiwan	175,839	185,430	156,932	146,175	132,459	109,976	154,934
Hongkong	921	602	368	508	155	1,207	324
Vietnam	5,850	2,400	-	100	-	-	-
Thailand	31,005	24,577	52,718	38,770	33,450	50,382	39,237
Singapore	18,783	16,117	20,534	16,367	24,734	10,534	17
Malaysia	3,387	3,123	6,528	19,049	8,916	11,233	7
Philippines	179,497	298,745	352,210	232,391	256,846	106,817	54,133
Indonesia	17,597	11,862	19,473	15,171	4,519	11,711	3,828
India	69,700	85,415	33,044	77,616	11,174	58,098	49,124
Sri Lanka	150	54	172	72	36	90	36
Bangladesh	3,917	1,507	3,500	2,500	2,500	3,000	-
Netherlands	-	57,160	75,247	-	101	-	-
Iran	-	-	500	-	-	-	-
Egypt	85	-	98	28	28	-	-
Belgium	-	38,394	19,263	-	-	-	-
France	77,417	16,393	38,113	-	-	-	-
Spain	-	49,330	54,300	-	-	-	-
Italy	-	-	4,945	-	-	-	-
Greece	35,458	138,981	11,000	-	-	-	-
Hungary	34,532	-	-	-	-	-	-
U.S.S.R. (C.I.S)	110,822	-	-	-	-	-	-
United Kingdom	-	-	-	36,920	-	37,160	-
Germany	38,363	-	-	11,000	632	-	79,236
Romania	566,124	801,979	528,970	232,500	167,304	277,760	230,826
Bulgaria	151,841	102,744	22,000	21,000	-	-	
Sweden	78,924	-	-	-	-	37,249	62,636
Venezuela	52,800	19,598	64,708	-	-	-	-
Peru	119,638	161,446	47,550	-	-	-	-
Algeria	-	-	40,000	-	-	-	-
U.S.A.	308,073	203,007	939,591	1,107,473	1,020,299	768,934	1,118,011
Chile	57,220	35,677	68,336	94,038	98,362	-	-
Brazil	-	119,246	527,341	464,355	402,634	253,559	770,746
South Africa	-	3	3	-	-	-	-
Australia	-	-	11,000	11,000	11,000	11,017	32,909
Qatar	6	5	-	-	140	636	221
Finland	-	-	-	-	-	-	24,936
Yugoslavia	-	-	-	-	-	-	11,000
Greece	-	-	-	-	-	-	11,000
Others	27	100	-	-	-	5,083	100
Total	2,256,872	2,465,642	3,364,104	2,642,800	2,283,777	1,878,885	2,755,173

(Source: Trade Statistics of the Ministry of Finance)

(Note) "Others" include Cuba (37 t) in 1985, Cuba (100 t) in 1986, Mexico (3,033 t) in 1990, and China (100 t) in 1991.