JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY OF INDUSTRY AND TRADE
PETROCHEMIA PLOCK S.A. (PPSA)
REPUBLIC OF POLAND

STUDY ON MODERNIZATION AND ENVIRONMENTAL POLLUTION CONTROL IN MAZOVIAN OIL REFINERY AND PETROCHEMICAL WORKS IN PLOCK, THE REPUBLIC OF POLAND

(MAIN REPORT)

JANUARY, 1995

UNICO International Corporation
IDEMITSU Engineering Co., Ltd.

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Preface

In response to a request from the Government of Poland, the Government of Japan decided to conduct a study on Modernization and Environmental Pollution Control in Mazovian Oil Refinery and Petrochemical Works in Płock, and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Poland a study team headed by Mr. Yoshiyasu Mikami, UNICO International Corporation, three times during November 1993 and November 1994.

The team held discussions with the officials concerned of the Government of Poland, and conducted field surveys at the refinery. After the team returned to Japan, further studies and analysis were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of Poland for their close cooperation extended to the team.

December, 1994

Kimio Fujita
President
Japan International Cooperation Agency

January 1995

Mr. Kimio Fujita
President
Japan International Cooperation Agency
Tokyo, Japan

Dear Mr. Fujita

Letter of Transmittal

We are pleased to submit to you the final report on the Study on Modernization and Environmental Polution Control in Mazovian Oil Refinery and Petrochemical Works in Plock(PPSA), the Republic of Poland. The report contains the analysis of present issues in the No.1 distillation unit and in the thermal power plants of the refinery and the advices and suggestions for the modernization of these facilities.

Concerning the modernization of the No.1 distillation unit, advices and suggestions were made based on the investigation and survey aiming the increase in the capacity of the unit and improvement of the product quality, saving energy, reduction of emission of offensive substances and replacement of the pneumatic instrumentation to DCS.

As for the modernization of the thermal power plants, or a boiler feed water system, boilers (No.1 - No. 3) and an electric power generator, advices and suggestions were made based on the investigation and survey aiming reduction of fuel oil and reduction of SO2 and NOx emissions, reduction of raw water and chemicals consumption and increasing the raw water processing capacity and increase of electricity supply capacity by installation of an extraction-condensing turbine generator.

It is concluded that, as the result of financial evaluation, investment required for No.1 distillation unit will have sufficient returns. It is recommended that the investment in the No.1 distillation unit shall be implemented. The modernization of the thermal power plant is well justifiable also, not only from technical viewpoints but also from the financial standpoint. In summary, both pro-

posed investments are quite rational.

We wish to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs, the Ministry of International Trade and Industry. We also wish to express our deep gratitude to the Ministry of Industry and Trade, Petrochemia Plock S.A. and other authorities concerned of the Republic of Poland for the close cooperation and assistance extended to us during our investigations and study.

Very truly yours,

Yoshiyasu Mikami
Team Leader
Study on Modernization and Environmental
Pollution Control in Mazovian Oil Refinery
and Petrochemical Works in Plock,
the Republic of Poland

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ABBREVIATIONS

API	American Petroleum Institute
ASTM	American Society for Testing Materials
ata	atmosphere absolute
ATMIZ.STM	Atomizing Steam
bbl	barrel(s)
BM	Breakdown Maintenance
BPSD	Barrel Per Stream Day
BTC	Break Through Capacity
CCR	Continuous Catalyst Regeneration Reformer
CDU	Crude Distillation Unit
CIF	Cost, Insurance and Freight
CEMA	Council for Mutual Economic Assistance
CM	Corrective Maintenance
CO	Carbon Monoxide
COP	Central Office of Planning
cSt	Centi-Stoke
DCS	Distributed Control System
EBRD	European Bank for Reconstruction and Development
EC	European Community
ECF	European Cooperation Fund
ECU	European Currency Unit
EIB	European Investment Bank
FBP	Final Boiling Point
FCC	Fluidized Catalytic Cracking
FDF	Forced Draft Fan
FOB	Free on Board
FSU	Former Soviet Union
GDP	Gross Domestic Product
G cal	Giga-Calorie
GJ	Giga Joule
GNP	Gross National Product
HCl	Hydrogen Chloride
H2S	Hydrogen Disulfide
Hz	Hertz
IBP	Initial Boiling Point
IBRD	International Bank for Reconstruction and Development
IDF	Induced Draft Fan
IFC	International Finance Corporation
IMF	International Monetary Fund
J/V	Joint Venture
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standard
kJ	kilo-Joule
kV	kilo-Volt
kwh	kilowatt-hour
LIBOR	London Inter Bank Official Rate
LPG	Liquified Petroleum Gas

MM-ton	million ton
MOIT	Ministry of Industry and Trade
MPa	Mega Pascal
MT	Metric Ton
MTBE	Methyl Tertiary Butyl Ether
MVA	mega-Volt Ampere
MW	mega-Watt
NaOH	Sodium Hydroxide, Caustic Soda
Na3PO4	Sodium Phosphate, Sodium tertiary Phosphate
Na2SO3	Sodium Sulfite
NH3	Ammonia
N2H4	Hydrazine
nm3/h	normal cubic meter per hour
NOx	Nitrogen Oxide
NPSH	Net Positive Suction Head
OCC	Opportunity Cost of Capital
Od-8	Vacuum overhead receiver
OECD	Organization of Economic Cooperation and Development
PdM	Preventive Maintenance
PDF	Piping Flow Diagram
P & ID	Piping and Instrumentation Diagram
PM	Planned Maintenance
PM	Preventive Maintenance
ppm	parts per million
PPSA	Petrochemia Plock S.A.
PVF	Polyvinyl Flvoride
P.W.	Pure Water
SAH	Steam Air Heater
SiO2	Silica
SO2	Sulfur di-Oxide
SO3	Sulfur tri-Oxide
TC	Tangential Line
tce	ton of coal equivalent
UN	United Nations
US$	United States' Dollar
U value	Overall heat transfer coefficient
V	Vanadium
VDU	Vacuum Distillation Unit
VGO	Vacuum Gas Oil
vol %	volume percent
wt %	weight percent
Zb-3	Slop tank
Zl.	Polish Zloty

Chapter 1

Review on Background of the Study

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Chapter 1 Review of Background of the Study

1.1 Introduction

To keep pace with the shift to a market economy, industries in Poland find themselves obliged to take measures to adapt themselves to the following changes;-

(1) Environmental protection has become one of the most crucial national issues for Poland. Registration procedures and regulations relative to pollution abatement are becoming more severe. In the mid-term future, it is expected that they will at least reach the level of strictness now enforced in west European countries.

(2) Dependence on the former communist countries for raw materials and products markets shall be gradually reduced. In order to have close relations with the European communities market, the quality of products manufactured in Poland must be compatible with those of other European Community countries.

(3) The price structures of Polish products, raw materials and energy must be adjusted to international levels in order to cope with the liberalization of both internal and external markets.

Petrochemia Plock S.A(PPSA), the largest refinery in Poland having more than a 50% share of the total refined products market, also is required to cope with such changing situations. Environmental issues entail several implications for PPSA: One of the most important, is that it is necessary to reduce emissions of pollutants and to eliminate odor in the refinery. Another major implication is that qualities of petroleum products such as gasoline and diesel oils should be set with consideration for pollution protection. This second point is also closely related to the item (2) mentioned above. As for the item (3), energy prices were intentionally kept low in the former economy, and not

so much care was taken for energy saving in the facilities constructed then. However, after the introduction of the market economy, domestic energy prices have been increasing to the level of international prices, and energy saving has become an important subject, also affecting of profitability of the facilities.

Step by step, PPSA is now making investments to correct such situations. Its petrochemical section and the facilities for producing final products such as gasoline have been replaced or newly installed, or they been revamped with the cooperation of process licensers and contractors, because these installations involve complicated technologies.

The distillation units also require modernization for energy saving, pollution protection, and improvement of both the quality and output volume of intermediate products, to be adequate for further fransformation into final products. PPSA has 4 distillation units, of which No.2 unit is already in the modernization stage. Among the remaining three units, No.1 unit is the oldest and most obsolete, having been constructed in 1964, and it is necessary to modernize its facilities as soon as possible. Therefore, No.1 distillation unit is now the subject of this study for purposes of achieving energy saving, changing patterns of products, and pollution control.

Another subject to be studied is the power plant. For the generation of electric power, PPSA has seven boilers with the capacity to maintain pressure of 139 ata and 540°C. Among these seven, No.1 through No.3 are very old and their technology was adopted without paying much attention to energy saving and pollution abatement. Therefore, these three boilers will be examined for modernization. For the power generation as a whole, the generation of electricity greatly depends on the steam demand because all the turbines are of extraction type. Due to the fact that PPSA is supplying steam to the public for heating purposes, steam demand in winter is high, while demand in summer is minimal. Installation of condensing turbines will be studied to avoid continuance of this situation. A further problem in the power

plant is high consumption of chemicals by the water treatment facilities, also to be investigated in this study.

1.2 Present Social and Economic Conditions of Poland

1.2.1 The switch over from centrally controlled economy to free market economy

The Mazowiecki Cabinet, the first Post-WWII Polish non-communist administration which started in September, 1989, was in the forefront of two types of transformation: political democratization and shifting to free market economy. Both of these types of changes occurred afterwards in other East European countries.

What more heavily influences the present and future standing of Petrochemia Plock S.A. (PPSA) is the latter - the switch over from centrally controlled economy to free market economy. This switch over stands upon the Economic Program called "Balcerowicz's Program", which was prepared by the group led by Mr. Leszek Balcerowicz, the Vice Premier and Minister of Finance of the Mazowiecki Cabinet, and was submitted to the Parliament on October 12, 1989. In the process of the preparation of the Program, Balcerowicz had intensive discussions with international financial institutions like the IMF (International Monetary Fund) and World Bank, and polished his draft carefully, taking the intentions of these institutions into consideration. The same economic transformation policy line has basically been followed up to now, although cabinets have changed four times, including the new Pawlak administration. Mr. Balcerowicz himself had resigned his post in January, 1992.

The main contents of the Economic Program are:

(1) policy of financial restraint in order to stabilize the economy (control of inflation and securing of foreign currency exchange), and

(2) system reforms like privatization of national enterprises, taxation reform and introduction of capital markets.

The target year for completing the system reforms was set at the end of 1991, expecting to fulfill the drastic results in only a two year term. So people called the Program "Shock treatment". Judging from the progress as of 1993, it can not be denied that the implementation of the Program was done too much in a hurry.

The main contents of financial restraint policy which have been implemented up to now are:

1) Financial restraint by means of setting of interest rats higher than inflation, curtailment of some kinds of government subsidies, checking of wage increases by introducing a "wage-growth tax" and introduction of personal income tax;

2) Revision of the Foreign Exchange Control Law and the Foreign Investment Law;

3) Abolition of price controls;

4) Liberalization of trade and lowering of customs duties; and

5) Reform of the banking system by revision of the Banking Law and introduction of the Antitrust Law which aims at elimination of monopolization in both industrial and trading fields and activation of the competition.

The main contents of system reforms are:

1) Introduction of the "Pact of the State-Owned Enterprises"

(After shifting of State-Owned Enterprises into State Treasury Partnerships, then the shares of some will be sold for privatization. This Pact also aims to sell the assets of other the state-owned enterprises to private enterprises, and to liquidate the corresponding state enterprises);

2) Introduction of the Securities Exchange Law and opening of the Stock Exchange in Warsaw;

3) Shifting from the CMEA (Council for Mutual Economic Assistance) barter trade settlement method, to the foreign currency settlement method (however, in the case of the states succeeding the former USSR, barter trade has still been maintained;

4) Active introduction of foreign capital through the implementation of the new Foreign Investment Law; and

5) Conclusion of an alliance treaty with the EC and conclusion of the free trade agreement with CEFTA, Hungary and the Czech Republic.

The results of the Economic Program up to now are:

(1) Comparative slowing down of inflation (According to the data provided by the Central Office of Planning titled "Poland 1989-1993 Economic Reform: Structural Transformations", hyperinflations of 251% in 1989 and 586% in 1990 were recorded compared with the respective previous years. However, the inflation rate has slowed down to 70% in 1991, 43% in 1992 and 35% in 1993);

(2) Expansion of the private sector (According to the same data, the private sector has grown up to the level of

sharing about 50% of Gross National Product and about 60% of labor absorption);

(3) Exchange rate comparatively stabilized against US dollars;

(4) Rapid increase of joint ventures tied with the foreign capital mostly coming from Western Europe (The number of J/V enterprises which were counted at 1,645 as of end 1990, has increased to 4,796 as of end 1991, to 10,131 as of end 1992, and to 15,053 as of end 1993);

(5) Increase of trade with EC countries in both value and volume (The share of export value for EC countries in Poland's total export value was about 60% in 1992. The corresponding figure was estimated to increase to about 80% in 1993. Meanwhile, the share of export value for CMEA countries in the same year was estimated to be only about 8%); and

(6) Diminishing of the shortage of consumer goods (Liberalization of foreign trade has made it possible for the consumers to get goods of good quality although the prices are high).

On the contrary, the problems which accompanied the implementation of the Economic Program are:

(1) Decline of output of industrial and mineral products (The growth rate of these sectors in 1990 compared with the previous year was minus 26% and in 1991 minus 12% which amounted, as a result, to minus 35% for those two years. Then the growth rate has recovered by 4% in 1992 and by 7% in 1993. Still, when comparison is made against 1989, the 1993 level of output remains at the level of minus 28%);

(2) Increase of unemployment (The number of unemployed which was 10,000 in 1989, has increased rapidly to 1,126,000 (unemployment rate: 6.3%) in 1990 and to 2,156,000 (11.8%) in 1991. Since then the unemployment shows no sign of decrease, counting 2,509,000 (13.6%) in 1992 and 2,950,000 (16.1%) in 1993;

and

(3) Other points like the decrease of real income as the result of inflation, and the increase of income inequalities are raised as problems.

1.2.2 Inauguration of the new administration and the future of the free market economy

As the result of the general election which took place on September 19, 1993, as predicted beforehand the Union of Democratic Left (SDL) tied up with the United Peasants' Party (PSL) won a sweeping victory, and as a result of signing of the agreement to combine the two parties, Mr. Pawlak the leader of the PSL was nominated as the Prime Minister. As both the parties named above are jointly occupying 303 seats out of the total 457 in the Parliament, the stability of the Administration seems to be assured.

Some people felt doubt about the future of the transformed free market economy when the SLD became the ruling party, but the economic policy statement titled "The Economic Program of the Prime Minister W. Pawlak's Government" which was announced soon after the political change, declared "an open, free market economy and maintaining the economic growth". So it became clear that the transformation to the free market economy will principally be continued though there may happen some slowing down.

The continuation of the privatization process is described as one independent item in the statement, accompanied with a statement concerning the practical use of the National Investment Funds. It is also stated that approval by the Parliament will be necessary for certain industries and companies selected for privatization.

1.2.3 Liberalization of trade in industrial products with the European Community

Following the "Association Agreement" (viz. "Europe Agreement Establishing an Association between the Community and Its Member States on the One Part and Poland on the Other Part"), which was signed on December 16, 1991 in Brussels and became effective in the field of foreign trade on March 1, 1992, liberalization of trade is now in progress. During the transitional period, customs duties should be reduced annually by 20% of the prevailing duty, until they reach the level of 0% by the end of the period. In the field of industrial goods, the time limit is set for eliminating duties on Polish exports to the Community by the end of 1997, and vice versa by the end of 1998.

At present the Polish petroleum sub-sector is protected by the following triple tariff barriers: border tax (6% on FOB), import duty (20% on FOB), and excise tax which differs by item. The Agreement, however, requires Poland to abolish the former two by the end of 1998.

Polish manufacturers including PPSA will face severe price and quality competition, not only in the domestic market but also in the international one, against industrial goods of EC origin. In the centrally controlled economy, "quantity" had the top priority, but in a free market

economy, "price" and "quality" share comparatively higher ranks. In the field of petroleum, refineries in EC countries have more or less excess capacities at present, and are aiming to export their comparatively low cost and higher quality products to Poland in the future days of liberalization, in order to operate their plants at full capacity.

PPSA will have to take measures for enduring such price and quality competition which is inevitable after 3-4 years, by lowering the production cost through several kinds of rationalization, and by up-grading their products' quality. This is one of the most important motives for PPSA to undertake a series of modernization programs.

1.3 Present Situation of and Policies on Industrial Development

1.3.1 Present situation of industrial development

Industry in Poland has been prospering since the years of the centrally controlled economy. The industry sector, as Table 1.3-1 shows, accounted for a 49.1% share of national GDP in 1988. At present, it is the second largest after the service sector.

The heavy chemicals industry like coal chemicals, the iron and steel industry, ship building and metalworking, and the food industry with abundant agricultural raw materials, together were the mainstream of the industry. In 1988, the share of the heavy chemicals industry's output reached the share of 48.9% in total industrial output.

According to the report prepared by the Central Office of Planning titled "Poland 1989-1993", the characteristics of Polish industry before the reformation were:

(1) Production of the means of production (called "first sector") had the priority against production of consumer goods (called "second sector");

(2) Concentration of production into big enterprises (67% of output was produced by the big enterprises which had more than 1,000 employees, and most of them were state-owned);

(3) Absence of foreign capital; and

(4) Dependence on the CMEA countries for raw materials.

Judging from the report cited above and hearings from officials in charge of the Central Office of Planning, it was presumed by the study team that the following measures were incorporated in the reformation:

(1) Shifting of the production structure, which had been much too heavily weighed on production of the means of production, toward the production of consumer goods. For example, the Polish government has a plan to establish a J/V with one of the "Big Three" of the U.S.A. which will make it possible to manufacture 500,000 to 600,000 cars per annum at the end of the 1990's, in comparison with present manufacturing capacity of 350,000 cars. This will profit PPSA by increased demand for gasoline, lubricating oil and grease, as well as plastic resin used for manufacturing car parts. Another policy was to promote plastics processors in order to supply daily used consumer goods made of plastics domestically manufactured, to replace the similar imported goods for the Polish people, which will also be favorable for PPSA as the producer of several kinds of plastics;

(2) Diversification of industrial production which is concentrated in big enterprises of mostly state-ownership, to medium and small scale enterprises of the private sector;

(3) Promotion of introduction of foreign enterprises, as the fruit of such government-provided incentives as enactment of the Foreign Exchange Control Law and the Foreign Investment Law, guarantee for remittance of the profit, and guarantee for political risk. Thanks to these initiatives, entry and advancement of medium and small enterprises from EC countries is becoming increasingly active. In the next stage, the government is planning to invite multi-national enterprises. The only one industrial field which is closed for foreign enterprises is the munitions industry; and

(4) Reduction of the dependence on CMEA countries for raw materials: Concerning crude oil, this affects PPSA severely, mostly because of the limitation on supply

volume from Russia. In 1992, about 50% of crude oil processed in PPSA was from Russia and the rest came from the North Sea and the Middle East. CIECH was the sole importer in former days, but other companies are entitled to engage in the import business at present.

1.3.2 Policies on industrial development

On June 29, 1994 the Polish government ratified "The Social-Economic Policy Programme for 1994-1997" prepared by the Central Office of Planning (COP). In this Programme, the following points were considered:

(1) Necessity of improvement of people's conditions of life;

(2) Continuation of restructuring and modernizing processes;

(3) Continuation of processes of rebuilding the economic system;

(4) Maintenance of the declining tendency of inflation; and

(5) Improvement of the condition of public finances.

COP suggests the state's active participation in two areas: Continuation of the structural and institutional transformation, and promotion of investment and export. The organization predicts, in the Programme, the achievement of a high rate of economic growth and gradual reduction of the unemployment rate as shown in Table 1.3-2.

In order to achieve average annual growth rate of 5.0% in GDP through 1994-1997, COP stresses that 6.0% average annual growth in the industry sector is indispensable.

According to the Social - Economic Policy Programme, the main purpose of the industrial policy is to increase efficiency and competitiveness of enterprises in market economy conditions. The Polish government is going to create convenient conditions for industrial development by restructuring of industry, expecting its own function to continue as stabilizer of the economic activities and as sustainer of the economic growth.

The most important aims of the restructuring programme are:

(1) Improving efficiency of those sub-sectors which influence "energy security" of the country's economy;

(2) Decreasing the share of "heavy" industries; and

(3) Increasing the share of manufacturing industries.

The highest growth is expected by COP in the following sub-sectors:
- chemical industry;
- electronic industry;
- timber-paper industry;
- mineral industry;
- textile industry; and
- transport industry.

COP states in the Programme that the Polish government has completed over 70 sectorial studies, which identify targets for employment reduction, production capacity, technological investment and industrial re-organization. The government has a particular strategy in industrial re-organization: consolidation of a number of firms into a new holding company so as to strengthen them, and placing responsibility for rationalization with the management of the holding company.

Table 1.3-1 GDP COMPOSITION BY SECTOR

(Unit: %)

Sector	1988	1989	1990	1991	1992	1993
Industry	49.1	49.1	43.6	39.2	39.6	40.3
Service	26.2	26.1	39.6	41.5	41.9	40.5
Agriculture	12.6	12.8	7.8	8.4	7.3	7.1
Construction	12.1	12.0	9.5	10.9	11.2	12.1

Source: World Economy Research Institute, "Poland 1992/93"
Central Office of Planning, "Information on the Economic Situation of Poland in the First Five Months of 1994"

Table 1.3-2 BASIC INDICATORS OF GROWTH OF MACRO ECONOMY

(Unit: %)

Item	1993	1994	1995	1996	1997	Average
GDP	3.8	4.5	5.0	5.2	5.5	5.0
Export	1.0	6.0	7.0	8.0	9.0	7.5
Import	10.0	3.0	4.0	4.5	6.0	4.4
Investment	2.5	6.0	9.0	9.7	10.5	8.8
Unemployment rate	15.7	17.2	16.7	15.6	14.0	-

Source: Central Office of Planning, "The Socio-Economic Policy Programme for 1994-1997"

1.4 Present Situation of and Policies on the Energy Sector in Poland

1.4.1 Indigenous resources of primary energy in Poland

Poland has relatively rich primary energy resources. Almost all of this is coal a shown in Table 1.4-1. Crude oil is almost entirely absent in Poland. The coal production sector was for many years over-developed in Poland due to the doctrine of full energy self-sufficiency. The ratio of indigenous energy production to energy consumption was 95% in 1989, while in most developed countries it is in the range of 30-60%.

Negative effects of sole concentration on coal resources, so-called "coal mono-culture", were the under-development of exploration for other energy sources and too heavy dependence on one-sided imports of other energy.

1.4.2 Structure of primary energy consumption in Poland

Table 1.4-2 shows the trend of primary energy consumption structure in Poland. The share of coal has been declining gradually as crude oil gains in share, indicating the prosperity of both petroleum and petrochemical industries in Poland.

The energy structure in Poland is considerably different from that of OECD-Europe countries where crude oil is the most important energy source, sharing 44% in 1990, followed by coal(19%), natural gas(17%), nuclear energy(14%) and hydro and others(6%).

1.4.3 Per capita energy consumption in Poland

Per capita primary energy consumption in Poland in 1989 was 4.6 tce (tons of coal equivalent), which was close to the figure of OECD-Europe countries' 4.7 tce. In 1990, however, the nation recorded a sharp decrease to 3.7 tce per capita because of the decline of industrial output.

In developed countries after the first "Oil shock" in 1973, an energy conservation and restructuring movement has taken place. As a result, per capita energy consumption in such countries decreased through the period of 1979-1984 and then increased again at a moderate rate, until it exceeded the 1979 level in 1990. Meanwhile in Poland, energy conservation plans were not implemented, so that in the period of 1975-1987 per capita consumption remained higher than that of OECD-Europe countries.

Per capita energy consumption of households, commerce and agriculture in Poland is relatively high - 1.4 tce in 1989 and 1.1 tce in 1990 - compared with 1.1 tce of OECD-Europe average in 1989.

1.4.4 Energy intensity of gross domestic product (GDP)

Energy intensity and electricity intensity of Polish GDP is 2-3 times higher than the same indicators in OECD-Europe countries, as shown in Table 1.4-3. Low energy efficiency of the Polish economy, according to the analysis of the authors of "Energy Policy of Poland and the Draft Programme to the Year 2010", is caused by:

(1) Disadvantageous structure of primary energy consumption - domination of inefficient solid fuels;

(2) Improper structure of final consumption - too low shares of oil products, gas and electricity, too high a share of coal;

(3) General disadvantageous structure of the economy, with too high shares of energy-intensive industries and too low a share of services; and

(4) Obsolete structure of Polish industry, low quality and low value of products.

1.4.5 Environment pollution in Poland

Because of the coal-dominated structure of primary energy consumption and lack of environment protection equipment, Poland is one of the biggest air polluters in the world as shown in Table 1.4-4. The higher CO_2 emission per 1 tce in Poland results from the higher share of coal in its fuel mix.

Table 1.4-1 PROVEN ENERGY RESOURCES IN POLAND

Energy carrier	In natural units	In billion tce[3)]	Share (%)
Hard coal	63.5 bil. ton	50.3	91.2
Brown coal	12.9 bil. ton	3.5	6.4
Natural gas[1)]	164.0 bil. cu, m	0.16	0.3
Peat	2.0 bil. ton	1.0	1.8
Wood	3.0 mil. ton/a	0.05	0.1
Hydro energy[2)]	12.0 bil. KWh/a	0.13	0.2

Source : MOIT, "Energy Policy of Poland and the Draft Programme to the Year 2010"

Note : 1) Excluding coal-bed methane, currently under investigation
2) Calculated as 35-years maximal annual utilization
3) tce = tons of coal equivalent

Table 1.4-2 STRUCTURE OF PRIMARY ENERGY CONSUMPTION 1960-1993

(Unit: %)

Energy carrier	1960	1970	1980	1989	1990	1991	1992	1993 (est.)
Coal	92.8	81.7	77.1	76.5	74.9	76.0	75.3	72.0
Crude oil	4.3	10.9	15.0	14.3	14.9	14.8	15.5	18.3
Natural gas	1.2	6.1	7.0	7.8	8.9	8.1	8.0	8.5
Nuclear energy	-	-	-	-	-	-	-	-
Hydro energy	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1
Others	1.6	1.1	0.7	1.3	1.2	1.0	1.1	1.1

Source : 1960 - 1990 ; MOIT, "Energy Policy of Poland and the Draft Programme to the Year 2010"

1991 - 1993 ; Energy Information Centre, "Primary Energy Balance of Poland"

Table 1.4-3 ENERGY INTENSITY OF GDP IN POLAND AND IN OECD-EUROPE COUNTRIES

	Poland 1989	Poland 1990	OECD-Europe 1989
Total primary energy consumption per GDP (MJ/US$)	32.2	29.7	14.5
Value of primary energy per GDP (US$/1000$ of GDP)	67.6	61.6	45.7
Direct consumption of all carriers per GDP (MJ/US$)	21.8	19.7	10.8
Direct consumption of electricity per GDP (KWh/US$)	0.923	0.962	0.690

Source : MOIT, "Energy Policy of Poland and the Draft Programme to the Year 2010"

Note : GDPs of Poland is shown by Purchasing Power Parities

Table 1.4-4 EMISSION OF AIR POLLUTANTS IN POLAND AND AVERAGE FOR OECD COUNTRIES IN 1989

	Per 1 tce of primary energy consumed (kg/tce)			Per 1 square km of country area (t/km^2)		
	Poland 1989	Poland 1990	OECD average	Poland 1989	Poland 1990	OECD average
Dust	13.8	13.6	2.0	7.7	6.2	1.1
SO_2	22.4	22.3	8.2	12.5	10.3	5.2
NOx	8.5	8.9	6.7	4.7	4.1	5.1
CO_2 [1)]	720	715	480	401	329	544
CO			24.5			14.5
HC			5.8			4.5

Source : MOIT, "Energy Policy of Poland and the Draft Programme to the Year 2010"

Note : [1)] : CO_2 emission expressed by the carbon content

1.5 Present Situation of and Policies on the Petroleum Sub-sector in Poland

1.5.1 Present situation of petroleum sub-sector

There are now seven refineries operating in Poland. The biggest one is PPSA, which has the capacity of 12,600 thousand tons of crude oil per year (= 290 thousand BPSD or about 72% of national oil refining capacity), followed by the Gdansk refinery which has 3,200 thousand tons of crude capacity (= 73 thousand BPSD or about 18% of the national capacity). These two together comprise a share of about 90% of total national refining capacity. The other five refineries, located in the south, together have total capacity of 1,750 thousand tons (= 40 thousand BPSD or about 10% of the national total). These five are not only small in capacity, but also too decrepit to be considered for renovation (they have been constructed in between 1883 and 1902).

Up to 1990, the whole crude oil demand in Poland was supplied monopolistically by the former USSR through the "Friendship" pipeline. Since 1991, Poland has to import crude oils such as sulfuric Iranian light, Arabic light, and low sulfuric Brent Blend, Oseberg and Statfjord. According to the "Foreign Trade Yearbook 1992 and 1993", the share of the former USSR was 65.4% of Poland's total supply source of crude oil in 1991, while in 1992, includes of the shar Russia, Kazakhstan and Turkmenistan all together declined to 49.7%. The second largest source of supply was the United Kingdom (20.9%), followed by Iran (18.1%) and Norway (9.3%).

According to the report titled "Energy Policy of Poland and the Draft Programme to the Year 2010", issued by the

Ministry of Industry and Trade, there is some price difference between the three major supply sources - Ural (ex-pipeline) US$ 132/ton, Persian Gulf (CIF) US$ 140/ton and North Sea (CIF) US$ 160/ton.

Table 1.5-1 shows the recent trend of production of major petroleum products from the above refineries. Important characteristics of Polish refineries' output are the high shares of gasoline and diesel engine oil and their low output of kerosene, both showing the nation's low dependence on petroleum products as heating fuel. This reflects the still-prominent position of coal in that use.

Production of major petroleum products showed a slight decrease between 1990 and 1992. However, domestic consumption of these products is quite firm, as Table 1.5-2 shows.

Consumer prices of major petroleum products like motor gasoline, diesel engine oil and fuel oil have been under control of the government, which lists these prices by province and by consuming industry.

1.5.2 Policies on the petroleum sub-sector

Under the framework of the national economic transformation program, Poland is undertaking the task of reconstruction and modernization of her energy sector, in which petroleum is included as one of the most important components.

The state energy policy, cited also from the report "Energy Policy of Poland and the Draft Programme to the Year 2010", aims to accomplish the following objectives:

(1) Fully satisfying energy demand: This is, as the report stresses, the basic goal. It comprises the creation of a consumer-oriented fuels and energy market, and ensuring energy supply security, i.e. the guarantee of continuous energy supply in various possible conditions. This objective requires diversification of energy supply sources, storage of emergency stocks, design of emergency procedures and ensuring the efficient control of energy sub-sectors.

(2) Proper environmental protection: This should be carried out in accordance with the state environmental policy as a whole.

(3) Increase in efficiency of fuels and energy consumption: This means a decrease in the energy intensity of the national economy and improvement in the efficiencies of energy transformation and consumption processes.

(4) Improved quality of energy supply for the residential sector:
This requires consumers' access to better quality of fuels supplies, to better installation services, and to modern household appliances.

(5) Minimization of supply costs and rationalization of prices.

(6) Accomplishment of necessary transformation and restructuring of the energy sector: old monopolistic structures should be reorganized and adjusted to market economy requirements, including consumer market principles and new methods of regulation.

All of these elements are applicable to petroleum.

1.5.3 Forecasted refining capacities of Polish refineries

Two expert teams, namely PPSA staff and Krakow's Department of Systems Research, were asked to forecast the maximal capacities of oil refining. The forecasted annual capacities of oil refining are shown in Table 1.5-3.

In the Table, "existing refineries" comprises: PPSA, Gdansk refinery and five small refineries in southern Poland. As for Gdansk refinery, gradual expansion of its capacity was assumed: to 3,700 thousand tons of oil in 1995 and to 5,700 thousand tons in 2000. Taking into account the current delay in the beginning of expansion investment, the planned extension of one million tons by 1995 proves not to be possible. The total capacity of the five small southern refineries is assumed to be one million tons/y until 1995 and 600 thousand tons/y after 1995. The characteristics of "new model refinery" technologies were designed assuming annual capacities of six million tons of oil, identically for both fuel and/or petrochemical profiles.

The figures contained in Table 1.4-3 indicate the dominant share of Plock refinery in the capacities, not only now but also in the future - 68.0% in 1995, 57.6% in 2000 and 50.7% in 2010. After the several modernization measures are carried out, the processing capacity of this refinery will increase by 2,700 thousand tons/y in 2000. Also the increase of Gdansk refinery capacity by three million tons/y by 2000 was taken into account in the assumptions.

Table 1.5-1 PRODUCTION OF PETROLEUM PRODUCTS IN POLAND

(Unit: 1,000 MT)

	1987	1988	1989	1990	1991	1992
Aviation Gasoline	-	-	-	-	-	-
Motor Gasoline	2,682	2,824	2,954	2,192	2,308	3,049
Jet Fuel	-	-	-	-	-	-
Kerocene	3	4	3	3	-	-
Diesel Engine Oil	5,009	5,174	4,845	3,963	3,675	4,401
Fuel Oil	3,200	3,252	3,686	3,631	3,480	2,982
LPG	270	249	280	143	143	158
Refinery Gas	366	354	337	226	239	295
Total	11,530	11,857	12,105	10,158	9,845	10,885

Source : UN, "Energy Statistics Yearbook"
CSO, "Fuels and Energy Statistics in the Year 1991 - 1992"

Table 1.5-2 BALANCE OF MAJOR PETROLEUM PRODUCTS IN POLAND

(Unit: 1,000 MT)

Product	Item	1985	1990	1991	1992
Motor Gasoline	Production & Stock	2,300	2,044	2,369	3,001
	Import	556	1,242	1,380	1,340
	Consumption & Stock	2,856	3,280	3,737	4,341
	Export	8	6	12	0
Diesel Oil	Production & Stock	4,873	3,974	3,809	4,464
	Import	1,220	1,694	1,359	677
	Consumption & Stock	5,883	5,568	4,922	5,109
	Export	210	200	246	32
Fuel Oil	Production & Stock	2,399	3,631	3,480	2,390
	Import	1,146	912	913	780
	Consumption & Stock	3,513	3,560	3,294	2,294
	Export	32	983	1,099	876

Source : Energy Information Centre, "Fuels and Energy in 1992"

Table 1.5-3(1) MAXIMAL CAPACITIES OF OIL REFINING IN POLAND

(Unit: Mtce)

Specification	1995	2000	2005	2010
Existing refineries	21.07	27.1	27.1	27.1
of which: Plock refinery	14.33	18.1	18.1	18.1
New refineries (fuel profile or petrochemical profile)	0	4.3	8.6	8.6
Total	21.07	31.4	35.7	35.7

Source : MOIT, "Energy Policy of Poland and Draft Programme to the Year 2010"

Table 1.5-3(2) MAXIMAL CAPACITIES OF OIL REFINING IN POLAND

(Unit: 1,000 Million MT, %)

Description	1995	2000	2005	2010
Existing refineries	14.7	19.0	19.0	19.0
of which: Plock refinery	10.0	12.7	12.7	12.7
(share)	(68.0)	(57.6)	(50.7)	(50.7)
New refineries (fuel profile or petrochemical profile)	0	3.0	6.0	6.0
Total	14.7	22.0	25.0	25.0

Source : MOIT, "Energy Policy of Poland and Draft Programme to the Year 2010"

Note : Original figures are expressed in million tons of coal equivalent.

1.6 Present Social and Economic Conditions and Regional Development Policy and Plan in the Plock Region

The Province of Plock, where PPSA is situated, is located almost at the center of Poland, close to the west side of Warsaw, the national capital. The province has population of about 518 thousand in 1992 and its capital is the City of Plock where some 125 thousand people are living. Plock city was the national capital in the period 1079-1138, during the reigns of Wladyslaw Herman and Boleslaw III. Throughout the Middle Ages, Plock was an important trading center, because of its advantageous location facing the Vistula. Plock has been a provincial capital for almost 500 years.

Table 1.6-1 shows the major socio-economic indicators of Poland and Plock province in 1992. Judging from indicators like sector-wise working population or share of farm land, Plock province may be categorized as agriculturally-oriented, but it is gradually changing to industrially-oriented. For example, the amount invested for industry has recorded about 65 percent growth from Zl. 1,048 billion in 1991 to Zl. 1,730 billion in 1992, showing that aggressive investment has taken place, taking into consideration the advantage of proximity to Warsaw (the distance from Warsaw to Plock is about 120 Km and about 1.5 hours drive). As of 1992, Plock province was ranked fifth among 49 provinces in industrial output, its share in the all-provinces total being 4.5%. In addition, the province is ranked sixth in per capita GDP, as shown in Table 1.6-2.

Fuel-related industry, represented by PPSA, accounts for more than 70% of total industrial production of the province. The fuel sector is followed by food industry, machine industry including a river shipyard, electric and electronic industry and clothing industry.

PPSA contributes economically to both Plock province and Plock city. It is by far the biggest tax payer and absorber

of employees as shown in the following list of the top eight enterprises in Plock province in 1990.

	Enterprise	Production(US$ mil.)	Employees
#1	Petrochemia Plock	1,801	8,442
#2	AGROMET(harvesting machines)	49	3,768
#3	Food processing enterprise	39	1,382
#4	POLFA(pharmaceuticals)	30	1,648
#5	ELGO(lightning equipments)	25	1,953
#6	COTEX(clothing)	10	2,902
#7	Agricultural machine factory	7	1,030
#8	WATINA(wool processing)	3	421

Source: Governor of Province of Plock, "Province of Plock"

Both Plock province and city have been aware of too heavy dependence on the refinery, and have made efforts to attract both domestic and foreign investors to the region. A brochure issued by Plock city declares that attracting and supporting both Polish and foreign investment is Plock's primary strategy for development. In accordance with this strategy, the city offers such incentives as the following:

- willingness to negotiate local tax rebates and other concessions;
- assistance with the purchase of low-cost real estate;
- coordination of access to utilities; and
- facilitating relations with other government institutions.

In parallel with the above incentives, the city has endeavored to improve infrastructure like roads, water treatment plant, sewage treatment, solid waste disposal, low-cost municipal housing, etc.

(1) Transportation

Plock has excellent highway connections not only with Warsaw but also with other large cities like Lodz, Poznan, Gdansk and Torun. As for rail, it has a line to Warsaw and Kunto, the largest rail junction in central Poland. A new international cargo and passenger airport will be built in Modlin, 75km from Plock.

(2) Telecommunication

A new central exchange was installed by an American firm. Plock has automatic connections with more than 30 Polish cities and 58 major cities worldwide, including the USA and Canada, and 27 cities in Europe.

(3) Public works

A new water intake from the Vistula has been completed and construction of a treatment station initiated using new technology.

The city is also increasing the capacity of the existing sewage treatment plant. A new plant for the eastern part of the city will be realized in the period 1994-1997.

As for solid waste disposal, the city is now seeking financial and technical assistance to develop a sorting, compacting, and recycling program. Its completion is expected in 1997.

As the fruits of these efforts, there are already six foreign manufacturers and 23 joint ventures located in the city.

Concerning energy supply, electricity is traded between the refinery and the Polish Power Grid Co., the national power company. The refinery can sell its surplus to that company. As for hot water, Plock city has its own municipal utility supplying organization which supplies city water, hot water and city gas. The refinery sells hot water in the winter season to this organization, in accordance with a supply contract.

Table 1.6-1 MAJOR INDICATORS OF POLAND AND PLOCK PROVINCE IN 1992

Item	Poland	Plock Province
Working Population (thousand)	15,495	217
Share of Working Population to Total(%)	40.3	41.7
Sector-wise Share of Working Population(%)		
- Industry	25.2	19.4
- Construction	7.0	6.5
- Agriculture	28.9	44.2
- Transportation/Communication	3.8	3.2
- Commerce	10.4	8.3
Rate of Unemployment(%)	13.6	18.5
Investment Amount(bn. Zl.)	201,597	3,418
Sector-wise Share of Investment(%)		
- Industry	33.8	50.6
- Agriculture	5.9	10.5
- Transportation/Communication	4.5	1.4
- Social	22.6	18.4
Total Farmland and Pasture (Thousand ha)	18,664	393
Share for Total Land(%)	59.7	76.8

Source: Central Statistical Office, Statistical Yearbook 1993

Table 1.6-2 PER CAPITA GDP BY PROVINCE IN 1992

Province	Population (thousand)	GDP (Zl. billion)	Per Capita GDP (Zl. thousand)	Ranking
Warszawskie	2,409	404	168	1
Legnickie	520	66	127	2
Szczecinskie	981	107	109	3
Katowickie	3,953	423	107	4
Piotrkowskie	644	67	104	5
Plockie	520	54	104	6
Opolskie	1,026	103	100	7
Elblaskie	486	47	97	8
Tarnobrzeskie	606	57	94	9
Gdanskie	1,438	134	93	10
Koninskie	476	44	92	11
Jeleniogorskie	522	48	92	12
Poznanskie	1,341	122	91	13
Lubelskie	1,021	91	89	14
Wroclawskie	1,132	99	87	15
Gorzowskie	506	44	87	16
Krakowskie	1,232	107	87	17
Koszalinskie	514	44	86	18
Zielonogorskie	667	57	85	19
Olsztynskie	763	65	85	20
Bydgoskie	1,123	95	85	21
Leszczynskie	393	33	84	22
Bielskie	907	76	84	23
Wloclawskie	433	36	83	24
Torunskie	665	55	83	25
Lomzynskie	352	29	82	26
Lodzkie	1,131	93	82	27
Walbrzyskie	742	60	81	28
Kaliskie	718	58	81	29
Bialostockie	698	56	80	30
Kieleckie	1,136	91	80	31
Pilskie	487	39	80	32
Slupskie	421	33	78	33
Czestochowskie	782	61	78	34
Sieradzkie	412	32	78	35
Tarnowskie	683	53	78	36
Suwalskie	480	37	77	37
Chelmskie	249	19	76	38
Rzeszowskie	735	56	76	39
Krosnienskie	502	38	76	40
Zamojskie	494	37	75	41
Bialskopodlaskie	309	23	74	42
Ciechanowskie	434	32	74	43
Radomskie	760	56	74	44
Ostroleckie	404	29	72	45
Skierniewickie	423	30	71	46
Siedleckie	658	45	68	47
Przemyskie	412	27	66	48
Nowosadeckie	716	40	56	49
Whole Poland	38,418	3552	92	-

Source: Central Statistical Office, Statistical Yearbook 1993

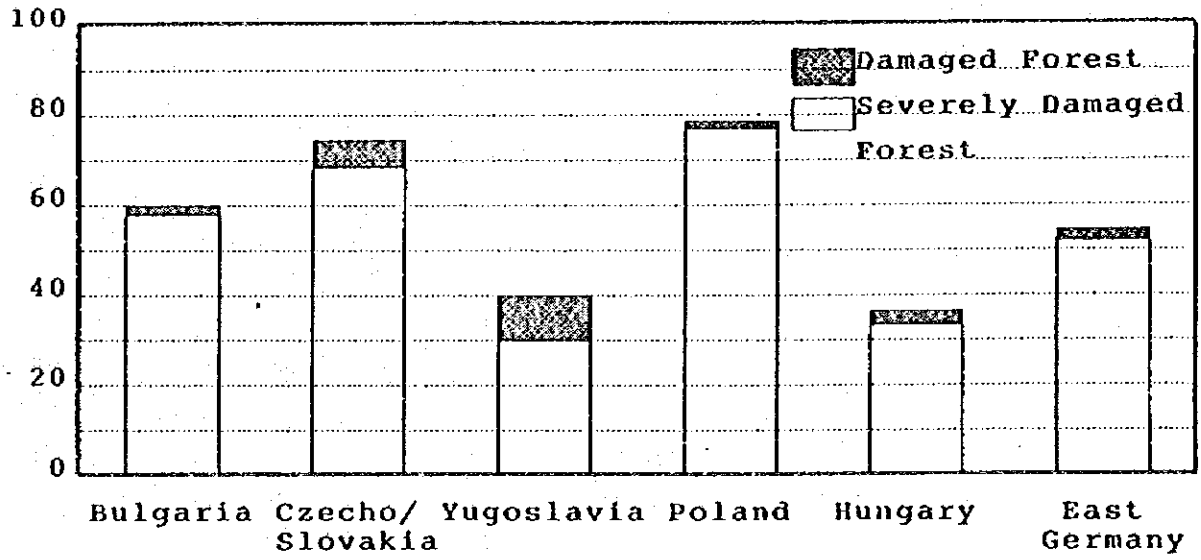
1.7 Present Situation of National Environmental Protection

1.7.1 Air

The major environmental problem in Poland as well as in the other countries of East Europe is air pollution due to emission of sulfur dioxide(SO_2), nitrogen oxide(NOx) and dust or soot. In the case of Poland these substances are regularly emitted from the main energy source, combustion of coal. Although highly effective dust collection equipment has been installed in large scale thermal power plants to reduce dust emission, it is said that almost no equipment has yet been put into operation to prevent emission of SO_2 and NOx in Poland.

Eastern Europe has produced and consumed relatively large quantities of coal, which has caused severe damage to the forests of Eastern Europe due to air pollution. This is especially true in Poland, where 78% of the total forest has been damaged, far above the forest damage among the other countries as shown in Figure 1.7-1.

Figure 1.7-1 PROPORTIONS OF FOREST DAMAGED (1988)



(Source)OECC

The situation of Silesia,as well as in the area of Southern and Western Poland, is significantly aggravated by the flux of transboundary air pollution arriving from the Czech Republic, Slovakia and Germany. The balance of export and import of main pollutants is negative for Poland equalling 1:9 in relation to Germany and 1:2 in relation to its southern neighbor.

It is at present recognized that particularly the two regions of the Sudeten Mountains and the Silesia-Ostrava region represent a main concern in Europe as far as air pollution is concerned.

Table 1.7-1 and Figure 1.7-2 show the balance of SO_2 and NOx inflow and outflow amounts between Poland and the other countries of Europe. It is observed in these tables and figures that as for SO_2, Poland is a net importer of 96 thousand tons per year, whereas for NOx, Poland's net export was 34.2 thousand tons per year in 1988.

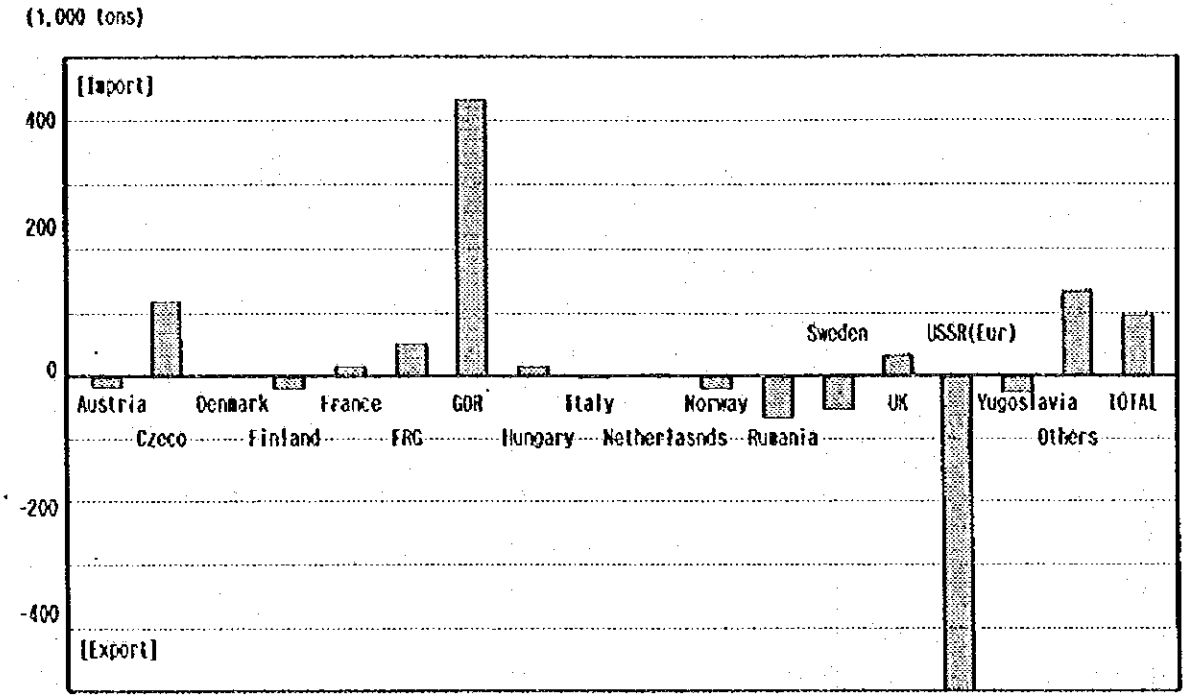
Table 1.7-1 AIR POLLUTANT BALANCE IN POLAND (1988)

(1,000 tons)

Country	SO_2			NOx		
	Import	Export	Balance	Import	Export	Balance
1 Austria	4.0	20.0	-16.0	1.3	4.2	-2.9
2 Czech	246.0	126.0	120.0	23.1	17.5	5.6
3 Denmark	8.0	6.0	2.0	3.5	0.7	2.8
4 Finland	0.0	20.0	-20.0	0.6	2.7	-2.1
5 France	22.0	6.0	16.0	7.3	4.1	3.2
6 FRG	78.0	26.0	52.0	34.4	6.9	27.5
7 GDR	468.0	36.0	432.0	24.4	6.3	18.1
8 Hungary	54.0	36.0	18.0	3.3	5.9	-2.6
9 Italy	12.0	16.0	-4.0	2.1	5.0	-2.9
10 Netherlands	8.0	2.0	6.0	5.0	0.4	4.6
11 Norway	0.0	20.0	-20.0	0.6	2.0	-1.4
12 Rumania	2.0	68.0	-66.0	1.4	12.6	-11.2
13 Sweden	2.0	56.0	-54.0	2.2	5.1	-2.9
14 UK	34.0	2.0	32.0	7.6	1.3	6.3
15 USSR	22.0	518.0	-496.0	3.4	75.3	-71.9
16 Yugoslavia	16.0	42.0	-26.0	0.6	8.2	-7.6
17 Others	146.0	14.0	132.0	10.0	2.5	7.5
Total	1122.0	1026.0	96.0	130.8	165.0	-34.2

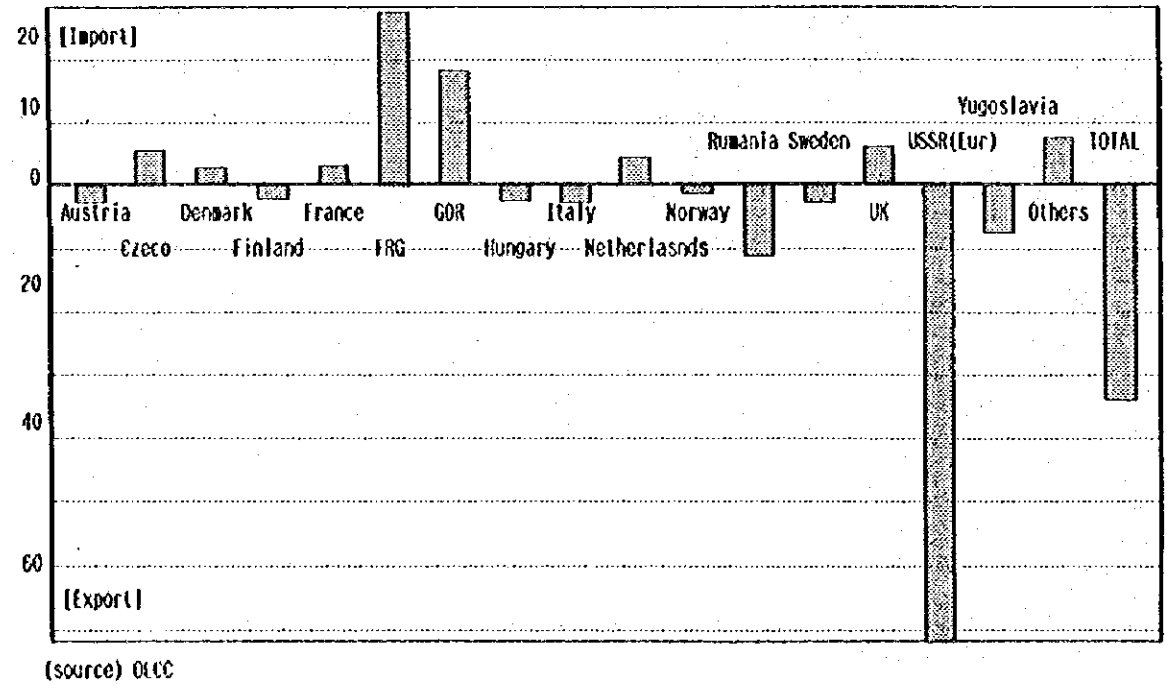
Source: OECC

Figure 1.7-2(1) SO_2 BALANCE OF POLAND (1988)



Source: OECC

Figure 1.7-2(2) NOx BALANCE OF POLAND (1988)



(source) OECC

1.7.2 Water

It is estimated that 99.7% of the area of Poland lies within the Baltic Sea basin. On the average, the Baltic receives about 80 billion m^3 of water per year from Polish territory. 50% of this amount is carried by the Vistula, 34% by the Oder and 16% are supplied directly by minor coastal rivers.

The rivers carry about 4.1 billion m^3 of waste water per year containing contaminants from cities and industrial enterprises. Organic and inorganic fertilizers and other farm chemicals, reaching surface water as runoff from agricultural areas, add to pollution loads.

River water salinity caused by the coal mines of Upper Silesia is a specific Polish problem. Nowadays, the amount of salts contained in mine water discharged yearly into the upper Vistula, the Oder and their tributaries is about 9,000 tons per year and is still growing. The salt concentration in some mine waters exceeds 70,000 mg/litter.

Assessment of the Vistula shows that the decisive factors determining its water quality are dissolved substances and especially chlorides and sulphates originating from coal mines. The present water quality of the river is as shown below.

class 2 : 5.4% of river length
class 3 : 37.5% of river length
Below standard : 57.1% of river length

Note: class-1 Potable water
class-2 Water suitable for swimming and recreation
class-3 Water suitable for industrial use and irrigation

However, it is said that elimination of the impact of saline water originating from coal mines alone would lead to limiting the range of occurrence of waters polluted below standard.

Pollution of underground waters is also becoming a wide spread phenomenon. It is estimated that the number of wells with poor water quality has doubled over the past decade. This applies particulaly to public and household wells.
All the facts presented above prove the alarming degree of water pollution in Poland.

1.7.3 Environmental policy

The Ministry of Environmental Protection, Natural Resources and Forestry, has published an environmental policy in November, 1990. This new policy aims at sustainable development, i.e. the attainment of a balance between social, economic, technical and environmental conditions in the process of development. The following matters are stated as basic principles.

(1) Control at the sources

(2) Principle of abiding laws

(3) The principle of common goods

(4) Economization principle

(5) Polluter-pays principle

(6) Principle of regionalization

(7) Principle of common solution by the entire international community to address European as well as global problems of environmental devastation

In order to realize the above principles, the policies with respect to economy and technology are as follows.

(1) Rationalization of energy management

(2) Change in the structure of industry

(3) Reduction of pollutants related to transportation

(4) Rationalization of mining & use of mineral resources

(5) Use, protection and landscaping of living natural resources

In order to achieve the above policy goals, the systems of authority and responsibilities are decided as follows.

(1) The duties of the central state authorities

(2) The tasks of the provincial government

(3) Responsibilities of economic entities

(4) Duties of citizens and roles of the public

The order of priority of environmental policy objectives had been categorized in the three periods as shown in Table 1.7-2.

Table 1.7-2 ENVIRONMENTAL POLICY

Type	Period (year)	Remarks
1 Near term	3-4	Urgent implementation objectives due to problems having hazardous effects on human health or life.
2 Medium term	Appx. 10, up to 2,000	To enable Poland to catch up to the EEC with respect to pollutant decrease. SOx : 4.2 down to 2.9MM tons/year NOx : 1.5 down to 1.3MM tons/year Dust : 92 up to 96% efficiency
3 Long term	25-30, up to 2,020	Environmental improvement due to implementing the principles of sustainable development. Budget : 260 billion US$.

Source: OECC

1.7.4 Monitoring system

The state environmental monitoring system will act as the controller of the environmental quality standards and the effectiveness of environmental programs.

In 1990, the Polish Prime Minister set up an interdepartmental team for working out the state environmental monitoring program. The team was chaired by the Minister of Environmental Protection, Natural Resources and Forestry. The coordination of these activities was given to the Chief Inspector of Environmental Protection.

The legal base for functioning of the state environmental monitoring system was laid down in July 1991, after the Parliament of Poland had passed the State Inspectorate of Environmental Protection Act (it became effective on October 29, 1991). On the basis of this act, the Chief Inspector of Environmental Protection becomes the coordinator of the State Environmental Monitoring System.

The State Environmental Monitoring System is the system of measurements, assessments and forecasts of condition of the

environment carried out by the units of central and local administration, as well as institutes and industries.

The goal of the State Environmental Monitoring System is to increase the effectiveness of the environmental protection activities through collecting, analyzing and providing data concerning the condition of the environment and the changes taking place within it.

The basis of the monitoring system consists of the following items.

(1) National network of monitoring stations (measurement and sampling sites)

(2) Regional network of monitoring stations

(3) Local network of monitoring stations

The national network of monitoring stations includes the following:

(1) Stations measuring environmental pollution in the border regions

(2) Stations of the radioactive contamination services, concerned with giving early warnings and counteracting extraordinary environmental hazards, especially by radioactive contamination measurement

(3) Stations operating within the international programs

(4) Periodic review of the effectiveness of national ecological policy

(5) Stations monitoring the function of the ecosystems typical for Poland

The organization units discharging more than 1,200kg/hour of sulfur dioxide or 800kg/hour of particulates through one emitter, are obliged to operate a continuous monitoring device of the quantities of these substances discharged into air.
The organization units which have the ability to discharge more than 100kg of sulfur dioxide or 100kg of particulates per hour, are obliged to measure the quantities of these substances twice a year on dates agreed with the local authorities at the provincial level.

The data on the surface water pollutants sources will be obtained from the industrial plant reports and from reports by other economic and administrative units.
The system for recording of point pollution sources should cover all waste water outflows which discharge more than $20M^3$/day.

Figure 1.7-3 illustrates control of measurements by the state environmental monitoring system.

1.7.5 International cooperation

The main topics of international cooperation are as follows.

(1) Participation of Poland in resolution of regional and global environmental problems

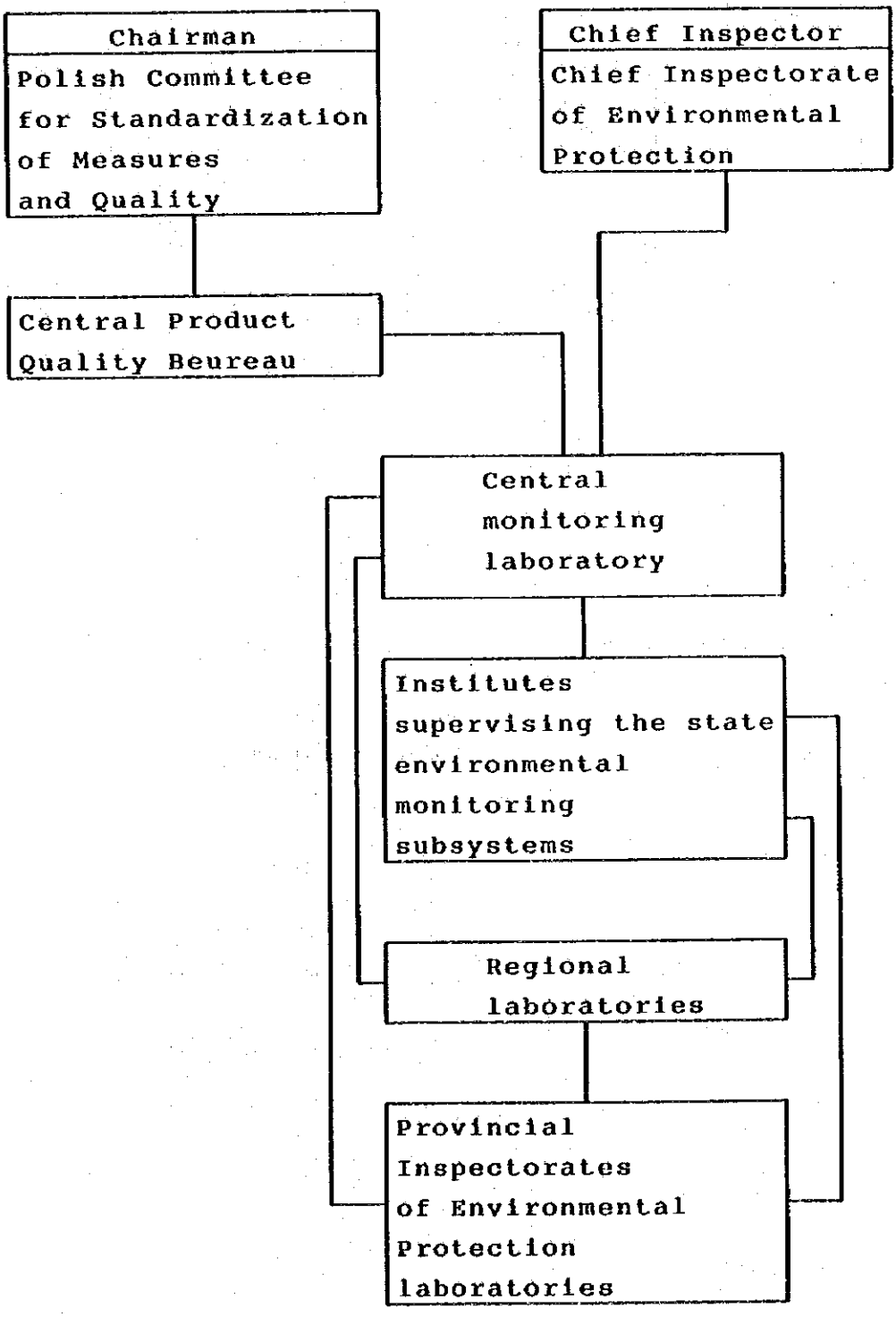
(2) Research on environmental conditions in frontier areas, in cooperation with neighboring countries

(3) Cooperation with foreign assistance donors oriented toward environmental projects

1.7.6 Administrative organizations

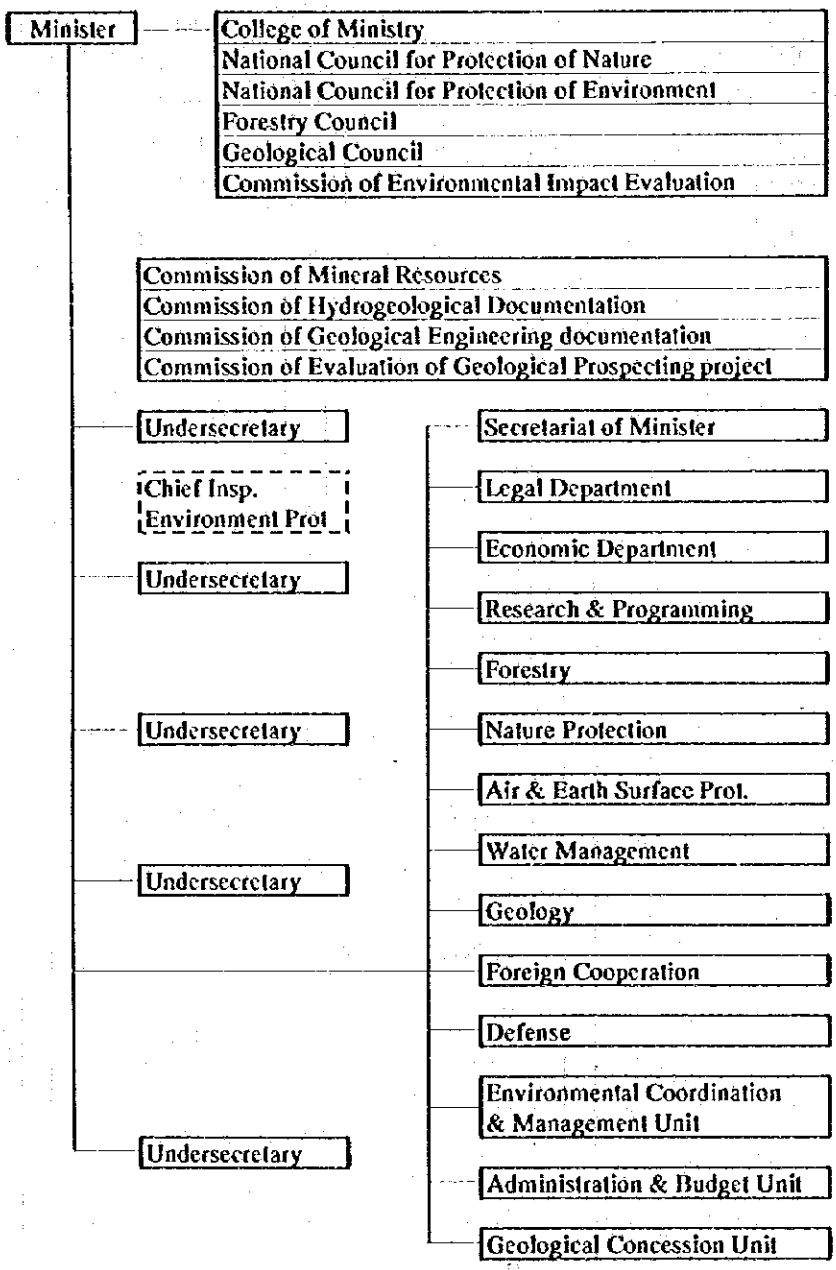
Refer to Figure 1.7-4.

Figure 1.7-3 MEASUREMENTS CONTROL OF STATE ENVIRONMENTAL MONITORING SYSTEM



(Source)OECC

Figure 1.7-4 ORGANIZATION OF MINISTRY OF ENVIRONMENTAL PROTECTION, NATURAL RESOURCES AND FORESTRY



Source: OECC

1.7.7 National environmental legislation

The structure of the environmental legislation in Poland is a little different from the corresponding legal structures in Japan or the other developed countries.
Although sophisticated comparisons of regulations country-by-country are difficult due to the above reasons, Annex 6.1 shows environmental quality standards for air pollution among the selected countries.
The following sections represent very brief comparisons of the environmental regulations between Poland and Japan, based on certain assumptions when necessary.
As for environmental quality standards in Japan, refer to Annex 6.2.

(1) Environmental quality standards for air

In Poland, areas subject to air quality regulation are divided into normal areas and specially protected areas, and they each have air quality standard values for 30 minutes, 24 hour average and annual average as shown in Table 1.7-3.
In general, the values in Poland are a little more lenient in normal areas but more stringent in specially protected areas in comparison to Japan, as shown in the following Table.

(ppm except pH)

Item	Quality Standard	Japan	Poland			
			Normal		Protected	
			-1998	1999-	-1998	1999-
SO_2	30 minute value	0.1(1hr)	0.210	0.154	0.087	0.052
	Daily average	0.04	0.070	0.052	0.026	0.026
	Annual average	-	0.011	0.011	0.044	0.044
NO_2	30 minute value	-	0.243		0.073	
	Daily average	0.04-0.06	0.073		0.024	
	Annual average	-	0.024		0.015	
CO	30 minute value	-	4		2.4	
	8 hour value	20	-		-	
	Daily average	10	0.8		0.4	
	Annual average	-	0.1		0.05	
SPM	1 hour value	0.2mg/m^3	-		-	
	Daily average	0.1mg/m^3	0.12mg/m^3		0.06mg/m^3	
	Annual average	-	0.05mg/m^3		0.04mg/m^3	

Source: Study for environmental problem in Poland (1993)

(2) Environmental emission standards for air

The permissible emission values for air pollutants are defined in Poland in the unit of g/GJ of fuels, and depend upon the year of construction of emission sources, as shown in Table 1.7-4.

The following comparison table is prepared on the assumptions described below.

- Combustion fuel: Hard coal 6,500kcal/kg
- Efficiency of power generation: 38%
- Exhaust gas volume: 1,664,000Nm_3/h
- Effective chimney height: 300m

In general, it appears that Polish standards are slightly more lenient in comparison to the Japanese ones.

Item	Japan	Poland A type	Poland C type
SO_2	K value 17.5 4,500 kg/h K value 3.0 770 kg/h	5,870 kg/h	950 kg/h
NO_2	400 - 200 ppm	460 ppm	240 ppm
Dust	150 - 50 mg/Nm^3	740 mg/Nm^3	370 mg/Nm^3

Source: Study for environmental problem in Poland
Note : As for type of A, B, C, refer to foot note of Table 1.7-4.

K value regulation in Japan.
The emission standard for sulfur oxides which applies to a given sulfur oxides emitting facility may be calculated by inserting a value K, specified under Cabinet Order for the region where the facility is located, into the following equation:

$$q = K \times 10^{-3} \times He^2$$

Here, q is the hourly volume of sulfur oxides emitted (in unit of Nm^3) and He, effective height of stack, is the sum of actual height of stack and smoke ascent height. The value of K, which varies by the region, inversely determines the severity of control. In other words, a reduction in K means a stiffer control standard. The standard for sulfur oxides has hence been labeled the "K - value regulation."

The general emission standard for sulfur oxides (the K - value) was put into force on September 28, 1976, and as a result all areas in japan are now under K - value control having sixteen K - value ranks ranging from 3.0 to 17.5.

(3) Environmental quality standards for water

Table 1.7-5 shows national environmental quality standards for water. The Japanese standards are defined by water sources, while Polish ones are just defined by quality of water as shown below. According to the table, Polish standards are lenient in terms of pH, BOD and COD.

(mg/l except PH)

Item	Japan						Poland	
	River		Lake		Coastal sea			
	AA	E	AA	C	A	C	Class-1	Class-2
pH	6.5 -8.5	6.0 -8.5	6.5 -8.5	6.0 -8.5	7.8 -8.3	7.0 -8.3	6.5 -8.5	6.0 -9.0
BOD	≤1	≤10	-	-	-	-	≤4	≤12
COD	-	-	≤1	≤8	≤2	≤8	≤10	≤30
SS	≤25		≤1	-	-	-	≤20	≤50
DO	7.5≤	2≤	7.5≤	2≤	7.5≤	2≤	6≤	4≤
Cd			≤0.01				≤0.05	≤0.1
Pb			≤0.01				≤0.05	
Cr6			≤0.05				≤0.05	
As			≤0.01				≤0.05	≤0.2
Hg			≤0.0005				≤0.001	≤0.01

Source: Study for environment problem in Poland (1993)
Note : Class-1 Potable water
Class-2 Water suitable for swimming and recreation
Class-3 Water suitable for industrial use and irrigation
For classification in Japan, refer to Annex 6.2

(4) Environmental emission standards for water

Table 1.7-6 shows national environmental emission standards for water. According to the following table, it seems the Polish standards for oily substances and Hg are lenient, pH and Cd are equal, with BOD, SS & Cr6 being stringent by comparison to Japan.

(mg/l except PH)

Item	Japan	Poland
pH	Exclusive of coastal area: 5.8 - 8.6 Coastal area : 5.0 - 9.0	6.5 - 9.0
BOD	160 (Daily average 120)	30
COD	160 (Daily average 120)	150 [Cr]
SS	200 (Daily average 150)	50
Oil	5	50
Cd	0.1	0.1
Pb	1	0.5
Cr6	0.5	0.2
As	0.5	0.2
Hg	0.005	0.02
Cu	3	0.5

Source: Study for environment problem in Poland (1993)

(5) Fees & fines for environmental pollutants in Poland

The following tables show fees & fines for environmental pollutants in Poland

Table 1.7-7(1) Fees on air pollutants
Table 1.7-7(2) Fees on effluents of BOD, COD
Table 1.7-7(3) Fees on other pollutant substances in effluents

Fees are levied on emission quantities of pollutants while fines are levied on the quantities exceeding emission standards, the amount of fines being 10 times of the corresponding fees in Poland. Fees are regarded as a legitimate business cost but fines are not tax- deductible. In Japan, fees are levied only for SO_2 emissions, by the pollution health damage compensation and prevention law, the lowest fee of which is ¥86,000/kg, almost 10 times of the case in Poland.

Table 1.7-3 NATIONAL ENVIRONMENTAL QUALITY STANDARD FOR AIR

($\mu g/m^3$)

	Normal Area			Specially Pratected Area		
	30 Minutes	Daily Average	Annual Average	30 Minutes	Daily Average	Annual Average
Dust	250	120	50	85	60	40
SO_2 (until 1997)	600	200	32	250	75	11
(after 1998)	440	150	32	150	75	11
NO_2	500	150	50	150	50	30
CO	5.000	1.000	120	3.000	500	61
Aliphatic H/C	3.000	2.000	820	1.000	500	130
Aromatic H/C	1.000	300	43	300	100	16
Benezene	35	10	2.5	35	10	2.5
H_2S	30	5	1	4	1	0.5
Cumene	50	21	4.4	-	-	-
Propane	5.000	2.000	380	-	-	-
CS_2	50	20	3.8	15	4.5	0.6
Acetone	350	150	31	100	43	8.7
Propylene	3.000	1.300	260	-	-	-
Stylene	20	7	2	10	3.5	1
Hexane	2.000	1.000	250	-	-	-
Ethylene	3.000	1.300	260	-	-	-
Glycol	30	10	1.6	10	3	0.4
EO	100	30	4.3	30	10	1.6
Propylbenzene	100	50	13	-	-	-
Phenol	20	10	2.5	10	3	0.4
Methanol	1.000	500	130	200	100	25
Methane	5.000	1.000	120	500	210	44
Methylether	200	100	25	-	-	-
Toluene	300	200	50	100	50	13
Silicon Dust	300	50	6.1	40	20	3.8
Ethylbenzene	500	200	38	-	-	-
Acetophenone	5	2.1	0.4	-	-	-

Source: Study for Environmental Problem in Poland (1993)

Table 1.7-4 NATIONAL ENVIRONMENTAL EMISSION STANDARD FOR AIR

(Unit: g/GJ)

	Fuel	Scale	Existing (Type A)			Existing (Type B)			New (Type C)		
			SO_2	NO_2	Dust	SO_2	NO_2	Dust	SO_2	NO_2	Dust
1	Fuel Oil	<50MW	1720	120	-	1250	120	-	1250	90	-
		>50MW	1720	160	-	170	160	-	170	120	-
2	Natural Gas	<50MW	-	60	-	-	35	-	-	35	-
		>50MW	-	50	-	-	50	-	-	50	-

Source: Environmental Protection in Poland (1992)

Note : Installations put into operation before March 28, 1990, have to comply with the requirements for type A until Dec 31, 1997, and after that date with the requirements for type B. Installations under construction on March 28, 1990 and starting operation before Dec 31, 1994 have to comply with the requirements for type B until Dec 31, 1997 and after that date with the requirements for type C. Installations under construction on March 28, 1990 and starting operation after Dec 31, 1994, as well as installations under construction which has begun after March 28, 1990 have to fulfill the requirements set for type C. The requirements are considered to be fulfilled when they are complied with for overall emissions.

Table 1.7-5 NATIONAL ENVIRONMENTAL QUALITY STANDARD FOR WATER

	Unit	Class I	Class II	Class III
Temperature	℃	≤ 22	≤ 26	≤ 26
Odor	-	≤ 3R	Natural	Natural
Color	mgPt/☒	Natural	Natural	Natural
pH	-	6.5 - 8.5	6.0 - 9.0	6.5 - 9.0
Total Suspension	mg/☒	≤ 20	30	50
BOD_5	mg/☒	4	8	12
COD_{Mn}	mg/☒	10	20	30
COD_{Cr}	mg/☒	25	70	100
Dissolved Oxygen	mg/☒	6	5	4
Nitrogen (NH_4)	mg/☒	1.0	3.0	6.0
Nitrogen (NO_3)	mg/☒	5.0	7.0	15.0
Nitrogen (NO_2)	mg/☒	0.02	0.03	0.06
Total Nitrogen	mg/☒	5.0	10.0	15.0
Phosphorus (PO_4)	mg/☒	0.2	0.6	1.0
Total Phosphorus	mg/☒	0.1	0.25	0.4
Hardness	mg$CaCO_3$/☒	350	550	700
Electric Conductivity	☒s/cm	800	900	1200
Co^-	mg/☒	250	300	400
SO_4	mg/☒	150	200	250
Na	mg/☒	100	120	150
K	mg/☒	10	12	15
Dissolved Material	mg/☒	500	1000	1200
Fe	mg/☒	1.0	1.5	2.0
As	mg/☒	0.05	0.05	0.2
B	mg/☒	1.0	1.0	1.0
Zn	mg/☒	0.2	0.2	0.2
Cr^{+3}	mg/☒	0.05	0.1	0.1
Cr^{+6}	mg/☒	0.05	0.05	0.05
Cd	mg/☒	0.005	0.03	0.1
Mn	mg/☒	0.1	0.3	0.8
Cu	mg/☒	0.05	0.05	0.05
Ni	mg/☒	1.0	1.0	1.0
Pb	mg/☒	0.05	0.05	0.05
Hg	mg/☒	0.001	0.005	0.01
Se	mg/☒	0.01	0.01	0.01
Ag	mg/☒	0.01	0.01	0.01
V	mg/☒	≤ 1.0	≤ 1.0	≤ 1.0
Free Chlorinde	mg/☒	n.d.	n.d.	n.d.
Free Cyanide	mg/☒	≤ 0.01	≤ 0.01	≤ 0.01
Compound Cyanide	mg/☒	1.0	2.0	3.0
F	mg/☒	1.5	1.5	2.0
CNS	mg/☒	≤ 0.02	≤ 0.5	≤ 1.0
S	mg/☒	n.d.	n.d.	≤ 0.1
Formaldehyde	mg/☒	≤ 0.05	≤ 0.05	0.2
Acrylonitrile	mg/☒	2.0	2.0	2.0
Volatile Phenol	mg/☒	0.005	0.02	0.05
Insecticides (Chloro H/C)	☒g/☒	≤ 0.05	≤ 0.05	≤ 0.05
Insecticides (Organic P Compds/Carbamate)	☒g/☒	≤ 1.0	≤ 1.0	≤ 1.0
Caprolactum	mg/☒	≤ 1.0	≤ 1.0	≤ 1.0
Surface Active Agent (Anion)	mg/☒	0.2	0.5	1.0
Surface Active Agent (Nonion)	mg/☒	0.5	1.0	2.0
Petroleum Ether Extracts	mg/☒	5.0	10.0	15.0
Benzpyrene	☒g/☒	0.2	0.2	0.2
Chlorophil	☒g/☒	≤ 10	≤ 20	≤ 30
(Sarobowosc)		*(Oligo do betamezo)*	*(betamezo do alfamezo)*	*(alfamezo)*
(Miano Coli typu kalowego)		≥ 1.0	≥ 0.1	≥ 0.01
(Bakterie chorobotworcze)		n.d.	n.d.	n.d.

Source: Study for Environmental Problem in Poland (1993)

Table 1.7-6 NATIONAL ENVIRONMENTAL EMISSION STANDARD FOR WATER

Item	Unit	Limit
Temperature	C°	35
pH	-	6.5 - 9.0
Total Suspension	mg/l	50.0
BOD_5	mg/l	30.0
CODCr	mg/l	150.0
TOC	mg/l	40.0
Nitrogen (NH_4)	mg/l	6.0
Nitrogen (NO_3)	mg/l	30.0
Total Nitrogen	mg/l	30.0
Total Phosphorus	mg/l	5.0
Total Hardness	$mgCaCO_3/l$	3,500
Cl^-	mg/l	1,000
SO_4	mg/l	500
Na	mg/l	800
K	mg/l	80.0
Dissolved Material	mg/l	2,000
Fe	mg/l	10.0
As	mg/l	0.2
Bs	mg/l	10.0
B	mg/l	1.0
Zn	mg/l	2.0
Cr^{+3}	mg/l	0.5
Cr^{+6}	mg/l	0.2
Cd	mg/l	0.1
Cu	mg/l	0.5
Ni	mg/l	2.0
Pb	mg/l	0.5
Hg	mg/l	0.02
Ag	mg/l	0.2
V	mg/l	2.0
Free Cl	mg/l	1.0
Free CN	mg/l	0.1
Compound CN	mg/l	5.0
F	mg/l	15.0
CNS	mg/l	10.0
S	mg/l	0.2
Formal dehyde	mg/l	2.0
Acrylonitrile	mg/l	20.0
Volatile Phenol	mg/l	0.5
Insecticides (Chloro H/G)	µg/l	0.5
Insecticides (Organic P /Carbamates)	µg/l	10.0
Caprolactum	mg/l	10.0
Surface Active Agent (Anion)	mg/l	5.0
Surface Active Agent (Nonion)	mg/l	10.0
Petroleum Ether Extracts	mg/l	50.0
Oily Substance	mg/l	15.0
Benzopyrene	µg/l	2.0

Source: Study for Environmental Problem in Poland (1993)

Table 1.7-7(1) FEES ON AIR POLLUTANTS

No.	Pollutants	Fees (zloty/kg)
1	Acrylocitrile (aerosol)	1,000,000
2	As	1,000,000
3	Asbestos	1,000,000
4	Benzene	1,000,000
5	Benzopyrene	1,000,000
6	Vinylchloride (gaseous)	1,000,000
7	Cr	1,000,000
8	Ni	1,000,000
9	Bi	500,000
10	Se	500,000
11	Sn	500,000
12	Zn	500,000
13	Dioxin	500,000
14	Fron/Halon	500,000
15	Cd	500,000
16	Co	500,000
17	Mn	500,000
18	Mo	500,000
19	Pb	500,000
20	PCB	500,000
21	Hg	500,000
22	SO_2	1,100
23	Dust (caused by fuel combustion)	600
24	Dust (caused by cement and fireproof material industries)	3,000
25	Silicon dust (more than 30% SiO)	3,000
26	Dust (caused by chemical industries)	3,000
27	Dust (caused by surface active agents)	3,000
28	Dust (caused by powdered coal)	3,000
29	Dust (caused by polymers)	1,000
30	NOx	1,000
31	CO	300
32	Aliphatic H/C	300
33	Aromatic H/C	3,000
34	Metalic oxides	3,000
35	Metal or metalic compounds	3,000
36	Metalloids	3,000
37	Metalloid compounds	3,000
38	Metalloid oxides	3,000
39	Aliphatic alchols	3,000
40	Aromatic alchols	5,000
41	Aliphatic aldehydes	2,000
42	Aromatic aldehydes	3,000
43	Ethers	3,000
44	Ketones	3,000
45	Organic acid & compounds	4,000
46	Organic sulfuric compounds	5,000
47	Amines	5,000
48	Azo compounds	10,000
49	Iso-cyclized compounds	3,000
50	Hetero-cyclized compounds	25,000
51	Oily substances	1,000

Source: Study for Environmental Problem in Poland (1993)

Table 1.7-7(2) FEES ON EFFLUENTS OF BOD, COD

(Unit: Zloty/kg)

Item	BOD	COD
Effluents from factories of chemicals, power generation, fuels, metallurgy, electric machines and light industries	20,100	13,860
Effluents from paper manufacturing factories	8,325	5,375
Effluents from food processing factories	5,190	3,465
Effluents from urban water purification and sewer treatment systems	1,950	1,175
Effluents from rural water and sewer treatment systems as well as treated effluents from factories and effluents from hospitals & public facilities	1,735	1,045
Others	9,715	5,550

Source: Study for Environmental Problem in Poland (1993)

Table 1.7-7(3) FEES ON OTHER POLLUTANT SUBSTANCES IN EFFLUENTS

(Unit: Zloty/kg)

Item	Measured Unit	Fees
In case that mine effluents are directly discharged into rivers.	Chlorides 1 kg Sulfates 1 kg	550
In case that mine effluents are discharged into sewers.	ditto	70
In case that effluents containing heavy metals are discharged.	Heavy metal 1 kg	100,000
In case that effluents containing volatile phenol are discharged.	Volatile phenol 1kg	40,000

Source: Study for Environmental Problem in Poland (1993)

Chapter 2

Overall General Situation of Petrochemia Plock S.A. (PPSA)

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Chapter 2 Overall General Situation of Petrochemia Plock S.A. (PPSA)

2.1 History of PPSA

Petrochemia Plock was established in 1959 and is at present the refinery with the largest atmospheric distillation unit and petrochemical factory in Poland.
The construction of the refinery was started in 1960, and the first stage construction was completed in 1964.
Since then, a petrochemical factory has been constructed and the capacity of atmospheric distillation unit was increased gradually.
Originally, this refinery was designed to refine Russian crude oil which was received by pipe line.
Refer to Table 2.1-1 for the capacity of the units in PPSA and the year constructed.

In 1990, the ex-Soviet Union reduced crude oil supply to the refinery. However the completion of the Northern pipe line in 1990 ensured the stable supply of crude oil to PPSA by importing from the Middle East and the North Sea.
Since the import of crude oil from these countries is still increasing, it is forecast that, for the time being, Poland will continue to depend on the Northern pipe line for its crude import.
Figure 2.1-1 shows crude oil throughput in PPSA from the year 1975 to 1993. Ural blend crude oil throughput in 1993 declined to about half of the amount of the 1980s.

In July 1993, Petrochemia Plock changed its name to Petrochemia Plock S.A. (PPSA) by changing its organization from state company to a state owned company.
And at the same time the supervising authority of PPSA was changed from the Ministry of Industry and Trade to the

Ministry of Privatization.

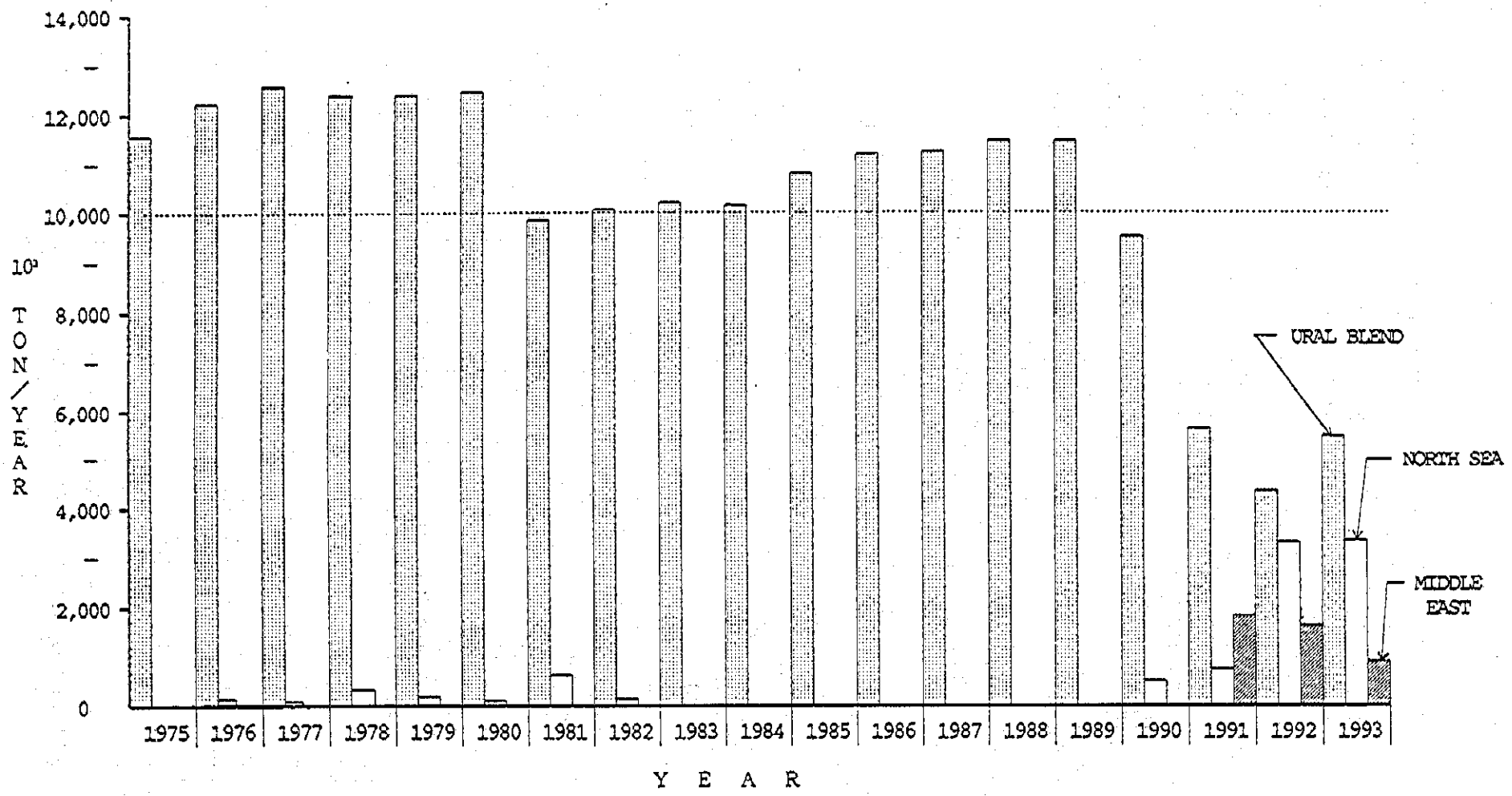
According to the Center Office of Poland, the privatization will be driven from now, based on the policy that the state companies will fall into private hands after restructuring and pursuing effective company management.

Table 2.1-1 THE PROCESSING CAPACITY IN PPSA

PLANT	CAPACITY (10³ t/y)	YEAR OF CONSTRUCTION
NO.1 CDRUDE DISTILLATION	2,400	1964
NO.2 CDRUDE DISTILLATION	3,400	1967
NO.3 CDRUDE DISTILLATION	3,400	1971
NO.4 CDRUDE DISTILLATION	3,400	1975
NO.1 REFORMER	300	1989
NO.2 REFORMER	300	1967
NO.3 REFORMER	300	1964
NO.4 REFORMER	330	1971
JET FUEL HDS	100	1975
NO.1 GAS OIL HDS	560	1967
NO.2 GAS OIL HDS	600	1971
NO.3 GAS OIL HDS	600	1975
NO.1 FCC	800	1966
NO.2 FCC	1,500	1976
HF ALKYLATION	150	1976
MTBE	60	1991
ASPHALT OXIDATION	630	1983
FURFURAL EXTRACTION	400	1967
SOLVENT DEWAXING	180	1967
HYDROFINISHING	215	1967
SULPHUR RECOVERY	50	1971
NO.1 ETHYLENE CRACKER	63	1980
NO.2 ETHYLENE CRACKER	300	1971
NO.1 POLYETHLENE	40	1978
NO.2 POLYETHLENE	100	1974
NO.1 POLYPROPYLENE	42	1976
NO.2 POLYPROPYLENE	42	1969
NO.1 ETHYLENE OXIDE/GLYCOL	301	1983
NO.2 ETHYLENE OXIDE/GLYCOL	601	1967
PHENOL/ACETONE	35/22	
NO.1 BUTADIENE		
NO.2 BUTADIENE		
AROMATIC PRODUCTION	480	1976/79
- BENZENE	40	
- TOLUENE	25	
- XYLENE	21	
- O-XYLENE	30	
- P-XYLENE		

SOURCE: POLAND-PETROLEUM SECTOR ENVIRONMENTAL REVIEWS-PHASE I
(The World Bank)

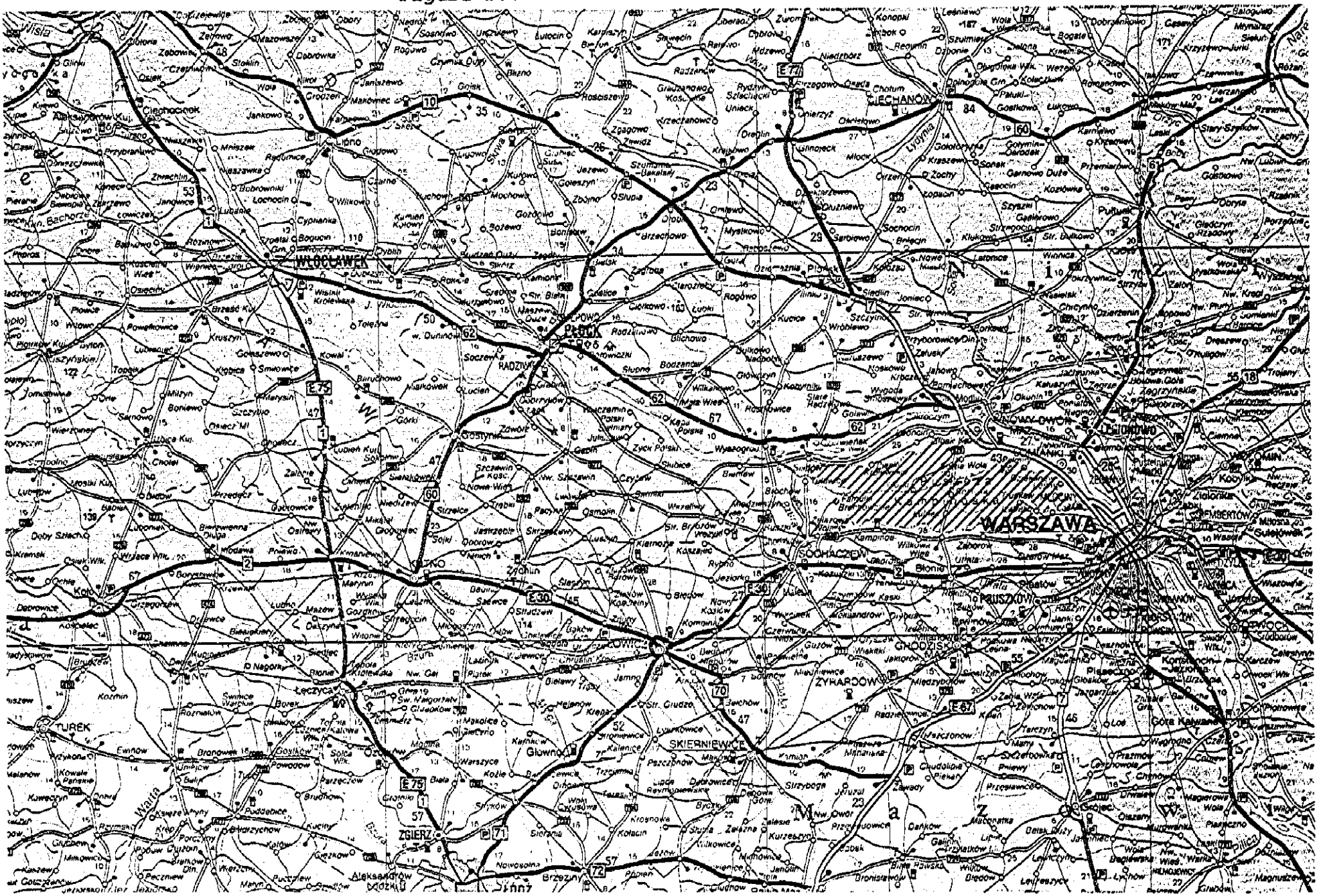
Figure 2.1-1 CRUDE OIL THROUGHPUT AT PPSA



2.2 Location of PPSA

PPSA is located in Plock city, 120 km north-West of Warsaw, the capital of Poland.
PPSA lies along the Vistula River with an area of 700 hectares (about 3.5 km from east to west, about 2.5 km from north to south). Refer to Figure 2.2-1 for the location.

Figure 2.2-1 MAP OF REPUBLIC OF POLAND



2.2-3

2.3 Plants of PPSA and their layout

2.3.1 Refinery section

There are four(4) trains of atmospheric distillation units, combined with vacuum distillation unit and the total capacity of the atmospheric distillation units is 12.6 million ton/year (290,000 BPD).
As can be seen in Table 2.1-1, this is a large scale refinery which includes 4 trains of reformer units, 2 trains of FCC units, 1 train of Alkylation unit and MTBE, etc., in addition to the atmospheric distillation units. However there is not an atmospheric residue desulfurization unit at present.

2.3.2 Petrochemical section

There are two(2) trains of ethylene plants, total capacity of 363 thousand ton/year and other petrochemical plants as shown in Table 2.1-1.
As can be seen in Table 2.1-1, there are 2 trains of polyethylene plants, 2 trains of polypropylene plants and aromatic production plants, etc., in addition to the 2 trains of ethylene plants.

2.3.3 Plant layout of PPSA and the typical oil flow between the plants

The layout of PPSA is shown in Figure 2.3-1.
Typical oil flow between the plants is shown in Figure 2.3-2.

2.3.4 Power plant section

PPSA has 10 boilers, of which No.1 through No.7 boilers generate high pressure steam (139 ata, 540°C) for electric power generation. Total generation capacity of high pressure steam is 2,640 t/h.
Remaining boilers are for heating purpose or backup and do not operate normally.
For the generation of power, there are 5 turbine generators, each having a capacity of 55 MW and totaling 275 MW. Power is generated at 10.5 KV and connected to the main bus of 30 KV through transformers. This main bus is connected to the national grid also.

2.3.5 Plants under engineering and construction (as of July 1994)

Plants under engineering and construction in PPSA as of July 1994 were as follows:

(1) A continuous catalyst regeneration reformer (CCR)

The CCR under the licence of UOP was under commissioning.

(2) A plant for the hydrodesulfurization of diesel oil

The plant is under price negotiation with a contractor at present.
Sulfur content of diesel oil will be decreased from 0.2 wt. ppm to 0.02 wt. ppm after the completion of the plant.

(3) Modernization of No.2 crude distillation unit

PPSA is implementing basic & detailed engineering except for detailed engineering of internal of the atmospheric and vacuum distillation columns.

Procurement is also being done by PPSA except for the internals of the two columns.
The site work will be started from September 1994 and the completion of the modernization will be March 1996.

(4) Modernization of No.4 crude distillation unit

PPSA is implementing the conceptual design which will be finished by the end of November 1994 followed by basic engineering, then detailed engineering and procurement.
The completion of the modernization will be Autumn 1997.

(5) Flue gas desulfurization unit

This is to treat the flue gas from the power plants to satisfy more stringent flue gas regulations which will be applied from the first of January 1998.
The selection of the process is undertaking at present.

Figure 2.3-1 LAYOUT OF PPSA

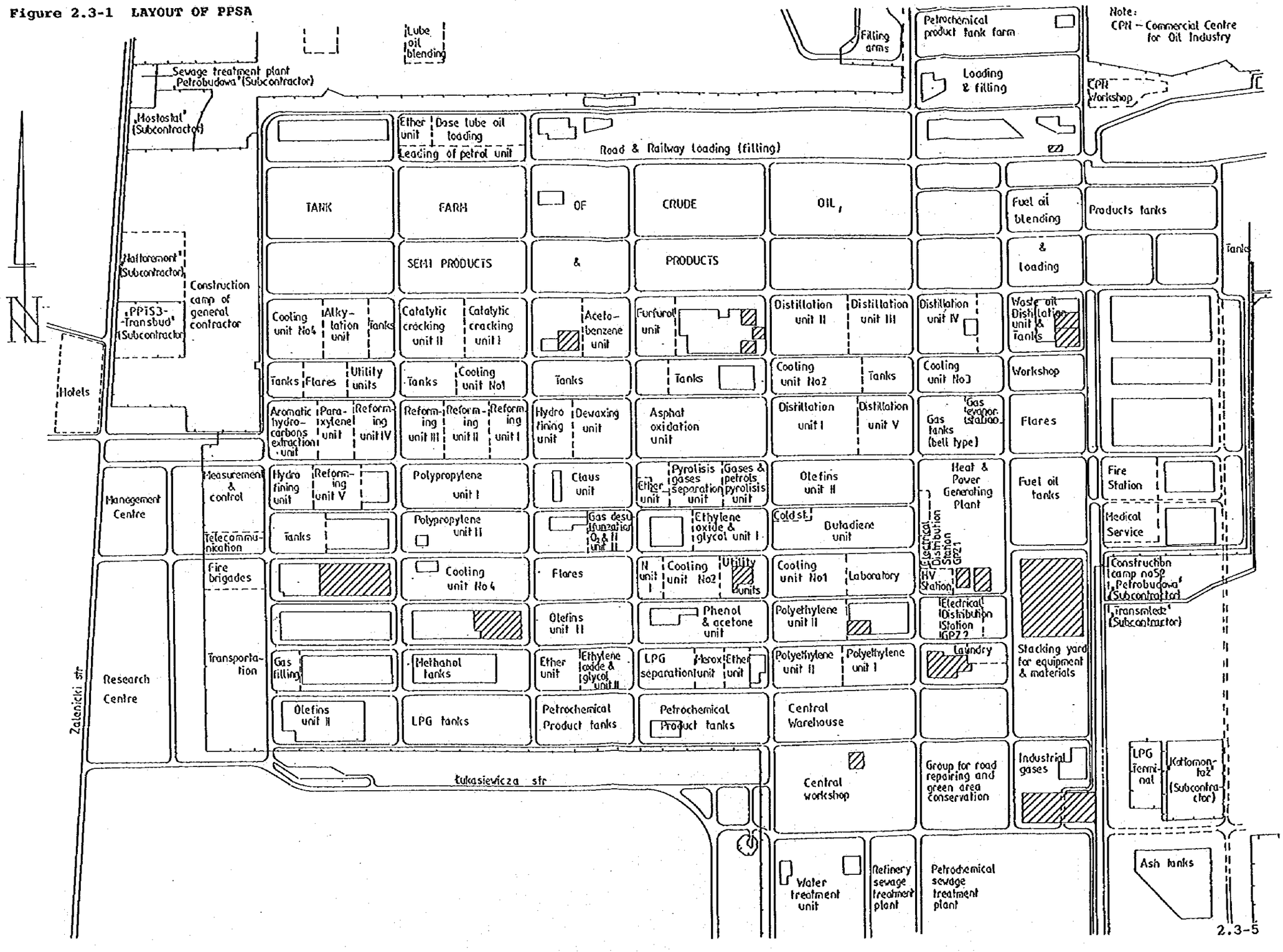
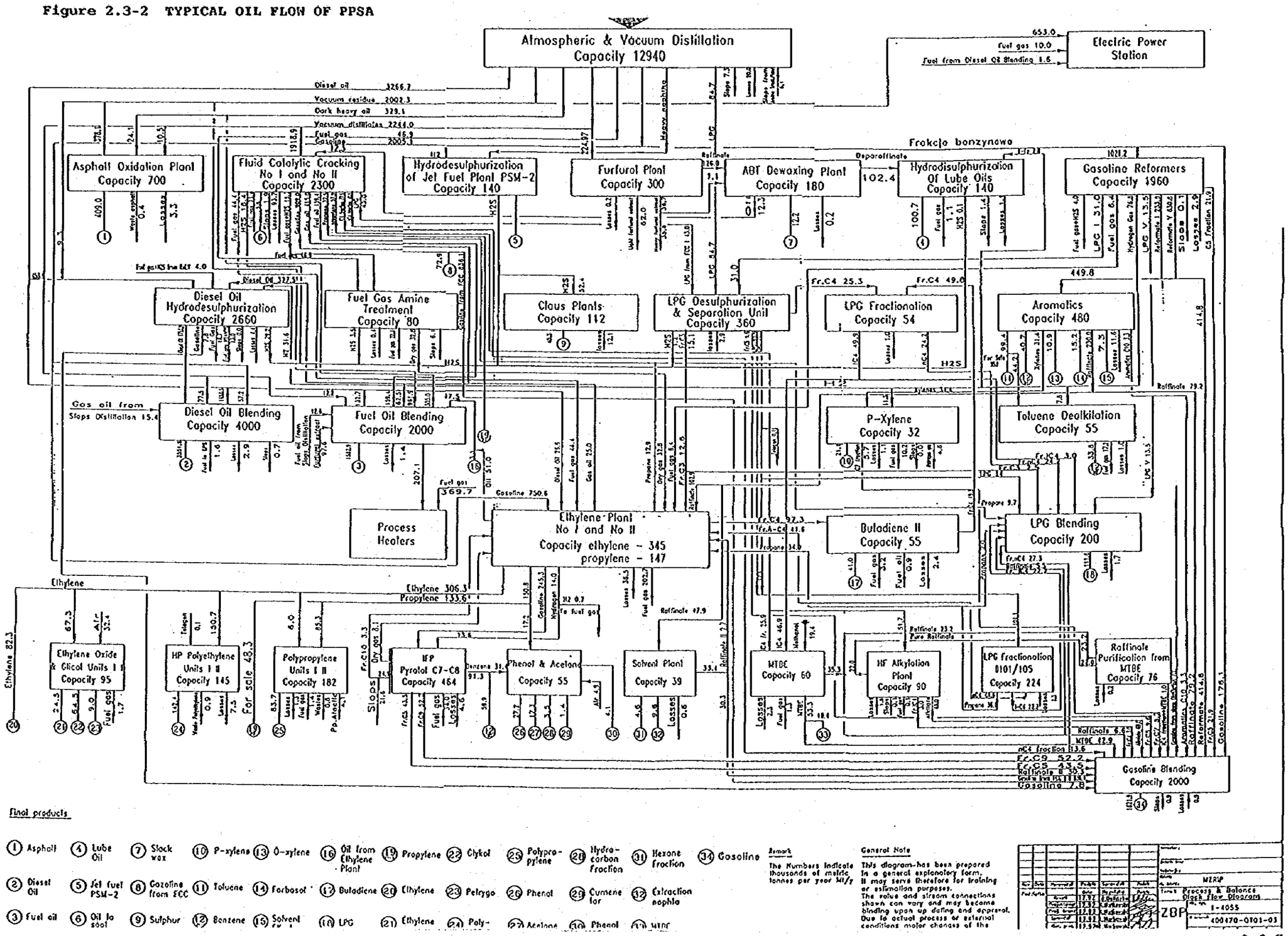


Figure 2.3-2 TYPICAL OIL FLOW OF PPSA

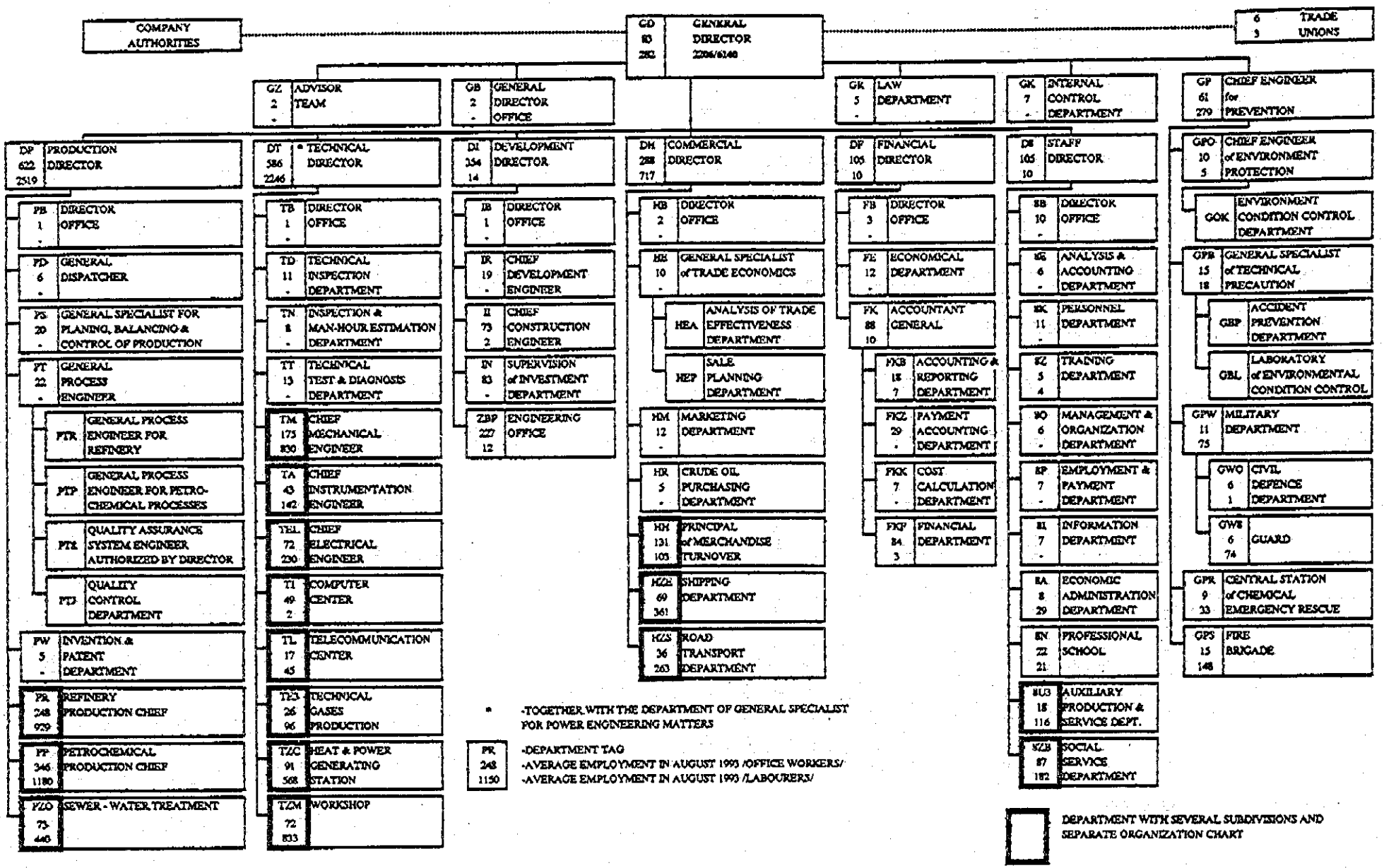


2.4 Management of PPSA

There is an executive board under the Ministry of Privatization consisting of ten(10) members of which three(3) Directors are nominated by the Minister,and six (6) nominated by the labor union. The remaining one(1) is the Managing Director of the company.

PPSA is managed by the President and five(5) Directors, i.e., Technical Director, Trade Director, Finance Director, Production Director and Social Director.
The outline of the organization of PPSA is as shown in Figure 2.4-1 which was received during the first site visit, November 1993.

Figure 2.4-1 ORGANIZATION CHART OF PPSA



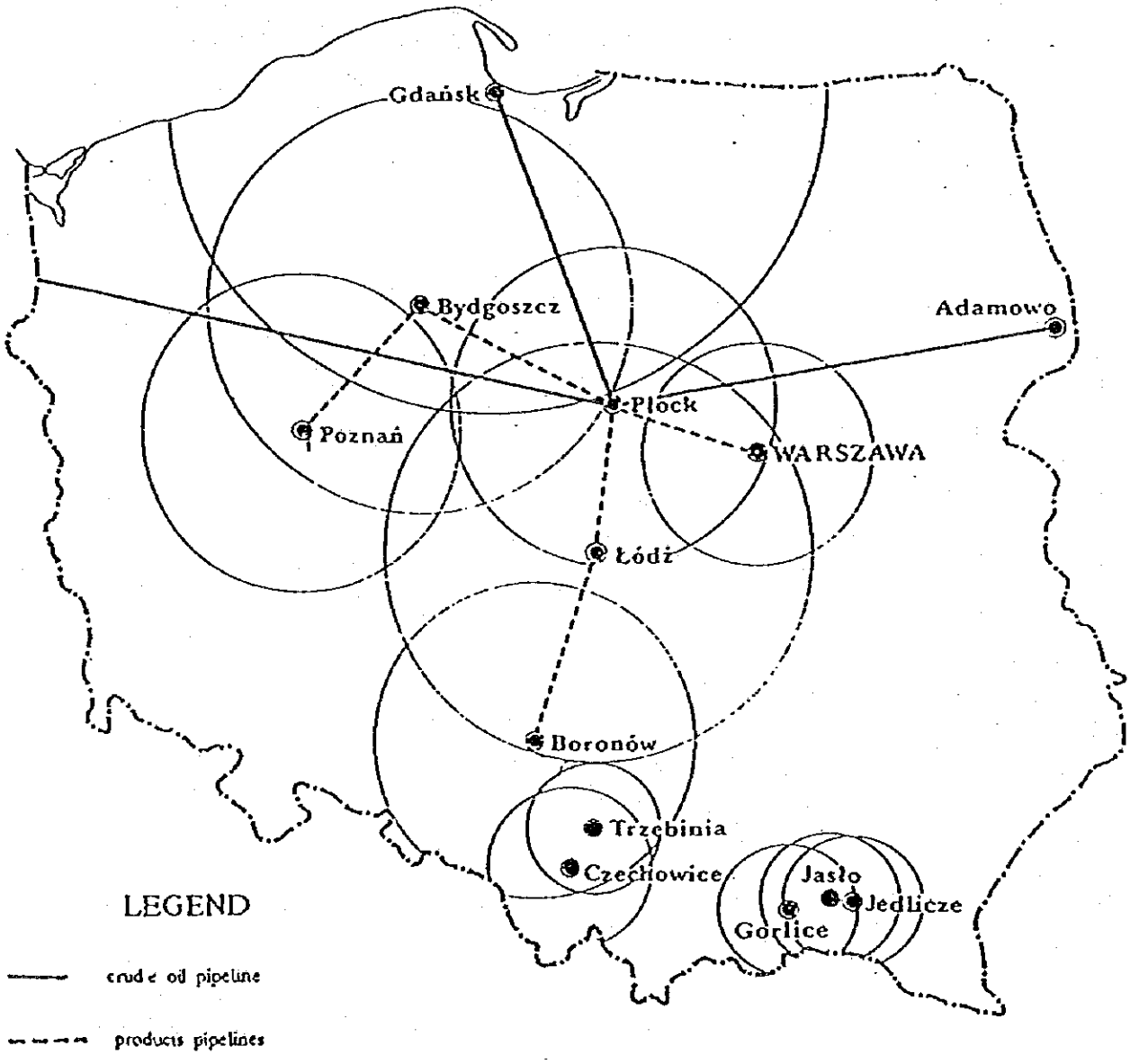
2.5 The Status of PPSA in Poland

The capacity of the atmospheric distillation unit of PPSA accounts for 72% of all capacity in Poland in 1992. According to Table 1.5-3(2), it is estimated that the capacity will account for 68% in 1995 and 50.7% in 2005, therefore PPSA is stable as a main refinery in Poland for the future.

2.6 Crude Oil Supply to PPSA

There are two(2) ways to supply crude oil to PPSA. One is by the friendship pipe line from Adamowo which supplies Ural crude oil. The other is by the Northern pipe line from Gdanisk on the coast of the Baltic Sea which supplies Middle East and North Sea crude oil (Refer to Figure 2.6-1).

Figure 2.6-1 MZRIP PLOCK, OTHER POLISH REFINERIES AND THEIR PRODUCTS DISTRIBUTION SYSTEMS LOCATION



2.7 Import of Crude Oil

There are no restrictions to importing crude oil into Poland. Therefore anybody can import crude oil from all over the world.

However, because of the barter trade, Russian crude oil is purchased through "CIECH" only.
Now, PPSA purchases 40 to 50% of its crude oil from the Middle East and the North Sea for PPSA's total throughput.

2.8 Investment Plan

Almost all the plant which was constructed under the old political structure emphasises plant maintenance and places little emphasis on modernization, although small revamps were implemented.

With the switching to a market economy and the tightening of regulations for environmental protection, modernization of the plants has become a necessity.

PPSA is now aiming to be a powerful, effective and profitable refinery by capital investment.

The following is the main items which PPSA plans:

2.8.1 Refinery section

(1) Modernization of crude units from No.1 to No.4

(2) Construction of asphalt plant

(3) Revamping of No.2 FCC unit

(4) Construction of fuel oil blend

(5) Construction of desulfurization plant of FCC charge oil

(6) Construction of desulfurization plant of lubricant oil

(7) Construction of crude oil blending plant

(8) Construction of Jet A-1 Merox plant

2.8.2 Petrochemical section

(1) Modernization of No.2 Olefins unit

(2) Construction of storage plant of No.2 ethylene plant

(3) Construction of polypropylene film plant

(4) Construction of No.3 polyethylene plant

(5) Construction of C_2 recovery plant from FCC gas

2.8.3 Power plant section

(1) Construction of flue gas desulfurization plant

(2) Construction of control unit of power plant

(3) Construction of No.6 power plant

(4) Modernization of boiler plant from No.1 to No.3

(5) Replacement of cables and transformers

2.8.4 Environmental pollution prevention section

(1) Recovery of hydrocarbon vapor from tank car

(2) Construction of waste water treatment plant

(3) Decrease of hydrocarbon vapor from waste water treatment plant

(4) Revamping of waste water treatment plant

(5) Decrease of benzene emission