THE STUDY REPORT ON RENOVATION OF THE CEPU OIL AND GAS TRAINING CENTRE IN THE REPUBLIC OF INDONESIA

(SUMMARY)

JANUARY 1986

JAPAN INTERNATIONAL COOPERATION AGENCY

TOKYO, JAPAN

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ABBREVIATIONS

AKAMIGAS	Akademi Minjak dan Gas Bumi; Oil and Gas Academy
APC	ASEAN Pacific Countries
API	American Petroleum Institute
ASTM	American Society for Testing and Materials
BOD	Batching oil distillate
CTC	Cepu Training Centre
HGO	Heavy gas oil
JICA	Japan International Cooperation Agency
JCCP	Japan Cooperation Centre for Petroleum Industry Development
JIS	Japan Industrial Standards
LCV	level control valve
LGO	Light gas oil
LPG	Liquefied petroleum gas
NBP	Normal boiling point
OJT	On-the-Job training
PERTAMINA	Pertambangan Minyak dan Gas Bumi Nasional; National oil and Natural Gas Mining
PH Solar	Paraffin high content solar
PID	Proportional, integral and derivative
PPT, MIGAS	Pusat Pengembangan Teknologi, Directorate Jenderal Minyak Dan Gas Bumi; Oil and Gas Manpower Development Centre
PPTMGB "LEMIGAS"	Pusat Pengembangan Teknologi Minyak dan Gas Bumi; Oil and Gas Research and Technology Development Centre
RPM, rpm	Revolution per minute
TBP	True boiling point
TCDC	Technical Cooperation among Developing Countries
TRC	Temperature record controller
UNDP	United Nations Development Programme

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Chapter 1 Introduction

1.1 Background, Objectives and Scope of the Study

This study on renovation of the Cepu Oil and Gas Training Centre is based on the matter officially requested by the Government of Indonesia under the registration number CTA-159 at the Annual Meeting on Technical Cooperation between the two countries held in August 1984. This request was a package of technical assistance which consisted of the following four major study items:

(1) Feasibility study of enhanced recovery programme of cude oil (secondary and tertiary recovery) from Kawengan field located near Cepu in the Central Java.

(2) Study on renovation of the existing refinery and related facilities, workshop machine and laboratory equipment of the Cepu Oil and Gas Training Centre (the Centre).

(3) Technical assistance programme project for training of the teaching staff and instructors of the Centre.

(4) Supply of equipment and materials to the Centre.

In responce to the above request, the Japan International Cooperation Agency (JICA), after a series of discussions with relevant government organizations of Japan, decided to take up the above item (3) on the study of renovation for the refinery and other facilities and equipment of the Centre, as a possible study item capable of being handled under the present organizational framework of JICA. Based on this decision, the pre-mission organized by JICA was despatched to Indonesia in March 1985, and accordingly reached an agreement with the Directrate General of Oil and Gas, Ministry of Mines and Energy.

The principal objective of the proposed renovation study is to diagnose the existing refinery and related facilities, workshop and laboratories of the Centre, to discuss and analyse possibilities for their renovation from the technical, economic and training points of view, and to formulate the most

suitable/appropriate renovation plan for the facilities and training activities of the Centre so as to satisfy the growing need raised from the oil and gas industry in Indonesia and ASEAN-Pacific region as well.

Enumerated below are the major study components stipulated in the agreed Terms of Reference:

a) Policy and basic idea of the Government of Indonesia for the Centre and its renovation.

b) Study on the organization and management of the Centre

c) Study on the refining process

e) Study on the training activities

f) Formulation, analysis and evaluation of renovation plans

g) Conclusions and recommendations

1.2 Study Procedures

In accordance with the agreement made between the two countries on March 6, 1985, JICA has undertaken the proposed study, and despatched the study team headed by Mr. Susumu Nakagawa and consisting of 8 experts to Indonesia to perform its field work during three weeks from July 1 to July 21 (from July 4 to July 19 in Cepu).

During the stay in Indonesia, the JICA study team carried out the following major activities supported with the assistance and colaboration given by the counterpart team consisting of the senior staff members of the Centre.

(1) Discussions on the operation and maintenance of the existing refinery and related facilities of the Cepu Oil and Gas Training Centre, the organization and management, and training activities, as well as on the necessity of renovation and future renovation plans.

(2) Inspection and diagnosis of the existing facilities and equipment of the oil fields, crude pipeline, refinery and related offsite, laboratory and workshop, and AKAMIGAS. Especially as for the refinery, both onstream inspection and shutdown/open inspection were carried out.

(3) Collection and review of relevant data and information.

(4) Inquiry to and interview with, the Training Department of PERTAMINA and the top management/ senior staff of the Centre as to the training need and training effectiveness of, the Centre's activities.

This report is a summary of the study report that has been prepared based on results of the field work in Indonesia and also through a detailed analysis and check up in Japan of the data and information with the participation of and interchange of opinions with, the three counterpart experts of the Centre (Ir. Santosa Suparma, Ir. Mustakim, and Ir. Sunarhadiyanto) in Japan for 4 weeks in October 1985.

The JICA team wishes to express its sincere gratitude to Mr. Muchtisar DP., Director of the Cepu Oil and Gas Training Centre and all the members of the counterparts team for their valuable assistance and cooperation extended for the completion of the proposed study.

Chapter 2 Factfinding on the Cepu Oil and Gas Training Centre

This Chapter summarizes the present situation of the Cepu Oil and Gas Training Centre, and points out and discusses the following major study items based on the findings and observations made through the field survey in Indonesia.

(1) Policy and basic idea of the Government of Indonesia as to the Cepu Oil and Gas Training Centre and its renovation.

(2) Organization and management of the Centre

(3) Training needs to the Centre

(4) AKAMIGAS and educational/training activities

(5) Existing facilities and equipment (refinery and related facilities, laboratory, workshop and other surface facilities)

2.1 Basic Idea of the Government of Indonesia for Renovation of the Cepu Oil and Gas Training Centre, and Organization and Management of the Centre

2.1.1 Basic Idea of the Government of Indonesia for Renovation of the Cepu Oil and Gas Training Centre

Through a series of discussions and mutual exchange of opinions with the top management and senior staff of the Centre, it is clarified that the fundamental necessity for the renovation of the Centre consists of the following three points:

(1) Development of knowledge and skill of the teaching staff and instructors of the Centre, especially professional knowledge in various fields of oil and gas industry. Development of teaching skill and profession.

(2) Development and adoption of more effective and efficient training method in order to reduce and minimize training cost and time.

(3) Improvement and modernization/renewal of educational and training facilities, equipment and aids.

At the same time, it is also understood that the basic idea of the Government for the Centre consists primarily of the following two points:

(1) The Cepu Oil and Gas Training Centre is an important and indispensable institution within the framework of the domestic educational and training system in the oil and gas industry.

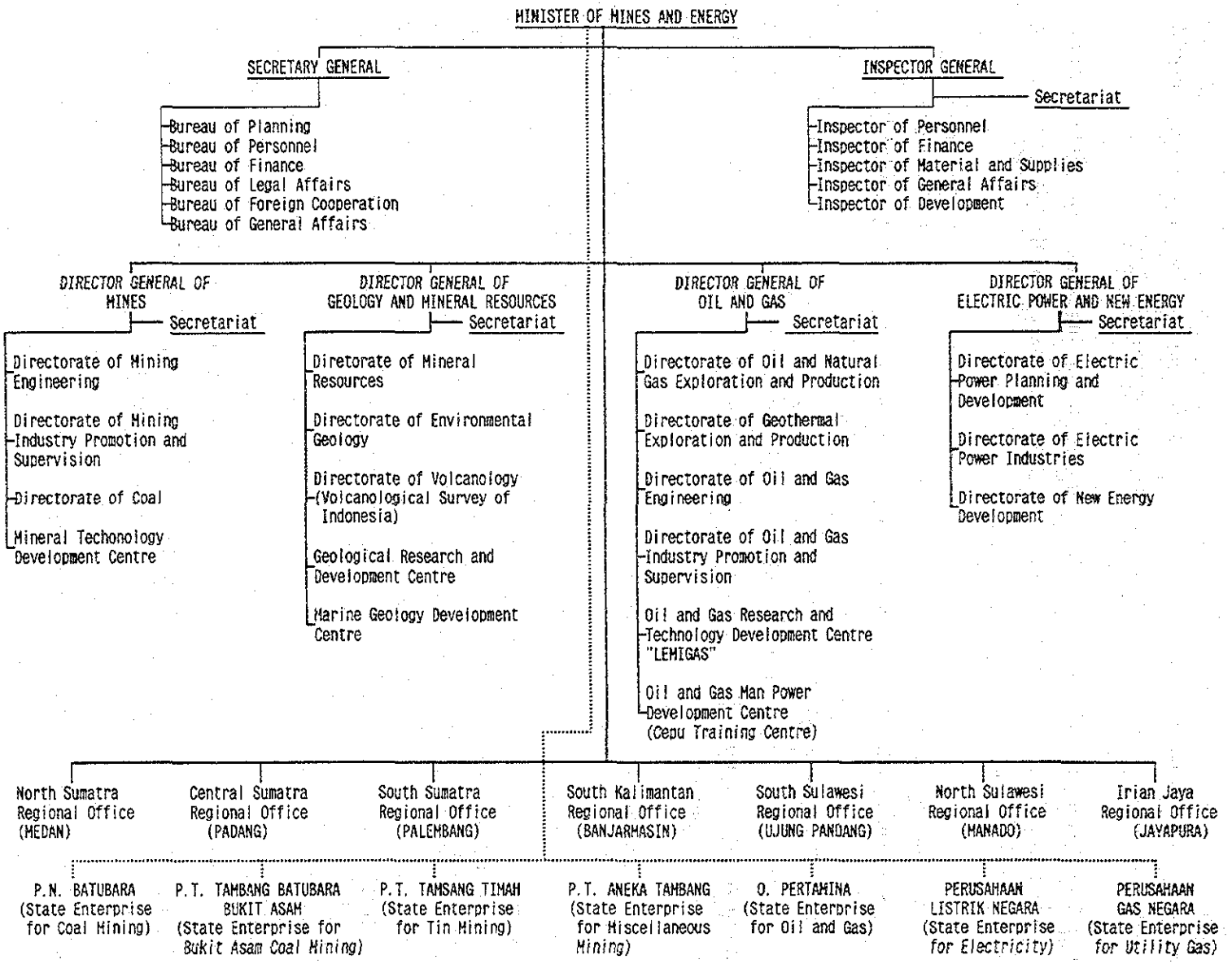
(2) At the same time, the Centre should be requested to strengthen and establish a solid position as a regional training centre for ASEAN-Pacific.

In line with such necessity and idea, it is strongly desired that the Cepu Oil and Gas Training Centre be equipped with all the necessary and enough training facilities and equipment and, as a result, be self-sufficient in its educational and training activities.

2.1.2 Organization and Management of the Cepu Oil and Gas Training Centre

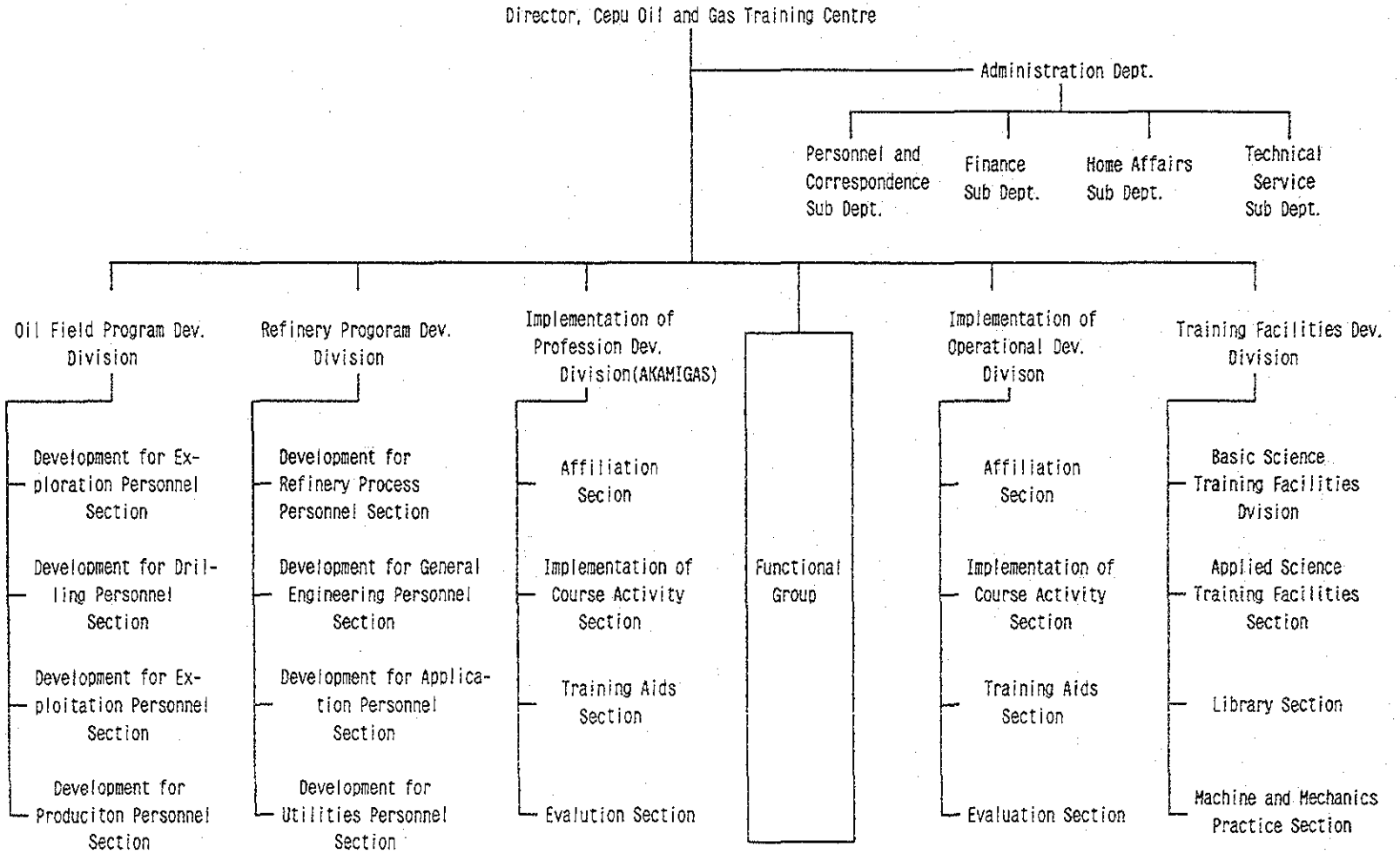
The Oil and Gas Technology Research and Development Centre (LEMIGAS), the mother's body of the Cepu Oil and Gas Training Centre, was established in Cipulia of Jakarta, in 1965 by the Indonesian decree. One year later, the oil fields near Cepu already reaching the end of its commercial life at that time, were transferred to LEMIGAS together with the Cepu refinery as training facilities, and the Cepu Oil and Gas Training Centre (called PPT MIGAS in the Indonesian language) was established there for the purpose to educate and train engineers and technicians working in the Indonesian oil and gas industry. As stated above, the Cepu Training Centre was traditionally a part of the organization of LEMIGAS. However, in line with the modification of the institutional structure of the Government of Indonesia (Figure 2-1 indicates the organizational structure of the Ministry of Mines and Energy as of April 1985) carried out in 1984, it was separated from LEMIGAS and became an independent of LEMIGAS and a parallel Governmental institution within the Ministry of Mines and Energy. Figure 2-2 shows an organization chart of the Oil and Gas Training Centre (hereinafter referred to as "The Centre"). As of July 1985, the total number of employees of the Centre amounts to 1,417.

FIGURE 2 – 1 ORGANIZATION CHART OF MINISTRY OF MINES AND ENERGY INDONESIA



(as of 1985)

Figure 2-2 ORGANIZATIONAL STRUCTURE OF CEPU OIL AND GAS TRAINING CENTRE



(as of July.1985)

The Centre comprizes 5 Divisions, 1 Department and 1 Functional Group.

Themajor function of the Centre can be summarized below:

a) Planning and evaluation of the training

b) Implementation/accomplishment of the training

c) Technical support to the training activities

d) Administration and finance of the training.

The Centre, as noted before, is an important governmental institution assuming responsibility to report directly to the Minister of Mines and Energy through the Director General of Oil and Gas, and at the same time, acts as a servicing institution to PERTAMINA in terms of education and training.

The discussions and interviews with the top management and senior staff of the Centre, findings and observations during the field survey in Indonesia, and investigation and check-up of relevant data and information, all of these have resulted in a conclusion that the organization of the Centre is properly functioned and the management is reliable and sure supported with its long history and abundant experience.

As for the management aspects of the Centre, it has to be only pointed out that there are still rooms for improving the organization and management for maintenance. It has to be clearly noted that the maintenance plan and its execution being applied to the existing refinery of the Centre does not totally meet even minimum permissible standard required for industrial plants, and that this problem brings to the operation of the refinery of the Centre a great danger (fire and explosion). Although this can not be attributable to the organization and management of the Centre, but should instead be attributed to lack of sufficient budget allocated so far to rehabilitation and renewal of the refinery. In any case, the Centre should pay highest attention to the maintenance and safety aspects.

2.2 Training Needs

The clients for the training courses offered by the Centre can be classified into the following five groups: i) PERTAMINA, the national petroleum company, ii) foreign oil contractors operating in Indonesia under the contract with PERTAMINA (eg. BADAK, HAFFCO, ASAMERA, PTSI, etc.), iii) oil and gas related companies (eg. P.T. ARUN, etc.), iv) oil and gas related institutions (eg. Ministry of Mines and Energy, Ministry of Industry, and their research institutions, etc.), and v) developing countries, especially in ASEAN-Pacific region.

The training need can be considered to be the most fundamental factor constituting the market for educational and training activities and business. In this respect, it is essential for the Centre to know and understand the present and future trends in the training need from the potential clients of the Centre, especially for the purpose to manage, develop and improve its training activities and facilities.

The training need can be divided into quantitative need and qualitative need. The quantitative need indicates trends in training volume/numbers of persons to be educated/trained, while the qualitative need consists of fields of specialization in which training is needed, and requirements for contents of training, training facilities and equipment, etc.

In order to substantiate such training need raised by the clients and to carry out training, it is indispensable to have a good reputation and confidence as a training institution. In this sense, it is greatly appreciated that the Centre has already established and have a highly reputable confidence of the clients and other relevant organizations in the country and abroad as well. It is therefore considered that a solid foundation has already been established for further development of the Centre in line with the basic policy and idea of the Government of Indonesia as stated in the previous section 2.1.

2.2.1 Quantitative Training Needs

As of 1985, PERTAMINA employs approximately 50,000 persons, and the foreign oil contractors together with the oil and gas related industries in Indonesia employ additional 50,000 persons. Therefore, at present, a total of 100,000 persons are engaged in the Indonesian oil and gas industry. According to the

Training Department of PERTAMINA, the total number of persons requiring training is estimated at about 11,000 persons each year, taking into account future development plans for the industry and also trends in new recruitment and retirement of employees.

On the other hand, the Centre can accept only 600 to 700 students each year for the regular courses (AKAMIGAS) because of lack of sufficient accomodation and facilities. The AKAMIGAS regular training courses are principally utilized as a means of carrier development programme of PERTAMINA employees. However, the training demand for PERTAMINA can not be covered only by the AKAMIGAS regular courses and therefore, four additional regular courses are set up within the curriculum of the short courses in order to partly supplement the AKAMIGAS regular courses.

It is basically impossible to absorb the extensive and excessive training demand/volume raised by the Centre's clients. In parallel with the AKAMIGAS regular courses, 20 to 30 short courses for different subjects are offered each year.

Yet, however, the Centre can accept only 500 to 1,000 short course students from PERTAMINA, and can not cover the potential training demand even only from PERTAMINA. It is a basic idea of PERTAMINA that, so far as possible, it wishes to despatch as many students/trainees as possible to the Centre, while reducing and stopping the corresponding training courses being implemented internally within PERTAMINA.

A good reputation of the Centre as a training institution in the fields of oil and gas technologies is increasingly being recognized also in the abroad, thanks to its steady and continuous efforts so far made for the development of training activities. Reflecting this situation, the training need is also arising in foreign countries. Under such circumstance, TCDC (Technical Cooperation among Developing Countries) programme was held in Cepu in 1984 under the financial assistance from UNDP. The growth of training need to the Centre from developing countries requires the continuation of this TCDC training programme every year. In 1985, also, the first ASEAN-Pacific training programme is opened in the Centre. Therefore, the Centre is requested not only to be an indispensable institution within the framework of domestic educational/training system, but at the same time to strengthen, in its nature, important role as a regional training centre.

2.2.2 Qualitative Training Need

AKAMIGAS is now offering 15 regular courses, each of which consists of three different levels called Grade-I, Grade-II and Grade-III. Historical performance of the regular courses shows that the highest training need exists in such fields of technologies as mechanical, petroleum refining, and instrumentation and electrical technologies.

As for the level and grade of courses, there is a greater demand in Grade-I, followed by Grade-II and Grade-III in descending order of training need. According to PERTAMINA, the education/training in AKAMIGAS is most appropriate to undergraduate students. The AKAMIGAS courses is insufficient for the training purpose of postgraduate students, for which more modern facilities and equipment would be required together with higher levels of curriculum.

Among different subjects for the short courses, courses for computers and management related subjects will be in a growing demand. In addition to the present subjects of the short courses, an increasing demand is found in the follwing new subjects:

- Inspection of facilities and equipment
- Firefighting
- Basic production
- Hydrocarbon distribution system
- Shipping operation
- Basic material science

In order to implement these new courses, additional funds are required for obtaining training equipment and materials in addition to the preparation of software such as curriculum, syllabus and instruction manuals, etc.

Naturally, the Centre's execution of training activities both in the regular and short courses requires adequate training facilities and equipment. Nevertheless, most of the existing facilities and equipment, especially, the existing refinery, and equipment and machine installed in the workshop and laboratories, are already technologically behind and too old/out-of-date to be used any longer properly for their purposes. It is clearly noted that the introduction/adoption of modern advanced equipment has been seriously delayed due to lack of sufficient

budget. The Training Department of PERTAMINA has, in this respect, great concerns with the improvement of the training facilities and equipment as well as the increase of the accomodation capacity of the Centre, with its desire that PERTAMINA would despatch more students to the Centre.

2.3 AKAMIGAS and Training Activities[1/]

Descriptions on the present state of AKAMIGAS and the Centre's educational/training activities are omitted from this English summary. Reference can be made to the main report.

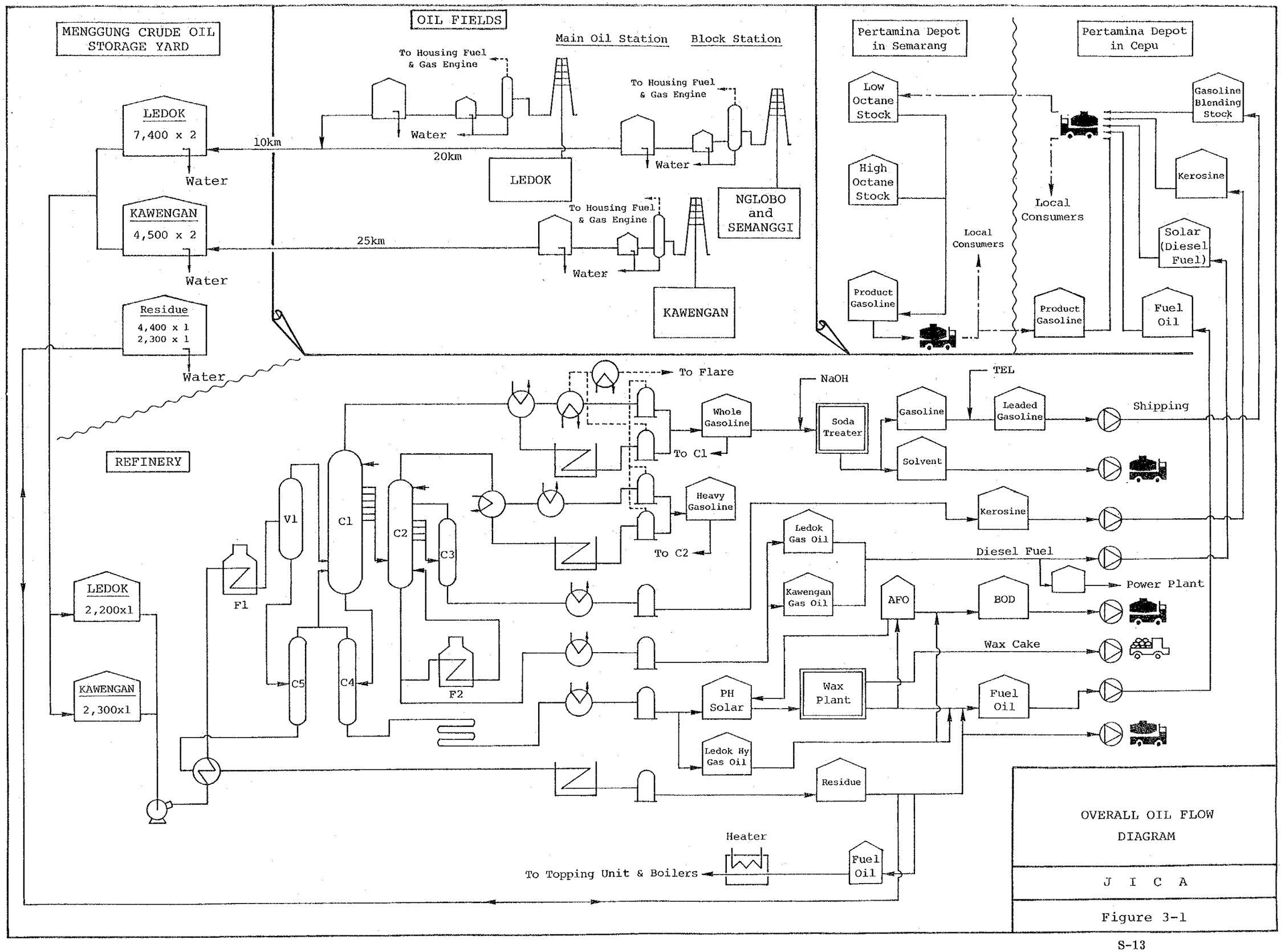
2.4 Existing Production Facilities of the Centre

The Centre's existing production facilities consist of the upperstream oil production facilities in the oil fields, the down-stream refinery (atmospheric distillation unit) and their related facilities, and the connecting pipelines, etc. Petroleum products from the Centre are destined both to PERTAMINA depot located in Cepu by pipeline and to local industries by means of tank lorries. An overall picture of oil flow is schematically shown in Figure 3-1.

An outline of those facilities related to the existing refinery as of July 1985 is given below:

Facilities and Equipment	Capacities and Remarks
Atmospheric Distillation Unit	2,000 BPSD
Wax Unit	60 K1/D
Storage Facilities	Crude oil: 2 units
	Semifinished Products: 34 units
	Other Tanks: 6 units

Note: 1/ For the sake of Japanese readers, descriptions are given in the Japanese summary.



OVERALL OIL FLOW DIAGRAM

J I C A

Figure 3-1

Distribution Facilities	Pipeline (gasoline, kerosene, gas oil and fuel oil) : 4 lines Tank lorries (solvents, BOD and residue): 3 units
Boiler	6 T/H x 3 units
Power Generator	820 KVA x 3 units (Diesel engine)
Water Treatment Facilities	Cooling water, boiler feed water, fire fighting water, and drinking water: 4 series Cooling tower (for the atomospheric unit and wax unit): 2 units
Fire Fighting Facilities	Tank foaming fire fighting installation: 2 series Fire fighting vehicle: 1 unit Portable fire engine: 2 units
Waste Water Treatment:	CPI: 1 unit Conventional oil separator: 2 units
Testing Facilities	Oil Laboratory and analytical laboratory
Workshop	Repair workshop, construction workshop, foundry, and pipeshop.
Others	Gasoline washing facility: 1 unit Loading facility: 1 unit Fuel oil system: 1 unit Fuel gas system: 1 unit

For further descriptions[1/] on the existing facilities especially as to the process and mechanical aspectes of the refinery, reference is to be made to the main report.

Note: 1/ For the sake of Japanese readers, descriptions are given in the Japanese summary.

Chapter 3 Diagnosis and Countermeasures

On the basis of the factfinding survey of the Cepu Oil and Gas Training Centre and the field inspection work done for the existing facilities and equipment, this chapter presents a summary of the JICA team's diagnosis and countermeasures for renovation of the existing refinery (atmospheric distillation unit) and its related facilities, workshop, laboratories, and the Centre's educational/training activities.

It has to be noted, however, that recommendations presented in this chapter are all made in view of renovation of the existing refinery (atmospheric unit), and that those for a new unit will be made in the next chapter.

3.1 Process, Operation, and Administrative Problems of the Existing Refinery

3.1.1 Operation Manual

The following points of care should be taken at the time of revising the operation manual of the atmospheric distillation unit:

(1) To supplement to the manual, a process flow sheet showing process conditions (temperature, pressure and flow rate) and major instruments, and simple diagrams indicating several lines for crude feed, distillates rundown, fuel and gas, and steam, etc.

(2) To chart every procedure by utilizing time schedule chart and check sheet as long as possible to make the procedure more easily understandable.

(3) To express, in numeric values as long as possible, the process operation conditions, utilities conditions, targets for properties of distillates, and rundown temperatures which are all important determinant factors for the operation of the unit.

(4) To supplement the control and consumption conditions of chemicals such as ammonia and caustic soda.

(5) To clarify job scope of each operator and equipment in his duty, and prepare to add a list of facilities and equipment by each person in charge.

3.1.2 Operation Record

The records of daily inspection during the operation in accordance with the check list, records for job transfer to next operation shift, and log sheets should be certainly taken and used as both fundamental data for performance diagnosis of facility and data for maintenance. In addition, the test run which forms a basis for the diagnosis for performance and modification of the atmospheric unit, should be executed twice a year.

3.1.3 Equipment List and Mainteance Report

The contents of the equipment list and mainteance report of the Center are neither sufficient nor well filed because the facilities are too old. Therefore, these records should be kept perfect and utilized for the improvement of facilities and their maintenance plan.

3.1.4 Operation Management of Heating Furnace

(1) Flow rate inside Heating Furnace Tube

The flow rate inside the current heating furnace tube is much lower than the lowest allowable limit. A proposal for changing the present parallel use of the 2 heating furnaces to the serial use of them causes pressure drop in tube (The present pressure drop of about 1kg/cm^{2}G is raised up to about 8kg/cm^{2}G.) so as to generate the problems such as the pump head and the resisting pressure of heat exchanger/heating furnace tube. Even this proposal makes the current condition slightly improved, but the flow rate is still insufficient so as to cause tube coking. The optimum size of heating furnace tube of the atmospheric distillation unit of 2,000 BPSD is calculated to be 2.5 inches. However, even if 1 unit of heating furnace is employed by replacing the present furnace tube with this size of tube, further and more extensive improvements should be required as to the burner capacity and the efficiency of heating furnace. If this is the case, the pressure drop of heating furnace tube is raised from the current value of about 1kg/cm^2 to about 16kg/cm^2 so that the present crude charge pump and heat exchanger need to be replaced accordingly.

(2) Operation management

The monitoring equipment should be improved in the following points in view of the safety and energy saving of each heating furnace.

a) To renew the combustion gas thermometer, heating tube surface thermometer, stack thermometer, and temperature recorders.

b) To install the combustion gas pressure gauge (draft gauge).

c) To install the oxygen concentration monitor (switchover type). (This is used also as an anlyzer of combustion gas samples)

d) To install the flow meters for fuel oil and fuel gas.

e) To install the alarm for monitoring the temperature at the heating furnace exit.

f) To improve the peep hole position.

3.1.5 Operation Management of Tower and Vessel, and Heat Exchanger

The instruments for measuring the temperature, pressure, and flow rate concerning to each tower and vessel should be completely provided and expanded, and they must be recorded on the log sheet so as to be used for not only checking inflows and outflows of material but also checking their performance. Moreover, it is important from the operation management points of view to plot these data items and testing data of properties of distillates on a graph, analyze them, and to clarify the relationship between yields/properties of distillates and the operation data.

Also for the heat exchangers, the thermometers and flow meters should be completely provided and expanded to check the degree of fouling by measuring the reduction of overall heat transmission coefficient. Further, the flow rate of cooling water in tubular side needs to be checked to minimize corrosion. If necessary, energy-saving operation to be performed by replacing the cooling tower pump and by the impeller cutting, should be studied.

3.1.6 Operation Management of Pump

In order to solve the problem of blocking of strainer for the centrifugal-type reboiler pump, improvement of strainer such as installation of switching strainer or automatic strainer can be considered, though this is not a drastic measure.

More suitably, however, the following measures should be taken from the viewpoints of preventing generation and deposition of scale on the upper stream side of the strainer

- Improvement of operation control facilities for the heating furnace
- Completion of the control measure against corrosion
- Regularization of cleaning the upper stream facility, (tower) and the inside of piping

3.1.7 Quality Control and Testing Facilities

The daily frequency of sampling distillates and the number of testing items are too high. This is principally attributable to the instability of operation of the atmospheric distillation unit.

In order to obtain the distillates with stabilized quality, periodical opening, cleaning, and maintenance of facilities should be first executed to improve the performance of the unit, and the relationship between the crude oil properties and operation condition should be next grasped to check the optimum operation condition at variance with crude oil properties and investigate the cause of instability of distillate oil properties.

Most of the testing facilities and equipment have been used for 10 to 15 years so that they are considered to already reach the time of renovation, and some of them are defective and cannot be used. In consideration of these conditions, the unusable equipment due to a failure and the equipment which has been used for 10 to 20 years and whose spare parts are no longer available sould be renewed. The automatic distillation tester, and automatic flash point tester, which have low MTBF (Mean Time Between Failures) and have been well used in Japan can be recommended.

3.1.8 Energy Saving

Energy saving is resulted from the cost conscious mind and as the barometer for evaluating it, the reduction of fuel oil/gas consumption has an important meaning. Based on the results of this renovation study centering on the atmospheric distillation unit, the model operation for an intrinsic facility for training will be established. Therefore, at this time, it is desirable to promote energy saving and foster the cost conscious mind.

3.1.9 On-the-job Training

For effective training, it is important to positively use the process control simulator and pilot plant. However, these facilities are greatly different from the actual production facilities in size so that they neither are so real nor covers all the works in an actual plant because the work contents and time are simplified.

At the present time when the simulator and pilot plant are being ready for use, renovation (modification or renewal of equipment) of the existing atmospheric distillation unit can be considered as essential requirements to enhance the effect of training activities of the Center especially for on-the-job training of those trainees who are supposed to work in modern refineries.

3.1.10 Quality Control and Process Flow

(1) LPG recovery

Since LPG content both in Kawengan and Ledok crude is very low, there is no need for recovering LPG by newly installing a stabilizer for the atmospheric distillation unit.

(2) Naphtha reforming and hydrodesulfurization of gas oil

The Center is not provided with processing units of petroleum distillates with a catalyst under high pressure, which are commonly installed in the modern oil refinery. Therefore, sometimes, an installation of naphtha reformer or hydrotreating unit of gas oil has been considered. However, there is only a small amount of naphtha and kerosene/gas oil so that this idea can not be properly justified. Consequently, it is reasonable that this problem is covered by the use of the process simulation and pilot plant.

(3) Increase in production of wax distillate

According to the analysis of Kawangan crude oil, the wax component exists at high concentration at more than 350`C fraction and is distributed on the both sides with the peak at 450 to 500`C fraction of TBP cut. That is, the wax component exists at high concentration in the distillate corresponding to the heavy vacuum distillate of the continuous vacuum distillation unit. Therefore, it can be understood as a general idea that the wax production can be increased by installing a vacuum distillation unit. Assuming that the ratio of Kawengan crude oil to the total processed crude oil is 5:8 with the yield of wax distillate from Kawengan crude oil being 31.1% (recorded in 1984), and that the number of onstream days is 150 days/year same as that of the atmospheric unit, the capacity required for the vacuum distillation unit can be calculated to be approximately 400 BPSD, based on the capacity of atmospheric distillation unit at 2,000 BPSD. The vacuum distillation unit of this size is not economical and unrealistic, as in the case for naphtha reformer and kerosene/gas oil hydrotreater. Next, deep cut of heavy gas oil with the atmospheric distillation unit can be considered as a measure to increase the production of wax distillate. However, the recent operation condition of the furnace for the existing atmospheric unit exceeds the limit of severity, judging from the coking in furnace tube, deterioration of tube, and other factors. Therefore, if installation of a new atmospheric distillation unit is adopted as a renovation plan, it can be considered that deep cut of heavy gas oil can be realized by re-circulating the residue to the furnace at the temperature of furnace exit of 365`C or injecting high-presure steam to the furnace inlet tube.

3.1.11 Purchasing and inventory control

For the purchasing and inventory control, the duties are well classified by their functions and the organization is well established corresponding to these duties. Therefore, it seems that the duties are well clarified and smoothly managed.

From the viewpoint of general concept, several problems can be pointed out. However, it has to be noted that the ideal inventory control (in a wide sense) cannot necessarily be executed in the Cepu training center, especially due to the Centre's special conditions, that most of the equipment and materials have to be purchased from the overseas and that the existing facilities are very old.

3.2 Mechanical Problems of the Refinery

3.2.1 Tower and Vessel

Column C1B has already caused buckling so that it is abnormal that the column is presently used. Oil leak has been often found in the rivet weld and caused the fire even if the emergency measure was taken against it. Therefore, this facility should not be used any more and it should be renovated.

For renovation of this facility, it is not recommendable to replace it with an identical one. The type of facility should be improved for easy maintenance. That is, the existing column has no side manhole so that the middle trays need to be lifted one by one from above and taken out for inspection after removing the top cover. To eliminate this very troublesome and time-consuming work, it is desirable that the new facility employ 3 side manholes for enabling each tray to be taken out. Further, the tray should be changed from the current bubble cap type to the valve type and the number of side-cut nozzles will be reduced to the minimum required number. The main frame is to be a monoblock structure welded. Therefore, the column weight can be greatly reduced. Though the existing column does not employ anchor bolts, the new column should have the improved structure and be fixed with anchor bolts. In addition, unnecessary column C1A should be removed.

For easy maintenance, column C2 also needs to be renovated. Moreover, it is desirable that evaporator V1 be renovated because it is very old having rivet structure, and its operation condition is very severe. Columns C3, C4 and C5 are also old and of bubble cap tray type. However, they are small and their maintenance seems to be not so difficult. Therefore, it is possible that they can be used as they are.

3.2.2 Furnace

The furnace is in an extremely bad condition so that it is unrecommendable to continue being used. (The Japanese law will immediately stop the operation of this furnace.) In this condition, it is not unusual if furnace wall falls at any time.

Though the furnace tube thickness has not become so thin as to be critical, thickness of 1.0 mm was detected at a point. This may not be the absolute

result in consideration of the reliability of measurement but the further detailed measurement is required for all the furnaces used to thoroughly detect every abnormal point. However, judging from the degree of color change and deformation, the tubes in the lower step should be replaced with new ones of 1/2% Mo. For furnace wall, all the inner and outer wall bricks should be replaced with new ones and the support beams in the furnace should be also replaced. All the baffleplates for the combustion gas in the furnace are broken and tube arrangement is disordered and deformed from the zigzag type almost to the square type. These may have greatly lowered the thermal efficiency of furnace.

All the facilities except the steel structure of main frame are in the unsatisfactory conditions so that they require total rehabilitation.

3.2.3 Heat Exchangers

(1) Heat exchanger

There are 3 crude oil-residual oil heat exchangers E1A, E1B, and E1C. E1C was replaced with a new one in 1974 due to corroded tube and E1A is not used now. E1B has no maintenance record since 1975 so that it has been used without maintenance. Therefore, it can be assumed that corrosion of the tube has almost reached the limit. The heat exchanger is a vertical type. E1C employs the floating head while the remaining 2 units employ the fixed tube sheet. Therefore, maintenance of shell is almost impossible. Moreover, they have been used for about 60 years. Therefore, E1A and E1B need to be renovated. In this case, for easy maintenance of shell, the new ones should be of floating head type.

Though it is related to the rehabilitation plan for the entire facilities, E1C should also be renovated at the same time so that it is replaced with 2 new units with the same dimensions as those of the convertional unit or 1 large-scale unit of horizontal type for easy maintenance.

(2) Condensor and cooler

Among 16 units currently used, other than 5 units is in good conditions (E4A, E5, E7, E14B, and E15A), the tube and tube sheet of the remaining 11 units are severely corroded. Many units have the leak tubes with plugs

and even the units (E5, E7, and E14B) in relatively good conditions have plugs. Therefore, if the tube end looks good at a glance, there seems to be many tubes which may cause leak. All of these units have been used for about 60 years and the cooling water tubes are extremely corroded as it is apparent from observation of open channel. The units like E12A and E12B, have a considerable amount of scale adheres on the cooling water tube.

In conclusion, there are the following 2 alternative proposals to improve 16 vertical units currently used:

Proposal 1: To replace all the tubes for E4A, E5, E7, E14B, and 15A while using their tube sheets again and replacing both upper and lower channels.

Proposal 2: To newly manufacture all the units.

Though the thickness of tube sheet was not measured at this survey, most of the tube sheets have been used for about 60 years so that it is doubtful whether they can be reused and there is no manufacturing drawing available so that partial renovation is impossible. Therefore, it is recommended that proposal 2 be employed.

3.2.4 Pump

All the pumps are new and there is no trouble found in them. Moreover, all of them are compact so that they seem to cause no special problem in the near future.

However, it fails to properly evaluate the importance of the matter that revoiler pump C2 is not used because the suction strainer is clogged. The cause of scale generation should be eliminated first for the strainer. This pump shall be immediately available for use.

Fuel pump P500-1A is not currently used because its drive steam turbine is failed. However, this is a very serious problem that there is no stand-by unit for the fuel pump which is very critical for the process. Therefore, this pump should immediately become available for use.

3.2.5 Piping

As minor renovations of piping, removal of unnecessary piping, maintenance of steam trap, and stop of ground leak of main steam valve can be considered. However, it cannot always be said that all the piping should be replaced immediately due to poor arrangement. If the tower and vessel, furnace, and heat exchanger are actually renovated according to the proposals, most of main pipings are inevitably replaced. Therefore, it is desirable that all the pipings be replaced with new ones by taking this opportunity. In this case, care shall be taken for the following points:

(1) While strictly following the piping material specification, use the valves and other parts manufactured by the same manufacturer to make their spare parts compatible.

(2) Avoid using the flanged couplings as far as possible and use the welded couplings.

(3) Use a minimum required number of valves.

That is, the block valve should not be provided for the heat exchanger. Moreover, in relation to piping, it can be proposed that the horse station for steam, compressed air, and water should be employed in the plant area. Though no horse station is currently provided, it is required for not only maintenance but also safety. The pipings and valves are partially colored by liquids to prevent illusion in the case of emergency and for training. In addition to this, the liquid flow direction and liquid name should be indicated. This should apply to all the pipings and valves in the entire refinery.

3.2.6 Instrumentation

The instrumental facilities presently function well so that they do not require a major improvement. However, the existing instruments are more than 10 years old except some of them. According to the Process Control Instruments Technology Association (IPC) in 1978, the expected life of instrument is 10 to 15 years. Also, in consideration of the holding time of 5 years for spare parts of the old model after model change, it's time to replace the instruments.

On the other hand, the number of air type instruments used has been greatly reduced. Therefore, a modern refinery employs electronic type instruments so that the existing air type instruments are not appropriate to the training purpose of the Centre. In conclusion, the latest instruments should be introduced at the time of replacement.

3.2.7 Structure and Heat Insulation

(1) Structure

The fire proof coating of structure is extremely slipped off and deteriorated so that the thermal resistance against the fire is completely lost. Since it actually caused the fire, it needs to be constructed again.

(2) Heat insulation

In order to enhance the heat insulation characteristic and prevent a person from a burn, the old diatomite heat insulator extremely slipped off and deteriorated needs to be re-constructed. Moreover, the flanges and valves may be insulated from heat.

3.3 Offsite Facilities

The field inspection and diagnosis has been conducted for the following offsite facilities:

(1) Power Generation Plant
(2) Electrical Facilities
(3) Fuel Facilities
(4) Water Treatment Facilities
(5) Boiler and Steam System
(6) Waste Water Treatment
(7) Tank and Tank Yard
(8) Offsite Pipeline
(9) Fire Fighting-Facilities
(10) Workshop
(11) Buildings
(12) Oil Fields Facilities
(13) Crude Pipeline

However, in view of the fact that among the above offsite facilities, only workshop is included as a direct object of the proposed renovation study in accordance with the Terms of Reference for the study, and also taking into account the observations made during the field survey in Cepu that problems encountered in those offsite facilities except the workshop, are not so extremely serious and therefore do not require urgent countermeasures as needed for the existing refinery, descriptions on the offsite facilities have been omitted from this English summary. Reference can be made to the main report. The following is only a summary of diagnosis and countermeasures for the renovation of workshop of the Centre.

Most of the machine used in the workshop is extremely old. They are installed in 1920s or 1930s so that they have very low working efficiency and operability and some of them may cause a danger. All of these old machine tools can not be used in view of the accuracy originally required. Since they are of pretty old models, the spare parts are not available so that they cannot be repaired or refurbished. Therefore, they are barely operated under bad conditions. Their rate of operation is very low and they will be scrapped in the near future. The necessary machine needs to be immediately renovated, while the remaining models may be scrapped. Along with renovation of machine and introduction of new machine, care should be taken for the following points to keep the machine in good condition for a long time:

(1) To train the specialists and let them operate the machine or operate the machine under their supervision.

(2) To perform the maintenance according to the manual and repair any trouble in its early stage.

(3) To fully manage the cutting tools to keep their accuracy. Therefore, be sure to provide the machine (grinder and tool grinder) required for correcting their accuracy.

At this time, it is recommended that the general-purpose machine tools be introduced and that the specialists mastering these tools be fostered rather than introducing the latest models employing numerical control or computer control.

3.4 AKAMIGAS, Facilities and Equipment of Training Laboratory, and Training Activities

3.4.1 AKAMIGAS, and Facilities and Equipment of Training Laboratory

(1) Facilities and educational/training aids of AKAMIGAS

a) Classroom

Now, the number of students for 15 regular courses is 600 and 30 short courses are held in a year. In this situation, the rate of utilization of the classrooms is high. Therefore, if the future expansion of new courses is considered, the classrooms will become insuffi cient.

b) Library

The library is well arranged in a small size but the number of reference books seems to be small for this kind of training center. Especially, the technical books related to the petroleum and gas industries and computer need to be more supplemented.

c) Drawing room

For this kind of training centre, the number of drawing stands and the room space seem to be insufficient. 20 to 25 drawing stands will be required including those for teaching staff.

d) Educational/training aids

The audio visual equipment (OHP, slides, video, studio, etc.) should be complete and fully used to enhance the teaching/learning effect and reduce the instruction load of the teaching staff or instructor.

e) Student dormitory

The capacity of the dormitory reaches the limit as the sleeping accommodations for 600 regular course students and short course participants. The management of the Center seriously accept this fact and decided to construct another dormitory accommodating 200 students in the near future. Early completion of this dormitory is desired.

f) Operation and management

The buildings, facilities, and equipment of AKAMIGAS are well operated, maintained, and managed by the established system supported by the long experience. The management also instructs the lecturers and instructors to effectively use the educational/training aids such as audio visual equipment. For this purpose, the effort should be made to properly prepare the educational film and tape.

(2) Facilities and equipment of training laboratory

a) Laboratory

At present, the laboratory space seems to be enough, because the number of equipment and tools for training is small. However, the space needs to be expanded if renovation of training equipment for experiment and practical training will be realized in the near future.

b) Laboratory equipment

Each laboratory is provided with various kinds of equipment for experiment, measurement, test, and practical training. However, most of them are technically behind and some of them are too old to be used properly. Further, progress in technologies requires the Centre to adopt new sophisticated equipment for its training activities. Since the Centre's training system and activities properly and normally function, it is not too much to say that renovation of the Centre and its training activities should be made with special emphasis on the hardwares, that is, the laboratory equipment in this case. The renovation of laboratory equipment can be considered in the following 3 cate gories:

i) Renovation of the equipment superannuated and disabled for use

ii) Renovation of the equipment technically behind (including completion of measuring instruments and controllers)

iii) Addition of new equipment required to master modern techniques

The following are examples of equipment categorized into the above ii) and iii).

- Some sorts of testing equipment and automatic analyzer of Refinery Laboratory

- Instrumental analyzers considered to be necessary for Chemical Laboratory and Oil Laboratory

- Inspection and diagnostic equipment and tools required for setting up new courses (such as the inspection course)

- Unit operation equipment

c) Simulator and pilot plant

These facilities make simulated operation of the actual plant and facilities possible, and they function as a substitute for the field work (OJT). The newly installed process simulator and pilot plants are necessary for learning the modern process technology so that the effective training is expected by using them. Instead of the small-scale unit operation equipment made by the Centre's instructors themselves, which has recently been installed in the Oil Laboratory, it is desirable to introduce a larger scale package unit operation equipment.

d) Operation and management

The training laboratory is well managed as in the same manner as other sections of AKAMIGAS. However, the maintenance of equipment is not satisfactory due to insufficient budget and lack of special technique. In the future, the properly planned allocation of the budget to the maintenance should be required, and for the newly purchased equipment, the after-sale service should be imposed on their manufacturers or the maintenance agreement should be made with them.

3.4.2 General Training Activities

Coupled with efforts of the management and staff members of the Centre, the proper advices of the UNDP consultants have greatly contributed to further improvement and development of the software such as the AKAMIGAS training system and curriculum. According to the advices of the consultants, the necessary improvements are now being carried out. Backed up by these achievements, the Indonesian oil and gas industry rates AKAMIGAS high. In addition, the training need from the overseas has increased so that AKAMIGAS is expected to become a regional center.

(1) Training system and method

The AKAMIGAS training system has already been established and functions well. It is a great feature and an ideal form for the training system of this center that classroom, laboratory practice, and field work (on-the-job training) are executed while linking one another. For education and training, the lecturers or instructors are expected to use the audio visual devices as frequently as possible. Use of these equipment and aids improves the teaching/learning effect. The lecturers and instructors should recognize that they can enhance their abilities and the training contents by producing the educational materials by themselves.

In the class room, it is desirable that questions and answers and roll play be effectively employed to make students active. During the laboratory practice, the instructors can employ not only the experiment and practical training to be performed according to the given guidance by the specified equipment but also the method planned, assembled, and executed by the students themselves. Employment of the latter method makes it possible for the students to develop their abilities in practical application in the future.

(2) Carriculum and syllabus

For the current curriculum and syllabus used by AKAMIGAS, the UNDP consultants agreed with most of them. Other advices made by the UNDP consultants are to enhance the effect of training activities of the Centre aiming at upgrading the practical knowledge and technique. Among them, the following three advices are considered more important:

a) Be sure to use the "Aims & Objectives" technique to develop the syllabus as an educational material.

b) Develop the carriculum and programme for the practical training (on-the-job training) in the company which features the sandwich system, that is, "Industrial Training."

c) Develop the curriculum and syllabus of the new subjects such as pollution control, material science, energy management and safety in offshore operation.

If the above 3 advices are executed, AKAMIGAS will be the educational and training body of educational-industrial complex meeting the potential need of the industry.

The AKAMIGAS short courses have made a remarkable progress in cooperation with their clients. New subjects can be programmed by themselves. However, in order to start and execute the Inspection & Maintenance course, the advanced diagnostic technique and the know-hows backed up by the years of experience are needed. In the beginning stage, assistance of some specialists who can choose the suitable diagnostic equipment and instruct its operation and practical maintenance training will be required. Such technical assistance services could be made available under the sponsorship of the international organizations and specialized agencies of foreign countries.

(3) Staff training

The Centre's staff members are given the training opportunities to enhance and develop their abilities in and out of the country. Especially, the fellowship programmes held in the overseas make a great contribution to the improvement of training system and training activities of the Centre. The fellowship programmes sponsored by foreign specialized agencies are expected to continue in the future in order to further complete the education and training activities and transfer new technologies and knowledge.

(4) Development as a regional training centre

The reputation of the Centre is high among the developing countries so that the training need from these countries have been raised increasingly. In this situation, the Indonesian Government desires that the Centre act as a regional Centre. However, for this purpose, a concrete policy should be established with support of improved facilities and equipment. Especially, to gain the effect of training for a short period, it is desirable to positively introduce the audio visual training system. In order to keep continuously its functions at the standard level, great efforts of the Centre's staff members and the financial support of the Government will be indispensable.

Chapter 4 Formulation and Analysis of Renovation Plans

4.1 Fundamental Conditions and Assumptions for Formulation of Renovation Plans

4.1.1 Object and Scope of Renovation

The formulation of the renovation plans has been made in accordance with the minutes of meetings on the interim report agreed between the representatives of the Centre and the JICA study team on July 18, 1985 and also, of course, based on the scope of work stated in the Terms of Reference for the proposed study, and moreover, in line with the concept that such facilities as those which could be considered rather easily renovated based only on goods and services (technologies and equipment/materials) available in Indonesia, in other words, those capable of being implemented only by the expense of local currency, are to be excluded from the scope and object of the renovation.

Accordingly, the formulation and analysis of the renovation plans has been made centering on the following major items:

(1) Refinery (The renovation is limited to the Atmospheric Distillation Unit, and the wax plant shall be out of scope).

(2) Workshop machine

(3) Laboratory equipment

(4) Equipment required for inspection and maintenance of facilities/equipment.

(5) AKAMIGAS training facilities/aids and training activities.

As for the renovation of the existing refinery, three alternative renovation plans which include a case for new installation of refinery (complete/total renewal) will be formulated and analyzed.

4.1.2 Basic Considerations in the Formulation of Renovation Plans for the Atmospheric Distillation Unit

In the formulation of renovation plans for the atmospheric distillation unit, the following important points should be, and whenever possible, will be taken into consideration so that the Centre's intrinsic functions as training centre could be displayed:

(1) The actual implementation/execution of renovation plans must not constitute an obstacle to accomplishing the Centre's daily training activities and training programme.

(2) The renovation should result in enabling the Centre to have a suitable function to carry out on-the-job training for students who are supposed to work in a modern refinery.

For this purpose, the following points will fully be taken into account, whenever possible.

a) Adoption of modern equipment

b) Introduction of instruments for operating data analysis

c) Adoption of equipment type which makes repair and maintenance easier

d) Safety precautions/considerations

(3) Replacement/renewal of deteriorated and superannuated equipment

(4) Introduction of equipment required for new training courses to be established and offered by the Centre.

(5) Introduction of equipment for maintenance of facilities and equipment of the Centre

(6) Restriction in availability of funds for renovation and their effective utilization

4.2 Renovation Plans for Refinery (Atmospheric Distillation Unit)

The following three alternative plans have been established for the renovation of the existing atmospheric distillation unit of the Centre:

(1) Plan-I:

New Installation (Complete Renewal) of Atmospheric Distillation Unit. It is determined that the new atmos-pheric distillation unit shall be designed at a capacity of 2,000 BPSD, 1/ both for Kawengan and Ledok crude oil, on the basis of the projected production of crude oil in Cepu and also by taking into account the duration for shutdown and turnaround of the plant especially for the training programme.

(2) Plan-IIA:

Partial Renewal of Atmospheric Distillation Unit

(3) Plan-IIB (Alternative of Plan-IIA)

Partial Renewal of Atmospheric Distillation Unit

The contents and results of analysis for each of the three alternative renovation plans are presented below.

Note: 1/ Minutes of Meetings on the Interim Report, July 1985.

4.2.1 Plan-I: New Installation of Atmospheric Distillation Unit

(1) Basic ideas and design concept for Plan-I

A conceptual design for the atmospheric distillation unit has been conducted by bearing in mind the following important points:

a) The number of tower, vessel and furnace/heater shall be minimized to make the process flow as simple as possible.

b) A network of heat exchangers shall be arranged so as to save consumption of utilities and, at the same time, to serve as a training medium for energy saving operation in the modern refinery.

c) The installation of the network of heat exchangers makes it possible to improve heat recovery and, as a result, to allow a compact design of the furnace/crude oil charge heater. This makes requirements for the area and investment for the furnace much less, and achieves a considerably high heat efficiency (approx. 80%).

d) All heat exchangers, coolers and condensors shall be of horizontal, multitube, floating head type, for the convenience of the training for maintenance in the modern refinery, and their arrangement shall be determined also by taking into account easiness of maintenance.

e) Valve type trays shall be adopted for the main distillation column and side strippers for the reasons that they are highly efficient, stably operated for a wider range of load, less expensive and more easily maintained than the present bubble-cap trays.

f) At the time of determining cut points for the distillation of crude oil, great attention shall be given to the collection/extraction of solvent for the paint industry and wax distillate to be fed into the wax unit of the existing refinery of the Centre.

g) In order to improve corrosion atmosphere of straight-run gasoline tank, a soda washing/injection unit shall be installed on the way of the gasoline rundown line.

h) Those instruments required for monitoring the furnace, heat exchangers, towers and vessels, etc. shall be sufficiently arranged at the same level as commonly adopted in the modern refinery.

(2) Results of conceptual design

On the basis of the fundamental ideas pointed out above, a conceptual design has been conducted for the a new 2,000 BPSD atmospheric distillation unit based on both Kawengan and Ledok crude. The following summarizes results of the conceptual design.

a) Process flow, and material and utilities balance

Figure 4-1 and Figure 4-2 illustrate the process flow, and material and utilities balance of the 2,000 BPSD capacity atmospheric distillation unit processing Kawengan crude and Ledok crude, respectively.

b) Equipment list

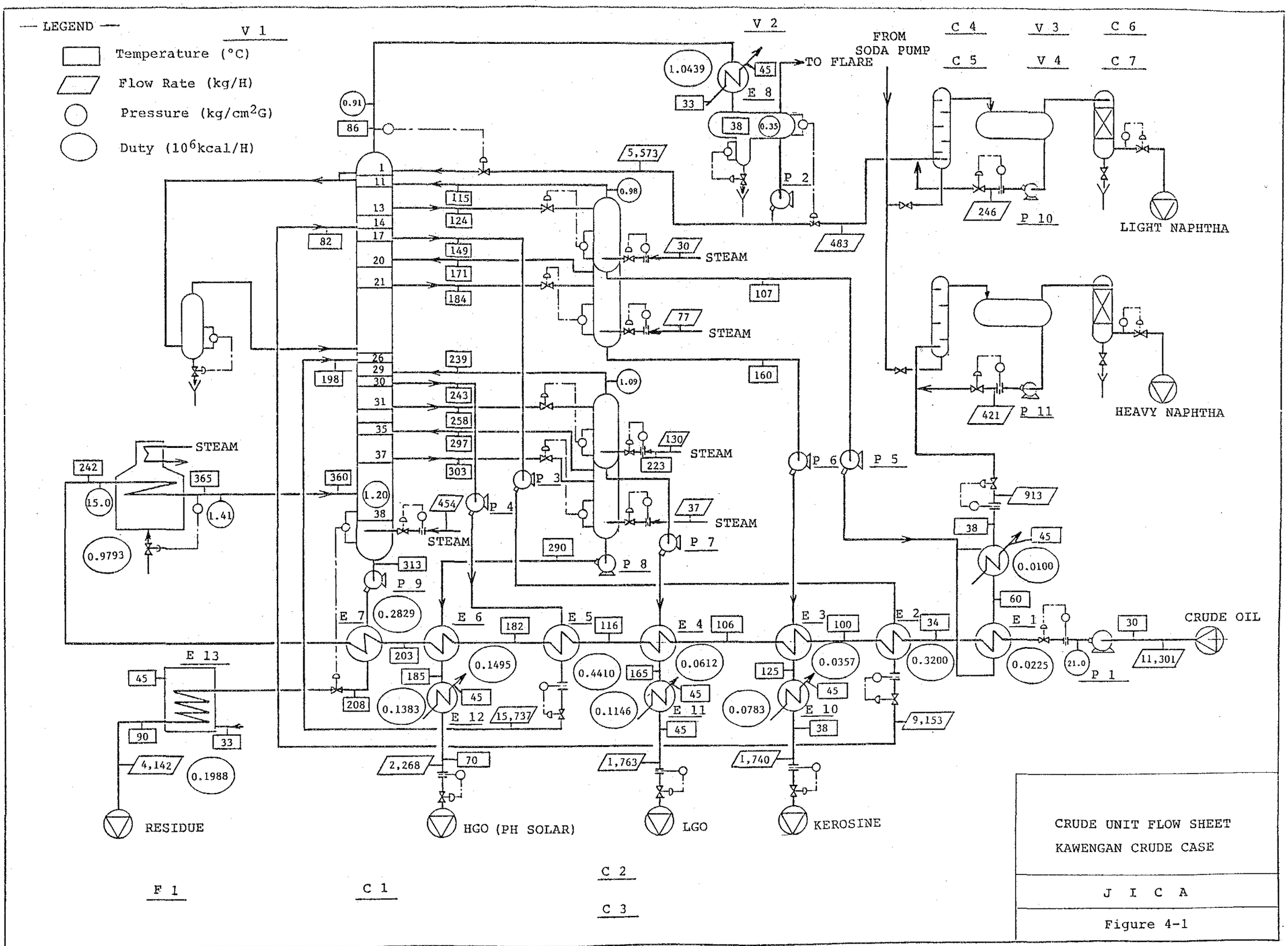
A list of equipment for the new atmospheric distillation unit is given in Table 4-1. The dimension of the main distillation column is of 1.2 m of diameter and 30 m of height.

c) Plot plan

A preliminary plot plan for the new atmospheric unit is shown in Figure 4-3. The new unit is to be installed in an adjacent area south to the existing unit.

d) Utilities consumption

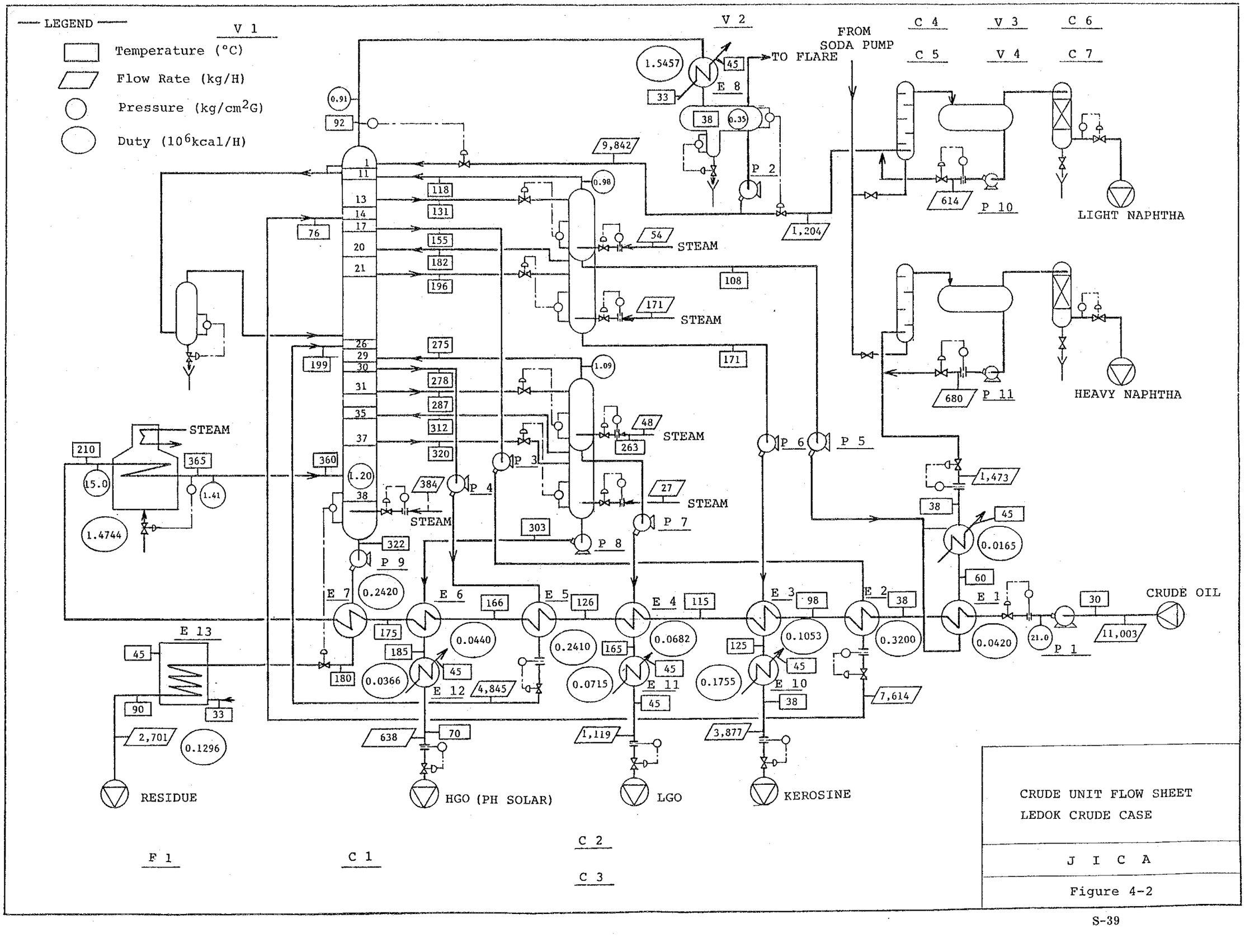
Utilities consumption figures of the new atmospheric distillation unit is compared below with those of the existing unit of the Centre. It is clearly noted that a considerable energy saving operation can be possible in the new unit.



CRUDE UNIT FLOW SHEET
KAWENGAN CRUDE CASE

J I C A

Figure 4-1



CRUDE UNIT FLOW SHEET
LEDOK CRUDE CASE

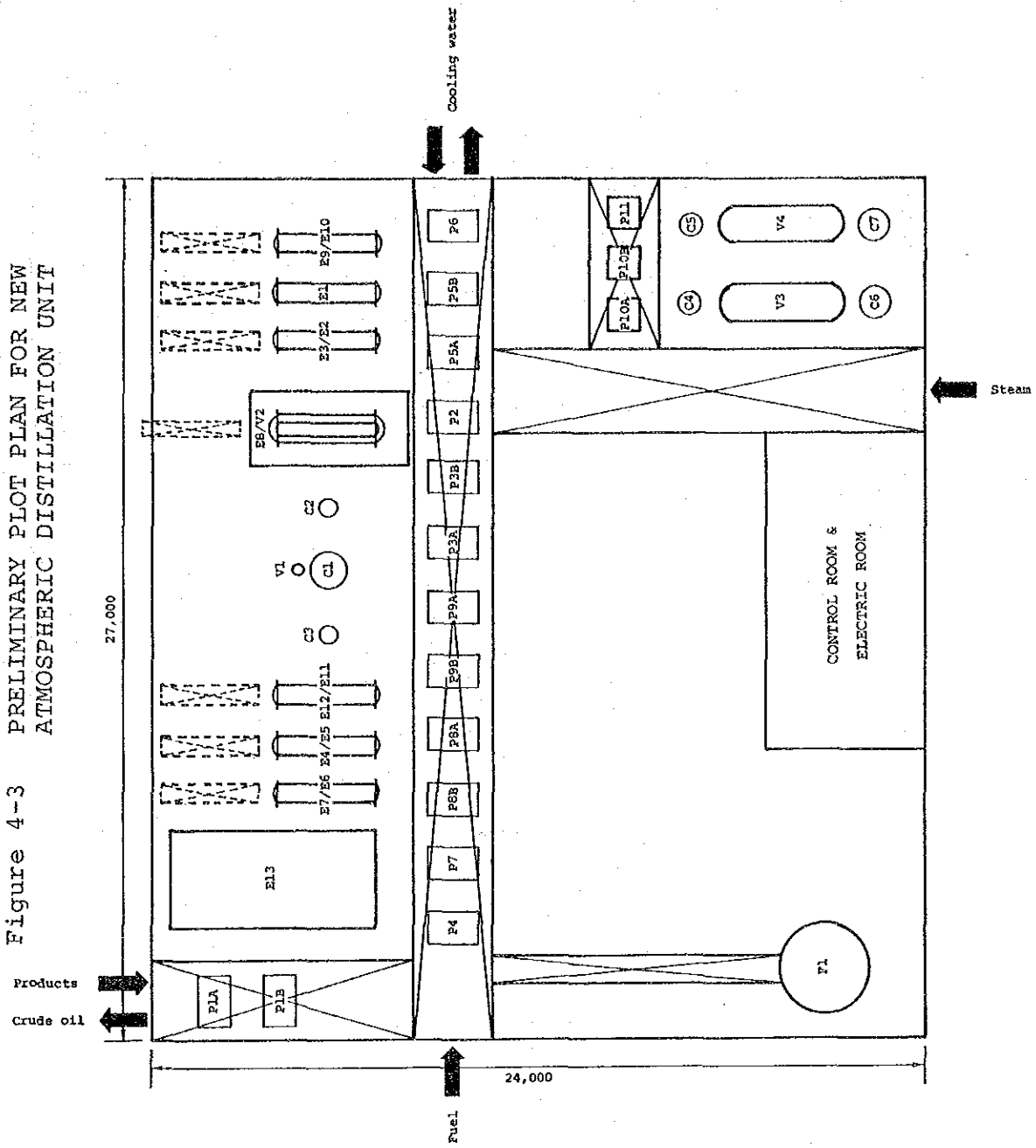
J I C A

Figure 4-2

Table 4-1 LIST OF EQUIPMENT OF ATMOSPHERIC DISTILLATION UNIT

Equipment NO.	Equipment Name	Number of Unit
C 1	Main Column	1
C 2	Stripper No.1/No.2	1
C 3	Stripper No.3/No.4	1
C 4	Soda Mixer No.1	1
C 5	Soda Mixer No.2	1
C 6	Sand Filter No.1	1
C 7	Sand Filter No.2	1
V 1	Water Drain Pot	1
V 2	Over Head Receiver	1
V 3	Soda Settler No.1	1
V 4	Soda Settler No.2	1
F 1	Crude Furnance	1
E 1	Crude/HN Exchanger	1
E 2	Crude/HN Ref. Exchanger	1
E 3	Crude/Kero Exchanger	1
E 4	Crude/LGO Exchanger	1
E 5	Crude/LGO Ref. Exchanger	1
E 6	Crude/HGO Exchanger	1
E 7	Crude/Residue Exchanger	1
E 8	Over Head Condenser	1
E 9	Heavy Naphtha Cooler	1
E 10	Kerosene Cooler	1
E 11	LGO Cooler	1
E 12	HGO Cooler	1
E 13	Residue Cooler	1
P 1	Crude Charge Pump	2
P 2	Over Head Refluxe Pump	1
P 3	Heavy Naphtha Refluxe Pump	2
P 4	LGO Refluxe Pump	2
P 5	Heavy Naphtha Pump	2
P 6	Kerosine Pump	1
P 7	LGO Pump	1
P 8	HGO Pump	1
P 9	Residue Pump	2
P 10	Soda Circulation Pump No.1	2
P 11	Soda Circulation Pump No.2	1

Figure 4-3 PRELIMINARY PLOT PLAN FOR NEW ATMOSPHERIC DISTILLATION UNIT



COMPARISON OF UTILITIES CONSUMPTION FIGURES BETWEEN THE EXISTING AND NEW ATMOSPHERIC DISTILLATION UNIT

Utilities Consumption	Existing Unit	New Unit
Fuel Oil (1/H)	1,180	200
Steam (kg/H)	2,770 1/	740
Electricity (KWH) 2/	123	157
Cooling Water (m^3/H)	230	150

Note: 1/ Including steam consumption of reboiler pump
2/ Including power consumption of cooling water pump and fuel oil system pump

e) Quality/Specification and Yield of Products after the Renovation (Plan-I)

The quality and yield of products obtained by the new atmospheric unit from Kawengan and Ledok crude is shown in Table 4-2 and Table 4-3, respectively.

For further reference, Table 4-4 summarizes the yield of products obtained from the new unit in comparison with that from the existing unit of the Centre.

Table 4-4 indicates that the gasoline yield from the new atmospheric distillation unit is rather higher than that from the existing old unit of the Centre. It is however, understood that according to Figure 4-4, the TBP point between gasoline and kerosene, that is 150`C, has a considerable allowance as against (as compared with) the minimum flash point of 100`F. For example, as the ASTM initial boiling point (IBP) of kerosene is 155`C for Kawengan crude and 161`C for Ledok crude, respectively, as against the TBP cut point of 150`C, it is judged that the TBP cut point can be reduced up to around 120`C for both crude.

According to the TBP curves for both Kawengan and Ledok crude oil illustrated in Figure 4-5, it is understood that the gasoline yield can be decreased by up to approx. 5% in case of Kawengan crude and about 9% in case of Ledok crude, resulting in reaching the actual performance figure of the Centre.

Table 4 – 2 QUALITY AND YIELD OF PRODUCTS OBTAINED FROM KAWENGAN CRUDE

Fraction	TBP Cut Point (℃)	Results of Calculation			
		ASTM Distillation (℃)	Sp. Gr (60℉)	KQ /H	%on Crude
Light Gasoline	IBP-110	40-110	0.7132	0.680	5.1
Heavy Gasoline	110-150	102-176	0.7662	1.190	9.0
Kerosine	150-230	155-243	0.8125	2.140	16.2
L G O	230-280	222-312	0.8558	2.060	15.6
H G O	280-360	264-501	0.8695	2.610	19.7
Residue	360-	277-524	0.9121	4.570	34.4
Total			0.8553	13.250	100.0

Table 4 – 3 QUALITY AND YIELD OF PRODUCTS OBTAINED FROM LEDOK CRUDE

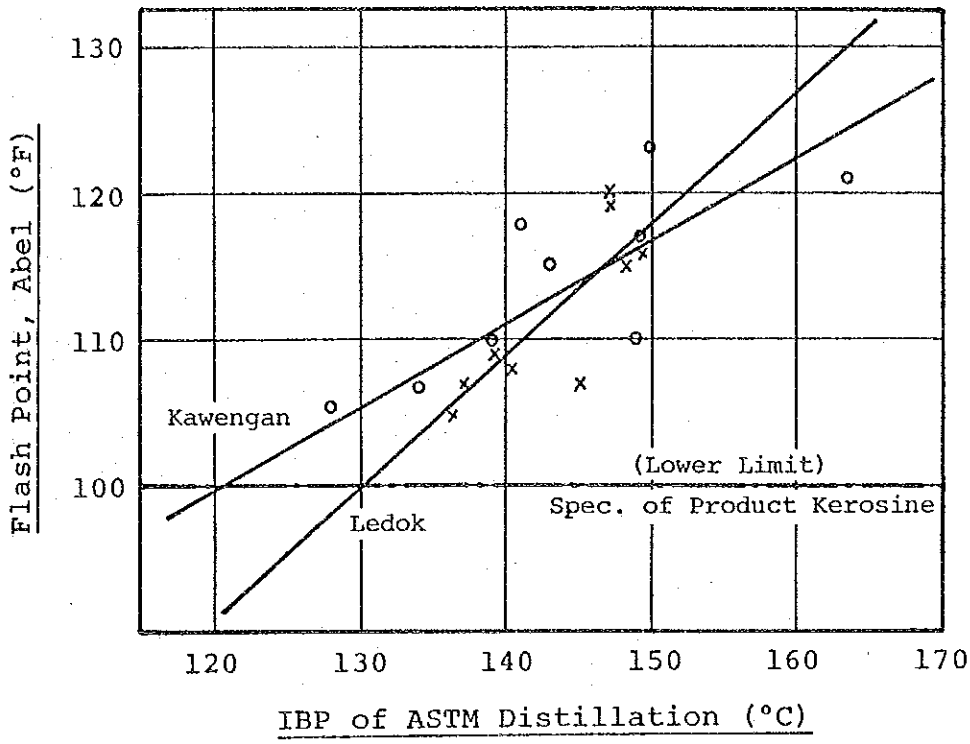
Fraction	TBP Cut Point (℃)	Results of Calculation			
		ASTM Distillation (℃)	Sp. Gr (60℉)	KQ /H	%on Crude
Light Gasoline	IBP-110	40-110	0.7005	1.720	13.0
Heavy Gasoline	110-150	103-172	0.7585	1.940	14.6
Kerosine	150-280	161-280	0.8197	4.730	35.7
L G O	280-320	251-351	0.8582	1.300	9.8
H G O	320-350	293-528	0.9019	0.710	5.4
Residue	350-	298-551	0.9423	2.850	21.5
Total			0.8298	13.250	100.0

Table 4 – 4 *COMPARISON OF PRODUCTS YIELD BETWEEN THE EXISTING AND NEW ATOMOSPHERIC UNITS*

(unit:%)

Fraction	Kawengan Crude			Ledok Crude		
	New Unit	Existing* Unit	Difference	New Unit	Existing* Unit	Difference
Light Gasoline	5.1	8.2	+5.9	13.0	15.6	+12.0
Heavy Gasoline	9.0			14.6		
Kerosine	16.2	18.8	-2.6	35.7	20.8	+14.9
L G O	15.6	21.7	-6.1	9.8	31.8	-16.6
H G O	19.7	20.7	-1.0	5.4		
Residue	34.4	31.1	+3.3	21.5	29.4	-7.9

Note: (*) Based on the actual production performance by the type of crude of the Centre in 1984/85 fiscal year. (Table Ⅱ-5-11)



Note: Based on data of the Refinery Laboratory in Feb. 1985.

Figure 4-4 RELATIONSHIP BETWEEN ASTM IBP AND FLASH POINT OF KEROSENE

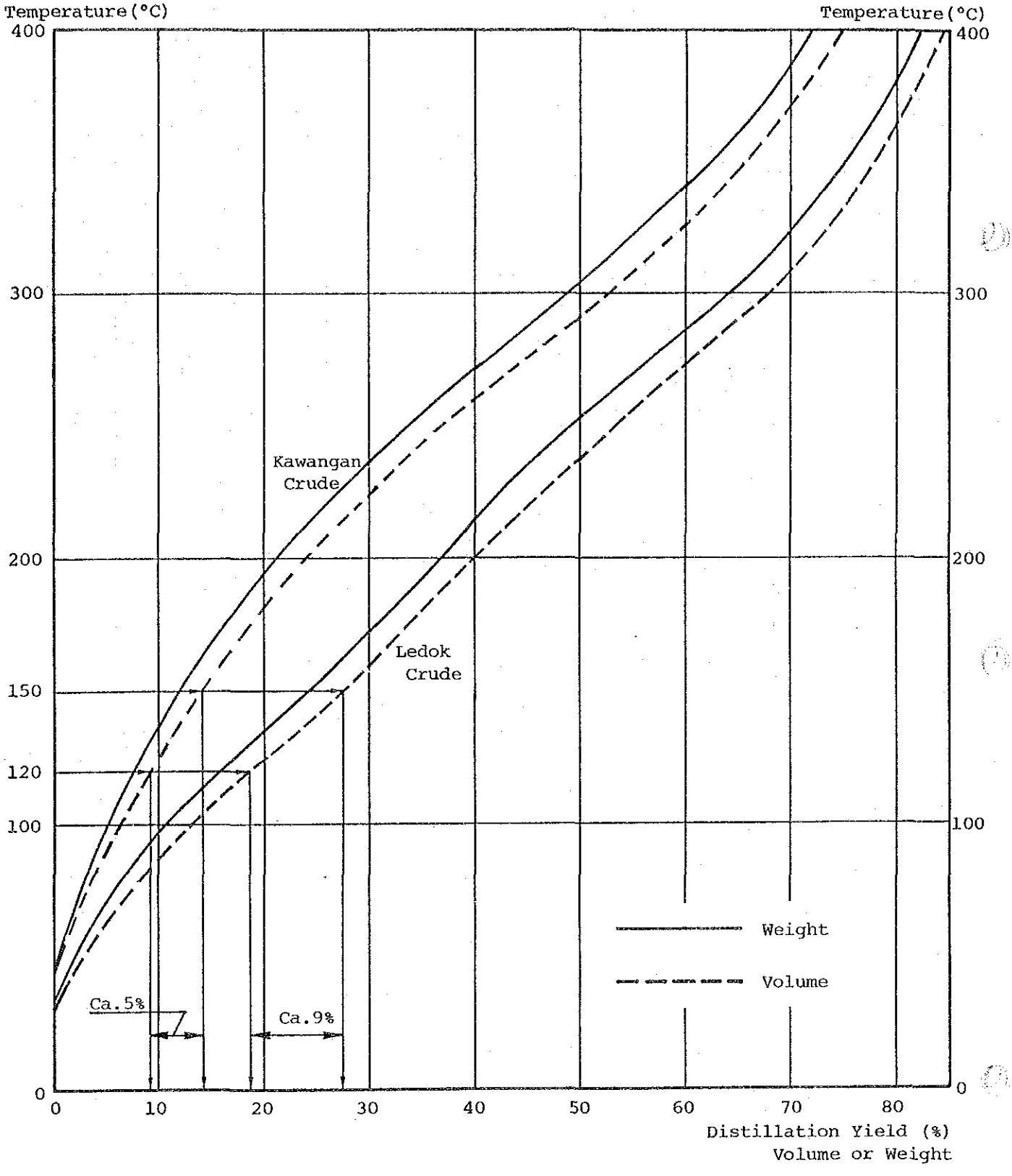


Figure 4-5 TRUE BOILING POINT DISTILLATION CURVES OF KAWENGAN AND LEDOK CRUDE OIL

On the other hand, the yield of heavy gas oil (HGO) fraction from Kawengan crude is the maximum one at the furnace outlet temperature of 365`C. If a higher yield of HGO is needed, either an injection/introduction of steam at the entrance of the furnace or a circulation/recycle of residue can be considered.

4.2.2 Plan-II: Partial Renewal of Existing Atmospheric Distillation Unit

With regard to the renovation through a partial renewal of equipment of the existing atmospheric unit of the Centre, the following two alternative plans have been set up and analyzed. Summarized below are the basic ideas for this case of renovation:

(1) Among various equipment integrated in the existing unit of the Centre, those which have already been seriously superannuated and those which, in case of emergency/accident, great influence and damage could be anticipated, shall be replaced and renewed.

(2) Among presently utilized equipment in the existing unit, due to structural impossibility for opening, those which have not been open-inspected and cleaned so far since the initial construction and therefore are in a condition of very low performance and/or would be damaged by cleaning, shall be removed and renewed.

On the basis of the above criteria, the following alternative renovation plans have been studied.

(1) Plan-II(A): Partial Renewal of the Existing Atmospheric Unit

Based on the discussions and for the reasons presented in the Part-III, the following renovation shall be made:

a) Removal and renewal of the main distillation tower C1B column.

b) Removal and renewal of the crude furnace F1A, F1B, F1C, and the reboiler heater F2.

c) Removal and renewal of 17 units of heat exchangers.

d) Removal of the main distillation tower C1A column that constitutes an obstacle/hindrance to the removal work of the main column C1B as described above.

e) Cutting and reconnection of related pipings and cables/lines.

f) Adjustment and appropriateness of pipings.

g) Dismantling and reassembling of related structures.

h) Repair work of insulation and fireproof coating and cover.

It has to be noted that according to this renovation plan, the corresponding equipment of the existing atmospheric distillation unit of the Centre is to be renewed based on the same original specification. Therefore, no special difference is expected in the quality and yield of products between before and after the renovation.

(2) Plan-II(B): Partial Renewal of the Existing Atmospheric Unit

This alternative plan is formulated based on the addition of the following two items to the Plan-II(A) mentioned above.

a) Removal and renewal of the auxiliary distillation tower C2 column, in accordance with the discussions developed in the Part-III before.

b) Renewal of the flasher V1.

In this case again, the corresponding equipment is to be renewed in accordance with the same specification and therefore, no special difference is expected in the quality and yield of products before and after the renovation.

4.3 Renovation Plans for Workshop Machine, Laboratory Equipment, and Equipment for Inspection and Maintenance

4.3.1 Renovation Plan for Workshop Machine

The following two alternative plans have been studied.

(1) Workshop Machine Renovation Plan-I

This alternative renovation plan for the workshop machine is based on the selection of machine which is considered necessary for the operation and maintenance of the refinery of the Centre and among which the existing workshop machine can not properly be utilized. A list of workshop machine with its specifications, which shall be newly introduced to the existing workshop of the Centre, is presented in page IV-21 of the main report.

(2) Workshop Machine Renovation Plan-II

This plan is based on the idea that such machine as noted as "bad condition" and/or "out of use" among the Centre's existing workshop machine used not only for the operation and maintenance of the refinery but also for the oil fields operation and maintenance as well as for the training activities shall be renovated. A list of new workshop machine with its specification is presented in pages IV-22 and IV-23 of the main report.

4.3.2 Renovation Plan for Laboratory Equipment

(1) Refinery laboratory

The renovation shall be made for those facilities and equipment of the refinery laboratory under the following basic principles:

a) Based on experience in the use of various auto-analysers in Japan, such equipment as for automatic distillation testing, automatic flash point testing and automatic residual carbon testing which can be used without a frequent trouble, among various auto-analysers, shall be newly introduced.

b) Equipment which can be considered no longer properly utilized, due to great extent of hitch and lack of spare parts, shall be replaced/renewed by the corresponding new one.

c) Equipment which is already more than 15 years old since its initial purchase and therefore whose spareparts is becoming difficult to obtain shall be replaced by new corresponding one.

d) Analytical equipment that is judged to be necessary in view of product specification items, shall be newly introduced/supplemented.

In line with these principles, a list of equipment to be newly introduced under the renovation plan of the refinery laboratory is presented in the main report.

(2) Training laboratory

The renovation of the training laboratory equipment has been planned based on the following idea.

a) Replacement/renewal of equipment which becomes too old to be used more or difficult in obtaining spareparts.

b) Renewal of equipment which has already been technologically behind, by corresponding new one.

c) Introduction/supplement of necessary equipment for the training/mastery of fundamental and modern advanced technologies as well.

By applying the above concept to the formulation of the renovation plan of the training laboratory, it is recognized that it is necessary to introduce/supplement such important instrumental analysers as frequently used for gas analysis and for the identification of materials and chemical elements in chemical laboratory as well as to introduce/renew training facilities for unit operations. A list of equipment to be newly introduced under the renovaton plan for the training laboratory is presented in the main report.

4.3.3 Equipment Needed for Inspection and Maintenance

(1) Equipment for inspection

The following categories of equipment will be required.

- Condition monitoring
- Static equipment monitoring
- Radio examination
- Magnetic particle examination
- Ultrasonic examination
- Eddy current examination
- Material examination
- Other examination

A list of necessary equipment for each of the above categories is given in the main report.

(2) Equipment for maintenance

A jet cleaner and compressors are included in a list of equipment for maintenance.

4.4 Improvement and Development of Training Activities

Summarized below are recommendations for further improvement and development of the Centre's training activities.

(1) It is recommendable that the syllabus for the regular and short courses be successively revised in colaboration with the clients through "Aims and Objectives" technique.

(2) It is recommendable to prepare successively curriculum and programme during the "industrial training" period (in the companies and institutions from which trainees are despatched to the Centre) of trainees within the frame of the present sandwich system. A close cooperation with the clients is also needed for this purpose.

(3) In order to implement and develop the above item (1) and (2), therefore, assistance of consultants and experts specializing in the field of training development would be necessary and useful.

(4) As for the teaching/learning method, it is desirable that students/trainees be involved as more in depth in lessons (as more student-oriented) as possible. It is recommended to utilize more overhead projectors and slides by arranging in advance teaching materials such as figures, tables illustrations, etc. It is also recommendable to arrange training programme by means of video-system.

(5) In the training practice in the laboratories, it is desirable not only to give all instructions to students/ trainees but also to adopt a method of training practice in which the students/trainees have to think, assemble and investigate themselves.

(6) It is recommendable that the training of the teaching staff for increasing their capability be kept up continuously and with more frequent opportunities so far as possible.

(7) It is also desired that great attention be given to maintenance of the laboratory equipment and workshop machine.

(8) It is desired that the existing library be more fully prepared, especially taking into account the development of the Cepu Oil and Gas Training Centre as a regional centre in the future.

(9) In the present day of Indonesia that the oil and gas industry is being steadily developed, the major problem from now can be considered as how to execute effectively and efficiently maintenance of process facilities and equipment.

In order to solve this problem and to satisfy the needs, it is highly desired that the Centre establish and offer a training course for inspection and diagnosis of facilities and equipment, and a training course for maintenance technology and practice. In addition to these subjects, it is realized that material science and energy management discipline are also needed by the Centre for further development of the Centre's training activities. Each of the new courses is expected to exceed 600 hours of training, and therefore, could be implemented as short courses ranging from 4 months to 6 months.

Would-be students/trainees are requested to participate in both courses so far as possible. Curriculum for these courses are indicated in the main reports.

Chapter 5 Funds Requirements and Evaluation of Renovation Plans

5.1 Estimation of Funds Requirements for Renovation Plans

5.1.1 Refinery (Atmospheric Distillation Unit)

Funds requirements have been estimated for each of the three alternative renovation plans for the refinery (atmospheric distillation unit). The results of estimation is indicated all together in Table 5-1. Total funds requirements are estimated as follows:

(Unit in million Yen)

Alternative Plans	Foreign Portion	Rp. Portion	Total
Plan-I (New Installation)	1,073.7	302.2	1,375.9
Plan-II (Partial Renewal)			
Plan-II(A):	870.2	272.9	1,143.1
Plan-II(B):	979.0	322.2	1,301.3

It is observed that in the alternative cases of the partial renewal of the existing refinery (atmospheric unit), no significant saving in funds requirements can be expected as compared to the complete renewal, and that, as a result, there is not much difference between Plan-II and Plan-I in terms of the amount of required funds. This is principally attributable to the following facts:

(1) In any case, major equipment of the existing atmospheric distillation unit has to be renewed.

(2) In case of the partial renewal (Plan-II(A) and Plan-II(B)), FOB equipment/materials cost and other related cost are expected to become less expensive than those of the new installation (complete renewal), while, on the other hand, the field erection cost which includes cost for removal of equipment, becomes considerably higher.

Table 5－1　ESTIMATED FUNDS REQUIREMENTS FOR THE RENOVATION OF REFINERY (ATMOSPHERIC DISTILLATION UNIT)

(Unit in million Yen)

	PLAN－ I			PLAN－ II A			PLAN－ II B		
	Foreign Portion	Rp Portion	Total	Foreign Portion	Rp Portion	Total	Foreign Portion	Rp Portion	Total
A. Plant Direct Cost									
(1) Equipment/Materials & Spareparts	512.9		512.9	366.3		366.3	418.1		418.1
(2) Erection work	32.2	123.0	155.2	36.4	160.0	196.4	44.6	195.1	239.7
(3) Civil work		81.0	81.0		22.0	22.0		26.0	26.0
Sub Total	545.1	204.0	749.1	402.7	182.0	584.7	462.7	221.1	683.8
B. Transportion & Insurance	39.3	8.1	47.4	31.5	7.2	38.7	36.6	8.3	44.9
C. Project expense	103.1	14.2	117.3	101.6	14.2	115.8	108.9	14.7	123.6
D. Supervising service	64.4	17.6	82.0	66.7	17.6	84.3	69.0	19.0	88.0
E. Engineering service	140.6		140.1	117.1		117.1	132.6		132.6
Base Prroject Cost (BPC) (in Jan. 1986 prices)	892.0	243.9	1,135.9	719.6	221	940.6	809.8	263.1	1,072.9
F. Physical contingency	44.5	17.1	61.6	36.0	14.7	50.7	40.4	15.2	55.6
(% of BPC)(5.0)	(5.0)	(7.0)	(5.4)	(5.0)	(6.7)	(5.4)	(5.0)	(5.8)	(5.2)
G. Price contingency	137.2	41.2	178.4	114.6	37.2	151.8	128.8	44.0	172.8
(% of BPC)	(15.4)	(16.9)	(15.7)	(15.9)	(16,8)	(16.1)	(15.9)	(16.7)	(16.1)
Erected Plant Cost (in Jan. 1989 prices)	1,073.7	302.2	1,375.9	870.2	272.9	1,143.1	979.0	322.3	1,301.3
Total Project Cost	1,073.7	302.2	1,375.9	870.2	272.9	1,143.1	979.0	322.3	1,301.3

(3) Due to the complicated, troublesome work expected for the partial renewal, such expenses as for supervision, project expense and engineering fees, other than equipment/materials cost and field construction cost, do not have special elements which would make the partial renewal of renovation considerably inexpensive.

5.1.2 Workshop Machine, Laboratory Equipment, and Other Equipment

Funds requirements for the implementation of the renovation plans for the workshop machine, laboratory equipment, and tools for inspection and maintenance have been estimated and presented in Table 5-2. Total funds requirements for each of the above categories are summarized below:

Table 5－2　REQUIRED FUNDS FOR RENOVATION OF WORKSHOP MACHINE, LABORATORY EQUIPMENT, AND EQUIPMENT FOR INSPECTION AND MAINTENANCE

(Unit in Million Yen)

	Work shop Machine Alternalive-Ⅰ	Work shop Machine Alternalive-Ⅱ	Laborototy Equipment	Inspection Tool	Maintenance Tool
F O B				82.6	50.7
Freight & Insurance				5.1	3.9
C I F	89.4	377.2	257.0	87.7	54.6
Inland transportation	0.8	2.8	0.3	0.2	0.2
Base Cost (in Jan.1986 price)	90.2	380.0	257.3	87.9	54.8
Price contingency	14.2	60.2	40.7	13.9	8.3
Total Cost (in Jan.1989 price)	104.4	440.2	298.0	101.8	63.1

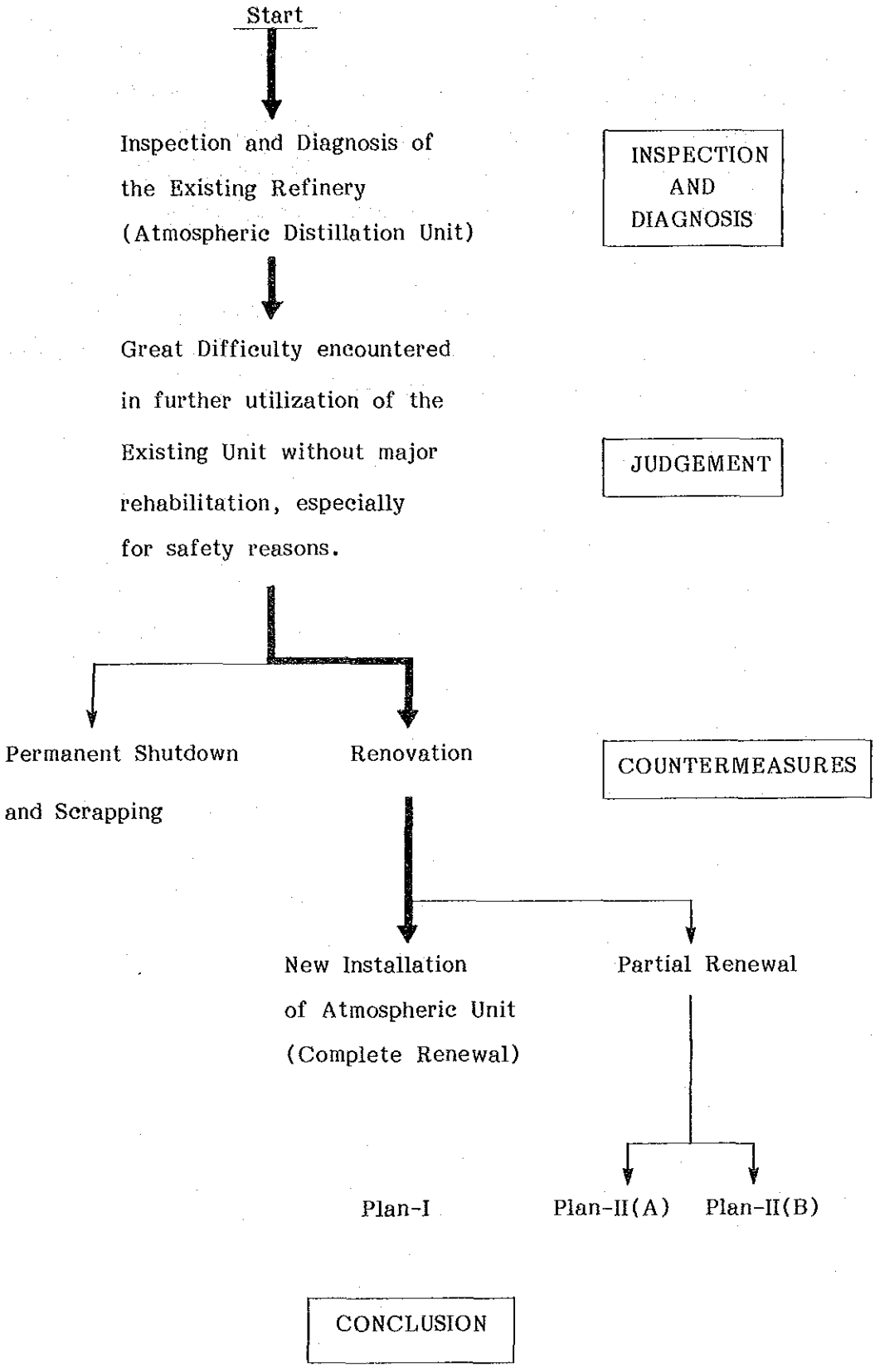
(Unit in million Yen)

	Foreign Portion	Rp. Portion	Total
Workshop Machine			
Alternative Plan-I:	103.6	0.8	104.4
Alternative Plan-II:	437.4	2.8	440.2
Laboratory Equipment: (incld. training aids)	297.7	0.3	298.0
Equipment for Inspection:	101.6	0.2	101.8
Equipment for Maintenance:	62.9	0.2	63.1
Total			
In case of alternative Plan-I of workshop machine:	565.8	1.5	567.3
In case of alternative Plan-II of workshop machine:	899.6	3.5	903.1

5.2 Evaluation and Comparative Advantage of Alternative Renovation Plans

5.2.1 Refinery (Atmospheric Distillation Unit)

On the basis of the results of inspection and disgnosis, the three alternative renovation plans have already been formulated. For further clarification of the problem, the following chart is given to systematically indicate several options to be taken, and a flow reaching to, and relative positions of, these options.


Start
Inspection and Diagnosis of the Existing Refinery (Atmospheric Distillation Unit)
INSPECTION AND DIAGNOSIS
Great Difficulty encountered in further utilization of the Existing Unit without major rehabilitation, especially for safety reasons.
JUDGEMENT
Permanent Shutdown and Scrapping
Renovation
COUNTERMEASURES
New Installation of Atmospheric Unit (Complete Renewal)
Partial Renewal
Plan-I
Plan-II(A)
Plan-II(B)
CONCLUSION

The size (2,000 BPSD) of the existing atmospheric unit and of the proposed new installation is extremely small as compared to the economical scale of modern new refineries that is usually considered as around 100,000 to 200,000 BPSD. It is therefore quite obvious that any renovation plans which include a complete renewal/new installation, can not be justified at all from commercial point of view, in other words, based on financial analysis applied to an ordinary industrial feasibility study.

If the investment costs required for the construction of 2,000 BPSD and 100,000 BPSD capacity atmospheric units are assumed to be I_1 and I_2 respectively, the following approximate relation generally exists between I_1 and I_2.

$$I_1 = I_2(2,000/100,000)^n = I_2(1/50)^n$$

where, n is called scale factor (usually 0.6 to 0.7).

If the investment requirements per unit BPSD of crude oil are expressed as i_1 and i_2 respectively for 2,000 BPSD and 100,000 BPSD atmospheric units, the following equations are then obtained:

$$i_1 = I_1/2,000 = (I_2/2,000)\ (1/50)^n$$

$$i_2 = I_2/100,000$$

Consequently, the investment cost ratio per unit BPSD between the two different capacity of atmospheric units can approximately be expressed as follows:

$$i_1/i_2 = (100,000/2,000)\ (1/50)^n = (50)^{1-n}$$

If n is assumed to be equal to 0.65,

$$i_1/i_2 = (50)^{0.35} = 4$$

In other words, the investment requirements per unit BPSD of crude oil for 2,000 BPSD atmospheric distillation unit is around 4 times higher than that for a commercial, economic size of modern atmospheric distillation unit having 100,000 BPSD capacity. It is therefore expected that, in case of 2,000 BPSD unit, fixed cost portion of crude oil processing cost will also become 4 times. It is self-evident that such size of atmospheric unit can not be justified from commercial point of view.

It has to be moreover noted that most of the products from the existing refinery of the Centre are not transacted on a commercial basis, but instead are transferred free of charge to PERTAMINA, which is, in turn, paying training fee to the Centre independently of such transfer of products. It has to be also pointed out that there is no applicable pricing system for crude and utilities and that, therefore, no definite basis exists for financial analysis of such small scale unit being operated principally for the training purpose of the Centre.

Therefore, the evaluation and justification of the renovation plans for the refinery (atmospheric distillation unit) has to be made based on intangible factors which, from practical point of view, are not quantified or can not be quantified at a reliable level of preciseness.

Now, as indicated in the previous flow chart, if an option of permanent shutdown and scrap of the existing unit without doing any renovation were to be taken, either one of the following two measures should inevitably be adopted:

a) Permanent stop of crude oil production in Cepu.

b) Transportation of crude oil produced in Cepu to PERTAMINA's existing refineries or crude oil terminals.

In any case, the on-the-job training of AKAMIGAS refining courses could no longer be carried out in the Centre. This would constitute a great obstacle to smooth implementation of these refining courses themselves by the Centre. In addition, despatching students/trainees to PERTAMINA's refineries would cause further increase of expenditure.

There would be additional problems in the supply of wax and batching oil distillate, etc. to local industries in the proximity of Cepu, and also in the availability of home fuel for the Centre.

Moreover, if the crude oil production were to be stopped in Cepu, those training courses related to oil fields, which are considered more important, could not be smoothly implemented either,because the practice and on-the-job training concering oil fields operation could no longer be conducted in Cepu. Again, a large number of students/trainees would have to be despatched to other oil fields in Indonesia. Such hypothetical but very serious situation mentioned above would symbolize complete loss of the background and significance of the location/site of

Cepu and, therefore, collapse of the fundamental reasons for being of the Cepu Oil and Gas Training Centre that has so far made a growing and significant contribution to the development of country's oil and gas industry in terms of education and training. It has to be clearly understood that, despite the future oil production near Cepu is projected at as low as 2,000 BPSD even taking into account the application of enhanced recovery programme presently planned by the Centre, the Centre must continue the exploration, drilling, production and exploitation activities of crude oil from educational and training point of view. In other words, the Centre is in a position never to be able to stop oil production, even from the oil fields which have already reached to the end of commercial life.

In case of the above (b), the problems of means and cost of transportation of crude oil from Cepu to PERTAMINA's existing refineries or crude terminals would have to be solved. However, this idea is also unrealistic, because, in actuality, there is no economically suitable and effective transportation method of crude oil to the PERTAMINA's refineries and crude terminals, all of which are located remote from the Centre.

It is therefore a logical conclusion that the Centre must continue processing crude oil produced in Cepu regardless of its volume. The option of permanent shutdown and scrapping of the existing unit would bring to the Centre as critical influence as one that the foundation of the Centre itself would be undermined. Practically, therefore, this option can never be adopted, for the reason of its extremely great influence. Consequently, the renovation of the existing refinery (atmospheric unit) which includes new installation, should be considered "indispensable option" and "must". Now, the main question in the subsequent discussions in which alternative renovation plan would be the most suitable and recommendable for the Centre, that is, which is more suitable, the new installation/complete renewal or the partial renewal. This choice can easily be made based on the discussions and results so far developed. The followings comparatively summarize major advantages and disadvantages/problems of the three alternative renovation plans for the refinery (atmospheric unit) of the Centre.

(1) Required funds for renovation

There is not much difference in the amount of required funds among the three alternative plans, although the alternatives of the partial renewal require, of course, relatively less funds.

(2) Problems related to shutdown period of the refinery

In case of Plan-I, a new atmospheric unit is installed in the area adjacent to the existing one, while maintaining the existing refinery as it is. Therefore, as far as it is operated with great care for a while until the completion of the new atmospheric unit, no special problem will occur as to the processing of crude oil produced in Cepu during the implementation of the renovation.

However, in case of the partial renewal of the existing atmospheric unit (Plan-II), at least one year's stop of the refinery is unavoidable. Therefore, during this period, problems will happen in relation to the crude oil production as to whether it is stopped or continued, in connection with the execution of training programmes, or in relation to the transportation of crude oil from the Centre to PERTAMINA refineries or crude terminals, if the crude production is continued during this period.

Such complicated/troublesome problems should be solved in case of Plan-II(A) or Plan-II(B).

(3) Suitability as training facility

In case of the partial renewal, the refinery after its renovation still carries such problems as lack of control system and instruments for operation data analysis as well as lack of availability of spareparts as pointed out before. Apparently, the new atmospheric distillation unit designed based on the concept described in Chapter 4 is much more superior to the partially renewed existing unit, as a training facility for those who are supposed to work in modern refineries.

(4) Energy saving and running cost

The new unit will make it possible to considerably decrease utilities consumption and to increase yield of products as compared to the partial renewal of the existing unit, resulting in a decrease of running cost. It is considered as one of the most important training objectives to bring up trainees who are supposed to work in modern refinery to have energy saving and cost conscious minds. In this respect, the renovation plans based on the partial renewal can not display such training effect.

(5) Operation, inspection and maintenance

Checking and open inspection, and maintenance can easily be done in case of the new installation. And this easiness and convenience displays significant training effect. For the purpose to establish and newly offer the training courses for inspection and maintenance as recommended before, this kind of training facility is indispensable and useful. However, in case of the partial renewal, problems of inconvenience for open inspection and maintenance still remain unsolved.

(6) Safety and performance of facility

In case of the new installation, both performance guarantee of equipment and guarantee for the total process can be assured. In case of the partial renewal, however, only performance guarantee for unit equipment renewed is obtained. This problem will relate to the problem of safety of the refinery.

On the basis of the results and discussions so far made, it is concluded that the renovation of the refinery of the Centre should be implemented by installing a new 2,000 BPSD atmospheric unit in the adjacent area to the existing refinery, while leaving the existing unit either as it is or scrapped after the completion of the new unit.

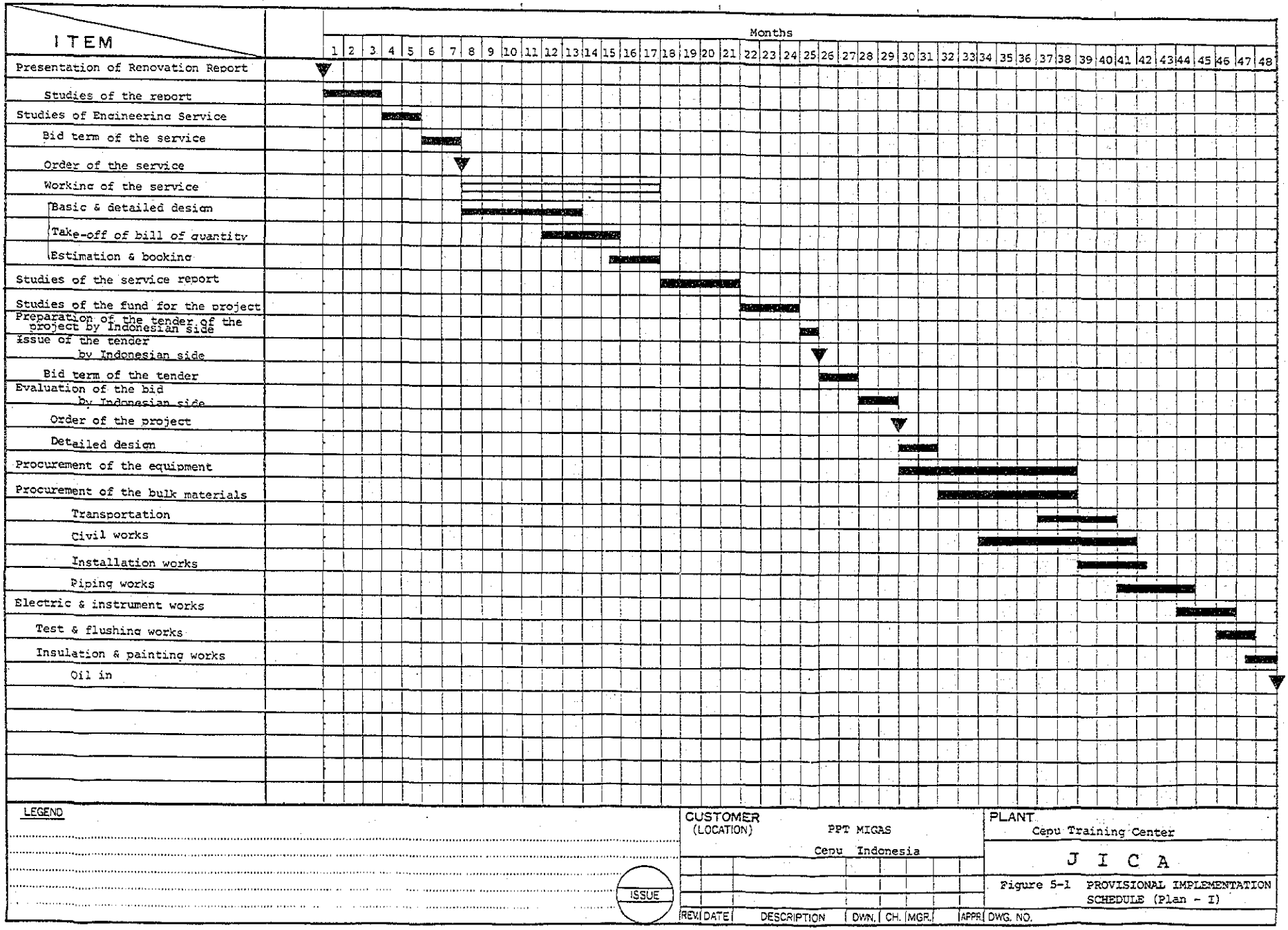
5.2.2 Workship Machine, Laboratory Equipment, and Equipment for Inspection and Maintenance

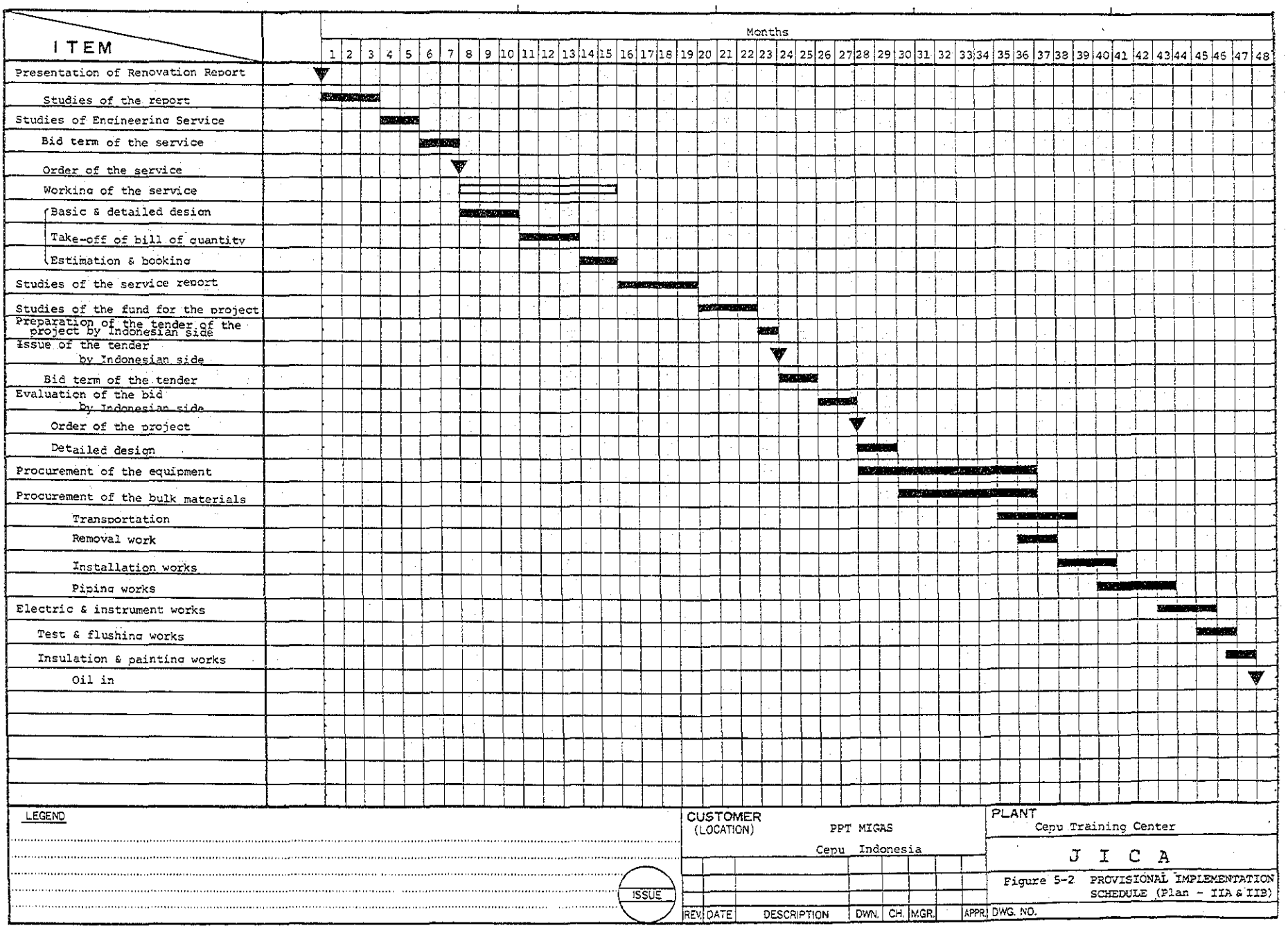
As for the workshop machine, although the two alternative plans were studied, it is basically desirable to select the greater extent of renovation plan, so far as funds are made available. However, it is more reasonable that these two alternative plans are not considered as exclusive options, but instead considered as two successive steps renovation.

It is judged that such machine and equipment as listed under the renovation plans for the workshop and laboratories should be newly introduced to the Centre as a matter of course if taking into consideration the training need arising from, and situation of, the oil and gas industry surrounding the Centre and also the important roles having been played by the Centre in the Indonesian oil and gas industry.

5.3 Tentative Implementation Schedule

A tentative schedule for the implementation of renovation of the existing refinery (atmospheric distillation unit) is shown in Figure 5-1 (Plan-I) and Figure 5-2 (Plan-II). There is no significant difference between Plan-I and Plan-II.


ITEM
Months
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 37 38 39 40 41 42 43 44 45 46 47 48
Presentation of Renovation Report
Studies of the report
Studies of Engineering Service
Bid term of the service
Order of the service
Working of the service
Basic & detailed design
Take-off of bill of quantity
Estimation & booking
Studies of the service report
Studies of the fund for the project
Preparation of the tender of the project by Indonesian side
Issue of the tender by Indonesian side
Bid term of the tender
Evaluation of the bid by Indonesian side
Order of the project
Detailed design
Procurement of the equipment
Procurement of the bulk materials
Transportation
Civil works
Installation works
Piping works
Electric & instrument works
Test & flushing works
Insulation & painting works
Oil in
LEGEND
ISSUE
CUSTOMER
(LOCATION)
PPT MIGAS
Cepu Indonesia
PLANT
Cepu Training Center
J I C A
Figure 5-1 PROVISIONAL IMPLEMENTATION SCHEDULE (Plan - I)
REV. DATE DESCRIPTION DWN. CH. MGR. APPR. DWG. NO.


ITEM
Months
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 37 38 39 40 41 42 43 44 45 46 47 48
Presentation of Renovation Report
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Bid term of the tender
Evaluation of the bid by Indonesian side
Order of the project
Detailed design
Procurement of the equipment
Procurement of the bulk materials
Transportation
Removal work
Installation works
Piping works
Electric & instrument works
Test & flushing works
Insulation & painting works
Oil in
LEGEND
ISSUE
REV. DATE DESCRIPTION DWN. CH. MGR. APPR.
CUSTOMER
(LOCATION) PPT MIGAS
Cepu Indonesia
PLANT
Cepu Training Center
J I C A
Figure 5-2 PROVISIONAL IMPLEMENTATION SCHEDULE (Plan - IIA & IIB)
DWG. NO.

Chapter 6 Conclusions and Recommendation

Based on the results of all the studies and discussions made in the previous parts of the report, the JICA study team concludes and recommends as follows. It is noted that the recommendation presented here has been made in accordance with the basic policy of the Government of Indonesia for further development of the Cepu Oil and Gas Training Centre:

(1) The Cepu Oil and Gas Training Centre, which belongs to the Directrate General of Oil and Gas, Ministry of Mines and Energy of the Republic of Indonesia, is an important governmental institution for the planning and implementation of educational and training activities in the fields of oil and gas industry.

(2) The clients of the training activities/courses offered by the Cepu Oil and Gas Training Centre consist of i) PERTAMINA, the national oil company, ii) foreign oil contractors contracting with PERTAMINA and operating in Indonesia, iii) oil and gas related companies, iv) oil and gas related institutions, and v) developing countries. Above all, PERTAMINA is the biggest client among them. In this respect, it is considered that the Centre acts as a servicing institution for PERTAMINA in terms of education and training.

(3) The core/key role played in the national economy of Indonesia by, and the recent development of, the oil and gas industry has been creating an extensive and intensive training need, both in terms of quantity and quality.

(4) In order to substantiate such training need raised by the clients and to implement training, it is essential to establish a good reputation as a training institution and to have the clients' confidence. The Centre's training activities and performance have already acquired and are enjoying, a highly reputable confidence from the clients and other relevant organizations. In this sense, therefore, the Centre's foundation for further development of training activities, --- the Centre being an important and indispensable institution within the framework of domestic educational and training system ---, has already been satisfactorily established.

(5) Reflecting such situation, an increasing training need to the Centre is also arising abroad. The growth of the training need from developing countries requires and makes it possible for the Centre to carry out/offer training courses under the TCDC programme and ASEAN-Pacific programme, and forms an appropriate background situation which requires the Centre to act, in its nature, as a regional training centre as well.

Under such circumstance, the Centre is strongly requested by the Government not only to be an indispensable institution under the domestic education/training system, but at the same time to become a regional training centre for the oil and gas industry, especially for ASEAN-Pacific region.

(6) On the other hand, the existing training facilities and equipment, which constitute hardware of the Centre, are in a quite unsatisfactory and unsufficient condition. The existing refinery (atmospheric distillation unit with nominal capacity of 2,000 BPSD), and most of the workshop machine and laboratory equipment are technologically behind and too old/out-of-date to be properly used more in training practice. Especially, the existing refinery is extremely old (50 - 60 years) and unsuitable for those who are supposed to work in modern refineries. Moreover, it has recently caused fire accidents several times due to the supperannuation of major equipment. Therefore, further operation of the existing refinery is no longer recommendable.

(7) These problems encountered in the existing facilities and equipment constitute the greatest obstacle to the implementation and development of more effective training activities to play the important role as required above. Apparently, the existing training facilities and equipment of the Centre can not suitably/properly respond to the potential need from the oil and gas industry in Indonesia.

(8) The renovation plans proposed in this study not only solve such problems of the Centre and to improve its situation, but at the same time, should be considered indispensable and 'must' for the Centre. In other word, without the realization of the proposed renovation plans, not only would the Centre be unable to satisfy the growing need of the clients, but also the Centre itself would lose the historical background and foundation of its existence as a training centre.

(9) As for the renovation of the existing refinery (atmospheric distillation unit), two alternative renovation plans have been studied; total renewal (new installation) and partial renewal. In view of such essential factors as required funds for renovation, problems related to shut-down period of the refinery, suitability as training-facility, energy saving and running cost, easiness of inspection and maintenance, and safety and performance of facility, it is concluded and recommended that the renovation of the refinery of the Centre should be implemented by installing a new 2,000 BPSD atmospheric distillation unit in the adjacent area of the existing refinery.

(10) As for the curriculum and syllabus of the Centre, detailed diagnosis and recommendations for further improvement and development are made under the assistance of UNDP. Especially, the development of curriculum and programme for the on-the-job training conducted in the clients' companies, which characterizes the present sandwich system of training, is very essential. Naturally, educational/training effects are influenced by various factors. Above all, however, they depend, to the greatest extent, upon the teaching staff's nature and capacity. In this respect, the present efforts being made for the trainers' training should be continued.

(11) The amount of funds required for the implementation of the proposed renovation plans is estimated at 1,376 million yens (of which the foreign portion is 1,074 million) for the refinery (atmospheric distillation unit) and at 903 million yens (of whch the foreign portion is 900 million) for the workshop machine, laboratory equipment, and equipment for inspection and maintenance. Therefore, the total equirements amount to 2,279 million yens, of which the foreign exchange portion is estimated at 1,974 million.

(12) Not as in the case for ordinary renovation of commercial plants, the proposed renovation of those facilities and equipment of the Centre is totally incapable of generating cash. Under the present budgeting and financial management system of the Centre, it is absolutely impossible to newly create any funds necessary for the realization of renovation by its own hands based on the Centre's financial operation, or to generate any available cash used for repayment of loan after the realization of the renovation (in case that the renovation is implemented based on loan). In any case, regardless of whatever the possible financial sources are, it is an

essential and indispensable condition that such funds for renovation should not constitute any burden to the Centre.

(13) Recognizing the importance and significance of long-term role and responsibility of the Centre in connection with the overwhelmingly dominant position of the oil and gas industry in the framework of the national economy of the country, it is highly desired that the proposed renovation plans which have proved to contribute to the significant increase of the training effectiveness of the Cepu Oil and Gas Training Centre, be urgently implemented.