Chapter 7 Improvement and Development of Training Activities

On the basis of the discussions developed in the previous Part III concerning the training activities of the Centre, major recommendations are enumerated below for further improvement and development of the Centre's training activities. Besides, increased opportunities for the assistance of foreign consultants and experts, and the training of the Centre's teaching staff, are also recommendable.

This Chapter also presents at its end a proposal on the contents of the new courses for inspection and maintenance supposed to be commenced/offered by the Centre in the near future.

(1) It is recommendable that the syllabus for the regular and short courses be successively revised through "Aims and Objectives" technique. For this purpose, it is necessary to grasp job and duty of corresponding course level. Further collaboration with the clients will make it possible to grasp clearly the job analysis and job description.

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

(3) The implementation and development of the above item (1) and (2) is not necessarily easy, especially in a short term. Therefore, assistance of consultants and experts specializing in the field of training development would be necessary and useful. In this respect, dispatch of experts or consulting firm staff in a long term under the technical and financial assistance from specialized agencies in the world would be considered as one of the realistic measures.

(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. For this purpose, the video-editing/compilation system would become useful. In order to prepare videotape teaching materials, considerable experience and skill is required. Therefore, training of teaching staff members who would take care of this is also important. It is desirable that both dispatch of experts from equipment manufacturers to the Centre and training of the Centre's staff in the equipment manufacturers would be desired.

(5) In the training practice in the laboratories, it is desirable not only to give all the necessary instructions in advance to the students/trainees but also to adopt a method of training practice in which the students/trainees have to think, assemble and investigate themselves. By means of this, they would be able to be educated/trained to develop potential ability to use the already acquired knowledge in the solution of practical problems in the near futrue.

(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. It is especially important to keep up with the progress in modern technologies and also to master industrial minds.

(7) It is also desired that great attention be given to maintenance of the laboratory equipment and workshop machine. As for newly introduced equipment/machine to the Centre, it is recommendable to make maintenance contract with equipment/machine manufacturers and suppliers.

(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. A complete list of technical books, magazines and other publications potentially needed for the Centre should also be prepared by fields of specialization.

(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. For this reason, presented below is a proposal for contents of these new training courses. Both courses are 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.

Non-destructive Inspection Course

This new course may be arranged to have the following training subjects and instruction hours.

Training Subject	Recommended Instruction Hours
a) Radiographic Testing Method	
- Introduction	12
- Physical Principles	30
- Radiation Source	18
- Radiation Detection	18
- Personnel Safety and Radiation Protection	18
- The Radiographic Process	48
- Test Result Interpretation	40
- Practice	30
Sub-Total	214 hours

b) Ultrasonic Testing Method

- Fundamental Properties of Sound	10
- Principles of Wave Propagation	15
- Generation of Ultrasonic Waves	15
- Ultrasonic Testing Methods	15
- Ultrasonic Testing Equipment	5
- Operation of Specific Equipment	20
- Specific Testing Procedures	35
- Variables Affecting Test Results	20
- Practice	35
Sub-Total	170 hours

c) Magnetic Particle Testing Method

- Principles of Magnets and Magnetic Fields	3
- Characteristics of Magnetic Fields	3
- Effect of Discontinuities on Materials	6
- Magnetization by Means of Electric Current	6
- Selecting the Proper Method of Magnetization	6
- Inspection Materials	3
- Principles of Demagnetization	3
- Magnetic Particle Test Equipment	6
- Types of Discontinuities Located by Magnetic Particle Testing	3
- Magnetic Particle Test Indications and Interpretation	12
- Practice	15
Sub-Total	66 hours

d) Liquid Penetrant Testing Method

- Introduction	3
- Liquid Penetrant Processing	8
- Selection of Penetrant Test Method	3
- Liquid Penetrant Test Equipment	6
- Liquid Penetrant Indications	8
- Inspection Procedures and Standards	6
- Practice	15
Sub-Total	49 hours

e) Eddy Current Testing Method

- Introduction	3
- Theory of Eddy Current Testing	5
- Type of Sensitivity Element	7
- Element Affected by Coil Impedance	7
- S/N Ratio	4
- Selection of Frequency	4
- Coupler	6
- Magnetic Field Strength and it's selection	6
- Consideration of Equipment	6
- Reading Device	6
- Application	8
- Standard and Operating Procedure	15
- Practice	35
Sub-Total	112 hours

f) Condition Monitering Method

- Introduction for each Equipment	6
- Handling of each Monitering Equipmen	8
- Interpretation of monitering Data	16
- Inspection and Maintenance of Rotating Machine	8
Sub-Total	38 hours

g) Other Testing Method

- Introduction (for each testing)	3
- Theory (for each testing)	3
- Characteristic and Selection of each Testing	4
- Operating Procedure	5
- Standard and Interpretation	5
- Practice	10
Sub-Total	30 hours
Grand Total:	679 hours

Note: The instruction hours are estimated assuming that the students/trainees have already basic technical knowledge equivalent to that of high school graduates.

Maintenance Course

Training Subject	Recommended Instruction Hours
a) Introduction	
- Material Science	25
- Energ Management	10
Sub-Total	35 hours
b) Maintenance Scheduling	
- Training of Critical Pass Method	30
- Daily Maintenance Scheduling	10
- Shut Down Maintenance Scheduling	
. Grasp of work details	10
. Estimation of standard man-power	30
. Planning of schedule	50
Sub-Total	130 hours

c) Preventive Maintenance

- Estimation of Corrosion Rate	15
- Estimation of Life	15
Sub-Total	30 hours

d) Maintenance of General Equipment

- Towers and Vessels	15
- Reactor	15
- Heat Exchangers	30
- Furnaces	20
- Pumps	50
- Compressor	50
- Fire Extinguisher	15
- Pipings	20
- Wirings	10
Sub-Total	225 hours

e) Maintenance of Special Equipment

- Instruments	50
- Diesel Engines	50
- Generator	50
- Boiler	30
- Electrical Motor	10
- Electrical Facilities	15
- Water Treater	20
- Cooling Tower	5
- Oil Separator	5
Sub-Total	235 hours
Grand Total:	655 hours

PART V

FUNDS REQUIREMENTS AND EVALUATION

OF RENOVATIONS PLANS

Part V FUNDS REQUIREMENTS AND EVALUATION OF RENOVATION PLANS

Chapter 1 Estimation of Required Funds for Renovation Plans

1.1 Refinery (Atmospheric Distillation Unit)

Required funds have been estimated for each of the three alternative renovation plans for the refinery (atmospheric distillation unit) of the Centre as proposed in chapter 2 of the previous Part IV. The results of estimation is indicated all together in Table V-1-1. Total required funds are estimated as follows:

(Expressed 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	322.3	1,301.3

It is observed that in the 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 reasons:

(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 the existing equipment, becomes considerably higher.

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

(Unit in million Yen)

	PLAN－Ⅰ			PLAN－ⅡA			PLAN－ⅡB		
	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 Project 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.

Summarized below are the basis and assumptions for the estimation of required funds for the implementation of renovation plans.

(1) FOB Equipment/Materials

a) Plan-I (New Installation)

All the equipment and materials stipulated in the equipment list and flow sheet presented in Section 2.2 of Chapter 2, Part IV are included, and assumed to be imported from Japan.

b) Plan-II (Partial Renewal)

Including equipment listed in Section 2.3 and 2.4 of Chapter-2, Part IV, pipings, electricals, instruments and insulations, etc. needed for the partial renewal. All equipment and materials are assumed to be imported from Japan.

(2) Spareparts

It is assumed that, as necessary spareparts after the renovation, a 10% on the FOB equipment/materials cost is included for each case assuming the import from Japan. Chemicals and lubricants are not included in this estimate by assuming that they are already available in the Centre.

(3) Erection work

A big crane is needed for the removal of old/superannuated equipment and installation of new equipment. In this estimate, it is assumed by, taking into account local conditions, that it will be hired from Singapore on a rental basis. The field erection will be done relatively easily, because the

atmospheric unit is neither of a facility operated at high temperature and pressure, nor made of special alloy. It is assumed that an Indonesian contractor will take care of the erection under the supervision of foreign experts.

(4) Civil work

It is assumed that all civil materials such as concrete pile, cement, sand, gravel, and steel bar and frame, are made available in Indonesia, and that the work will be done by an Indonesian contractor under the supervision of foreign experts.

(5) Transportation and insurance

Costs for Ocean transportation with marine insurance, from Japan to Surabaya, and for local handling which includes unloading in the port and inland transportation are estimated based on freight-ton of imported equipment and materials.

(6) Project expense

This expense consists of those costs for trips, communication, printings, books, use of computer required for the project execution in the prime contractor's home office and field office, in addition to those costs required for the temporary work, erection insurance, export insurance, insurance for third parties, etc.

(7) Supervising service

This includes all the fees and expenses such as trips, transportation, daily subsistence, insurance, etc. needed for supervising local construction work by foreign experts.

(8) Engineering fee

The following services are included:

a) Basic engineering

b) Detail engineering

c) Preparation of engineering standards for specified jobs

d) Procurement services of equipment and materials

e) Transportation services of equipment and materials

f) Preparation of manuals, etc.

(9) Physical contingency

This cost provides for unforeseen increase of the required funds which could be caused by change of the conceptual design and unexpected factors which were not grasped precisely during the field survey in Indonesia.

(10) Price contingency

This makes provision for future price escalation of goods and services. The following escalation rates are assumed from October 1985 when the estimation is made, to the mechanical completion and start-up of the atmospheric distillation unit.

1986: 4%
1987: 5%
1988: 6%

1.2 Workshop Machine, Laboratory Equipment, and Tools for Inspection and Maintenance

Funds requirements for the implementation of the renovation plans as proposed in the previous Part IV for the workshop machine, laboratory equipment, and equipment for inspection and maintenance have been estimated and presented in Table V-1-2. Total required funds for each of the above categories are summarized below:

(Expressed 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*:	297.7	0.3	298.0
Inspection Tool:	101.6	0.2	101.8
Maintenance Tool:	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

* Including Training Aids for AKAMIGAS

These estimates for the required funds are made based on the same basis and assumptions applied to those for the refinery.

Table V－1－2 REQUIRED FUNDS FOR RENOVATION OF WORKSHOP MACHINE, LABORATORY EQUIPMENT, AND EQUIPMENT FOR INSPECTION AND MAINTENANCE

(Unit in Million Yen)

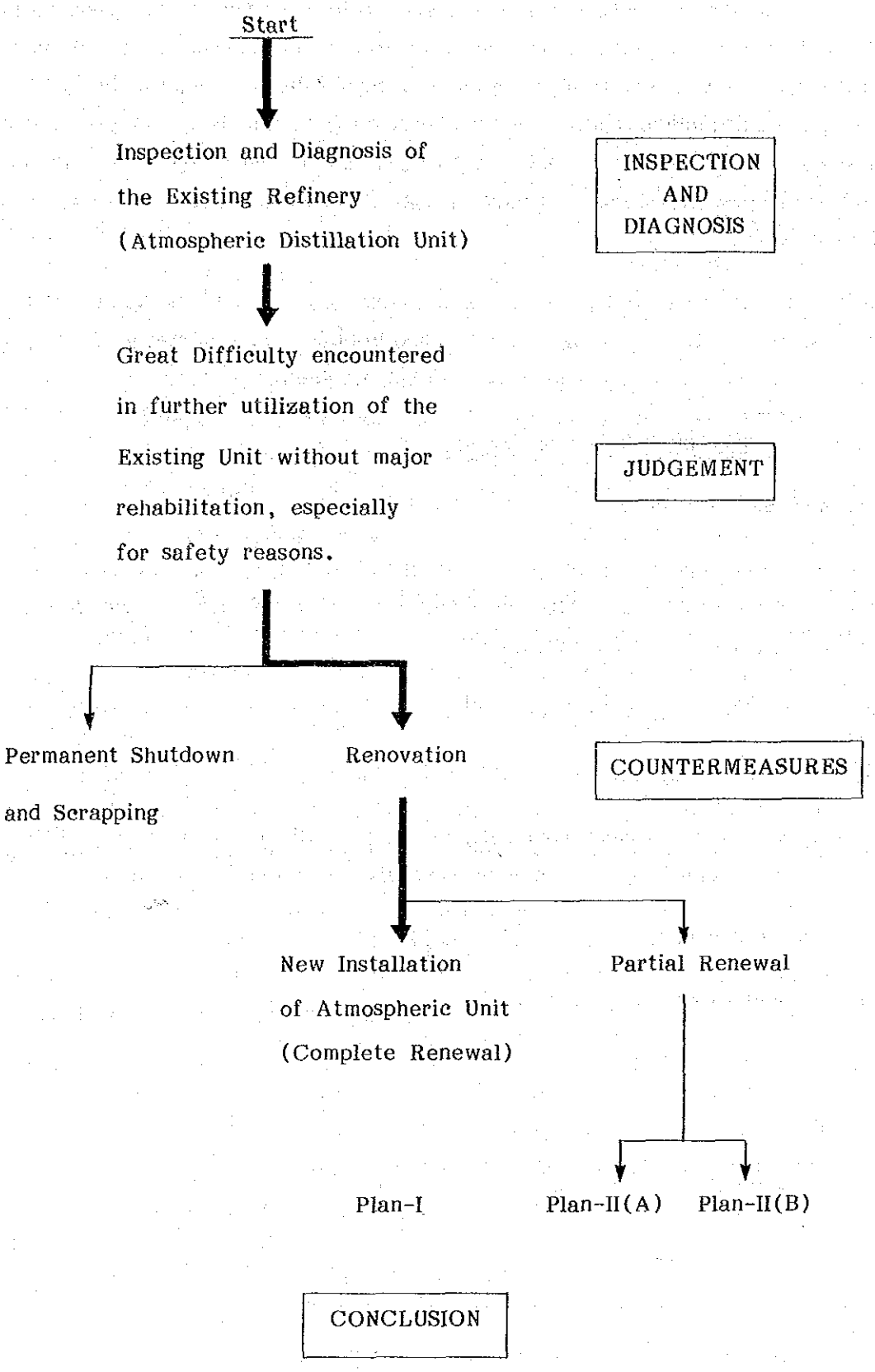
	Work shop Machine Alternative-Ⅰ	Work shop Machine Alternative-Ⅱ	Laborototy Equipment	Inspection Tool	Maintenance Tool
F O B				82.6	50.7
Freight & Insurance				5.1	3.9
C I F	89.4	377.2	257.0	87.7	54.6
Inland transportation	0.8	2.8	0.3	0.2	0.2
Base Cost (in Jan.1986 price)	90.2	380.0	257.3	87.9	54.8
Price 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

Chapter 2 Evaluation and Comparative Advantage of Alternative Renovation Plans

In Part IV and in Chapter 1 of Part V, the renovation plans for the refinery (atmospheric distillation unit), laboratories, workshop, and equipment for inspection and maintenance have been formulated and analysed, resulting in the estimation of required funds for each renovation plan. This chapter discusses evaluation and comparative advantage of the renovation plans.

2.1 Refinery (Atmospheric Distillation Unit)

On the basis of the results of inspection and disgnosis described in Part II and Part III, 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[1/].

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 follow:

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

If n is assumed to be equal to 0.65,

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

Note: 1/ Interim Report and Minutes of Meeting, July 1985.

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 atomospheric 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 will inevitably have to adopted:

a) Permanent stop of crude oil production in Cepu.

b) Transportation of crude oil produced in Cepu to a PERTAMINA's existing refinery or crude oil terminal.

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 by the Centre themselves. 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 critical situation mentioned above would simbolize 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 remarkable 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 in the proximity of 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 refinery or crude terminal 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 one of 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 parmanent shutdown and scrapping of the existing unit would bring to the Centre as a 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 is which alternative renovation plan would be the most suitable and recommendable one 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 carrys 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 Part IV 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 useful and indispensable. 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 perfomance 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.

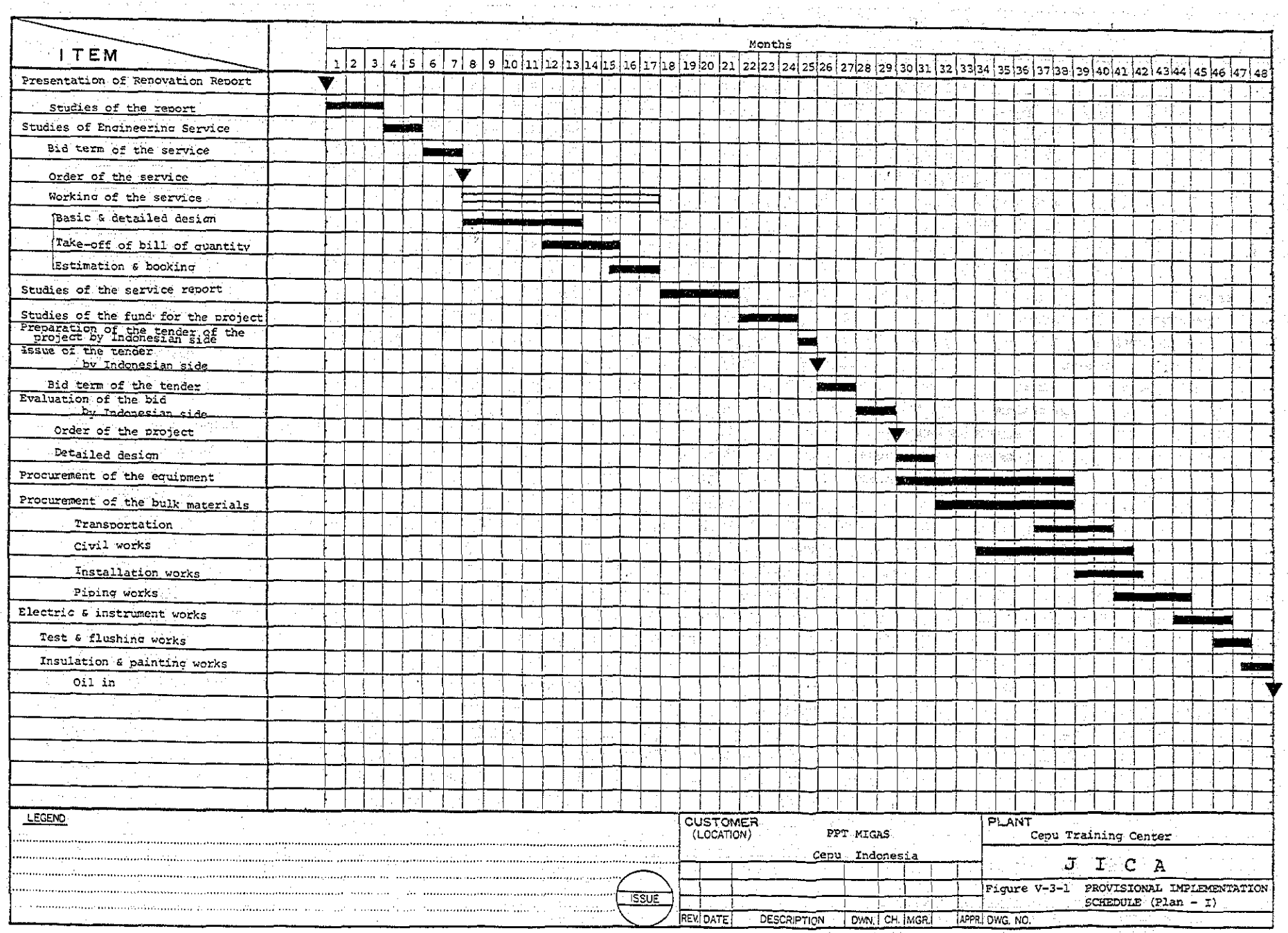
2.2 Workshop Machine, Laboratory Equipment, and Equipment for Inspection and Maintenance

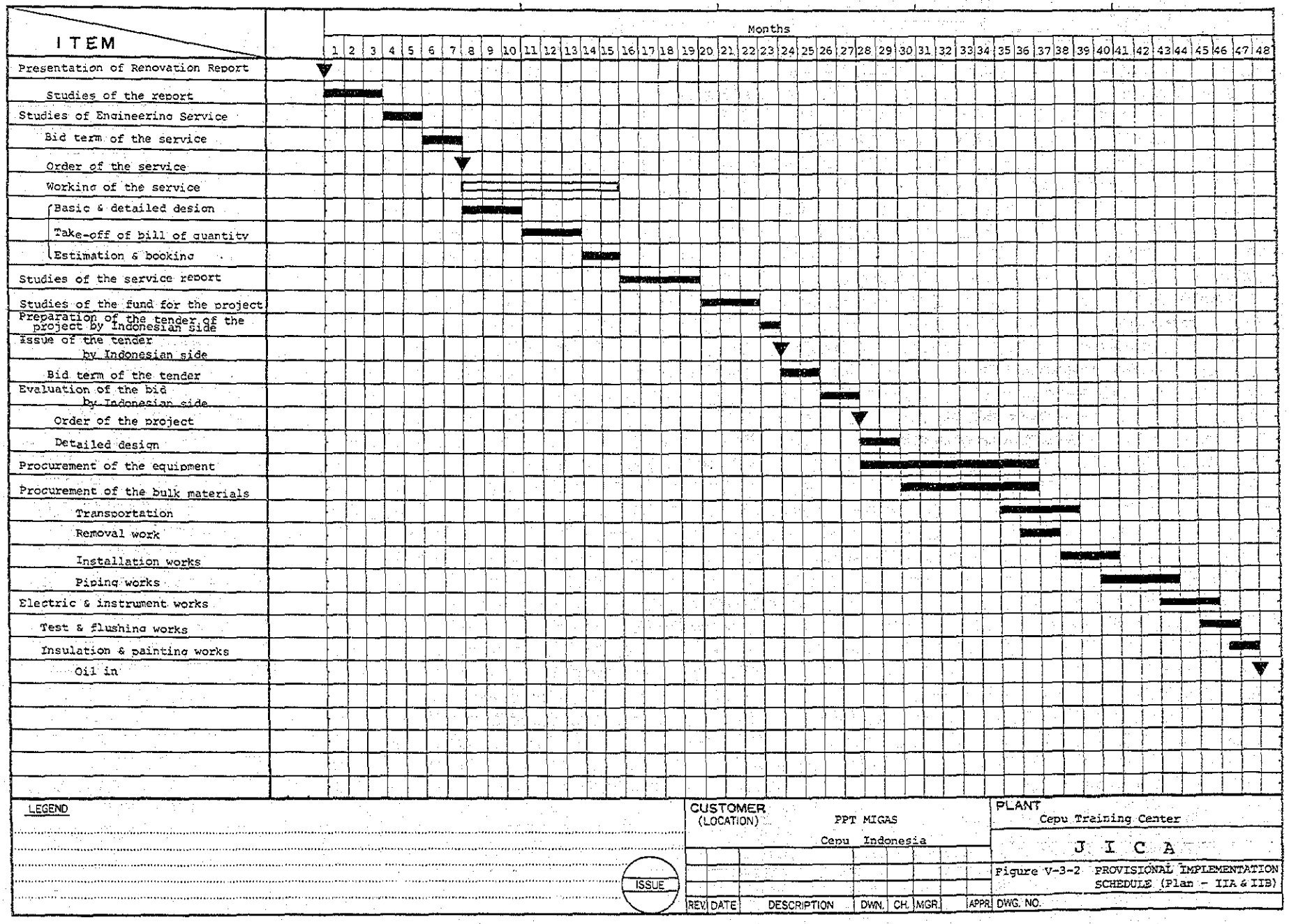
As for the workshop machine, although the two alterntive plans were studied, it is basically desirable to select the greater extent of renovation plan, so far as funds can be made available. However, it is more reasonable that these two alternative plans are not considered as exclusive options, but instead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

It is judged that such machine and equipment as listed before 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.

Chapter 3 Tentative Implementation Schedule

A tentative implementation schedule for renovation of the existing refinery (atmospheric distillation unit) is presented in Figure V-3-1 (Plan-I) and Figure V-3-2 (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 V-3-1 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
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
Removal work
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 V-3-2 PROVISIONAL IMPLEMENTATION SCHEDULE (Plan - IIA & IIB)
REV. DATE DESCRIPTION DWN. CH. MGR. APPR. DWG. NO.

PART VI

CONCLUSIONS AND RECOMMENDATION

Part VI 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 pertial 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.

ANNEX

ANNEX I

Annex I-1-1

Scope of Work for the Study

on

the Renovation of Cepu Training Center (CTA-159)

in

the Republic of Indonesia

agreed upon between

the Directorate General of Oil and Gas

Ministry of Mining and Energy

and

the Japan International Cooperation Agency

Jakarta, March 6, 1985

Keiichi TAKEDA
Leader of Japanese Survey Team
JICA

Ir. MUCHTISAR DAENG PUTRA
Director of Cepu Oil & Gas
Training Centre

I. INTRODUCTION

In response of the request of the Government of the Republic of Indonesia, the Government of Japan has decided to conduct a study on the Renovation (hereinafter referred to as "the Study") of Cepu Training Center, "PPT MIGAS" (hereinafter referred to as "CTC") in accordance with the laws and regulations in force in Japan.

The Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study, in close cooperation with the authorities concerned of the Government of the Republic of Indonesia.

The Directorate General of Oil and Gas, Ministry of Mining and Energy (hereinafter referred to as "DGOG") shall act as a counterpart agency and also designate CTC as the executing body to the Japanese study team (hereinafter referred to as "the Team") in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study. The present documents set forth the scope of work with regard to the Study.

II. OBJECTIVE OF THE STUDY

The objective of the Study is to diagnose CTC and to investigate the possibility of their renovation from technical, financial and economic points of view and also from the viewpoint of effectiveness of training in order to contribute to improvement of the ability of CTC as a training center.

III. SCOPE OF THE STUDY

In order to achieve the above objective, the Study will cover the following items:

1. Policy of the Government of the Republic of Indonesia with respect to the renovation of CTC.

2. Diagnosis of management of CTC
   - 2-1 operation of the refinery, training school and associated facilities
   - 2-2 maintenance of the refinery, training school and asssociated facilities
   - 2-3 process control, quality control, pollution control, safety control and cost control
   - 2-4 training activities
   - 2-5 purchasing practice and inventory control of spare parts
   - 2-6 administration

3. Technical diagnosis of the existing facilities
   - 3-1 conditions of the processing, offsite and auxiliary facilities including selected surface production facilities.
   - 3-2 conditions of the facilities for training
   - 3-3 conditions of the machine tools, workshop, warehouse of spare parts and other buildings

4. Study on the process
   - 4-1 present process scheme
   - 4-2 crude oils processed
   - 4-3 products quality
   - 4-4 modification of the processing scheme
   - 4-5 offtake by Pertamina of the products in relation to the quantity and quality of the products
   - 4-6 effectiveness of training in relation to the processing scheme

5. Study on the training activities
   5-1 need of training
   5-2 the training curriculums and methods
   5-3 training equipment

6. Formulation of renovation program
   6-1 renovation plan
   6-2 capital requirement
   6-3 implementation schedule

7. Evaluation
   7-1 financial analysis
   7-2 economic evaluation
   7-3 evaluation of the effectiveness of training

8. Conclusion and recommendation

IV. STEPS AND SCHEDULE OF THE STUDY

1. Steps
   Step 1: Preparatory office work in Japan
   Step 2: Field work in Indonesia
   Step 3: Home office work in Japan
   Step 4: Presentation of and Discussion on the Draft Final Report

2. Schedule
   As shown in Annex

V. REPORTS

JICA will prepare and submit the following reports written in English to the Government of the Republic of Indonesia:

1. Progress Report at the end of Step 2: 10 copies
2. Draft Final Report and its summary within 3.5 (three and a half) months after the commencement of Step 2: 15 copies
3. Final Report and its summary within 2 (two) months after the receipt of comments on the Draft Final Report by DGOG 30 copies

VI. UNDERTAKING OF THE GOVERNMENT OF THE REPUBLIC OF INDONESIA

The Government of the Republic of Indonesia shall accord privileges, immunities and other benefits to the Team and, through the authorities concerned, take the following necessary measures to facilitate the smooth implementation of the Study:

1. The Government of the Republic of Indonesia shall make necessary arrangements with the cooperation of other governmental and non-governmental organizations concerned for the following:

   1-1 to secure the safety of the Team

   1-2 to permit the members of the TEam to enter, leave and sojourn in Indonesia for the duration of their assignment therein, and exempt them from alien registration requirements

   1-3 to exempt the members of Team from taxes, duties and other charges on requirement, instrument and other materials brought into Indonesia for the implementation of the Study

   1-4 to exempt the members of the Team from income taxes and other charges of any kinds imposed on or in connection with any emoluments or allowances paid to the members of the Team for their services in connection with the implementation of the Study

   1-5 to provide the necessary facilities to the Team for the remittance as well as utilities of fund introduced in Indonesia from Japan in connection with the implementation of the Study

   1-6 to provide medical services as needed and its expenses will be chargeable on the members of the Team

   1-7 to secure permission to take all data and documents related to the Study (including photographs) out of Indonesia to Japan by the Team

2. The Government of the Republic of Indonesia shall, at its own expenses, provide the Team with the following, in cooperation with other agencies concerned, if necessary:

   2-1 counterpart personnel

   2-2 suitable office spaces with necessary equipment including telephone in Cepu

2-3 credentials or identification cards
2-4 necessary vehicles with drivers, fuel and spare parts in the projected areas
2-5 necessary personnel for the Study

3. The Government of the Republic of Indonesia shall bear claims, if any, which may arise against the membes of the Team resulting from, occurring in the course of, or otherwise connected with the discharge of their duties in implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of members of the Team.

VII. UNDERTAKING OF THE GOVERNMENT OF JAPAN

For the implementation of the Study, the Government of Japan will, through JICA, take the following measures:

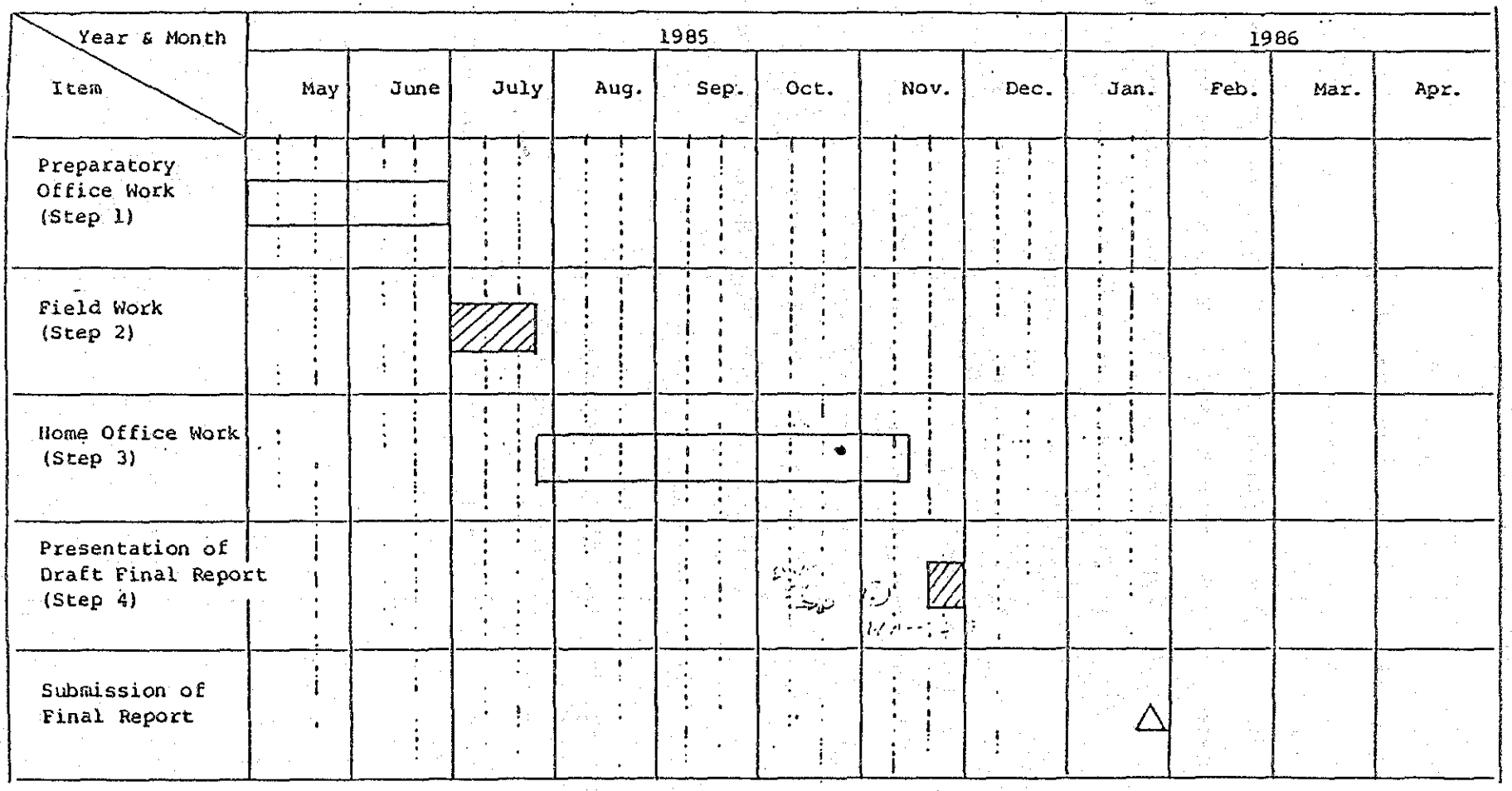
1. To dispatch, at its own expense, the Team to Indonesia
2. To pursue technology transfer to the Indonesian counterpart personnel in the course of the Study

VIII. CONSULTATION

JICA and DGOG will consult with each other in respect of any matter that may arise in the interpretation of implementation of the present arrangement.

Tentative Schedule of the Study

Annex



Annex I-2-1 JICA Study Team Members

Team Leader	Susumu Nakagawa	Toyo Engineering Corp.
Sub-leader	Takashi Uchiyama	Toyo Engineering Corp.
	Shoji Odagiri	Cosmo International Corp.
	Hirofumi Tokumoto	Koa Oil Co. Ltd.
	Minoru Takada	Cosmo International Corp.
	Yoshiaki Nakamura	UNICO International Corp.
	Soichi Sato	P.I.M[1/]
	Shunsaku Kondo	P.I.M[1/]
	Tetsuo Kanamori	Toyo Engineering Corp.[2/]
	Mitoshi Higashiuchi	Toyo Engineering Corp.[2/]

Note: 1/ For field inspection

2/ For home office work

Annex I-2-2 PPT MIGAS COUNTERPART TEAM MEMBERS

Name	Background	Assigned work
Messers.		
Muchtisar DP	Chemical Engineer	Overaal management and Coordination
Soepanan	Chemical Engineer	Renovation Programme - Product Quality
Koesmartono	Chemical Engineer	Renovation Programme management and administration (CTC).
Parjono	Chemical Engineer	Renovation Programme
Sumaryo	Mechanical Engineer	Management and training system.
Sakino Ng	Economics	Education and training system " AKAMIGAS ".
R. Hartojo	Mechanical Engineer	Training system
MD. Hartanto	Agr. Academic	AKAMIGAS
BP. Simandjuntak	Civil Engineer	Inspection and maintenance, Coordination. Buildings structur and foundation.
Djoko Purnomo	Instrument Engineer	- Inspection and measuring. - Instrumentation
R. SumarsonoBcM	Mechanical Engineer	Inspection and measuring
Wisnu Priyanto BcM	Mechanical Engineer	Work Shop
Sandjojo BE	Mechanical Engineer	Work Shop
Indrawan	Electrical Engineer	- Inspection and measuring - Electrical fasilities. - Electrical power fasilities.

Name	Background	Assigned Work
Zuhdan Fathoni	Chemical Engineer	Safety Control
F.X. Suwar	Technician	Safety Control
Sulistijanto	Chemical Engineer	Pollution Control
Hermadi S.	Industrial Engineer	Pollution Control
Mustakim	Chemical Engineer	- Process study, coordination - Simulator - Cut off model
Asmorowati	Chemical Engineer	Laboratories Library
Sulindrijo	Chemical Engineer	Process study
Suparno	Chemical Engineer	Process study
Winarno BcM	Chemical Engineer	Refinery Operation
Ichsan Muchtar	Chemical Engineer	Refinery Operation
Praseno	Chemical Engineer	Product Quality
Sunarhadiyanto	Mechanical Engineer	Technical Disaigns. Pumps, Compressors Well pump and driver
Suparto	Mechanical Engineer	Gathering Tank, storage tank. Piping Boiler. Water receiving and distributing facilities
Kuskun	Technician	Maintenance
Purwanto	Technician	Maintenance
IP. Lubis	Business Administration	Purchasing, inventory control of sparepart
Warimin W.BSc	Business Administration	Financial Analysis
Jan Pieter	Legal & Administration	Administration
Santosa Suparma	Fishery Engineer	Affiliation Section
Sumadi A.	Linguist	English Instructor

ANNEX II

ANNEX II-2-1 FINANCIAL SITUATION OF THE CEPU OIL AND GAS TRAINING CENTRE

The financial situation of the Centre for the fiscal year 1984/1985 is summarized below:

(1) Annual Revenue

(Unit in million Rp.)

Government Budget	
Routing Budget:	3,562
Development Budget	855
Sub-Total:	4,417
Non-governmental Sources of Funds	
Training Fee from PERTAMINA	1,901
Training Fee from Other Companies and Institutions:	1,084
Own Sales of Products:	2,294
Other Miscellaneous Income:	241
Sub-Total:	5,520
Rest Beginning	1,990
Total Annual Revenue:	11,927

(2) Annual Expenditure

Personnel Expenditure:	2,593
Goods Expenditure:	3,515
Maintenance Expenditure:	962
Itinerary/Office Tour Expenditure:	328
Assets Expenditure:	866
Other Expenditure:	82
Total Annual Expenditure	8,346

(3) Rest Ending 3,581

For further reference, trends in the financial status of the Centre are indicated in Table A1-1 during the past five fiscal years from 1980/81 to 1984/85.

The sources of operating funds of the Centre can be divided into the government and non-government ones. The government budget consists of the routine budget and development budget (or project budget). The non-government funds consist of training fee from PERTAMINA, training fee from other companies and institutions, the Centre's own sales (such products as gasoline, kerosene, gas oil and fuel oil are transferred to PERTAMINA free of charge, and the remaining products as wax, solvent, batching oil distillate and some residue are directly sold by the Centre to local industries.) and other income such as obtained through the supply of power and water to a part of Cepu town and by the use of the hospital and guest house by people outside of the Centre.

The routine budget is for the following five items of expenditure:

- Personnel expenditure
- Purchasing of goods (including fee for non-regular lecturers of AKAMIGAS)
- Repair and maintenance
- Transportation and daily subsistence for travels of the staff members
- Others

On the other hand, the development budget is for the following items of expenditure (but tax is excluded from the fiscal year 1984/85:

- Expenditure/fee for project personnel
- Purchase/acquisition of land
- Purchasing of routine materials
- Purchasing of equipment

Table AII-1-1 FINANCIAL SITUATION OF CEPU OIL AND GAS TRAINING CENTRE
(Fiscal Year 1980 - 1984)

PPT MIGAS CEPU FINANCIAL DEPARTMENT		CASH FLOW SOURCE OF CAPITAL GOVERNMENT /NON GOVERNMENTAL BUDGET			PERIOD: APR, 1 - MAR, 31 YEAR: 1980/81 - 1984/85	
Number	Explanation	1980/1981	1981/1982	1982/1983	1983/1984	1984/1985
1.	Rest Beginning	208,696.6	694,230.3	689,287.6	923,577.8	1,989,978.5
2.	Income: Routine	2,074,980.8	2,580,350.3	2,868,914.2	3,457,865.4	3,562,459.3
	Project	723,132.6	930,102.6	1,172,857.8	1,134,863.8	854,660.8
	Trainning Fee Pertamina	-	568,165.4	1,565,580.7	1,547,300.7	1,900,652.0
	Trainning Fee Other	578,128.9	613,997.1	1,499,268.4	883,461.3	1,084,056.3
	Own Sales	863,045.4	800,321.3	1,085,552.3	1,583,526.6	2,293,606.8
	Other Income	54,305.0	61,985.1	92,731.9	160,899.8	241,324.9
	Total 2	4,293,592.7	5,554,921.8	8,284,905.0	8,767,917.6	9,936,760.1
3.	Total 1 + 2	4,502,289.3	6,249,152.1	8,974,192.6	9,691,495.4	11,926,738.6
4.	Expenditure:					
	Personal Expenditure	1,318,451.9	1,911,502.1	2,580,023.9	2,574,311.4	2,593,251.6
	Goods Expenditure	1,539,110.0	2,405,162.2	2,903,891.7	3,138,631.2	3,514,542.1
	Maintenance Expenditure	521,367.9	705,291.7	784,615.5	928,129.5	962,241.0
	Itenarery/Office Tour Expenditure	213,617.8	310,492.8	317,973.7	289,997.2	327,568.1
	Assets Expenditure	98,480.7	149,369.8	1,463,257.3	769,233.0	865,640.8
	Other Expenditure	117,030.7	78,045.9	852.6	1,214.6	82,115.4
	Total 4	3,808,059.0	5,559,864.5	8,050,614.8	7,701,516.9	8,345,359.0
5.	Rest Ending 3 - 4	694,230.3	689,287.6	923,577.8	1,989,978.5	3,581,379.6

Note: Unit of Scale = Rp 1,000,-

- Construction
- Tax
- Others

It is understood that the development budget is basically utilized for similar type of expenditure related to projects, with the exception of the formation of fixed assets such as procurement of equipment and land, and construction which represents the major difference from the routine budget.

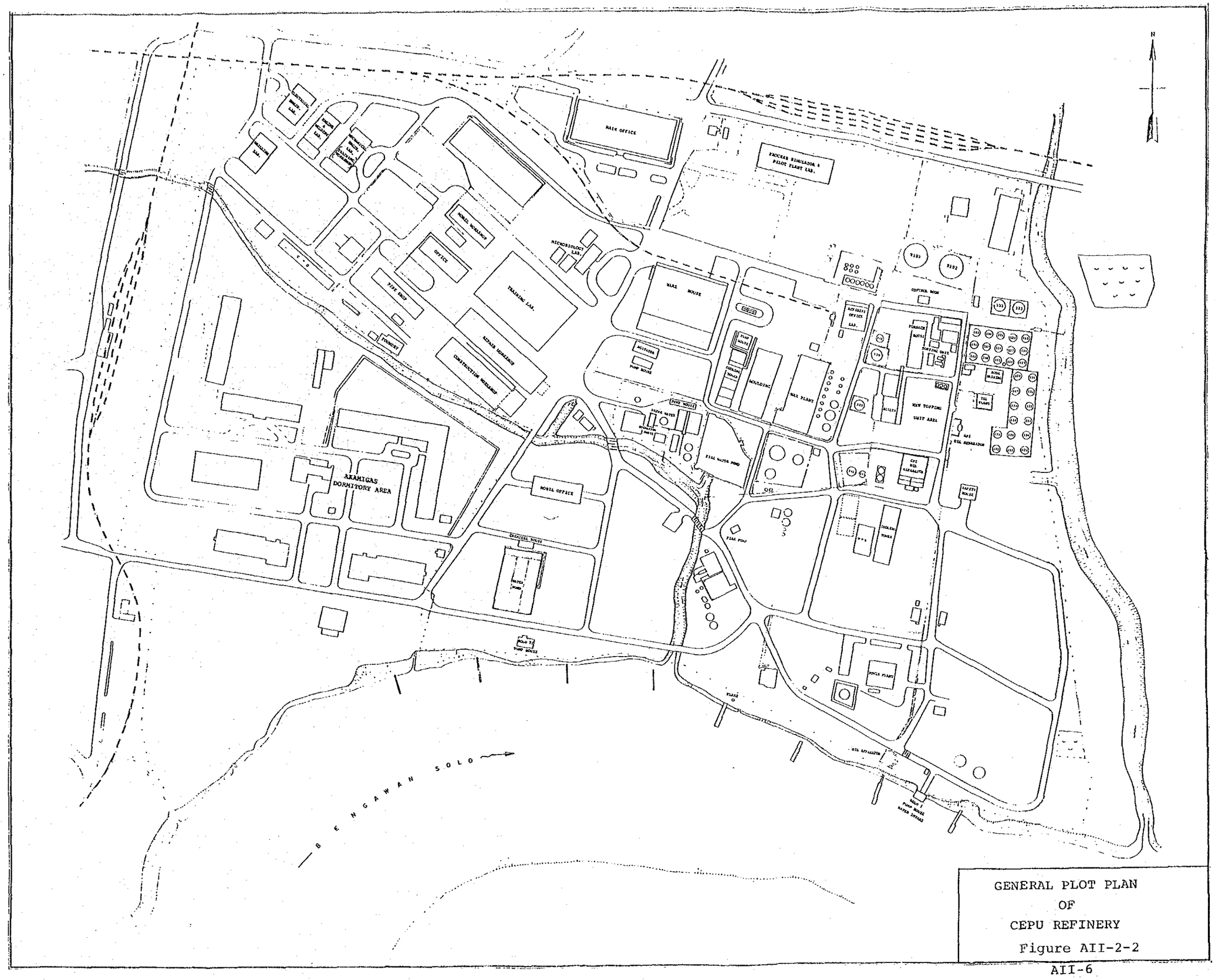
AREA

PERTAMINA DEPOT	A
MENGGUNG OIL STORAGE YARD	B
AKAMIGAS LECTURE BUILDING	C
AKAMIGAS DORMITORY	D
REFINERY AREA	E
TRAINING LAB. AREA	F
NGLAJO GAS WELL	G

N

SITUATION MAP OF AREAS
IN CEPU

Figure AII-2-1



GENERAL PLOT PLAN
OF
CEPU REFINERY
Figure AII-2-2

Annex II-3-1 RESPONSE TO QUESTIONNAIRE FOR AKAMIGAS GRADUATES' IMMEDIATE SUPERIOR (1)
(Number of Respondents: 22)

No.	Question	Answer, Percentage		Summary
1	Has he enough knowledge on applied science and industrial science to carry out his job?	Sufficient 40% Good 45%	85%	Considered as sufficient and good.
2	In relation to the above-mentioned question when looked from the point of view of:			
	1) Management	1) Sufficient 69% Good 13%	82%	ditto
	2) Performance	2) Sufficient 56% Good 31%	87%	ditto
	3) His awareness toward budget and spending policy	3) Sufficient 50% Good 25%	75%	ditto
3	Has he enough basic knowledge to carry out his job?	Sufficient 43% Good 48%	91%	ditto
4	Has he enough general knowledge and leadership to carry out his job?	Sufficient 62% Good 29%	91%	ditto
5	Lecture on subjects which are considered as not sufficiently given?	English Principle on Supervision	42% 42%	These 2 subjects are considered as not sufficiently given and expected its development be increased.
6	On the duration of 50 days practical/field work?	Sufficient 55% Good 19%	74%	Longer duration is needed but not too long.
7	Site of field work?	Other area within own company:	87%	Field work other area within the company is desirable.
8	Ability and Performance in holding preliminary post?	Sufficient 78% Good 17%	95%	Considered as able.
9	Matters in which he is not capable to perform well?	Planning Decision making Organizing English (language)	16% 27% 14% 19%	The matter received much attention.
10	Matters which show his incapability?			Minimum response, not valid.

Annex II-3-1 RESPONSE TO QUESTIONNAIRE FOR AKAMIGAS GRADUATES' IMMEDIATE SUPERIOR (2)
(Number of Respondents: 22)

No.	Question	Answer, Percentage		Summary
11	Act of creativeness?	Sufficient 50% Good 40%	90%	Considered as sufficient and good.
12	Working spirit?	Sufficient 18% Good 77%	95%	ditto
13	Spirit of endurance?	Sufficient 59% Good 41%	100%	ditto
14	Act of decisiveness?	Sufficient 82% Good 18%	100%	ditto
15	Communication with superior?	Sufficient 46% Good 54%	100%	ditto
16	Communication with colleague?	Sufficient 46% Good 54%	100%	ditto
17	Communication with subordinate?	Sufficient 50% Good 50%	100%	ditto
18	Ability to analyse?	Sufficient 77% Good 9%	86%	Considered as sufficient and good.
19	Act of cooperativeness?	Sufficient 36% Good 64%	100%	ditto
20	Sense of responsibility?	Sufficient 45% Good 55%	100%	ditto
21	Attitude of flexibility?	Sufficient 73% Good 27%	100%	ditto
22	Ability to control suboridinates?	Sufficient 68% Good 27%	95%	ditto
23	Ability to take decision after 1-2 years occupying the post?	Sufficient 68% Good 32%	100%	ditto
24	Ability to take decision after 2-4 years occupying the post?	Sufficient 59% Good 41%	100%	ditto
25	Ability to take decision after 4 years occupying the post?	Sufficient 13% Good 82%	95%	Recognized as good.

Annex II-3-1 RESPONSE TO QUESTIONNAIRE FOR AKAMIGAS GRADUATES' IMMEDIATE SUPERIOR (3)
(Number of Respondents: 22)

No.	Question	Answer, Percentage		Summary
26	What medium is suitable to keep alumnus always in touch with latest technological development?	Post AKAMIGAS 18% University 9% Short Course 68%		Short courses are considered as suitable medium.
27	Content of suggestion ever submitted?	Fair 50% Good 36%	86%	Considered as fair.
28	Sensibility toward environment, its situation and condition?	Fair 73% Good 22%	95%	ditto
29	Effort to develop own capability?	Sufficient 45% Good 36%	91%	Considered as sufficient and good.
30	Level of one's knowledge which will help him to hold higher post?	Sufficient 68% Good 23%	91%	ditto
31	Type of education most suitable for the job in the field?	AKAMIGAS (Oil system) 23% AKAMIGAS (New system) 54%		AKAMIGAS (Sandwich system) is desirable.

Annex II-4-1 RESPONSE TO QUESTIONNAIRE FOR AKAMIGAS GRADUATES (1)

No.	Question	Input	Number of Respondent	Percentage	Summary
	Types of Responder	a. AKAMIGAS (Old system)	24	23%	Major responders are AKAMIGAS graduates (New system)
		b. AKAMIGAS (New system)	40	38%	
		c. Crash Program Course	34	33%	
		d. Special Course for Graduates	6	6%	
		Total	104	100%	
1	When latest post held after graduation?	a. 1 year	35	36%	New post were held between 1 and 2 years after graduation.
		b. 2 years	30	31%	
		c. 3 years	16	16%	
		d. 4 years	9	9%	
		e. 5 years	1	1%	
		f. 6 years	5	5%	
		g. 7 years	2	2%	
		h. 8 years	0	0%	
		i. 9 years	0	0%	
2	Present rank?	a. Level 4	0		Majority are in the lower rank. (Level 9)
		b. Level 5	4		
		c. Level 6	19		Note: 1) First graduate came out in 1970.
		d. Level 7	14		2) Refer to Manpower pattern of PERTAMINA regarding the rank level.
		e. Level 8	16		
		f. Level 9	21		
		g. Level 10	0		
3	Relation between studied subject and job	a. Applicable	83	83%	Applicable is the answer of almost all.
		b. Of little use	17	17%	
		c. Non applicable	0	0%	
4	Is additional OJT necessary?	a. Necessary	51	52%	Nearly half answered it is necessary and another half not necessary.
		b. Not necessary	48	48%	
5	Suggestion on given subjects	a. Applied and industrial subjects	28	39%	Contents of subject should be increased. English language lesson should be increased.
		b. Basic knowledge subjects	31	43%	
		c. General knowledge and leadership subjects	13	18%	
6	Type of education desired after graduation from AKAMIGAS	a. Post AKAMIGAS (Grade IV)	51	54%	AKAMIGAS graduates wanted this type of education.
		b. University	32	34%	Crash program course graduates wanted this type of education.
		c. Other level of education	12	13%	Responders of the 6th rank level group wanted this type of education.
7	Has responder been promoted?	a. Not yet	34	34%	Responders just graduated within 2 years.
		b. Has been promoted	66	66%	Responders graduated more than 3 years ago.

Annex II-4-1 RESPONSE TO QUESTIONNAIRE FOR AKAMIGAS GRADUATES (2)

No.	Question	Input	Number of Respondent	Percentage	Summary
8	Your present job has any relevancy with your education?	a. Has relevancy	89	88%	In general jobs are relevant to their education.
		b. No relevancy	12	12%	
9	Handicap faced in day-to-day works?	a. English language barrier	32	38%	Responder's most complained handicap.
		b. Difficulty in working procedure	24	28%	Responder's complained handicap.
		c. No handicap situation	27	32%	Responders which belong to 6th rank group.
10	Handicap in developing own capability?	a. Language (Engligh) barrier	15	18%	
		b. No guidance	6	7%	
		c. No opportunity	36	42%	Being kept busy by routine work.
		d. No handicap	28	33%	Some responders give no comments.
11	Is subject of management beneficial to you?	a. Very helpful	30	30%	It is really very helpful.
		b. Quite helpful	65	66%	
12	Suggestion on how to have better education system	a. Should have better curriculum	23	28%	Expecting better and upto-date content of subjects.
		b. Upgrading of instructor's knowledge	14	17%	
		c. Betterment of process of education	25	25%	Visit of quest lecturers is independable.
		d. Upgrading of teaching aids	10	12%	
		e. Upgrading of supporting facilities	4	5%	Expecting upgrading of sports facilities for students activity.
		f. Encouragement on act of discipline	10	12%	

Annex II－4－2　　INSTRUMENTATION & ELECTRONICS LABORATORY EQUIPMENT LIST

No.	Name of Equipment	No. of Unit	Year of Purchase	Present Condition	Remarks
1	Panel Educational Process Controller Electronic "EQUIPMENT"	1 unit	1975	40%	Out-of-use
2	Process Control Training Unit	1 unit	1978	80%	Good
3	Old Type Panel Process Control	1 unit	1974	70%	Good
4	Pneumatic Controller "FOXBORO" M130	2	1975	75%	Good
	Consotrol Controller with Shelves		1975	25%	Broken
5	Pneumatic Controller "FOXBORO" M40 Stabilog Controller	1	1975	75%	Good
6	Pneumatic Recorder "FOXBORO" M40 Type: Diaphragm meter	1	1975	25%	Broken
7	Pneumatic Recorder "FOXBORO" M124	2	1975	60%	Good
	Type Multipoint Recorder		1975	40%	Out-of-use
8	Differential Pressure Transmitter, 12A "FOXBORO"	2	1975	75%	Good
9	Differential Pressure Transmitter, 13FA "FOXBORO"	1	1975	75%	Good
10	Pneumatic Transmitter "FOXBORO" M45P	1	1975	75%	Good
11	GEC Elliot Transducer	1	1975	25%	Broken
12	Kent Foster Cambride Potentiometer PP332	1	1976	80%	Good
13	YEW Potentiometer Type 2727	1	1980	80%	Good
14	Dead Weight Tester Budenberg Gauge	1	1970	60%	Usable
15	Ashcroft Portable Dead Weight Tester	1	1980	80%	Good
16	Indicator FOXBORO M5001, Ribbon Type	1	1975	75%	Good
17	Sart Control Valve, Size: 1 1/2"	3	1979	75%	Good
18	Masoneilan Control Valve, Size: 2"	1	1978	75%	Good
19	FOXBORO Control Valve	1	1975	75%	Good
20	Pressure Gauge FOXBORO, 3-15 Psi	10	1975	75%	Good
21	William M. Wilson/sons Flow meter	1	1974	60%	Usable
22	Oscilloscope GOLD Type OS 250 B	8	1975	60%	2 units: usable
				25%	6 units: broken
23	Ocilloscope Philips Type PM 3233 0-10 MHZ	3	1976	70%	Good
24	Demonstration Oscilloscope Leybold	1	1970	40%	Out-of-use
25	Oscilloscope Philips Type PM3110, 0-10 MHZ	1	1972	25%	Broken
26	Oscilloscope Telequipment	1	1968	25%	Broken
27	Oscilloscope TRIO Memory Type	2	1982	90%	Good

No.	Name of Equipment	No. of Unit	Year of Purchase	Present Condition	Remarks
28	Function Generator AC Philips Model PM5167	3	1977	40%	Out-of-use
29	AC Mili-Voltmeter Philips Type PM2454B	3	1977	60%	Good
30	Low Frequency Generator Philips Type PM5106, 0-10 KHZ	5	1977	45%	4 units: Out-of-use 1 unit: broken
31	Generator Signal Sinus Leybold, 0-300 KHZ	1	1968	45%	Out-of-use
32	Dual Type Power Supply 0-30 V, DC	8	1974	50%	Usable
33	Sweep/Function Generator TRIO Model FG271, 0-2MHZ	3	1974	50% 25%	2 units: usable 1 unit: broken
34	Frequency Counter TRIO Model FC-756	3	1983	80%	Good
35	PAL TV Pattern Generator Type PM5509 Philips White & Black and Color	1	1977	75%	Good
36	Multimeter Philips Model PM2503	4	1977	25%	3 units: out-of-use 1 unit: broken
37	Digital Multimeter AlphaII, ADVANCE INSTRUMENT	8	1975	40% 25%	6 units: out-of-use 2 units: broken
38	SANWA Multimeter Analog Model 501-ZX-TR	6	1980	40%	Out-of-use
39	SANWA Multimeter Analog Model AX-303-TR	2	1980	25%	Broken
40	Phasor Meter J. J.	1	1973	40%	Out-of-use
41	Metravo 3 Multimeter Analog	1	1968	25%	Broken
42	Capacitance Hi-Tester Type HIOKI 3501	1	1984	80%	Good
43	DIP Meter TRIO	4	1984	90%	Good
44	Power Supply Unit Leybold 0-300V	1	1968	25%	Broken
45	Penyedia Daya AVUS/Tegangan Leybold	1	1968	25%	Broken
46	Alat Tester Tabung Electronic Leybold	1	1968	25%	Broken
47	Geiga Counter Tabung Leybold	1	1968	25%	Broken
48	J. J. Demonstration Unit For Electrical *1	1	1968	25%	Broken
49	Ward Leonard Control System with Amplifier Control PLT. 60-6011	1	1968	25%	Broken
50	Komputer Daser Taran (panel)	8panel	1968	60%	Usable
51	Servo Unit (panel)	8panel	1968	60%	Usable
52	Unit Transceiver Signal Lapangan Udara EX. Pertamina Cilacap	1unit	1982	40%	Out-of-use
53	Unit Transceiver ISB EX. Telkom Pertamina Pusat	2unit	1985	40%	Out-of-use
54	AKD 741 Extension 50 point Telephone EX. Pertamina Pusat	1unit	1984	40%	Out-of-use
55	Telex Model T100 EX. Pertamina Pusat	4unit	1984	40%	Out-of-use

No.	Name of Equipment	No. of Unit	Year of Purchase	Present Condition	Remarks
56	Panel LB & CB Telephone	2unit	1984	40%	Out-of-use
57	Panel Kabel-Kabel Telecommunication	1unit	1984	40%	Out-of-use
58	Panel Peraga Electronic Tabung Tavan	30unit	1968	40%	Out-of-use
59	Panel Praktikum Micro Electronica Linear EX. ITS Surabaya	6unit	1982	85%	Good
60	Panel Praktikum Teknik Digital EX. ITS Surabaya	11unit	1982	85%	Good
61	Panel Praktikum Telecommunication	11unit	1968	60%	Good
62	Panel Praktikum Pengukuran/Rangkaian Listrik EX. TQ ELECTRONICS INGGRIS	4unit	1974 1974 1974	40% 40% 40%	Out-of-use Out-of-use Out-of-use

Note: *1 Those units of equipment under No. 48 to No. 62 are "used equipment" provided by PERTAMINA and the universities which is presently utilized as teaching models or for demonstration purposes.

Annex Ⅱ-4-3 COOLING TECHNIQUE LABORATORY EQUIPMENT LIST

No.	Name of Equipment	No. of Unit	Year of Purchase	Present Condition	Remarks
1	Training Unit (Commercial Refrigration Model 9051)	1unit	1973	70%	Good
2	Refrigeration Training System with Open Type Unit Compressor	1unit	1983	80%	Good
3	Refrigeration Training System AC Unit(made by Trainees)	1unit	1984	80%	Good
4	Freezer Unit for Training (made by Trainees)	1unit	1984	80%	Good
5	Refrigration Cylinder Demonstration Unit	2unit	1983 1985	80%	Good
6	Charging Cylinder	1	1983	80%	Good
7	Vacuum Pump	3unit	1973 1983 1984	90%	Good
8	Charging Mainfold	3unit	1973 1983 1984	70% 80% 100%	Good
9	AVC Meter, SANWA	2	1985	100%	Good
10	Pain Type Ampere Meter	2	1973 1985	80% 100%	Good
11	Electronic Thermometer	3	1973 1973	40% 70%	2 units: out-of-use 1 unit: good
12	Thermal Vacuum Check	3	1973	25% 70%	2 units: broken 1 unit: good
13	Electronic Checking Equipment	1	1973	60%	Usable
14	Thermal Hermetic Check	1	1973	60%	Usable
15	Soldering Gun	1	1973	70%	Usable
16	Flaring Tools	3unit	1973	80%	Good
17	Flaring & Swagging tools	4unit	1983 1984	80% 80%	2 units: good 2 units: good
18	Swagging tools punch type	2unit	1973 1984	80% 90%	Good
19	Supporting tools for repair		1985		Decided to purchase

Annex II－4－4　　PRODUCTION LABORATORY EQUIPMENT LIST

No.	Name of Equipment	No. of Unit	Year of Purchase	Present Condition	Remarks
1	Retort Kit	3		60%	Usable
				60%	Usable
				40%	Out-of-use
2	Analytical Balance	2		50%	Narrowly usable
				20%	Broken
3	Electrical Balance	1		40%	Out-of-use
4	Mud Mixer	4		60%	
				60%	3 units: usable
				50%	
				40%	1 unit: out-of-use
5	Mud Balance	3		60%	2 units: usable
				60%	
				40%	1 unit: out-of-use
6	Marsh Funnel	1		60%	Usable
7	PH Meter	3		70%	Good
				70%	
				50%	Lack of spareparts
8	Viscometer	4		50%	Narrowly usable
				50%	
				40%	Out-of-use
				25%	Broken
9	Rheometer	1		50%	Narrowly usable
10	Resistivity Meter	1		50%	Narrowly usable
11	Filter Press	2		50%	Narrowly usable
				50%	
12	HPHT Filter Press	1		40%	Lack of spareparts
13	Sand Content	2		50%	Narrowly usable
				40%	Out-of-use
14	Fluorescent Lamp	2		60%	Usable
				50%	Narrowly usable
15	Turbidity Meter	1		50%	Incomplete
16	Spectronic	1		50%	Lack of spareparts
17	Oven	1		60%	Usable
18	Murfel Furnace	1		50%	Narrowly usable

No.	Name of Equipment	No. of Unit	Year of Purchase	Present Condition	Remarks
19	Hot Plate	4		60% 60% 30% 40%	Usable Out-of-use
20	Sieve Shaker	2		50% 50%	Usable
21	Hydraulic Press	1		30%	Out-of-use
22	Vicat	1		40%	Out-of-use
23	Mercury Pump	2		? ?	From Lemigas, Jakarta
24	Vacuum Pump	1		50%	Narrowly usable
25	Permeameter	1		50%	Narrowly usable

Annex II－4－5　　CHEMICAL LABORATORY EQUIPMENT LIST

No.	Name of Equipment	No. of Unit	Year of Purchase	Present Condition	Remarks
1	Analytical Balance	1	1975	90%	Good
2	Constant Temperature Bath	1	1975	10%	Broken
3	Water Distillation Apparatus	1	1980	50%	Narrowly usable
4	Driver (1) Drying Machine	1	1978	75%	Good
	(2) Desicator	12	1975	50%	Narrowly usable
5	Stop Watch	3	1982	90%	Good
6	Manometer	2	1975	40%	Out-of-use
7	Vacuum Pump	1	1975	30%	Broken
8	Centrifugal Machine	1	1984	90%	Good
9	Thermometer	80	1975	90%	Good
10	Measuring Glass Ware (Pipette, Funnel, etc.)	110	1975	90%	Good
11	Heater (1) Gas Burner	15	1975	70%	Good
	(2) Electric Heating Mantle	8	1972	40%	Out-of-use
12	Reagent Storage Cabinet	2	1972	30%	Out-of-use
13	Acid Cupboard	2	1972	50%	Narrowly usable
14	Sulphur Content Measurement	1	1972	50%	Narrowly usable
15	Polarimeter	1	1972	40%	Out-of-use
16	Six Paddle Stirrer	1	1984	99%	New
17	Bansh & Lomb Spectronic 20 Spectrophotometer	1	1980	70%	Good
18	Turbidimeter	1	1983	80%	Good
19	PH Meter	4	'83/'84	70/90%	Good
20	Hot Plate Stirrer	6	1982	80%	Good

Annex II-4-6 OIL LABORATORY EQUIPMENT LIST

No	Name of Equipment	No. of Unit	Year of Purchase	Present Condition	Remarks
1	ASTM Distillation	3 unit	1972	40%	Out-of-use
2	Penetrometer	1 unit	1969	50%	Narrowly usable
3	Carbon Residue Conradson	1 unit	1971	40%	Out-of-use
4	Ductility	1 unit	1971	40%	Out-of-use
5	R.V.P. Constant Temperature Bath	1 unit	1972	40%	Out-of-use
6	Aniline Point APP.	1 unit	1974	50%	Narrowly usable
7	Kinematic Viscosity Bath	1 unit	1974	50%	Narrowly usable
8	Water Content Dean & Stark APP.	1 unit	1972	40%	Out-of-use
9	Flash Point Abel Pensky	1 unit	1971	40%	Out-of-use
10	Smoke Point APP.	1 unit	1972	30%	Broken
11	Redwood Viscometer	2 unit	1972	60%	Usable
12	Centrifuge	1 unit	1969	30%	Broken
13	Saybolt Viscometer	1 unit	1972	30%	Broken
14	ASTM Color Measurement	1 unit	1974	60%	Usable
15	Existent Gum APP.	1 unit	1972	40%	Out-of-use
16	Bomb Calorimeter	1 unit	1969	50%	Narrowly usable
17	Flash Point Tester	1 unit	1969	40%	Out-of-use
18	Saybolt Chromometer	1 unit	1969	50%	Narrowly usable
19	Fractional Distillation Unit	1 unit	1972	50%	Narrowly usable
20	Constant Temperature Bath	1 unit	1976	50%	Narrowly usable
21	Flash Point Tag.	1 unit	1972	40%	Out-of-use
22	Flash Point Cleaveland Open Cup	1 unit	1972	40%	Out-of-use
23	Copper Strip Corrosion Bath	1 unit	1972	40%	Out-of-use
24	Oxidation Stability APP.	1 unit	1973	40%	Out-of-use
25	Lovibond Tintometer	1 unit	1984		Not yet installed
26	Pour Point APP.	1 unit	1976	50%	Narrowly usable
27	Melting Point APP.	1 unit	1974	40%	Out-of-use
28	Muffle Furnace	1 unit	1973	40%	Out-of-use
29	Drying Oven	1 unit	1973	30%	Broken
30	Engler Visimeter	1 unit	1973	30%	Broken
31	Cooperative Fuel Research Machine (CFR) F1/F2	1 unit	1976	90%	Good

ANNEX II-5-1 STUDY FOR OIL VELOCITY OF CRUDE FURNACE TUBE

It is widely known that the lower oil velocity of furnace tube not only promotes the formation of scale and coke which is accompanied by the rise of the pressure drop of furnace tube, but also decreases the efficiency of heat transfer.

If there is a growing coke formation, the tube skin temperature goes up sharply and becomes very dangerous.

Further there have been some papers described on the hot spot of furnace tube and the oil leakage from it.

In order to avoid this condition the size of heating tube is designed so as not to underrun the lower limit of the allowable velocity.

(1) Existing Tube Velocity

The crude charge heaters are now operated in parallel. The three calculations below is carried out under the following conditions

- Crude oil through-put	2,000 BPSD
- Fluid properties	Sp.Gr (60/60°F) 0.853 Viscosity 7.5 cSt @60°F
- Size of tube	4 inches (Sch. 80) OD: 114.3mm, Thickness: 8.6mm Cross section area: 74.05cm^2

(H.S. Bell's Criteria)

$U > 0.143\ d.u$

U: Flow rate (Gal/min), d: ID of tube (inches)

μ: Viscosity (Sec.Saybolt)

μ = 7.5 cSt = 50 Sec.Saybolt
d = 97.1mm = 3.8 in

0.143 d.μ = 0.143 x 50 x 3.8 = 27.2 Gal/min

This value is the minimum oil velocity for a turbulent flow,

U = 2,000 x 0.159 x 264.19/(24 x 60 x 2) = 29.2 Gal./min

Above result shows the velocity for a turbulent, but the value is near the lower limit of the allowable velocity.

(W.L. Nelson's Criteria)

$$V = 2{,}000 \times 0.159 \times 10^{6}/(24 \times 60 \times 60 \times 30.48 \times 2)$$
$$= 0.8 \text{ ft/sec}$$

Topping to 600°F	2 - 5 ft/sec
Topping to 800°F (over 60% vaporization)	3 - 4 ft/sec

The calculated value does not satisfy above two criterias. In case of using two furnaces in series the calculated value is 1.6 ft/sec, still it can't reach to the minimum allowable velocity.

(H.L. Berman's Criteria)

$$V = \frac{2{,}000 \times 0.159 \times 0.853 \times 2.205 \times 10^{3} \times 0.5}{24 \times 60 \times 60 \times 74.05 \times 10.764 \times 10^{-4}} = 87 \text{ lb/s/ft}^2$$

The allowable mass velocity as the criteria is 175 - 250 lb/s/ft^2. In case of using two furnaces in series the calculated value also can't reach to the minimum allowable velocity.

(2) Optimum Size of Furnace Tube

The relationship between the sizes of furnace tube and their oil velocities in two cases of Nelson's and Berman's criteria is shown in Fig. AII-5-1. This figure makes us understand that the arrangement of two furnaces should be modified from the parallel one to the series one and present 4 in. size of furnace tube should be replaced by 2.5 in. size of one.

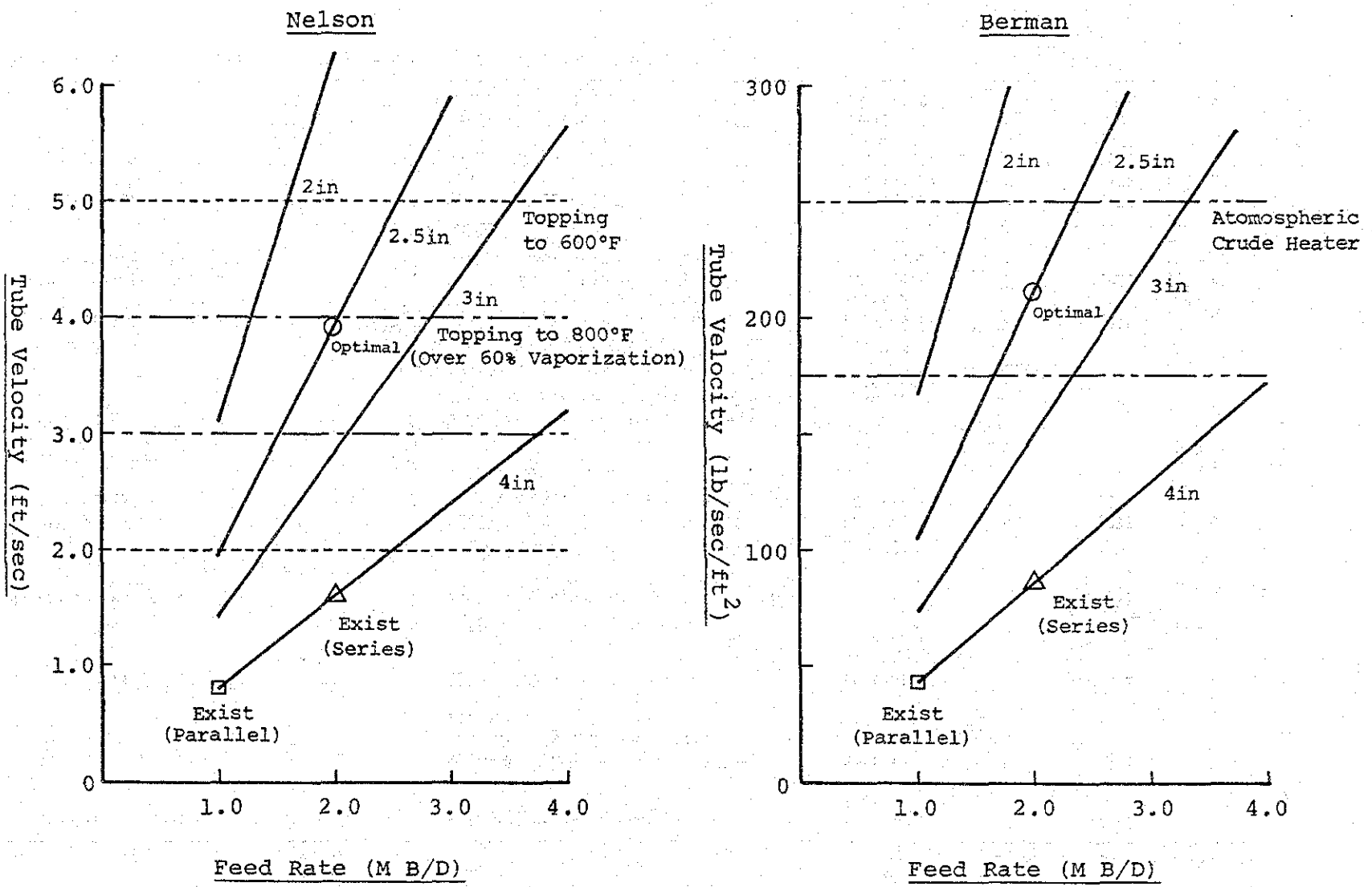


Figure AII-5-1 RELATIONSHIP BETWEEN SIZES OF FURNACE TUBE AND THEIR OIL VELOCITIES

Annex II-5-2 LIST OF LABORATORY EQUIPMENT AND APPARATUS (1)
(Oil Laboratory in the Refinery)

No.	Name	Test Method	Q'ty	SPEC.	Maker & Model	Automatic /Manual	Purchased Year	Judgement
1	Sampling Apparatus	ASTM D270	3	Weighted copper beaker, 1 quart	Karl Kolb (Germany)	M	1972	A
2	Analytical Balance		2	Range 0 - 160g, Precision ±0.05mg, Mechanical weight application and optical scale range	Mettler (USA), H10	M	1974	A
3	Refrigerator		1	257 l, 220 V, 50 Hz, 150 W	General Electric (Germany)		1984	A
4	Laboratory Table		6	Percelein, Dimention 6,000x1,500x800			1972	A
5	Drier							
	(1) Drying Oven		2	Temperature range: 40 - 250°C	Karl Kolb	M	1973	C
	(2) Desicator		1	ID 150mm, Net weight 2.55 Kg	(Germany)	M	1972	A
6	Draft Chamber		1					A
7	Stop Watch		2	Large dial subdivided in 30 sec. and small dial subdivided in 1/10 sec.	Han Hard Fisher, AMICO(USA)			A
8	Pump							
	(1) Air Pressure Pump		2	Single stage cap. 120 l/min. 220 V. Pressure max. 10 bar.	Karl Kolb (Germany)	M	1975	A
	(2) Precision Vacuum/ Pressure Air Pump		1	220 V. Max. Delivery 2,500 l/h max. pressure 2 bar. ultimate max. vacuum 1 bar.	Karl Kolb (Germany)	M	1985	A
9	Thermometer	ASTM 5F	2	Range -36 to +120°F	Analis(USA)	M	1978	A
		ASTM 6F	2	Range -112 to +70°F	Analis(USA)	M	1978	A
		ASTM 15F	1	Range +30 to +180°F	Analis(USA)	M	1978	A
		ASTM 10F	2	Range +200 to +700°F	Analis(USA)	M	1978	A
		ASTM 2C	2	Range -2 to +400°C	Analis(USA)	M	1978	A
		ASTM 7C	2	Range -2 to +300°C	Analis(USA)	M	1978	A

Note: A = Good condition, B = Barely in use, C = Out of order or not in use

Annex II-5-2 LIST OF LABORATORY EQUIPMENT AND APPARATUS (2)
(Oil Laboratory in the Refinery)

No.	Name	Test Method	Q'ty	SPEC.	Maker & Model	Automatic /Manual	Purchased Year	Judgement
10	Measuring Glass Ware							
	- Measuring cylinder		each 20	Cap. 10, 25,100, 250 ml.	Pyrex, Yena(USA)		1975	A
			each 5	Cap. 500, 1,000 ml.	Pyrex, Yena(USA)		1975	A
	- Volumetric flask		each 10	Cap. 25, 50, 100, 250 ml.	Pyrex, Yena(USA)		1975	A
			each 5	Cap. 500, 1,000 ml.	Pyrex, Yena(USA)		1975	A
	- Beaker glass		each 25	Cap. 100, 250, 500 ml.	Pyrex, Yena(USA)		1975	A
			each 10	Cap. 1,000, 2,000, 3,000 ml.	Pyrex, Yena(USA)		1975	A
11	Other Glass Ware							
	- Measuring pipettes		each 5	Cap. 10, 25 ml.	Pyrex, Yena(USA)		1975	A
	- Reagent bottles		each 5	Cap. 250, 500 ml.	Pyrex, Yena(USA)		1975	A
	- Burettes		each 2	Cap. 25, 50 ml.	Pyrex, Yena(USA)		1975	A
12	Heater							
	(1) Gas Burner		5	High Temperature Type Fisher maker, head 30 mm	Karl Kolb Germany	M	1978	A
	(2) Electric Heating Mantle							
	- Globe		4	Cap. 250, 500 ml, 220/110 V, 700 W	Karl Kolb (Germany)	A	1978	A
	- Tape		4	Long 3 m. 110 V, 270/500 W	Karl Kolb (Germany)		1978	A
13	Reagent Storage Cabinet		2					A
14	Specific Gravity							
	(1) Hydrometer	ASTM D1298		Application for crude oil and petroleum oil		M		A
	(2) Pyknometer	ASTM D941		Application for high pour point fuel oil and petroleum wax		M		A
15	Distillation	ASTM D86	3	Application for gasoline, Kerosine and gas oil	Karl Kolb (Germany)	M	1972	B

Note: A = Good condition, B = Barely in use, C = Out of order or not in use

Annex II-5-2 LIST OF LABORATORY EQUIPMENT AND APPARATUS (3)
(Oil Laboratory in the Refinery)

No.	Name	Test Method	Q'ty	SPEC.	Maker & Model	Automatic /Manual	Purchased Year	Judgement
16	Flash Point							
	(1) Tag Closed Tester	ASTM D56	1	Application for crude oil and kerosine	Labline Instrument Co., USA	M	1972	C
	(2) Aber Tester	IP 170	1	Application for crude oil and kerosine	Sette Stanhope, USA	M	1972	B
	(3) Pensky-Martens Closed Tester	ASTM D93	1	Application for gas oil and fuel oil	Labline Instrument Co., USA	M	1969	C
	(4) Cleveland Open Cup Tester	ASTM D92	1	Application for petroleum wax	Labline Instrument Co., USA	M	1972	C
17	Smoke Point	ASTM D1322	1	Application for kerosene	Sette Stanhope (USA)	M	1972	C
18	Reid Vapor Pressure	ASTM D323	1	Application for crude oil and gasoline, constant temperature bath has 5 testing, compartment	E.C.O.(USA) 120 - 14	M	1968	C
19	Redwood Viscosity	IP 70	1	Application for fuel oil with 50 ml flask, gas heating bath, stirrer, etc.	Sommer & Runge KG (Germany)	M	1972	A
20	Pour Point	ASTM D97	1	Application for crude oil, gas oil and fuel oil	Karl Kolb (Germany)	M	1968	C
21	Water Content	ASTM D95	1	Application for crude oil, gas oil and fuel oil	Karl Kolb (Germany), Sba-II-4 plates	M	1972	C
22	Water and Sediment	ASTM D96	1	Application for crude oil, gas oil and fuel oil	Karl Kolb (Germany), UJ.3	M	1968	C

Note: A = Good condition, B = Barely in use, C = Out of order or not in use

Annex II-5-2 LIST OF LABORATORY EQUIPMENT AND APPARATUS (4)
(Oil Laboratory in the Refinery)

No.	Name	Test Method	Q'ty	SPEC.	Maker & Model	Automatic /Manual	Purchased Year	Judgement
23	Conradson Carbon Residue	ASTM D189	1	Application for crude oil, gas oil and fuel oil	Karl Kolb (Germany)	M	1968	C
24	Ash	ASTM D482	1	Application for crude oil, gas oil and fuel oil	Heraeus (Germany)	M	1973	B
25	Copper Corrosion	ASTM D130	1	Application for gasoline, kerosine and gas oil	Karl Kolb (Germany), K2531	M	1969	C
26	Color							
	(1) ASTM	ASTM D1500	1	Application for gas oil	SETA(England), GL-PE	M	1974	A
	(2) Lovinbond	IP 17	1	Application for Kerosine	Lovinbond (England)	M		A
27	Aniline Point	ASTM D611	1	Application for gasoline and kerosine	Karl Kolb (Germany)	M	1969	C
28	Needle Penetration	ASTM D1321	1	Application for petroleum wax	Sommer & Runge KG, Germany	M	1969	C

Note: A = Good condition, B = Barely in use, C = Out of order or not in use

Annex II-5-3 LIST OF LABORATORY EQUIPMENT AND APPARATUS (1)
(Analytical Laboratory in Refinery)

No.	Name	Test Method	Q'ty	SPEC.	Maker & Model	Automatic /Manual	Purchased /Manual	Judgement
1	Analytical Balance		3	Range 0 - 160 g, Precision +0.05 mg		M	1974	A
2	Draft Chamber		1					A
3	Laboratory Table		3					A
4	Glass Ware		3	Burrets cap. 10 ml in 1/10 ml	Kimax (USA)		1978	A
			3	Burrets cap. 25 ml in 1/10 ml	Kimax (USA)		1978	A
			2	Burrets cap. 10 ml in 1/10 ml coloured glass	Dewarex (England)		1969	A
			5	Graduated pippettes 10 ml in 1/10 ml	Kimax (USA)		1978	A
			5	Volumetric pippettes 25 ml	Kimax (USA)		1978	A
			10	Erlenmeyer cap. 250 ml (Graduated)	Duran(Germany)		1976	A
			50	Test tubes cap. 10 ml	Kimax (USA)		1978	A
			1	Water estimator	Kimax (USA)		1978	A
			3	Flat bottom flask	Kewarex (England)		1969	A
			30	Petri dish ø 3"	Kimax (USA)		1978	A
			5	Watch glass ø 1 - 2"	Kimax (USA)		1978	
			10	Stirring rods	-		1976	A
			4	Beaker glass cap. 250 ml	Kimax (USA)		1978	A
				Beaker glass cap. 25 ml	Kimax (USA)		1978	A
			2	Wash bottles made of plastics	-		1967	A
			3	Measuring cylinder graduated, cap. 100 ml in 1/100	Cenco (USA)		1966	A
			2	Volumetric Flask cap. 100 ml neck 12/21	Cenco (USA)		1966	A
			3	Funnel ø 5"	Cenco (USA)		1966	A
			3	Desicator inside diameter 150 mm net weight 2.55 Kg	Cenco (USA)		1966	A

Note: A = Good condition, B = Barely in use, C = Out of order or not in use

Annex II-5-3 LIST OF LABORATORY EQUIPMENT AND APPARATUS (2)
(Analytical Laboratory in Refinery)

No.	Name	Test Method	Q'ty	SPEC.	Maker & Model	Automatic /Manual	Purchased /Manual	Judgement
5	Turbidity	ASTM D1889	1	Application for boiler water, cooling water and drinking water	Hellige Inc., (USA)	M	1961	C
6	pH by glass electrode	ASTM D1293	1	Application for boiler water, cooling water, drinking water and waste water pH Range 0 - 14, 110 - 125 volt, 80 W	Methrom He Risau (Switzerland), E350B	M	1961	C
7	Dissolved Oxygen		1	Application for boiler water	Electronic Instments Ltd. (England), model 1510	M	1961	C
8	Soild Content	ASTM D1888	1	Application for boiler water, cooling water and waste water	Gallenkamp (Germany), LMB 5	M	1962	C
9	Incubator	ASTM	1	Application for drinking water	Mememrt(Germany)	M	1976	A
10	Hot Plate with Magnetic Stirrer	-	2	Application for preparating titration reagent, etc	Cenco (USA) Catalogue No. 34532-1	M	1961	C
11	Spectrophotometer	-	1	Application for metal content in water	Hach company (USA)	M	1984	A

Note: A = Good condition, B = Barely in use, C = Out of order or not in use

RESPONSE ANALYSIS, SHELL STRESS CALCULATION

1. SECTION NUMBER			1
*** DESIGN CONDITION ***			
2. HIGHT OF CALCULATION LEVEL (FROM BASE PLATE)	SHGTL	M	0.50
3. OPERATING PRESSURE	SPRS	KG/CM2	0.50
4. OPERATING LOWER PRESSURE	SPRSL	KG/CM2	0.0
5. DESIGN TEMPERATURE	STMP	°C	350.00
SHELL			
6. INSIDE DIAMETER (COR.)	SDIL	MM	2033.40
7. PLATE THICKNESS (COR.)	STHK	MM	7.80
8. MATERIAL NAME (CLASS)			(3) 5541
DESIGN TEMP.			
9. TENSILE STRENGTH	SU	KG/MM2	41.00
10. YIELD POINT	SY	KG/MM2	17.00
11. ELASTIC MODULUS	SEM	KG/MM2	17700.00
ROOM. TEMP.			
12. TENSILE STRENGTH	SUO	KG/MM2	41.00
13. YIELD POINT	SYO	KG/MM2	25.00
14. JOINT EFFECIENTY	SWEF		0.20
15. HALF APEX ANGLE	SANGL	DEG	0.0
*** RESPONSE ANALYSIS ***			
HORIZONTAL RESPONSE COEFF.	BETA4		
16. IN CASE H < = 16			2.33
17. IN CASE 16 < H < = 35			0.0
18. IN CASE 35 < H			0.0
19. DESIGN ACCEL. BETA4*RKGH	RKSH		0.30
WEIGHT FOR			
20. HORIZONTAL SEISMIC FORCE	SWGTM	KG	19132.29
21. VERTICAL SEISMIC FORCE	TWGTW	KG	19132.29
22. HORIZONTAL SEISMIC FORCE	FHT	KG	5739.68
*** COMPUTED AND ALLOWABLE STRESS ***			
23. SEISMIC MOMENT	SMOM	KG*MM	3.79033E 07
23. MEAN DIAMETER (COR.)	SDML	MM	2041.20
25. ALLOW. TENSILE STRESS	ASTEN	KG/MM2	3.19
26. SMALLER VALUE (SY. SYO)	SYDAS	KG/MM2	17.70
27. ALLOW. BUCKLING STRESS	SDAS	KG/MM2	8.12
28. ALLOW. COMPRESSIVE STRESS	ASCON	KG/MM2	8.12
COMPUTED STRESS AND EVALUATION			
33. COMPUTED TENSILE STRESS	SCTEN	KG/MM2	1.43
34. EVALUATION			OK
35. COMPUTED COMPRESSIVE STRESS	SCCON	KG/MM2	1.87
36. EVALUATION			OK
REMARKS: ALLOWABLE STRESS	S	KG/MM2	15.93

RESPONSE ANALYSIS, SHELL STRESS CALCULATION

1. SECTION NUMBER			2
*** DESIGN CONDITION ***			
SKIRT TYPE	JSWLD		A (PRESSURE)
2. MATERIAL NAME (CLASS)			(3) 5541
3. PLATE THICKNESS	STHK	MM	7.80
4. MEAN DIAMETER	SDML	MM	2041.20
5. DESIGN TEMPERATURE	STMP	°C	350.00
DESIGN TEMP.			
6. TEMSILE STRENGTH	SU	KG/MM2	41.00
7. YIELD POINT	SY	KG/MM2	17.70
8. ELASTIC MODULUS	SEM	KG/MM2	17700.00
ROOM. TEMP.			
9. TENSILE STRENGTH	SUO	KG/MM2	41.00
10. YIELD POINT	SYO	KG/MM2	25.00
11. OPENING WIDTH	SYOPSM	MM	0.0
12. SEISMIC MOMENT	SMOM	KG*MM	4.08571E 07
13. WEIGHT	TWGTW	KG	20146.80
26. HALF APEX ANGLE	SANGL	DEG	0.0
*** COMPUTED AND ALLOWABLE STRRES ***			
SKIRT TYPE A (WELDED TO PRESSURE PARTS)			
27. ALLOW. TENSILE STRESS	ASTEN	KG/MM2	3.19
28. SY' : MIN (SY, SYO)	SYDAS	KG/MM2	17.70
29. Allow. buckling stress	SDAS	KG/MM2	8.12
30. F : = MIN (SYO, 0.75*SUO)	F	KG/MM2	17.70
31. ALLOW. COMPRESSIVE STRESS	ASCON	KG/MM2	8.12
32. COMPUTED COMPRESSIVE STRESS	SCCON	KG/MM2	2.00
39. EVALUATION			OK
SKIRT TYPE B (WELDED TO NON PRESSURE PARTS)			
34. F : = MIN (SYO, 0.7 *SUO)	F	KG/MM2	0.0
35. SY' : = MIN (SY, SYO)	SYDAS	KG/MM2	0.0
36. ALLOW. BUCKLING STRESS	SDAS	KG/MM2	0.0
37. ALLOW. COMPRESSIVE STRESS	ASCON	KG/MM2	0.0
38. COMPUTED COMPRESSIVE STRESS	SCCON	KG/MM2	0.0
39. EVALUATION			0.0

RESULT SUMMARY (1) (SHELL & SKIRT)

SECT NO.	COMP. NO.	TYPE	SHAPE DIMENSION					WIND LOAD		TENNSIL & STRESS			COMMPLESSIVE STRESS			STRESS EVAL.
			LENGTH (MM)	DIA. (MM)	INSULA. O.DIA. (MM)	INITI. THK. (MM)	DESIGN THK. (MM)	FORCE (KG)	MOMENT (KG*MM)	WIND (KG/MM2)	SEISMIC (KG/MM2)	ALLO. (KG/MM2)	WIND (KG/MM2)	SEISMIC (KG/MM2)	ALLO. (KG/MM2)	
1	2	CYLN	13010.0	2033.4	2049.8	7.80	7.80	5.067E 03	3.500E 07	1.32	1.43	3.19	1.75	1.87	8.12	OK
2	4	STRA	500.0	2049.8	2049.8	7.80	7.80	5.215E 03	3.757E 07	0.0	0.0	3.19	1.87	2.00	8.12	OK

Remarks: Top of Deflection for Seismic 4.0MM

Top of Deflection for Wind 3.5MM

Annex II-5-5 RECORDS OF TROUBLES IN THE POWER GENERATORS

GENERATOR NO. I/ELECTRICAL

No.	Trouble	Cause	Date	Solution
1.	Generator switch off	Reverse power relay is not correct	6 May, 1975	To be adjusted
2.	Failure in Exciter	Can not off	21 March, 1982	Repair
3.	Generator switch off	The exciter is suddenly off	18 July, 1983	Replacement the contacted
4.	Failure in switch gear	O.C.B. is not running well	23 July, 1983	Repair
5.	Failure in emergency stop	Solenoid is broken	2 May, 1984	Replacement
6.	Failure in electric motor of water pump	Short circuit	17 May, 1985	Rewinding

DIESEL ENGINE NO. I

No.	Trouble	Cause	Date	Solution
1.	The ability to support the load is decrease	Governor is not correct	5 April, 1976	Governor is adjusted/repair
2.	Shut down	Temperature of cooling water is too high	12 April, 1976	Clean the cooler
3.	Leaking fuel	One fuel delivery pipe is crack	27 July, 1980	Replacement
4.	Engine is not running well	Seals of the fuel injection pump of cylinder No. 4, 5 & 6 are broken	14 May, 1982	Replacement
5.	Failure in cylinder No. 1	Cylinder head No. 1 is crack	18 April, 1983	Replacement

Notes: 1. Start of operation; 25 May, 1973
2. The first overhaul; 31 October, 1979
3. The second overhaul; 3 January, 1984
4. In overhaul, measuring devices and relays are calibrated/test.

GENERATOR NO. II/ELECTRICAL

No.	Trouble	Cause	Date	Solution
1.	Failure in switch gear	Short circuit because of mouse inside	6 February, 1974	To close the air cooling hole by wire screen
2.	Failure in electric motor of cooling tower	Short circuit	29 November, 1975	Rewinding
3.	Failure in electric motor of cooling water pump	Short circuit	18 July, 1982	Rewinding
4.	Failure in automatic adjuster of governor	Motor speed short circuit	26 September, 1982	Rewinding
5.	Failure in electric motor of raw water pump	Short circuit	7 April, 1983	Rewinding
6.	Exciter can not be adjusted	Adjuster winding is broken	6 November, 1984	Replacement

DIESEL ENGINE NO. II

No.	Trouble	Cause	Date	Solution
1.	Shut down	Cooling water is over temperature	10 May, 1976	Clean the cooler
2.	Failure in turbo charger	The bearing is loose	21 June, 1976	Replacement the bearing
3.	The ability to support the load is decrease	Governor is not correct	26 June, 1981	Governor is adjusted
4.	Failure in cylinder No. 4	The spring of fuel injection pump is broken	20 June, 1982	Replacement
5.	Failure in cooling system	The bearing of water pump is broken	20 July, 1982	Replacement
6.	Leaking fuel	One fuel delivery pipe is crack	6 August, 1982	Replacement

Notes: 1. Start of operation; 25 May, 1973
2. The first overhaul; 12 January, 1980
3. The second overhaul; 24 February, 1984
4. In overhaul, measuring devices and relays are calibrated/test.

GENERATOR NO. III/ELECTRICAL

No.	Trouble	Cause	Date	Solution
1.	The load is out	Exciter is not running well	11 Jaunary, 1980	Repair
2.	Failure in switch gear	Electric motor of O.C.B. is short circuit	16 August, 1983	Replacement
3.	Failure in emergency stop	Solenoid is broken	22 October, 1984	Replacement
4.	Failure in electric motor of cooling tower	Short circuit	18 May, 1985	Rewinding

DIESEL ENGINE NO. III

No.	Trouble	Cause	Date	Solution
1.	Leaking fuel	One fuel delivery pipe is crack	28 March, 1978	Replacement
2.	Engine is not running well	Failure in Booster pump	17 May, 1979	Repair
3.	Leaking fuel	Fuel valve of cylinder No. 1 and 2 are loose.	23 May, 1982	Replacement
4.	The ability to support the load is decrease	The cooler is closed up	6 October, 1984	To be cleaned

Notes: 1. Start of operation; 2 December, 1977
2. The first overhaul; 30 June, 1982
3. In overhaul, measuring devices and relays are calibrated/test.

Annex II-5-6 TANK DATA

Tank No.	Service	Size (m)		Volume (m^3)	Joint R. Rivet W. Weld.	Year of		Leak from Joint	Bottom plate condition	Roof plate thickness (mm)				Lower shell plate thickness (mm)			
		Dia.	Hight			Construction	Rost Repair			Origin	A	B	C	Origin	A	B	C
101	Kawengan Crude	19.47	9.21	2,742	R	1928	-	Trace	No good	4.5	2.6	2.6	2.4	10.0	8.1	8.5	8.5
102	Ledok Crude	20.06	8.51	2,690	R	1928	-	Trace	Very good	5.0	4.2	4.0	4.0	8.0	7.1	7.1	7.1
103	Slop	5.99	2.82	79.5	R	1928	-	Trace	Slightly good	3.5	2.9	2.5	2.7	6.5	5.3	5.7	5.5
104	Solar	5.99	2.82	79.5	R	1928	-	Trace	Slightly good	2.4	1.9	1.5	2.2	-	-	-	-
105	Fuel	5.99	2.82	79.5	R	1928	-	Trace	No good	4.0	3.3	2.3	2.4	-	-	-	-
106	Kerosene	6.09	2.82	82.1	R	1973	-	Trace	No good								
107	Gas Oil	5.99	2.82	79.5	W	1928	1977	Trace	No good	Many corrocion holes							
108	Gas Oil	5.99	2.82	79.5	W, R	1928	1982	Trace	No good								
109	Heavy Gasoline	5.99	2.82	79.5	W	1973	-	Trace	No good								
110	Gasoline	5.99	2.82	79.5	W, R	1928	1967	Trace	No good	Many corrocion holes							
111	Gasoline	5.99	2.82	79.5	R	1928	-	Trace	No good	Many corrocion holes							
112	Gasoline	6.09	2.82	82.1	W	1973	-	Trace	No good	Many corrocion holes							
113	Gasoline	5.99	2.82	79.5	W	1973	-	Trace	No good	Many corrocion holes							
114	Gasoline	5.99	2.82	79.5	W, R	1928	1967	Trace	No good	3.0	1.7	1.8					
115	Gasoline	6.09	2.82	82.1	W	1973	-	Trace	No good	Many corrocion holes							
116	Gasoline	6.09	2.82	82.1	W	1973	-	Trace	No good	Many corrosion holes							
117	Gasoline	6.09	2.82	82.1	W	1973	-	Trace	No good								
118	P.H. Solar	5.49	4.25	79.5	R	1928	-	Trace	No good	3.5	3.4	3.3	2.8				
119	P.H. Solar	5.49	4.25	79.5	R	1928	-	Trace	No good	3.5	2.9	2.3	3.1				
120	Solar	5.49	4.25	79.5	R	1928	-	Trace	Good	3.5	2.9	2.2	2.8				
121	B.O.D.	5.49	4.25	79.5	R	1928	-	Trace	No good	3.1	2.7	2.9	2.8				
122	Residue	8.40	5.31	294.2	R	1928	-	Trace	No good	4.0	3.7	3.7	3.9	6.8	6.2		
123	Residue	8.40	5.24	290.3	R	1928	-	Trace	No good	4.0	1.7	2.3	3.3				
138	Fuel	7.99	6.41	321	R	1928	-	Trace	No good								
139	Fuel	9.49	7.73	548	R	1928	-	Trace	No good								
143	Residue	23.91	11.95	5,367	R		-	None	No good								
201	P.H. Solar	11.98	6.25	705	R	1928	-	Trace	No good								
202	P.H. Solar	9.00	8.45	538	R	1928	-	Trace	No good								
216	Filter Oil	9.00	8.45	538	R	1928	-	Trace	No good								
931	Kawengan Crude	23.50	11.82	5,127	R		-	Trace	No good	4.0	2.6	3.2	2.6	16.5	15.5	15.9	15.9
933	Kawengan Crude	23.50	11.82	5,144	R		-	Trace	No good	3.5	3.1	3.1	3.2	16.5	15.5	13.8	15.5
369	Residue	20.05	8.42	2,658	R		-	Trace	No good	4.0	3.8	3.3	3.0	7.5	5.9	5.2	6.1
941	Ledok Crude	29.99	11.50	8,123	R		-	Trace	No good	4.0	2.9	3.2	3.2	25.4	23.7	23.9	23.8
942	Ledok Crude	29.99	11.47	8,102	R		-	Trace	No good	4.0	3.3	2.6	2.4	25.4	23.9	23.5	23.8

Annex II-5-7 E Q U I P M E N T L I S T [REPAIR WORKSHOP EQUIPMENTS (1)]

Item No.	Object No.	Kind of Object	Short Spec.	Purpose of Use	Condition	Year	Remark
1	3057	Lathe Machine	Center height(H) = 200 mm, Length(L) = 1,300 mm, Chuckdia(D) = 45 mm	General purpose	movable	1938	Bad condition
2	3060	Lathe Machine	H = 250 mm, L = 750 mm, D = 45 mm	General purpose	unmovable	1938	Out of use
3	3063	High Speed Lathe Machine	H = 180 mm, L = 1,500 mm, D = 45 mm	Precion high speed lathe, Small size	movable	1938	Bad condition
4	3065	Lathe Machine	H = 220 mm, L = 1,500 mm, D = 70 mm	Surfacing and screw cuttig	movable	1938	Bad condition
5	3068	Lathe Machine	H = 300 mm, L = 2,000 mm, D = 50 mm	Surfacing and screw cuttig	unmovable	1938	Out of use
6	----	Lathe Machine	H = 175 mm, L = 1,400 mm, D = 35 mm	General purpose	movable	--	Bad condition
7	3088	High Speed Lathe Machine	H = 175 mm, L = 1,400 mm, D = 35 mm	General purpose	movable	1938	Bad condition
8	----	Lathe Machine	H = 160 mm, L = 2,600 mm, D = 70 mm	General purpose	good	1971	Good condition
9	3078	Hgih Speed Lathe Machine	H = 190 mm, L = 1,500 mm, D = 50 mm	Shaft threading	movable	1937	Bad condition
10	3075	Lathe Machine	H = 180 mm, L = 1,300 mm, D = 70 mm	Shaft threading	unmovable	1929	Out of use
11	3071	High Speed Lathe Machine	H = 280 mm, L = 1,800 mm, D = 45 mm	General purpose	unmovable	1929	Out of use
12	3104	Lathe Machine	H = 300 mm, L = 1,500 mm, D = 52 mm	General purpose	movable	1928	Bad condition, unusable
13	3113	High Speed Lathe Machine	H = 325 mm, L = 2,000 mm, D = 66 mm	General purpose	unmovable	1930	Out of use
14	3109	High Speed Lathe Machine	H = 400 mm, L = 4,000 mm, D = 65 mm	General purpose, Big size	movable	1928	Bad condition
15	3136	Vertical Lathe Machine	H = Dia.Max = 70 cm Speed Max = 730 rpm	Lining cylinders	movable	1929	Bad condition,

Annex II-5-7 E Q U I P M E N T L I S T [REPAIR WORKSHOP EQUIPMENTS (2)]

Item No.	Object No.	Kind of Object	Short Spec.	Purpose of Use	Condition	Year	Remark
16	3136	Horizontal Boring Machine	Max.H = 630 mm, Max.Speed = 730 rpm	Reaming cylinders and bore surfaces	movable	1929	Bad condition, unusable
17	3140	Slotting Machine	Stroke = 300 mm	Gears Pins etc.	movable	1929	Bad condition
18	3098	Horizontal Milling Machine	Table: 12" x 42"	Plane and universal	movable	--	Bad condition
19	3132	Planing Machine	H = 30", W(Width) = 30" L = 8 ft	Facing surface	movable	1920	Bad condition
20	3124	Radial Drilling Machine	Bore Max. = 4", Column = 11"	Drilling holes	movable	1929	Bad condition, unusable
21	----	Shaping Machine	Stroke = 16"	Facing surfaces	unmovable	--	Out of use
22	3121	Shaping Machine	Stroke = 32"	Facing surfaces	movable	1929	Bad condition
23	3118	Vertical Milling Machine	Table: 335 x 115 mm	Plain and universal	movable	1926	Bad condition
24	----	Vertical Milling Machine	Table: 300 x 1,200 mm	Plain and universal	good	1971	Good condition
25	3150	Horizontal Jack	Stoke = 3.2 m	Remove or install piston & bearings	unmovable	1920	Out of use
26	3155	Drilling Machine	Bore.Max = 25 mm, Stroke = 90 cm	Drilling holes	movable	1920	Almost not used, Bad condition
27	3157	Drilling Machine	Bore = 2 - 10 mm Stroke 25 cm	Drilling holes, small size	movable	1920	Almost not used, Bad condition
28	3149	Vertical Jack	Stroke = 1.3 m	Remove or install piston & bearing	movable	1920	Almost not used, Bad condition
29	----	Jack Pump	Capacity Max. = 25 kg/cm^2	Testing valves & cocks	movable	--	Almost not used, Bad condition
30	3151	Clean Table	Table: 0.5 x 1.0 m Dia = 0.3 m	Precise surfacing	unmovable	1920	Out of use

Annex II-5-7 E Q U I P M E N T L I S T [REPAIR WORKSHOP EQUIPMENTS (3)]

Item No.	Object No.	Kind of Object	Short Spec.	Purpose of Use	Condition	Year	Remark
31	----	Lathe Machine	D = 50 cm, L = 300 cm, Max.Speed = 1,180 rpm	General purpose	good	--	Good condition
32	----	Lathe Machine	D = 20 cm, L = 100 cm, Max.Speed = 2,000 rpm	General purpose	good	1983	Good condition
33	----	Milling Machine	Max.Speed = 2,000 rpm	Plane and universal	good	1983	Good condition
34	----	Hacksaw Machine	Capacity = 8"	Sawing materials	good	--	Good condition
35	----	Hacksaw Machine	Capacity = 1.5 KW Max.Speed = 1,420 rpm	Sawing materials	good	--	Good condition
36	----	Hacksaw Machine	----	Sawing materials	good	--	Good condition
37	----	Boring Machine, Type 430	Strokcey = 125 mm, Max.Speed = 2,400 rpm	Reaming cylinders & bore surfaces	good	--	Good condition
38	----	Boring Machine, Type KID-420	Max.Speed = 2,500 rpm	Reaming cylinders & bore surfaces	good	--	Good condition
39	----	Boring Machine, Type LC-14	Max.Speed = 1,960 rpm	Reaming cylinders & bore surfaces	good	--	Good condition
40	----	AC-Arc Welding Machine	Capacity = 19 KW, 40V (load)	Welding metals	good	--	Good condition
41	----	AC-Arc Welding Machine	Capacity = 40 - 80 V, 100 - 300 A	Welding metals	good	1974	Good condition
42	----	AC-Arc Welding Machine	Capacity = 105 KW, 32, 6 V, 250 A	Welding metals	good	1974	Good condition

Annex II-5-7 E Q U I P M E N T L I S T [CONSTRUCTION WORKSHP EQUIPMENTS]

Item No.	Object No.	Kind of Object	Short Spec.	Purpose of Use	Condition	Year	Remark
1	----	Hacksaw Machine	-----	Sawing materials	broken	--	Out of use
2	3250	Hacksaw Machine	Capacity: 10"	Sawing materials	movable	--	Bad condition, usable
3	3243	Shearing Machine	----	Shearing plates	movable	1925	Bad condition, usable
4	3241	Punching Machine	----	Punching plates	broken	1925	Out of use
5	3236	Radial Drilling M.	----	Drilling holes	movable	1925	Bad condition, usable
6	3233	Bending Roller	----	Bending plates	movable	--	Bad condition, usable
7	3232	Grinder	----	Grinding surfaces	broken	1926	Out of use
8	----	Radial Drilling M.	----	Drilling holes	broken	--	Out of use
9	3225	Steam Hammer	----	Forging materials	unmovable	1933	Almost out of use
10	3226	Steam Hammer	----	Forging materials	unmovable	1929	Almost out of use
11	3212-3216	Arm Chain Hoist	2,000 kg	Handling heavy materials	movable	1929	Almost out of use
12	----	Grinder	250 mm	Grinding surfaces	broken	1938	Out of use
13	3227, 3230	Furnance	----	Redheat steel	broken	--	Out of use
14	3270	Welder	----	Welding metals	broken	--	Out of use
15	3273	Shield Arc Welder	----	Welding metals	usable	--	Bad condition, usable
16	----	Welder	----	Welding metals	broken	--	Out of use
17	----	Arc Welder	----	Welding metals	broken	--	Out of use
18	----	Arc Welder	18V, 220/250A, 3 phase	Welding metals	broken	--	Out of use
19	----	Arc Welder	18V, 220/250A, 3 phase	Welding metals	usable	--	Bad condition, usable

Annex II-5-7 E Q U I P M E N T L I S T [PIPE SHOP EQUIPMENTS]

Item No.	Object No.	Kind of Object	Short Spec.	Purpose of Use	Condition	Year	Remark
1	3304	Pipe threader (Lathe Machine)	D = 24"	Pipe threading	movable	1929	Bad condition, Almost not-used
2	3309	Pipe threader (Lathe Machine)	D = 10"	Pipe threading	movable	1929	Bad condition, Almost,not-used
3	3312	Pipe threader (Dies Machine)	For pipes ½" - 4"	Pipe threading	movable	1938	Bad condition, Almost not-used
4	3315	Pipe threader (Dies Machine)	For pipes 2½" - 12"	Pipe threading	movable	1929	Bad condition, Almost not-used
5	3318	Pipe threader (Dies Machine)	For pipes 1" - 6"	Pipe threading	movable	1929	Bad condition, Almost not-used
6	3321	Pipe threader (Dies Machine)	For pipes ½" - 6"	Pipe threading	movable	1929	Bad condition, Almost not-used
7	----	Pipe Press	Capacity = 100 Ton	Pipe threading	movable	--	Bad condition, Almost not-used