THE FEASIBILITY STUDY

FOR

THE LOCAL CONDOM PRODUCTION PROJECT

IN

THE REPUBLIC OF INDONESIA

OCTOBER 1981

JAPAN INTERNATIONAL COOPERATION AGENCY

PREFACE

In response to a request of the Government of the Republic of Indonesia, the Japanese Government decided to conduct a survey on the Local Condom Production Project and entrusted the survey to the Japan International Cooperation Agency (JICA).

The JICA sent to Indonesia a survey team headed by Mr. Itsuo Koyama from June 8 to July 5, 1981.

The team exchanged views with the officials concerned of the Government of Indonesia and conducted a field survey in Jakarta and Bandung areas.

After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

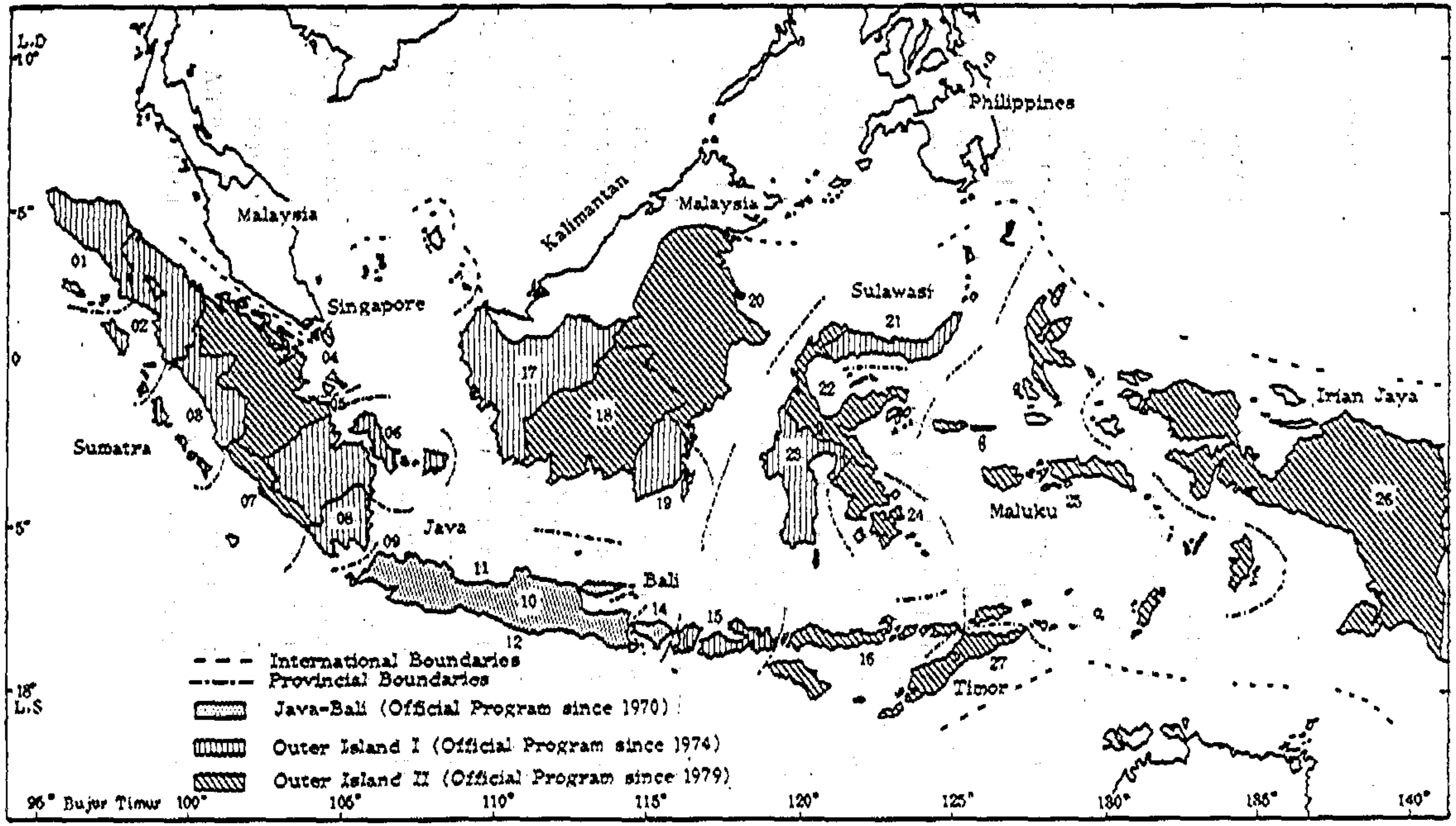
I wish to express my deep appreciation to the officials concerned of the Government of Indonesia for their close cooperation extended to the team.

October, 1981

Keisuke Arita

Keisuke Arita
President
Japan International
Cooperation Agency

THE REPUBLIC OF INDONESIA



Code Number	Name of Province	Provincial Capital
1.	D.I. ACEH (Special Territory)	BANDA ACEH
2.	NORTH SUMATRA	MEDAN
3.	WEST SUMATRA	PADANG
4.	RIAU	PAKAN BARU
5.	JAMBI	JAMBI
6.	SOUTH SUMATRA	PALEMBANG
7.	BENGKULU	BENGKULU
8.	LAMPUNG	TANJUNG KARANG
9.	D.K.I. JAKARTA (Special Capital Territory)	JAKARTA
10.	WEST JAVA	BANDUNG
11.	CENTRAL JAVA	SEMARANG
12.	D.I. YOGYAKARTA (Special Territory)	YOGYAKARTA
13.	EAST JAVA	SURABAYA
14.	BALI	DEMPASAR
15.	WEST NUSA TENGGARA	MATARAM
16.	EAST NUSA TENGGARA	KUPANG
17.	WEST KALIMANTAN	PONTIANAK
18.	CENTRAL KALIMANTAN	PALANGKA RAYA
19.	SOUTH KALIMANTAN	BANJARMASIN
20.	EAST KALIMANTAN	SAMARINDA
21.	NORTH SULAWESI	MENADO
22.	CENTRAL SULAWESI	PALU
23.	SOUTH SULAWESI	UJUNG PANDANG
24.	SOUTH EAST SULAWESI	KENDARI
25.	MALUKU	AMBON
26.	IRIAN JAYA	JAYAPURA
27.	TIMOR TIMUR	DILI

ABBREVIATIONS

Ac	Acceptance
ACCR	Adjusted Cumulative Continuation Rate
AQL	Acceptable Quality Level
ASTM	American Society for Testing and Materials
atm	Atomosphere
BAPPENAS	Badan Perencanaan Pembangunan Nasional (National Development Planning Agency)
BKKBN	Badan Koordinasi Keluarga Berencana Nasional
BKPM	Badan Koordinasi Penanaman Modal (Investment Coordinating Board)
C	Centigrade
Ca	Calcium
CIF	Cost Insurance and Freight
Cl	Chlorine
cm	Centimeter
DGI	Dewan Gereja di Indonesia
DI	Daerah Istimewa
DKI	Daerah Khusus Istimewa
DRC	Dry Rubber Content
EB	Elongation at Break
etc.	et cetra
FDA	Food and Drug Administration
Fe	Ferrum = Iron
Fig.	Figure
FOB	Free on Board
FY	Fiscal Year
H	Hour
HA	High Ammonium
Hz	Hertz
IBRD	International Bank for Reconstruction and Development
i.e.	id est = that is
IFRR	Internal Financial Rate of Return
IPPF	International Planned Parenthood Federation

IUD	Inter-Uterine Device
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standard
JLN	Jalan
JOICFP	Japanese Organization for International Cooperation in Family Planning
kg	Kilograme
km	Kilometer
KOH	Value of Patassium Hydroxide
KTSM	Kanebo Tomen Sandang Synthetic Mills
kVA	Kilo Volt Ampere
kWH	Kilo Watt Hour
	Liter
m	meter
m^2	Square meter
Max	Maximum
MDF	Marine Diesel Fuel
Mg	Magnesium
Min	Minimum
mℓ	Milliliter
mm	Millimeter
MPC	Media Production Center
MST	Mechanical Stability
(NFPCB)	(National Family Planning Coordinating Board)
NH_3	Ammonia
No.	Number
OECF	The Overseas Economic Cooperation Fund (Japan)
OTCA	Overseas Technical Cooperation Agency (Japan)
pH	Hydrogen Ion Concentration
P.L.N.	Perusahaan Umum Listrik Negara (State Electric Power Co.)
p.m.	past-meridiem = afternoon
P.T.	Perseroan Terbatas (Company Limited)
P.T.P.	P.T. Perkebunan
Re	Rejection

REPELITA	Rencana Pembangunan Lima Tahun (5 Year Development Plan)
Rp	Rupiah
r.p.m.	Rotation/revolutions per minute
S	Sample
SE	Standard Error
Si	Silicon
SIDA	Swedish International Development Authority
t	Ton
TB	Tensile Strength
TSC	Total Solid Content
UNFPA	United Nation Fund for Population Activity
UNICEF	United Nation Children's Fund
USA	United States of America
USAID	United States Agency for International Development
US$	United States Dollar
VCDC	Village Contraceptive Distribution Center
VFA	Volatile Fatty Acid
¥	Yen

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SUMMARY, CONCLUSION

AND

RECOMMENDATIONS

S U M M A R Y

I. OUTLINE OF THE PROJECT

1. Production Capacity

1983/84	2,300 gross/day	550,000 gross/year
	(240 stream days per calendar year)	
1990/91	2,730 gross/day	900,000 gross/year
	(330 stream days per calendar year)	

2. Natural Rubber Latex

For the production of condoms, there is a need to use latex of the highest quality. The Indonesian side is in hopes of using refined Javanese latex available in areas close to the proposed plant site, but it is desirable that relatively stable Sumatran latex be put to use at the first stage and efforts to develop Javanese latex should be started as soon as possible.

3. Plant Site

Plant site has been decided as 15,000 m² out of 1 million m² rice field at Banjaran located 18 km south of Bandung. In this report, it is described as Site C.

4. Sales of the Products

All the products to be manufactured as scheduled by BKKBN will be purchased by BKKBN and distributed through its network free of charge.

The Government of Indonesia intends to determine the price of condoms taking into account the price at which the U.N. or other donor agencies purchase in international market.

5. Management of the Venture

The government owned pharmaceutical company, P.T. Kimia Farma will be engaged in the operation of the plant as one division of its organization.

II. BACKGROUND FOR NECESSITY OF CONDOMS

1. Population in Indonesia

The Republic of Indonesia has a population of 147 million, which increases at an annual average rate of 2.32% (1970-80). It represents the world's fifth largest population and about 64% of the total population is concentrated in Java and Bali, the land of which accounts for only 7% of the entire national land area.

2. The National Family Planning Program

As a result of the activities of the National Family Planning Coordinating Board (BKKBN), established under the Presidential Decree No. 8 in 1970, the number of persons who participate in family planning has steadily increased for the last 10 years.

The acceptors targets were always exceeded except at the beginning of the program. In 1980/81, the number of current users reached 7.79 million which exceeded the target. The program target for current users in 1990/91 is set at 16.82 million.

3. The Role of Condoms in the Program

Due to the shortage of condom supply, the condom users are estimated to be low compared to that of contraceptive pill and IUD. The use of condom will increase if local production will become reality and constant supply will be assured, since more than 18% of new acceptors chose condom as contraceptive in 1974/75 and 1975/76 in cafeteria method, when condoms were substantially supplied with USAID assistance. As no side effect among the users is observed, the use of condom will take the important role in the family planning program.

III. STUDY OF DEMAND FORECAST AND CONDOM DISTRIBUTION SYSTEM

1. Demand Forecast

The ratio of condom users has remained at low level, 5-6% of total acceptors. The reason for the relatively low acceptance rate is ascribable to the unstable supply of condoms both in terms of quantity and quality.

The number of condoms to be used by acceptors per year is estimated at 144 pieces (1 gross). However, the feasibility study team assumed more realistic premise that actual acceptors (6% of total acceptors) will use 120 pieces of condom per year. Thus, quantity of condom required will be 550,000 gross in 1983/84 and 900,000 gross in 1990/91.

2. Distribution System

The condoms to be produced by P.T. Kimia Farma will be distributed through BKKBN network in province and regency. Under the provincial and regency BKKBN, there are family planning clinics, mobile medical teams, field workers village contraceptive distribution centers (VCDC), and sub-VCDC (acceptors group).

IV. RAW MATERIALS' STUDY

1. Natural Rubber Latex

At the time of meeting with BKKBN on 9th September by the representatives of feasibility study team, BKKBN has decided to propose the Ministry of Agriculture to improve quality of latex being refined in P.T.P. V in Sumatra and P.T.P. XI in Java as a result of additional study.

2. Compounding Chemicals and Other Materials

Most of those chemicals and materials can not be obtained locally and must be imported.

3. Packing Materials

As the result of study, the study team found that local packing materials are accessible and usable.

V. STUDY OF TECHNICAL ASPECTS RELATED TO CONDOM PRODUCTION

1. Site Condition of Proposed Site C

No problems as to supply of water and labour force can be foreseen since there are textile and paper mill factories as well as river near proposed Site C, though quality of water and electric supply is questionable. Therefore, installation of generator and water treatment equipment shall be essential to cope with the difficulty.

2. Infrastructure and Utilities

2-1 Road

Four routes exist from Jakarta to Banjaran and no serious problem can be expected as to delivery of machinery and equipment for condom production.

2-2 Electric Power Supply

Although electric supply by P.L.N. is assured, installation of generator will be essential due to the existance of supply stoppage.

2-3 Supply of Fuel Oil

There is no problem regarding supply of fuel oil. The condom plant will need a stockpile of fuel oil sufficient for a period of one month since supply of refined oil relies on import.

2-4 Water Supply

Condom plant will consume an estimated 14 t of water per hour. The river water must be treated with purification facility. The capacity of underground water supply is between 3.5-15 t per hour. The condom plant plans to use both river and well water.

2-5 Waste Water Treatment

The waste water from the plant must be treated before disposal in order to meet Indonesian Standard for Waste Water.

2-6 Consumption of Energy Sources

The annual consumption of energy sources for the production of 600,000 gross condoms are described as follows:

Vapour consumption	900-1,200 kg/H
Fuel oil consumption	80- 110 ℓ/H (MDF) 90- 120 ℓ/H (Solar Oil)

Electric power consumption	300 - 350 kWH
Water supply	12 - 16 t/H

3. Major Base Factor Taken for Examination and Conceptual Design of Facilities for the Condom Production Plant

3-1 Required Condom Production

The condom requirement calculated from demand forecast is described as follows. The plant should be designed to fulfill the following requirement.

1983/84	550,000 gross
1984/85	610,000 gross
1985/86	660,000 gross
1986/87	690,000 gross
1987/88	750,000 gross
1988/89	800,000 gross
1989/90	850,000 gross
1990/91	900,000 gross

3-2 Specification of Condom, Natural Rubber Latex and Packing Material

(A) Specification of condom

As a result of discussion between BKKBN and P.T. Kimia Farma, specifications of condom are set as follows :

Dimension :

Length	: Not less than 17 cm
Width	: 49-52 mm
Thickness	: 0.05±0.02 mm

Physical Properties :

Tensile strength before aging	: 600%

Tensile strength after aging	:	540%
Elongation at break	:	200 kg/cm^2
Water leakage test	:	AQL 1.0%
Bursting volume	:	Not less than 25ℓ (Average)

(B) Specification of natural rubber latex

a)	Total Solid Content	:	61.5 - 61.8%
b)	Dry Rubber Content	:	60.0 - 60.4%
c)	Difference, a) - b)	:	Not more than 1.45%
d)	Total Alkalinity Percent	:	0.70 - 0.75%
e)	Viscosity	:	60 - 70 cp
f)	KOH No.	:	0.50 - 0.55%
g)	MST	:	1,800 - 2,000 sec
h)	pH value	:	10.4 - 11.9
i)	VFA No.	:	Not more than 0.02%

(C) Specification of laminated aluminium tape for packing

Materials	:	Cellophane PT No. 30 Polyethylene, 15 micron Aluminium, 7 micron Polyethylene, 40 micron
Width	:	72 mm

4. Conceptual Design and Plan of Facilities and Related Work for the Condom Production Plant

The proposed condom production plant in this project will be designed to manufacture 550,000 gross in 1983/84 and 900,000 gross in 1990/91 with yearly increase of production output.

(A) Production facility

Compounding equipment	: Vulcanizing capacity of 1,200 ℓ/day, Sulphur vulcanizing method
Moulding machine	: Full automatic type; 3 lines Electric heater drying system
Pinhole testing machine	: Automatic type with feeder; 4 lines, Wet system detective type
Packing machine	: Automatic type with feeder; 8 sets, Oblong type
Laboratory apparatus	: Multi-type water filling equipment; 1 set Digital-type air inflation test machine; 1 set

(B) Utility facility

Electric receiver	: 500 kVA
Generator capacity	: 500 kVA (3 sets of capacity 250 kVA each)
Boiler capacity	: 1,200 kg/H (Pressure 6-8 kg/cm^2)

Supply water treatment facility	: Concentration and precipitation facility 30 m^3
	Filtering apparatus 25 m^3
	Water softner 1.5 m^3/H
	Demineralizer 0.2 m^3/H
Waste water treatment facility	: Neutralizing concentration and precipitation apparatus 30 m^3
	Filtering apparatus 25 m^3

5. Production Process and Technology

Condom production by the continuous dipping method needs particular technique in all the phase of manufacturing process. Processing in high-temperature conditions is accompanied by several difficulties, which is one of the cause for the failure of condom production in tropical regions.

6. Project Implementation and Plant Operation

6-1 Organization for Implementation of This Project

The company which will implement the Project and operate the factory will be the Government owned pharmaceutical company, P.T. Kimia Farma, which is working with BKKBN being designated as executing agency of the Project by the Government of Indonesia.

6-2 Major Tasks which must be Performed by Indonesian Counterpart up to the Time of Delivering Plant Equipment

On the basis of prerequisites, leveling of the land, construction of factory building, access road, water supply and waste water treatment facility and necessary piping and wiring works in the factory shall be completed by P.T. Kimia Farma before the arrival of machinery and equipment to the factory.

6-3 Implementation Schedule

In the view of the Feasibility Study Team, the construction schedule for condom plant would be as follows:

Commencement of designing	1981/82
Mechanical Completion of Factory	1983/84
Starting of trial operation	1983/84

6-4 Organization for Plant Operation and Manpower Planning

The organization of the plant will be composed of three devisions and eleven bureaus and manpower program will be as follows:

Production capacity	600,000 gross/year	900,000 gross/year
Executives	4	4
Middle class manager	29	31
Clerk and factory workers	112	151
	145	186

7. Technical Assistance Services

From the fact that there is few successful case of condom production in tropical country and Indonesia is situated in the similar climate zone, it is expected that technical assistance services by the experienced engineers will be required in order to lead this project to success.

The term of assistance services is as follows :

(A) Technical assistance in Indonesia

a) Technical assistance services for a period of additional one year after the transfer of plant machinery and equipments as well as the short period of construction of factory building and the period of machinery and equipment installation.

b) Technical assistance services related to operation and maintenance for a period of at least 3-5 years following the starting up of the plant.

(B) Overseas training

It is considered to provide overseas training for Indonesian engineers for the purpose of achieving smooth operation after installation and transfer of machinery and equipment.

VI. CAPITAL REQUIREMENT AND FINANCING PLAN

1. Capital Requirement

The total capital requirement is estimated as follows:

Foreign Currency Portion (000)	Domestic Currency Portion (000)	Total (000)
¥2,248,742 Rp 6,184,042	Rp 1,310,038	Rp 7,494,080

Above calculation is based on an exchange rate of US$1= ¥225=Rp 620.

2. Financing Plan

Foreign component of the capital requirement is to be covered by long-term loan on favorable condition of which terms are supported to be 15 years including grace period of 5-7 years with annual interest rate of 3-5%.

Local portion of the capital requirement is to be covered by equity. The working capital is to be financed by short-term loan from state banks with annual interest rate of 13.5%.

VII. FINANCIAL ANALYSIS

Under the assumptions that the purchase price of condom is US$4.0 - 4.5 per gross and the annual interest rate for long-term loan is 3.0 - 5.0%, the internal financial rate of return for the project is estimated at 9.40 - 12.88% before tax and 6.84 - 10.28% after tax. Therefore, if long-term loans are available at an interest rate of 3.0 - 5.0%, the project is considered financially feasible at the prevailing purchase prices in the international market.

VIII. ECONOMIC EVALUATION

The internal economic rate of return for the project is computed at 8.59 - 12.18%, which is not particularly high compared with the opportunity cost of capital in Indonesia. Considering its contribution to the national family planning program, foreign exchange saving effect by import substitution of condom, and other conceivable benefits, however, the project is considered justifiable and desirable for the national economy.

CONCLUSION

According to the result of the study, the project of establishing condom production plant in Banjaran on the outskirts of Bandung using domestic latex refined in Sumatra in the first stage and refined in Java in the second stage is considered financially and economically feasible.

RECOMMENDATIONS

The following recommendations are made as being essential to insure the success of the project.

1. The production of condom needs specific techniques incomparable to those for other manufacturing industry. Especially, production of condom in a tropical area is linked with weather conditions. With Indonesia also being a tropical country, it will be desirable to adopt well experienced foreign technolgies for production in order to make this project successful.

2. Indonesian natural latex, which has not been used for the production of condom, is required to be used in the project. It is therefore expected that development plan of Indonesian latex will be materialized before trial operation of plant by taking immediate action.

3. Technical assistance services by plant supplier would require at least 3-5 years. Especially, technical assistance by the technicians experienced in manufacturing condom for long enough period is recommended.

PART I

INTRODUCTION

PART I INTRODUCTION

CHAPTER 1 BACKGROUND, PURPOSE AND METHOD OF THE STUDY

1-1 Background

The core of the national family planning activities in the Republic of Indonesia is the National Family Planning Coordinating Board (BKKBN-NFPCB), which is fully responsible for coordinating all family planning activities implemented by ministries and other organizations such a the Ministry of Health, the Ministry of Education, the Armed Forces Family Planning Institute and the Indonesian Planned Parenthood Association and other voluntary organizations. The main population problems and identified as follows:

(1) Size of population: the population is estimated at 147 million at the end of 1980. This makes Indonesia the fifth most populous country in the world.

(2) High population growth rate: according to the population census of 1980, the population growth rate is 2.32%.

(3) Unfavorable age-composition of population: the population tend to be young. This results in a high dependency ratio.

(4) Unbalanced distribution of population: about 64% of the total population has concentrated on the Java and Bali which represent only 7% of the total land area.

(5) Concentration of population in urban areas.

All these facts are considered to be disadvantages to the socio-economic development of Indonesia. To cope with these problems the Government of the Republic of Indonesia has adopted the national program for family planning in 1969 as a part of the National Five-Year Development Plan. In the current Five-Year Plan (Repelita III, 1979/80-83/84), the Government of Indonesia has formulated a more comprehensive policy which goes beyond "family planning" and has expanded its program areas to cover all of Indonesia. The number of eligible women is about 22 million according to the population census held in 1980, and this fact is commanding the Government's full attention for carrying out the national family planning program more intensely.

For the promotion of the national family planning program, it is important not only to motivate eligible couples to participate in family planning but also to guarantee regular supplies of contraceptives to acceptors. In Indonesia, condoms are less popular contraceptives compared to oral pills or IUDs. It is not an exaggeration to say that the reason for this lies in the fact that the supply of condoms has not bee sufficient and stable. It is therefore very obvious that with the availability of a codom plant in Indonesia which consequently will eliminate the constraint unstable and inadequate supply, the use of condoms will open wider horizon for the Family Planning Program and ultimately will become popular under the Indonesian community.

Under the circumstances, the Government of the Republic of Indonesia requested the cooperation of the Government of Japan in carrying out a feasibility study of a project to establish a condom manufacturing plant. The project is expected to guarantee a regular and continuous supply of condoms for distribution to new and old acceptors in the national family planning program by local production. In response to this request, the Japanese Government sent a preliminary survey team in March 1981. A field investigation was carried out by a team of 8 experts for 28 days from June 8 to July 5, 1981.

1-2 Purpose of the Study

The purpose of the study was to investigate the feasibility of the project to construct a condom plant in Indonesia, and the contents of its final report is summarized as follows:

(1) Outline of the Project
(2) Background for Necessity of Condoms
(3) Demand Forecast
(4) Raw Materials' Study
(5) Study of Technical Aspects Related to the Condom Production
(6) Capital Requirement and Financing Plan
(7) Financial Analysis
(8) Economic Evaluation

1-3 Method of the Study

In order to find out the best alternative design of a condom plant and to examine its soundness as a project, the method of feasibility study is used in the study. Fig. I-1 shows the flow chart of the study. Main steps of the study are as follows;

(1) Survey on the national family planning program and market study

As a result of Indonesian family planning history, the role of the Government in this field is dominant. Therefore, in order to estimate the condom demand in Indonesia, comprehensive survey on the national family planning program is needed as a market study.

(2) Raw material and input study

It covers present and projected availability of raw materials and inputs basic to the project and the present and projected price trends of such materials and inputs. For the condom manufacturing, quality of latex is crucial. Careful investigation of the availability of latex is required.

(3) Technology selection study

It includes location study such as plant site study and infrastructure survey, technology selection study and equipment selection study. After a comprehensive assessment of the production capacity of the project, necessary facilities have to be determined.

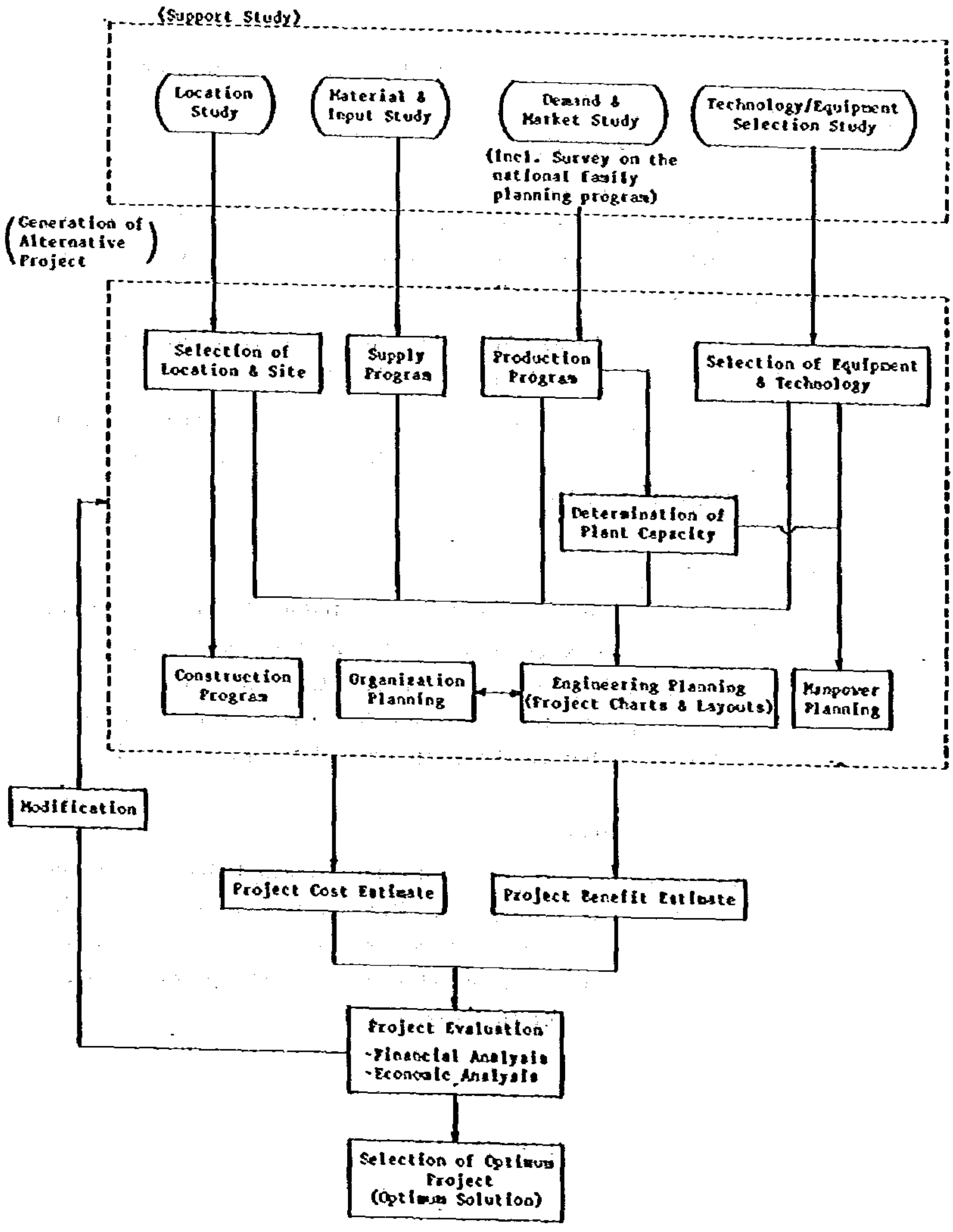
(4) Project evaluation

It is necessary to investigate the financial soundness of the project and also to evaluate the direct and indirect effects of the project on the national economy. The index of the evaluation used in the study is the internal rate of return which is calculated by the benefits and the costs of the project. The internal rate of return is the discount rate at which the present value of cash inflows is equal to the present value of cash outflows. It is calculated from the following formula.

$$\sum_{t=1}^{n} \frac{Bt-Ct}{(1+i)^t} = 0$$

Bt: benefit in the tth year
Ct: cost in the tth year
i : the internal rate of return

Fig. 1-1 FLOW CHART OF THE STUDY



CHAPTER 2 BASIC ASSUMPTIONS UNDERLYING THE PROJECT

The study was carried out with the following assumptions.

(1) Production capacity

In the preliminary survey stage, the demand was forecasted at 293,000 gross in 1981/82 and 584,000 gross in 1990/91. However the demand forecast has been revised by BKKBN as follows:

550,000 gross in 1983/84 increased gradually to 900,000 gross in 1990/91.

This was considered realistic based on the examination of the program discribed in CHAPTER 3, PART II, and CHAPTER 2, PART III.

(2) Local latex

As is strongly suggested by the Indonesian counterparts, Indonesian latex shall be used. In this case, it is necessary to raise the standard of latex and fulfill the requested specifications at each designated refinery in Java and Sumatra before the completion of the proposed plant.

(3) Market for condoms

The plant is considered to be operated by a national pharmaceutical enterprise, P.T. Kimia Farma (see the ANNEX 3). The market for the products is secured by the government. The BKKBN will take charge of purchase and distribution of the products.

PART II

BACKGROUND FOR

NECESSITY OF CONDOMS

PART II BACKGROUND FOR NECESSITY OF CONDOM

CHAPTER 1 POPULATION IN INDONESIA

The Republic of Indonesia is made up of 13,667 islands of which about 3,000 are inhabited, stretching 5,110 km from east to west and 1,880 km from north to south. Its national land covers an area of about 1,920,000 Km^2. Five islands, (Kalimantan, Sumatra, Irian Jaya, Sulawesi and Java) are large, which account for 91% of the national land. With the equator lying in between, the Republic of Indonesia lies along lat. 6°08' N. and lat. 11°15' S. and features a tropical and oceanic climate with high temperature and humidity (the dry season falls in June to September and the rainy season in December to March).

Since her independence in 1945, Indonesia is a constitutional republic with a president elected by Peoples Consultative Assembly. Administratively, the nation consists of 27 provinces (provinsi).

Each province is made up of regencies (kabupaten) and municipalities (kotamadya), and each regency consists of a number of subdistricts (kecamatan). Each subdistrict is comprised of a number of villages (desa). At present, there are 246 regencies, 54 cities, 3,349 subdistricts and about 60,000 villages (according to the statistics, in 1978/79).

The Republic of Indonesia is an agricultural country, in which 31% of the gross national product (at nominal value in 1978) and a little more than 60% of the labor force are accounted for by agriculture, forestry and fisheries. Rice, sugar, copra and other agricultural products, however, are partially imported.

The national economy is sustained by the oil sector, which accounted for US$10.1 billion (about 65% of the US$15.5 billion worth of all exports in fiscal 1979). The average annual economic growth rate is 7.8% (GNP in 1970-78) but the per capital income still remains low, estimated at a mere US$360. Prices rise at an annual average rate of 20% (1970-78), reflecting sharp rises in the prices of oil.

According to the latest national population census held at the end of October 1980, the total population of the Republic of Indonesia is 147,490,298, which is the world's fifth largest population, following China, India, the Soviet Union and the USA.

In addition to this magnitude, the population of Indonesia features an excessively unbalanced distribution. About 64% of the total population is concentrated in Java and Bali, the area of which accounts for a mere 7% or so of the national land. The average population density stands at about 77 persons per km^2, but it stands at 2,8 persons/km^2 in Irian Jaya and 12.5 persons/km^2 in Kalimantan, whereas Java and Bali have a density of 680.5 persons/km^2, suggesting the existence of an exceedingly big disparity. (See Table II-1)

The DKI Jakarta has an exceedingly great density of 11,022.8 persons/km^2. Unemployment and urbanization problems have been taken up as grave social issues.

According to the population census in 1971, the total population stood at 119,208,229. In the 1971-80 period, the population rose by about 27.7 million at an annual average rate of 2.32%. The population will continue doubling every 30 years or so, should it keep rising at this rate in future.

The age-composition of the population indicates that people at 0-14 years of age constitute 44% of the total population, suggesting that the share of young people in the population is high as is the case with many developing countries. This has turned out to be a big burden (with the dependency ratio standing at 88.7) on the all working population (15-64 years of age), and also an impediment to any attempt to check a rise in population.

The crude birth rate and the crude death rate are estimated at 36 and 13 per 1,000 population respectively. According to an estimate of the Central Bureau of Statistics, the total fertility rate, estimated to be 5.5 in the period of 1966-70 has decreased to 4.87 in 1975. Because of an increase in the population of women of reproductive age (15-44), there is a need to exert greater efforts to drop the crude birth rate.

A check of the composition of the population by religion reveals that Muslims account for the majority (90% of the population) and the remainder is shared by Christians (6%), Hindus and Buddhists (3%).

Table II-1 POPULATION - 1971-1980 CENSUS

	Area		1971 (24 September)			1980 (31 October)			Average Annual Growth Rate (%)
	km^2	Ratio (%)	Person	Ratio (%)	Population Density ($Person/km^2$)	Person	Ratio (%)	Population Density ($Person/km^2$)	
Sumatra	473,606	24.9	20,808,148	17.4	43.9	28,016,160	19.0	59.2	3.32
Java-Bali	137,748	7.2	78,206,649	65.6	567.8	93,739,458	63.5	680.5	2.01
Nura Tenggara 1/	82,927	3.6	4,498,752 2/	3.8	66.1 2/	6,017,180	4.1	72.6	2.15 2/
Kalimantan	539,460	28.3	5,154,774	4.3	9.6	6,723,086	4.6	12.5	2.96
Sulawesi	189,216	9.9	8,526,901	7.2	45.1	10,409,533	7.1	55.0	2.22
Maluku	74,505	3.9	1,089,565	0.9	14.6	1,411,006	1.0	18.9	2.88
Irian Jaya	421,981	22.2	923,440	0.8	2.2	1,173,875	0.8	2.8	2.67
Indonesia	1,919,443	100.0	119,208,229 2/	100.0	62.6 2/	147,490,298	100.0	76.8	2.32 2/

Notes: 1/ excluding Bali
2/ excluding East Timor

Source: Central Bureau of Statistics

CHAPTER 2 THE NATIONAL FAMILY PLANNING PROGRAM - ITS TARGET AND ACHIEVEMENT -

The program goal of the current Five-Year Development Plan is to lower the fertility level of 1971 (44 per 1,000 population) by 50% by 1990, 10 years earlier than anticipated by the presidential instruction. BKKBN is striving to accomplish this demographic target by taking the following plan of action: after the number of eligible couples (married couples of reproductive age) is estimated based on the latest census population, the percentage of current users to the eligible couples required by the ultimate target of the national program is calculated. According to this computation, the number of eligible couples will be 27.8 million out of a total population of 176 million in 1990/91. And the target rate of current users to achieve the fertility goal is calculated at 60.55%, which was 34.05% in 1980/81 (see Table II-2).

On the basis of this rate and the number of eligible couples, the number of persons targeted for family planning under the national program is computed. Taking into account the past developments of the family planning program, the target for current users is determined for each province.

A check of achievement under the past national programs reveals that the family planning diffusion rate (the percentage of current users to eligible couples) has gradually risen in proportion to a wider application of the program (see Table II-3). In 1979/80 when the national program encompassed every nook and corner of the Republic of Indonesia, the diffusion rate stood at 30.69% but rose to 36.07% in 1980/81. Even if it is taken into account that this actual rate of 36.07% was in excess of the 34.05% targeted for 1980/81, there is a need for greater efforts on the part of the Government of the Republic of Indonesia in order to achieve the target of reducing the fertility rate by 50% in twenty years.

Table II-2 TARGET OF THE NATIONAL FAMILY PLANNING PROGRAM

Year	Total Population	Increase Rate	Birth Rate	Death Rate	Diffusion Rate of Family Planning Acceptor	Estimate of Eligible Couples	Target of Current Users
1980/81	147,383,075	23.40	35.90	12.50	34.05	22,107,461	7,527,590
1981/82	150,831,839	22.08	34.18	12.10	37.32	22,624,776	8,443,566
1982/83	154,162,206	20.84	32.55	11.71	40.43	23,154,196	9,361,241
1983/84	157,374,946	19.66	30.99	11.33	43.41	23,696,004	10,286,435
1984/85	160,468,938	18.55	29.51	10.96	46.21	24,250,490	11,206,151
1985/86	163,445,636	17.44	28.07	10.63	48.86	24,808,251	12,121,311
1986/87	166,296,128	16.49	26.76	10.27	51.17	25,378,841	12,986,353
1987/88	169,038,351	15.55	25.48	9.93	53.85	25,962,554	13,980,835
1988/89	171,666,897	14.65	24.26	9.61	56.17	26,559,693	14,918,580
1989/90	174,181,817	13.80	23.10	9.30	58.36	27,170,566	15,856,742
1990/91	176,585,526	12.99	21.99	9.00	60.55	27,784,621	16,823,588

Source: Bureau of Planning, NFPCB

Table II-3 DIFFUSION RATE OF FAMILY PLANNING ACCEPTORS BY PROVINCE (NUMBER OF CURRENT USERS PER 1,000 ELIGIBLE COUPLES)

	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81
DKI Jakarta	40.1	76.2	96.1	104.6	128.4	149.3	209.7	218.7	202.9	247.3
West Java	20.3	52.7	75.1	109.2	145.0	189.2	233.9	244.0	253.1	316.3
Central Java	20.6	56.1	88.8	118.5	168.9	197.7	263.3	269.3	443.4	519.0
D.I. Yogyakarta	39.9	97.4	137.9	127.9	176.4	190.5	268.5	273.8	503.3	553.1
East Java	31.1	108.9	191.7	266.5	316.9	337.8	402.1	504.0	571.7	603.8
Bali	67.4	155.7	225.1	236.5	319.9	354.8	428.4	460.1	497.8	536.7
Java and Bali	28.4	77.4	124.1	166.5	212.0	241.4	301.0	368.4	418.0	472.3
D.I. Aceh				16.3	33.4	45.6	59.9	64.2	77.7	148.0
North Sumatra				18.5	42.4	66.0	88.0	106.8	125.9	125.5
West Sumatra				13.4	33.3	54.7	89.6	97.4	144.1	203.9
South Sumatra				17.9	36.2	50.9	67.9	89.0	87.2	131.5
Lampung				15.0	30.6	47.7	92.6	173.2	197.3	278.8
West Nusa Tengarra				8.4	23.8	51.2	82.7	103.2	134.2	242.2
West Kalimantan				14.0	24.4	36.5	79.2	58.3	72.7	129.6
South Kalimantan				18.7	51.2	74.2	139.9	151.4	189.6	269.1
North Sulawesi				44.8	109.9	179.9	261.4	209.5	298.2	353.1
South Sulawesi				20.6	42.4	61.4	95.1	75.6	126.4	231.5
Outer Island I				18.6	40.2	62.0	95.7	106.4	137.5	196.6
Riau									15.8	77.9
Jambi									46.8	97.7
Bengkulu									93.3	217.1
East Nusa Tengarra									9.9	39.9
Central Kalimantan									42.2	72.1
East Kalimantan									66.3	124.9
Central Sulawesi									31.8	76.1
Southeast Sulawesi									24.8	66.0
Maluku									18.2	38.1
Irian Jaya									13.2	24.7
East Timor									0.0	2.9
Outer Island II									27.8	69.1
Total Indonesia				128.4	166.7	193.9	246.4	297.1	306.9	360.7

Source : Bureau of Reporting and evaluation, NFPCB.

Table II-4 indicates the estimated number of current users computed on the basis of the aforementioned premise and that of persons targeted for family planning by contraceptive methods. According to this table, the number of current users is expected to increase from 8.4 million in 1981/82 to 17 million in 1990/91 at an annual rate of about 8%. By contraceptive method, the rates of 58% for pills, 31% for IUDs, 5% for condoms and 6% for others in 1981/82 will be brought to 40%, 40%, 5% and 15%, respectively, in 1990/91 according to the plan. The category, "others", includes contraceptive injections, vaginal tablets and sterilization.

The targeted rates by contraceptive method reflect the intention of the Government which has noted the achievement of the past programs and the possibility of supplying contraceptives. Discernible from this is the policy of reducing the rate of oral pill which has thus far remained high, increasing that of IUD and other contraceptives, and retaining the rate of condom use at a certain level (5%). This reflects the policy of the Government to shift from oral pills to IUDs, as a means of reducing the heavy costs and logistic complications of distribution. And due to the high continuation rate and effectiveness of contraception, the Government wants to encourage acceptors to try IUDs.

On the basis of the achievements under the national programs, let us see the feasibility of realizing the target number of current users by contraceptive method. Oral pills increased in importance from about 40% of all method selected by new acceptors in 1971/72 to more than 60% in the latter half of the 1970s (see Table II-5).

IUDs, on the other hand, declined in relative importance from 55.3% in 1971/72 to 25.9% in 1980/81. The rate of condom users levelled off at a rate of a little over 5-6% in the latter half of the 1970s with the exception of the two fiscal years of 1976/77 and 1977/78 and rose to 6.1% in 1980/81.

Table II-4 TARGET OF CURRENT USERS BY CONTRACEPTIVE METHOD
1981/82 - 1990/91

Year	Target of Current User	I U D		Pill		Condom		Others	
		Ratio(%)	Target	Ratio(%)	Target	Ratio(%)	Target	Ratio(%)	Target
1981/82	8,400,000	31	2,600,000	58	4,900,000	5	420,000	6	480,000
1982/83	9,400,000	32	3,000,000	56	5,300,000	5	470,000	7	630,000
1983/84	10,300,000	33	3,400,000	54	5,600,000	5	510,000	8	790,000
1984/85	11,200,000	35	3,800,000	52	5,800,000	5	560,000	9	1,040,000
1985/86	12,100,000	35	4,300,000	50	6,100,000	5	610,000	10	1,090,000
1986/87	13,000,000	36	4,700,000	48	6,300,000	5	650,000	11	1,350,000
1987/88	14,000,000	37	5,200,000	46	6,500,000	5	700,000	12	1,600,000
1988/89	15,000,000	38	5,700,000	44	6,600,000	5	750,000	13	1,950,000
1989/90	16,000,000	39	6,200,000	42	6,700,000	5	800,000	14	2,300,000
1990/91	17,000,000	40	6,700,000	40	6,800,000	5	850,000	15	2,650,000

Source: Bureau of Planning, NFPCB, 26 June, 1981.

Table II-5 HISTORICAL RATIO OF CURRENT USERS BY METHOD

Year	Current User	Ratio of Current User by Method (%)				
		Total	Pill	IUD	Condom	Others
1971/72	366,669	100.0	43.2	55.3	1.5	-
1972/73	1,025,472	100.0	44.5	53.5	2.0	-
1973/74	1,680,665	100.0	51.5	45.6	2.9	-
1974/75	2,469,484	100.0	59.3	34.6	5.6	0.5
1975/76	3,202,305	100.0	62.3	31.6	5.0	1.1
1976/77	3,808,890	100.0	59.8	34.0	4.2	2.0
1977/78	4,687,723	100.0	60.1	32.1	4.4	2.9
1978/79	5,541,517	100.0	64.4	27.0	5.5	3.1
1979/80	6,497,382	100.0	63.4	26.9	6.3	3.3
1980/81	7,791,537	100.0	64.1	25.9	6.1	3.9

Source : Bureau of Reporting and Evaluation, NFPCB

Judging from these figures, it follows that there is a need to exert considerable efforts to replace the predominant position of pills to IUDs.

Contraceptives are distributed on a "cafeteria basis" in the national program, which means that the selection of contraceptive method is left to the discretion of the acceptors. However, the distribution of family planning services depends largely on the actual supply of contraceptives.

Therefore, it might be said that the target of increasing the number of current users may be achieved to some extent, depending on the supply and distribution of family planning services by BKKBN. A check of changes in the number of new acceptors under the past national programs (Table II-6) reveals that the achievements was more than the target with the exception of 1969/70, the first year of a national program, though in 1971/72 and 1979/80, the actual percentage was slightly lower than 100%. Therefore, it can be said that Indonesia's national programs have successfully made progress to a considerable degree.

Incidentally, a check of changes in the rate of new acceptors by contraceptive method indicates that pills began to share 60-70% in the latter half of the 1970s whereas the share of IUDs greatly dropped from the level of 40-50% at the beginning of the first national program and levelled off at 10-20% in proportion to a rise in the absolute number.

In respect to condoms, the acceptance has greatly fluctuated. Changes in the rate of condom users are proportional to some extent to those in the supply of condoms under the national program. Table II-7 indicates the supply of condoms that has been made since the first year of the first national program. In 1974/75 and 1975/76

Table II-6 TARGET & ACHIEVEMENT OF NEW ACCEPTORS

Year	Target	New Acceptor		Ratio of Contraceptive Method (%)				
		Actual Number	Rate of Achievement(%)	Total	Pill	IUD	Condom	Others*
1969/70	100,000	53,103	53.1	100.0	27.5	54.7	17.8	-
1970/71	125,000	181,059	144.8	100.0	44.0	42.2	13.8	-
1071/72	550,000	519,330	94.4	100.0	54.3	40.9	3.1	1.7
1972/73	1,000,000	1,078,889	107.5	100.0	56.3	35.2	7.2	1.3
1973/74	1,250,000	1,367,077	109.5	100.0	62.6	21.4	15.4	0.6
REPELITA I	3,025,000	3,199,458	105.8	100.0	57.5	31.0	10.6	1.0
1974/75	1,450,000	1,592,891	109.9	100.0	68.3	11.7	18.9	1.1
1975/76	1,600,000	1,966,585	122.9	100.0	67.6	12.8	18.1	1.4
1976/77	1,775,000	2,212,790	124.7	100.0	66.9	18.1	12.6	2.4
1977/78	1,975,000	2,248,468	113.8	100.0	70.9	16.3	8.9	3.9
1978/79	2,200,000	2,215,884	100.7	100.0	68.8	18.3	8.0	4.9
REPELITA II	9,000,000	10,236,618	113.7	100.0	68.6	15.7	12.8	2.8
1979/80	2,341,071	2,229,791	95.2	100.0	69.6	17.9	7.5	5.1
1980/81	2,677,918	3,051,244	113.9	100.0	69.5	16.3	8.7	5.5
REPELITA III	13,511,000	-	-	-	-	-	-	-

Source : Bureau of Reporting and Evaluation, NFPCB.

Note : *Others - Foaming Tablets, Contraceptive Injection, Sterilization.

Table II-7 CONDOM SUPPLIES IN THE NATIONAL PROGRAM

Year	Quantity of Condom Supply (Gross)	Unit Price (US$)	Donor Agencies
1969-70	11,153	4.07	IPPF, SIDA
1970-71	-		-
1971-72	25,000	-	OTCA
1972-73	400	-	USAID
1973-74	43,419	CIF 4.65	USAID, IPPF
1974-75	270,318	CIF 4.65 FOB 6.44	USAID, JICA (JOICFP)
1975-76	213,564	CIF 4.65 FOB 6.44	USAID, JICA (JOICFP)
1976-77	199,939	2.76	IBRD/UNFPA
1977-78	-		-
1978-79	55,284	FOB 6.44 2.76	JICA (JOICFP), UNFPA, IPPF
1979-80	154,840	4.07	UNFPA
1980-81	99,245	FOB 3.71	UNFPA
1981-82	24,958	FOB 3.71	UNFPA

Source : Bureau of Supply and Logistics, NFPCB.

Price : USAID, UNICEF, JICA (JOICFP), NFPCB.

when the share in the rate of new acceptors has risen, USAID supplied condoms in massive quantities. The supply of condoms by the United States came to an end in 1975/76. In 1976/77, condoms were supplied with the assistance of IBRD/UNFPA but this supply also ceased in the following year.

In 1978/79, assistance was provided by the Japanese Government, UNFPA, etc., but the supply was small, standing at 55,000 gross. Reflecting the supply situation, the rate of new acceptors with condoms dropped below 10% in 1977/78 and subsequent fiscal years.

Judging from these facts, it was in the nature of things that the Government of the Republic of Indonesia, which had cooperated with countries/agencies in the supply of condoms is hesitant to promote the importance of condom in the national program unless stable supply is assured. In fact, there have been cases in which the Indonesian Government authorities (BKKBN) provides guidance so that the use of condoms may be deliverately restrained and that of the pills being strongly recommended. Judging at least from changes in the number of current users by contraceptive method, it might be concluded that there would be a considerable demand for condoms under a cafeteria method as long as a stable supply was assured.

CHAPTER 3 THE ROLE OF CONDOMS IN THE PROGRAM

In the national family planning program of Indonesia, oral pill is the most popular contraceptive followed by IUD. In 1980/81, 64% of the total current users receive oral pills, 26% used IUDs, 6% condoms and 4% other contraceptives. According to these figures, the rate of condom users is low. However, in 1974/75 and 1975/76, acceptance of condom is 18.9% and 18.1% of all new acceptors respectively (see Table II-6). The supply of condoms since the inception of the program is shown in Table II-7. In the period of 1974/75 to 1976/77, when the share of condom acceptors was relatively high, about 700,000 gross were supplied by donor agencies such as USAID and UNFPA. In 1978/79, however, condom supply became nil, and the supply in the subsequent period till 1980-81 almost halved from the aforementioned three-year period. As a result of the supply situation, the rate of condom acceptance to total new acceptors went down. The condom users share of total current users, however, rose to 6.3% and 6.1% in 1979/80 and 1980/81, respectively, which were higher than the figure of 5% forecast by BKKBN (see Table II-5). The condom users share of total new acceptors stood at 7.5% and 8.7% in 1979/80 and 1980/81, respectively.

According to these facts, it is expected that the share of condom users of all family planning acceptors is increasing with a guarantee of regular supply.

On the other hand, the policy of BKKBN is to drop the share of oral pills, which has been around 60%, to 40% by 1990/91 (see Table II-4). The reason for this is, as is described in Table II-8, that 12.1% of habitual pill takers suspend the use of physical and emotional reasons in two years and 15.3% in three years after they start taking pills. In the second year, the percent of persons who continue using pills is only less than 50%. In the third year, the percentage drops to a little more than 30% as observed in

Table II-8 RATES BY REASON FOR TERMINATION BY METHOD

	Months Since Acceptance	Want Child	No Need	IUD Expulsion	Health	Physical Emotional	Accidental Pregnancy	Other
	12	6.5	1.8	0.0	7.1	8.6	3.2	8.7
Pill	24	13.0	2.1	0.0	9.4	12.1	4.9	11.5
	36	17.4	2.4	0.0	12.3	15.3	5.9	14.5
	12	0.8	0.4	3.0	3.5	1.4	0.9	0.2
IUD	24	2.4	0.4	5.7	5.7	3.6	2.4	0.2
	36	4.2	0.4	7.1	7.1	4.1	2.4	0.5
	12	8.9	3.6	0.0	8.0	0.0	3.0	20.0
Condom	24	9.4	4.1	0.0	9.2	0.0	4.6	20.0
	36	9.4	4.1	0.0	9.2	0.0	4.6	20.0
	12	4.6	1.5	1.1	5.8	5.2	2.3	7.0
First Method	24	8.5	1.7	2.2	8.0	7.7	3.9	8.4
	36	11.2	1.8	2.9	9.8	9.3	4.4	10.2
	12	4.8	1.5	1.0	4.9	4.1	2.2	5.7
All Segments	24	8.7	1.7	1.6	6.8	6.3	3.7	7.1
	36	11.4	1.9	2.1	8.4	7.7	3.9	8.4

Source : Technical Report Series, National Family Planning Coordinating Board, Monograph No. 17.

Table II-9 FIRST METHOD CONTINUATION RATES BY PROVINCE, PILL

Months Since Acceptance	Jakarta		West Java		Central Java		Yogyakarta		East Java		Bali		Java-Bali	
	ACCR*	SE**	ACCR	SE	ACCR	SE	ACCR	SE	ACCR	SE	ACCR	SE	ACCR	SE
1	90.0	1.6	97.1	2.1	92.4	1.3	75.0	5.7	93.5	1.2	93.6	0.0	93.4	0.6
2	79.1	3.7	92.7	1.3	85.7	2.3	69.3	6.1	88.8	2.0	83.3	5.4	87.7	1.0
6	68.0	4.6	80.5	2.3	74.7	3.2	59.8	6.7	75.1	2.9	67.6	7.5	75.4	1.2
12	48.9	5.0	68.8	2.9	65.0	3.7	52.6	7.0	64.0	3.3	56.4	8.1	64.2	1.7
18	37.5	5.0	61.5	3.2	52.9	4.3	48.8	7.7	51.2	3.7	-	-	54.6	1.9
24	28.1	5.0	52.8	3.5	43.8	4.8	-	-	45.6	4.1	-	-	47.1	2.1
30	-***	-	44.4	3.9	39.2	5.2	-	-	39.2	4.5	-	-	40.2	2.3
36	-	-	38.6	4.3	-	-	-	-	-	-	-	-	32.3	2.7

* ACCR = Adjusted Cumulative Continuation Rate

** SE = Standard Error

*** - = Indicates that number of women entering a month was not sufficient to make a reliable estimate (15).

Source : Technical Report Series, National Family Planning Coordinating Board, Monograph No. 17.

almost every area (Table II-9). In the case of IUDs on which the government intends to put stress, problems are posed for their insertion. In other words, (1) there are religious constraints toward the gynecological examination, (2) there exists a psychological barrier against insertion of alien substance into the body.

For these reasons, it is expected that the condom users, including those who switch from oral pills or IUDs, will increase in number and that the percentage to total acceptors will exceed the hypothesized rate (5%) of the Government.

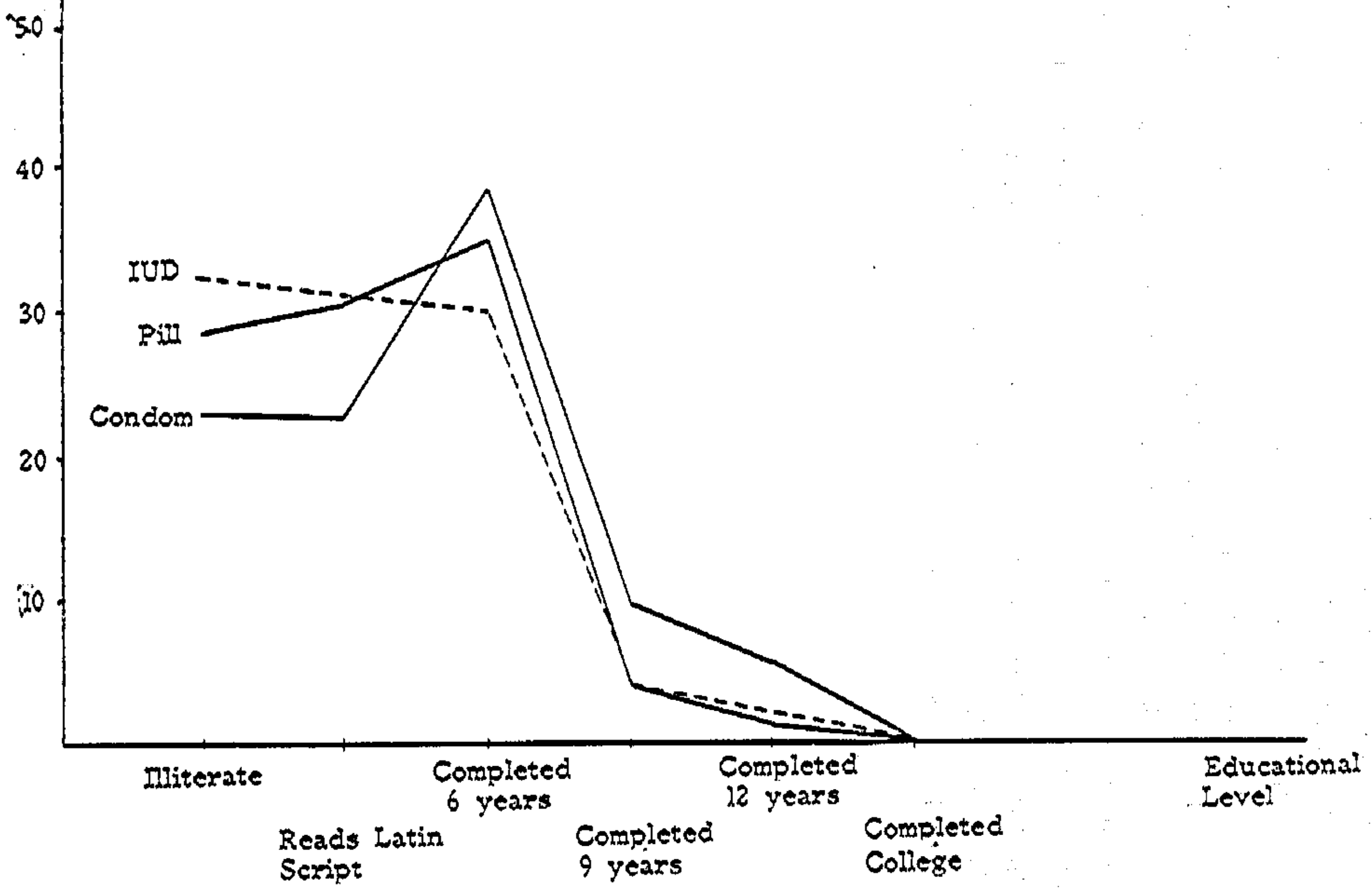
According to an interview with employees of a certain enterprise, it turns out that two out of three males have experience in using condoms obtained through commercial channels and that the remaining one has the intention of using condoms at all cost if they are actually accessible. As shown in Fig. II-1, the condom users find themselves at higher educational levels than those for other contraceptives (in interviews with users of condoms at family planning clinics, the majority said that their husbands are teachers or government officials).

The educational target by 1978/79, the last year of Repelita II, was to set at 85% for the school attendance rate of pupils, 7-12 years of age, or to bring the rate to the similar level as for secondary education. From this, it is conceivable that education will permeate at an increasingly fast pace.

In conjunction with the spread of education, the proper knowledge of the side effects of oral pill usage will reach a greater proportion of the population and the increase of oral pill takers may slow down. And due to the problems posed for the insertion, and necessity of having a regular medical check-up (four times in the initial year in Japan), the acceptance of IUDs may not increase sharply.

In the last decade, officials of BKKBN have participated in the seminar on family planning conducted by JOICFP in Japan every year, and their familiarity with the realities of family planning with condoms in Japan is of advantage to the diffusion of condoms in the Republic of Indonesia. A check of the future national family planning program of Indonesia, which is considered as one of the top priorities in the present development program, leads to the supposition that the necessity of condoms may increase, but not decrease, as is the case with pills and IUDs. In an interview at family planning clinics, the shortage in the supply of condoms was conspicuous and BKKBN is striving to make up for the shortage. It is essential for the family planning program that regular supplies of contraceptives should be secured. From the standpoint of regular supply, domestic production of condoms is strongly desired.

Fig. II-1 PERCENTAGE DISTRIBUTION OF NEW ACCEPTORS IN JAVA AND BALI BY EDUCATIONAL LEVEL - 3rd QUATER FY 1976-77



Source: BKKBN, Technical Report Series Monograph No. 12, Jakarta 1976.

PART III

STUDY ON DEMAND FORECAST AND DISTRIBUTION SYSTEM OF CONDOM

PART III STUDY OF DEMAND FORECAST AND CONDOM DISTRIBUTION SYSTEM

CHAPTER 1 INTRODUCTION

As no statistical data are available on the number of current users outside the national program, it is difficult to make a numerical computation. However, judging at least from the fact of retrogression of private family planning programs or their absorption into the national program in conjunction with the expansion of the national program, it can be assumed that the majority of current users in Indonesia are covered by the national program. Particularly, this holds true in the case of persons who use IUDs, oral pills or other contraceptive methods which are subject to a medical check-up. However, persons who use condoms or traditional contraceptive methods are not necessarily covered by the national program.

In fact, about 75,000 gross of condoms were imported on a commercial basis in 1980, according to statistical data of the Ministry of Health. This fact shows that there exist condom users outside the national program.

To estimate the condom demand in Indonesia, condom requirements not only in the national program but also outside the program have to be taken into account. However, the project for the domestic production of condoms is based on the premise of satisfying the amount of condoms required in the national program. In the subsequent demand forecast, therefore, studies will evolve primarily around the target figures presented in the national family planning program and their reality.

CHAPTER 2 DEMAND FORECAST

BKKBN estimates the necessary quantity of condoms for each fiscal year under the national program as shown in Table III-1. The premise for the computation includes the following three factors.

(1) The ratio of condom users to current users is calculated at the level of 5%.

(2) The number of condoms to be used by acceptor per year is estimated at 144 pieces (1 gross).

(3) A supply of condom enough for about two years, including those in stock at each level, will be maintained.

Table III-1 ESTIMATE OF DEMAND FOR CONDOM

Year	Target of Current Users	Condom Users*	Condom Demand** (gross)	Stock Required*** (gross)	Condoms Annually Required (gross)
1982/83	9,400,000	470,000	470,000	420,000	520,000
1983/84	10,200,000	510,000	510,000	470,000	550,000
1984/85	11,200,000	560,000	560,000	510,000	610,000
1985/86	12,200,000	610,000	610,000	560,000	660,000
1986/87	13,000,000	650,000	650,000	610,000	690,000
1987/88	14,000,000	700,000	700,000	650,000	750,000
1988/89	15,000,000	750,000	750,000	700,000	800,000
1989/90	16,000,000	800,000	800,000	750,000	850,000
1990/91	17,000,000	850,000	850,000	800,000	900,000

Source : Bureau of Planning, NFPCB.

Note : * Calculated as 5% of current users.

** Calculated as 144 pieces/current user per year.

*** Stock for a period of 1 year shall be secured at the beginning of the fiscal year.

There are no grounds for the premise that each current user will use 144 pieces of condoms a year. In broad terms, this figure is somewhat too large. Rather, a more reasonable quantity is said to be somewhere between 100 and 120 pieces.

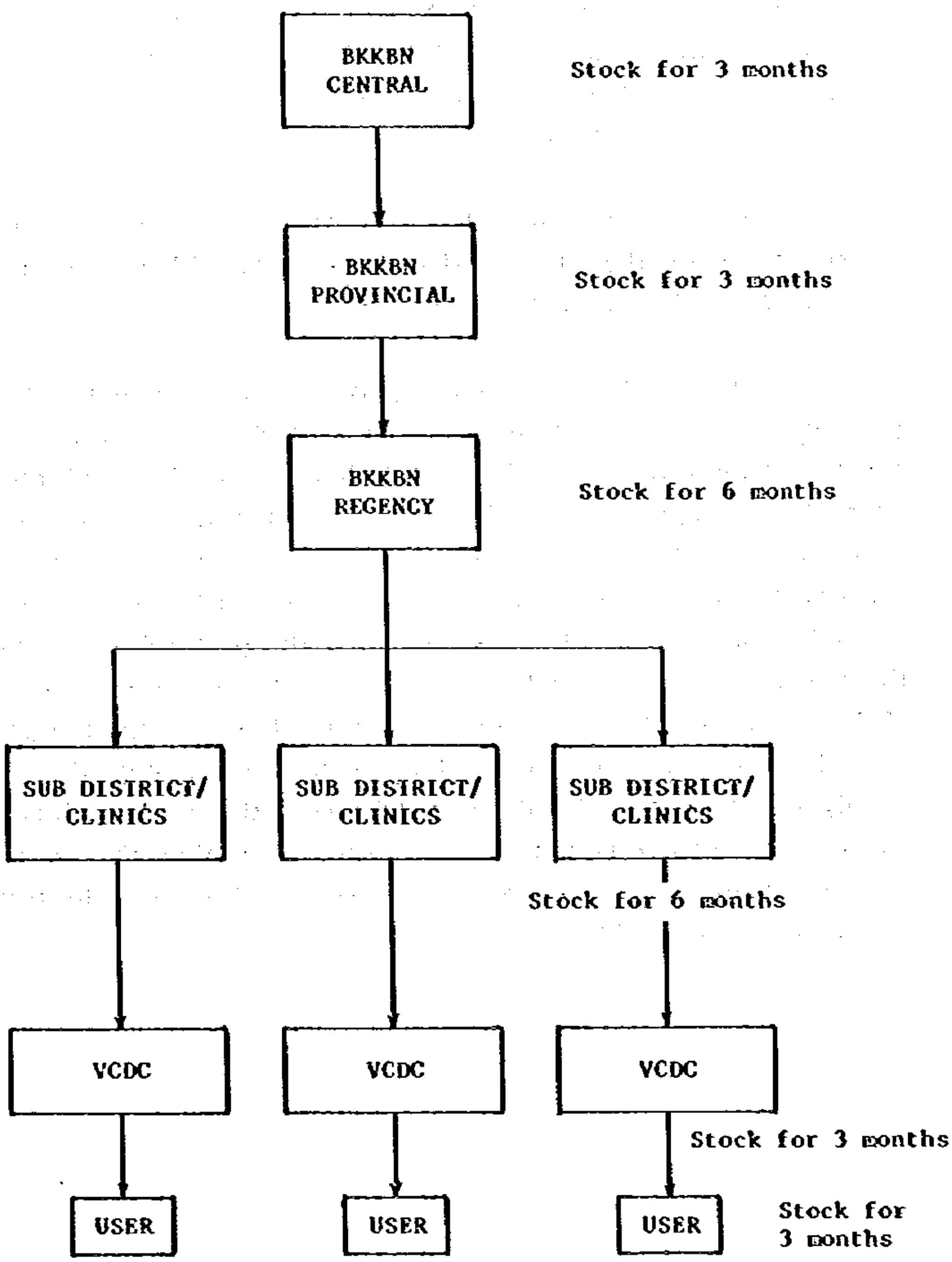
As for the first premise that the rate of condom users is 5%, this percentage might be considered somewhat too small when past records are taken into account. As the study team has already observed, the actual rate of condom users has remained at a little more than 6% in recent years, and the rate of condom users out of new acceptors has been around 10%. If a stable supply could be assured, it is fully expected, as has been elucidated earlier, that this percentage will rise in future.

Therefore, the premise that the condom users out of current users will be 6% and that 120 pieces will be used per acceptor yearly is more realistic. The results of a computation of the required supply of condoms on the basis of this premise coincide with the results of a computation done by BKKBN - that is, a rate of 5% and the consumption of 144 pieces per acceptor a year. Therefore, the numerical data on condoms under the national program shown in that table might be considered reasonable, though a different premise is used.

Now, let us look at the third premise. In order to work for a stabilization of the supply of condoms to current users, BKKBN estimates the stock of condoms at each family supplies enough for about two years. (See Fig. III-1)

Central level	Supplies for 3 months
Pronvincial level	Supplies for 3 months
Regency and municipal level	Supplies for 6 months
Subdistrict level	Supplies for 6 months
Village level	Supplies for 3 months
Acceptor level	Supplies for 3 months

Fig. III-1 DISTRIBUTION CHART



VCDC = Village Contraceptive Distribution Center:

At present, the storehouses and other facilities at each level are inadequate and the realization of this stock program is problematical. Under a BKKBN program, the expansion of storehouses and other facilities and the improvement of the distribution system of family planning services are under way, so the difficulties will be overcome in the near future.

The required annual supply of condoms, which is computed on the basis of the aforementioned premises will rise from 550,000 gross in 1983/84 to 900,000 gross in 1990/91.

Whether the required supply of condom under the national program is reasonable, it depends on a number of premises set forth for its computation - particularly, whether the targeted number of current users, rate of condom use and quantity of condoms to be used per acceptor yearly are reasonable. As we have already observed, the accomplishment of the targeted number of current users might be considered fully feasible, when the past achievements under the national program are taken into account. In respect to the rate (5%) and the quantity of condoms to be used per acceptor a year (144 pieces), there is some room for consideration, but the required supply might be considered adequately realistic, as has already been elucidated, when it is taken into consideration that the same results were obtained with some corrections (6%, 120 pieces) to bring the figures closer to reality.

CHAPTER 3 DISTRIBUTION SYSTEM

According to BKKBN, which will execute this project, the production of condoms will be entrusted to the state owned pharmaceutical company, P.T. Kimia Farma and that the total output as scheduled by BKKBN will be purchased.

All condoms which are produced by P.T. Kimia Farma will be distributed free of charge through distribution channels specified by BKKBN.

Products are scheduled to be delivered to BKKBN directly from P.T. Kimia Farma for supply to the provincial and regency branches of BKKBN, family planning clinics and village contraceptive distribution centers (VCDC).

To carry out planning and distribution smoothly, BKKBN plans to store condoms for nine months' supplies at the provincial and regency depots.

As of 1980/81, there are 5,609 clinics, the breakdown of which is given below. (See Table III-2)

Ministry of Health	4,652
Other Ministries	176
Armed Forces	401
Individual Clinics	380

As is the case with the distribution of pills, that of condoms is also made by the distribution centers (one for a population of about 3,000) which belong to the family planning clinics in the case of Central Java, D.I. Yogyakarta and East Java, where very large quantities of condoms are consumed. There are 44,734 distribution centers throughout the country. On the other hand, in D.I. Jakarta and West Java, where condoms are not consumed so much, about half of the family planning clinics supply condoms directly to consumers. (See Tables III-3 and III-4)

In other words, condoms are distributed and offered by 672 hospitals, 5,609 family planning clinics, 44,734 village contraceptive distribution centers, 5,609 mobile medical teams, 7,059 family planning field workers, 111,483 acceptor groups in 27 provinces, 300 regencies, 3,349 sub-districts and 51,240 villages. Thus the distribution system of BKKBN is well organized, and it will be improved gradually if the condom supply system is established.

Table III-2 FAMILY PLANNING CLINICS BY PROVINCE - 1980/81 -

Province	Ministry of Health	Military	Other Ministry	Private Clinic	Total
1. DKI. Jakarta	126	36	24	52	238
2. West Java	576	50	24	34	684
3. Central Java	599	53	14	59	725
4. DI. Yogyakarta	103	7	0	15	125
5. East Java	1,081	57	18	55	1,211
6. Bali	143	7	0	7	157
Total Java & Bali	2,628	210	80	222	3,140
7. DI. Aceh	131	14	5	3	153
8. North Sumatra	204	23	22	26	275
9. West Sumatra	184	14	5	11	214
10. South Sumatra	114	12	18	9	153
11. Lampung	86	8	7	5	106
12. West Nusa Tenggara	80	7	0	7	94
13. West Kalimantan	101	8	1	7	117
14. South Kalimantan	109	5	2	2	118
15. North Sulawesi	95	10	0	22	127
16. South Sulawesi	191	21	2	18	232
Total Outer Island I	1,295	122	62	110	1,589
17. Riau	84	11	10	3	108
18. Jambi	68	6	8	1	83
19. Bengkulu	73	6	3	1	83
20. East Nusa Tenggara	98	4	0	9	111
21. Central Kalimantan	82	8	1	5	96
22. East Kalimantan	90	9	8	10	117
23. Central Sulawesi	79	6	0	9	94
24. Southeast Sulawesi	50	5	2	2	59
25. Maluku	54	8	1	7	70
26. Irian Jaya	38	6	1	1	46
27. Timor Timur	13	0	0	0	13
Total Outer Island II	729	69	34	48	880
Total Indonesia	4,652	401	176	380	5,609

Source: Bureau of Reporting and Evaluation, NFPCB.

Table III-3 FAMILY PLANNING PROGRAM NETWORK 1980/81

Administrative Unit (number)	Population per Adm. Unit (Approx.)	Family Planning Service Implementing Unit (Number)
Province (27)	5,460,000	hospital (672)
Regency/Municipality (300)	490,000	
Sub District (3,349)	44,000	family planning clinic (5,609)
		mobile medical team (5,609)
		family planning field worker (7,059)
Village (approx. 51,240)	2,880	village contraceptive distribution center (VCDC) (44,734)
		acceptor group (sub-VCDC) (111,483)

Source : CBS Statiscal Yearbook of Indonesia 1979, Dec. 1980.
Population Census 1980.
Bureau of Reporting and Evaluation, NFPCB.

Table III-4 PILL AND CONDOM DISTRIBUTION CHANNEL IN NATIONAL FAMILY PLANNING PROGRAM

- Java and Bali in 1980/1981 -

Unit: percent

Province	Family Planning Clinic	Mobile Medical Team	VCDC	Private Doctor/Midwife	Others
(Pill)					
DKI Jakarta	61	17	13	7	2
West Java	18	12	69	0	1
Central Java	5	5	90	0	0
D.I. Jakarta	9	6	85	0	0
East Java	5	9	86	0	0
Bali	54	4	42	0	0
Java and Bali	9	8	82	0	0
(Condom)					
DKI Jakarta	59	15	16	6	4
West Java	46	20	28	5	1
Central Java	4	10	83	1	2
D.I. Jakarta	5	7	85	0	2
East Java	13	17	67	2	2
Bali	44	7	49	1	0
Java and Bali	9	11	78	1	2

Source: Bureau of Reporting and Evaluation NFPCB.

PART IV

RAW MATERIALS' STUDY

PART IV RAW MATERIALS STUDY

CHAPTER 1 NATURAL RUBBER LATEX

1-1 General

Natural rubber latex, which is usable for the production of condoms, is Hevea Brasiliensis which is cultivated and collected in Java and Sumatra.

The place of origin of the Hevea rubber trees is the basin of the Amazon River in South America. In 1876, seeds were sent to the Kew Botanical Garden in London and they were germinated. Thirteen trees were sent to the Singapore Botanical Garden and nine to the garden of the Viceroy's Official Residence in Kuala Kangsar in the Province of Perak, and they were successfully transplated.

It is elaborately recorded in the history of rubber that the transplantation served as the basis for cultivating Hevea rubber trees on a commercial basis.

The Hevea rubber tree comes into flower once a year. The flowering season comes right after the winter season or when new leaves are formed. The dry season of the cultivation area holds sway over wintering and flowering. It extends from February to April on east coast of Sumatra and from August to October in Java.

After a lapse of one year or so, a sapling will grow as big as about 2.5 cm in diameter. Here, the full-dress transplantation of grown saplings is conducted. Or grown saplings are used as basic trees and the buds extracted from superior trees are grown as grafting saplings before full-dress transplantation.

The best season for full-dress transplantation is right before the rainy season. The number of trees rooted per hectare is 600 natural saplings and 450 bud-grafting saplings. The distance and interval of transplantation differs, depending on the plantation. On some plantations, saplings are transplanted in the form of a square. In others, saplings are transplanted with the distance between rows kept broad and the distance between trees kept narrow. On the rubber plantations in Indonesia, the latter method is employed.

In a newly transplanted forest, weeds tend to grow fast, as the plantation is exposed directly to the sunlight. Then, cover plants, mainly leguminous plants, will be propagated to avoid the growing of weeds and to protect dissolution from the soil component and from washing away of soil.

After their transplantation, Hevea rubber trees will grow in three to four years at a rate of 10 cm in circumference. In the meantime, the poor trees or those damaged by blight and pests will be thinned out. Rubber trees are tapped trially and trees with poor rubber content will also be thinned out. During the course of tapping the number of trees will be reduced to 350-400 per hectare. Thinning will be continued further. For a matured forest of trees, 10 years of age, the standard number of trees is 220-250 per hectare.

If the number of trees is reduced by thinning, the output per tree will increase. This will serve to lower the tapping cost and to reduce the production cost. If the number of trees is reduced, the space for each tree will become broader, making it easier to regenerate or recover bark.

1-1-1 Collection of Latex

Tapping: It depends on soil fertility, but trees will grow as big as 50 cm in circumference at a height of 1 m above the ground in five or six years after their full-dress transplantation, making it possible to tap them. When tapping is started, the growth of trees is inevitably hampered, but the time when the tapping should be started, is determined by given economic factors.

Latex is housed in a laticifer. As the inside of the laticifer is highly pressurized with 10-13 atm of turgor pressure before dawn when no evaporation takes place, if the laticifer is damaged and holed, latex will spout out of the laticifer.

The turgor pressure goes down as a result of the evaporation of water in conjunction with the rise in daily temperature. Then, it is a normal practice to engage in tapping work early in the morning.

The rubber content (DRC) of outflowing latex is great at first. DRC decreases gradually after 10-30 minutes from outflowing latex and eventually it stays at a certain level. DRC of latex in the laticifers of non-tapped trees is extremely high, reaching as high as 60%. The latex outflown by the first tapping yields little volume, but has high viscosity. When the tree is tapped, the yield of latex gradually increases and on the contrary, DRC decreases. After several tappings, the yield will stay at a certain level and DRC will also remain at a constant level or at 30-35%.

1-1-2 Regeneration of Bark

At each tapping, 1-1.7 mm of bark will be taken off. Even if the bark has been tapped, new bark will be regenerated by the cambium, as long as the cambium is not damaged. The frequency of regeneration differs, depending on the vitality of the tree, fertility of the soil, plantation density and other factors. In normal circumstances, the regenerated bark will become 75-80% as thick as the maiden bark after a lapse of three years. Regeneration will be delayed after a lapse of three years, but tapping can be performed again after a lapse of 6-7 years.

In the case of bud-grafting trees, the first tapping may be carried out for about 20 years with the maiden and primarily regenerated bark in a semi-circumference tapping method, if started at 125-150 cm above the ground. A lapse of 10 years from regeneration seems to be the most matured.

1-1-3 Refining of Latex

The latex which has just come out of a rubber tree is called "fresh latex". The fresh latex is unstable and will soon become solid if left without any processing. To prevent its coagulation, a little amount of ammonia is added to it before collection. Normal latex and concentrated latex shall be produced with the addition of a preservation agent to the collected latex.

The latex stabilized with a preservation agent in this manner is called as "preserved latex" against fresh latex. Meanwhile, latex temporarily stabilized in the plantation without any processing, in original density is called "field latex".

The properties of natural rubber latex are indicated in terms of total solid content (TSC), dry rubber content (DRC), ammonium content, viscosity, volatile fatty acid (VFA No.), mechanical stability (MST), potassium hydroxide (KOH No.), etc. Many other factors influence the quality of latex such as age of the tree, seasons (rainy, dry or winter), fertilizer, soil (fertility and soil properties), tapping interval, tapping skill, cleanness of containers and equipment during collection and transpotation from plantation to refinery, condition of time and preservation like ammonium, cleanness of container and facility in refinery, water density, revolving speed in centrifugal separator, amount of water to be filled, preservation agent, stabilizer and preservation tank after concentration.

For the production of condoms, high quality natural rubber latex is required. But, the specifications of latex to be used for general goods like foam rubber, sheet and other rubber products are as follows:

Table IV-1 STANDARD OF NATURAL RUBBER LATEX BY ASTM. JIS

		ASTM D 1076-674 Type I	JIS-K 6381
(1)	Total Solid Content (Min.) %	61.5	61.5
(2)	Dry Rubber Content (Min.) %	60.0	60.0
(3)	Difference (1) - (2) (Max.) %	2.0	2.0
(4)	Total Alkalinity %	>1.6	>1.6
(5)	Viscosity 25°C Max. cp	50	150
(6)	KOH No. (Max.)	0.8	0.8
(7)	Coagulation Content % against TS	<0.08	<0.08
(8)	MST (Min.)	475	500

1-2 Criteria for the Evaluation of Natural Rubber Latex

(1) Total Solid Content (%)

The total solid content is an important element as the basis of the computation of the yield and compounding, i.e. it will be referred largely at the time of compounding and vulcanization necessary for production of condom.

One important thing about the total solid content is that there should be no disparity in value among different batches of latex supplied as raw materials.

Should the difference be great, the compounding plan must be changed from time to time and this makes operational control in moulding section difficult, thus manufacturing of good quality condoms on a constant basis can not be expected.

(2) Dry Rubber Content (%)

It does mean that the mass of rubber content made after coagulation, cleansing and drying is expressed in terms of percentage against the mass of test sample.

Therefore, the dry rubber content represents the value of a product from which the non-rubber content has not been excluded by the aforementioned process.

As is the case with the total solid content, the dry rubber content is the fundamental factor for the computation of the yield and compounding, or an important element for the vulcanized latex required for the production of condoms.

(3) Balance between Total Solid Content and Dry Rubber Content (%)

The balance between the total solid content and the dry rubber content is considered to influence the speed of vulcanization and generation of pinholes and the difficulty and easiness in molding and processing.

Normally, the difference between the total solid content and the dry rubber content is expressed as a non-rubber content which is important as an indication for absorbability of water, vulcanization speed and anti-aging.

(4) Total Alkali Content (%)

The total content of free alkali in natural rubber latex is looked upon as a content of ammonium and expressed in percentage as against latex or the content of water in the latex. The latex with extremely unbalanced total alkali content should not be used, as it influences compounding vulcanization and moulding in every field of the production process.

As the ammonium becomes the preservation agent in the raw material latex in the case of HA system (High Ammonium), if the value of total alkali content varies greatly, the quality of condom will be quite uneven and it will leave a great impact on the chemical reaction.

(5) Viscosity

As the viscosity influences compounding and the vulcanized latex and greatly affects on the formation of rubber film, careful checking is required.

If the viscosity of latex is too high, the film of condom becomes too thick and the output will consequently be reduced. Therefore this is also one of the most important checking point.

Generally, the latex with too high viscosity means that the quality of latex itself is poor.

(6) KOH No. (Value of Potassium Hydroxide)

The value of potassium hydroxide is an element to indicate the quality of latex. It is defined as the G number of KOH equivalent to that of the acid residue existing in natural rubber latex.

As volatile fatty acid which reduces the stability and amino acid which is a hydrolyzate of protein is closely related with KOH, so that it is used as an indication of stability along with the value of volatile fatty acid (VFA No.).

At present, greater emphasis is put on the value of volatile fatty acid.

(7) Coagulation Content (%)

If coagulated rubber matter, foreign particles and impurities would be contained in latex used, it will be a cause of pinhole. The lower coagulation content is, the better quality for the production of condoms.

According to JIS and ASTM standards, the quantity of foreign matter is set at not more than 0.08%, but a lower value is preferable as a matter of course.

In any event, natural rubber latex with high coagulation content is not suitable for the production of condoms.

(8) MST (Mechanical Stability)

With a high-speed latex mechanical stability testing apparatus, latex is mixed at a high speed of 14,000 r.p.m., and the stability can be indicated in terms of time until coagulated matter will be generated in latex.

If this value would be low, at the time of stirring in the compounding or other manufacturing process, coagulated matter will be produced and it will bring about pinhole and protrusion. Therefore, the desired level of MST latex should be obtained.

There are some chemicals to raise mechanical stability but such chemicals might cause possible trouble in comparison with non-addition of the chemicals, therefore, the chemical to improve mechanical stability is not used. The supply of mechanical stability specified as raw latex without chemical additives is therefore necessary.

(9) pH

The pH value is necessary as a yardstick to judge the nature of latex as raw materials. Changes in the value bring about a great impact on compounding, vulcanization and the formation of film. The pH value also should be within a desirable range.

If pH is too close to neutral, the colloidal condition will become unstable. Caution in this respect should be paid.

(10) Volatile Fatty Acid Number

The volatile fatty acid number is defined as the same amount as the G number of KOH in natural rubber latex.

If the management in the rubber estate is not appropriate at the time of tapping the tree and collecting latex, low fatty acids will be generated by fermented acetic acid by propagation of bacteria.

Fermented acetic acid will turn into ammonium salt. This remains in the latex and reduces the stability of latex.

As it is an important index to evaluate the capability of management in latex refinery condition as well as tapping and collection of latex, and at the same time, it is a significant index for compounding and vulcanization, the supply of latex should conform to the specified pH.

For the production of condom, much higher grade quality than ASTM and JIS is required, for example, VFA No. shall not be more than 0.02%, MST shall be not less than 1800 and viscosity shall be desirable in the range of 60-70 CP.

The following Table IV-2 may be considered as a general standard for the production of latex condom.

Table IV-2 STANDARD VALUE OF LATEX FOR CONDOM

Item		Standard Value
(1)	Total Solid Content	61.5 - 61.8%
(2)	Dry Rubber Content	60.0 - 60.4%
(3)	Difference : (1) - (2)	Not more than 1.45%
(4)	Total Alkalinity	0.70 - 0.75%
(5)	Viscosity	60 - 70 cp
(6)	KOH No.	0.50 - 0.55%
(7)	MST	1,800 - 2,000 sec
(8)	pH Value	10.4 - 11.9
(9)	VFA No.	Not more than 0.02%

1-3 Comparison of Latex Refined in Java and Sumatra

1-3-1 Latex Refined in Java

About 900,000 t of natural rubber is produced in Indonesia (1979). It was estimated that the output might have reached 1,000,000 t in 1980.

Of the output, 30% came from estates and 70% from small holders. Of the estates, 80% are run by P.T. Perkebunan (P.T.P.) under the management of the Government.

The productivity by small holders is extremely low, as it is estimated at around 300 kg/ha. Because of traditional consciousness that they have succeeded to their estate from their ancestors and economic reasons, replantation of rubber trees is liable to delay. In these estates, therefore, tree ages that exceed 28-30 years, which would be reasonably considered maximum, can be seen quite often.

The proposed plant site, Banjaran is located in West Java where there are many rubber estates and latex is also refined there, but most of the latex refined in West Java is used for rubber sheet. P.T.P. XI and P.T.P. XII are known as refineries in West Java.

All of the latex refined by both P.T.P. are consumed locally for the production of foam rubber and so on.

The latex of P.T.P. XI was studied by the preliminary survey team, and the findings of its analysis are given in Table IV-3.

The feasibility study team carried out a study on the latex of P.T.P. XII. The findings of its study are mentioned in Table IV-4.

Table IV-3 ANALYSIS DATA OF LATEX REFINED ON P.T.P. XI STUDIED BY THE STUDY MISSION

	Item of Inspection	Analysis Value
(1)	Total Solid Content	62.2%
(2)	Dry Rubber Content	60.9%
(3)	Difference : (1) - (2)	1.3%
(4)	Ammonium Content	0.73%
(5)	Viscosity	-
(6)	Sludge Content	-
(7)	KOH No.	0.58
(8)	MST (Sec)	1,800
(9)	pH Value	10.43
(10)	Mn Content	0.004%
(11)	Cu Content	-
(12)	VFA No.	0.03

Table IV-4 ANALYSIS DATA OF LATEX REFINED IN P.T.P. XII INSPECTED BY BALAI PENELITIAN PERKEBUNAN BOGOR

Inspection Item		Testing Value
(1)	Total Solid Content	61.1%
(2)	Dry Rubber Content	59.3%
(3)	Difference (1) - (2)	1.8%
(4)	Total Alkalinity	1.81%
(5)	Viscosity 30°C	-
(6)	Sludge	-
(7)	KOH No.	0.73%
(8)	Mechanical Stabislity(s)	75
(9)	VFA No.	0.13%

Example of the Latex Refinery Process of P.T.P. XII (Cikumpal)

Tapping is done at 4.00 - 6.30 AM. Same rubber tree is tapped once every three days.

0.1% of 20% ammonium solution will be added to the field latex. Then, the latex will be transferred to the field latex. Then, the latex will be transferred to the refinery. It is stored in three tanks, each with a capacity of 4,400 kg.

Three centrifugal separators are operated to condense the rubber content to 60% from 18:30 PM with a revolving speed of 3,000 r.p.m.

The latex thus condensed is temporarily stored in tanks, while a stabilizing agent will be mixed and 0.6% ammonium gas will be added. Moreover stabilizing agent will be made by olein acid 700 g, water 600 g and 5,000 mℓ of 20% ammonium water. To this stabilizing agent 2-5 mℓ, one liter latex is added.

After the mixing, the latex is poured into storage tanks with a capacity of 4,400 kg by compressed air and some latex will be separated into 200-liter barrels, if necessary.

(Note) Although 0.6% of ammonia is poured, the actual percentage is set at 1.2% or so while taking note of possible evaporation during the period of storage.

At the plant, the latex is stored over a period of up to one week.

Quality Control of Latex in P.T.P. XII

At the refinery, only DRC and the ammonium content are checked. As for other items to be checked, samples are sent to the Research Institute for Estate Crops for analysis whenever necessary. (Table IV-4)

1-3-2 Latex refined in Sumatra

Medan in the northern part of Sumatra is known as Indonesia's largest natural rubber production area. The rubber produced in this area is collected at the port of Belawan, 26 km north of Medan for shipment to foreign countries.

From this port, 4,000 t of latex are shipped per month, coming from P.T.P. II, III and V. The output of latex in P.T.P. II and III is less than that of P.T.P. V, so that the products of the three plants are mixed in the collecting tanks of the port for shipment as products of P.T.P. V.

Therefore, the latex of P.T.P. V will be described in detail below.

P.T.P. V is situated in Rambutan, about 70 km east of Medan. Latex tapped in its plantations is collected at the plant. Twenty centrifugal separators are used in condensing the rubber content to 60%, and the speed is 6,800 r.p.m. Centrifuged latex is added with a stabilizing agent and stored in storage tanks. After about eight days of storage in the plantation, the VFA No., ammonium content, TSC, etc., are analyzed.

The condensed latex of P.T.P V is transported to Belawan by rail. Before the latex will be put into storage tanks, samples for an analysis are taken and the TSC, DRC, VFA No., ammonium content, MST, etc., are analyzed. Similarly, TSC, DRC, VFA No., KOH No., MST, etc., are analyzed at the laboratory of P.T.P. V in Galang, about 45 km east of Medan. (Tables IV-5, IV-6)

The storage tank at Belawan is so large (a capacity of 100 t) that when a small quantity is delivered, vacant parts in the tank might possibly exist and the stability of the latex might be hampered with an evaporation of the stabilizing agent. Cleaning of the tank is also important, but in fact, cleaning does not seem to be thoroughly carried out due to frequent arrivals and deliveries of latex. (Table IV-7)

Daily changes in the quality of latex in the storage tank at Belawan is analyzed. The latex which arrives in Belawan comes from P.T.P. II, III and V. Sampling is done for each P.T.P. upon arrival but the latex in the three refineries is put into the same storage tank.

Analysis data traced with daily intervals for the latex refined in P.T.P. III and V, which have been obtained in P.T.P. V in Utung Baru Belawan are shown as per Table IV-8-1 - IV-8-14.

P.T.P. V in Utung Baru Belawan is a collecting spot for latex refined in P.T.P. II, III and V, having a storage tank of 100 t and analysis of delivered latex is performed. At the time of shipment, the latex is considered as originated in P.T.P. V.

The analysis is made in accordance with ASTM method.

Table IV-5 ANALYSIS DATA OF CENTRIFUGED LATEX IN FACTORY P.T.P. V IN RAMBUTAN

Testing Date	T.S.C.	NH_3	VFA No.
April 21 '81	62.16	0.758	0.011
April 30 '81	60.00	0.74	0.011
May 10 '81	61.70	0.76	0.011
May 20 '81	61.60	0.74	0.011
May 30 '81	75.2	-	0.011
June 11 '81	62.03	-	0.013
June 20 '81	62.45	0.756	0.013
June 24 '81	61.98	0.754	0.015

Table IV-6 ANALYSIS DATA COMPARISON

Item	Analysis Data by P.T.P. V		Analysis data by the Study Team	
	PA IV	PT II	RA IV	RT II
Refining Date	June 24 '81		June 24 '81	
Testing Date	June 24 '81		July 10 '81	
TS	61.98	61.90	62.79	62.38
DRC	-	-	60.78	60.73
NH_3	0.754	0.75	0.823	0.774
KOH No.	-	-	0.69	0.68
VFA No.	0.015	0.014	0.029	0.056
MST	-	-	886	798

Table IV-7 QUALITIY CONTROL CONDITION OF LATEX IN P.T.P V

o Mark : Tested item

Item Tested	Factory P.T.P. V in Rambutan	Central Laboratory of P.T.P. V in Galang	Depot of P.T.P. V in Belawan
(1) TSC	o	o	
(2) DRC		o	o
(3) NH_3	o	o	o
(4) MST		o	o
(5) VFA No.	o	o	o
(6) KOH No.		o	
(7) Viscosity		o	
Remarks: Inspection time		Inspection at Belawan is performed for arrived latex. Before clarification of above results, all the latex delivered from P.T.P. II III V are contained in the same storage tank.	Inspections at arrival, storage and delivery are performed. Checking in respect of storage condition is performed frequently, but the checking is made on mixed latex as well as Central Laboratory of P.T.P. V in Galang.

Table IV-8-1 ANALYSIS DATA OF P.T.P. III

(1)

Date of Entry	Date of Inspection	DRC	NH_3	MST	VFA No.
12 31 '80	12 31 '80	60.18	0.72	605	0.049
4 16 '81	4 18 '81	60.05	0.68	1,255	0.027
4 16 '81	4 18 '81	60.05	0.73	846	0.016
4 8 '81	4 18 '81	60.55	0.71	1,112	0.065
4 9 '81	4 18 '81	60.04	0.72	748	0.089
4 21 '81	4 23 '81	59.88	0.62	685	0.044
4 16 '81	4 23 '81	60.13	0.73	1,027	0.041
4 8 '81	4 23 '81	60.52	0.75	1,123	0.073
4 9 '81	4 23 '81	60.00	0.71	726	0.097
4 21 '81	5 2 '81	59.92	0.68	692	0.094
4 29 '81	5 2 '81	60.12	0.73	924	0.120
4 16 '81	5 2 '81	60.15	0.73	1,034	0.031
4 9 '81	5 2 '81	61.54	0.70	712	0.118
4 21 '81	5 9 '81	59.86	0.69	1,226	0.124
4 29 '81	5 9 '81	60.15	0.73	1,116	0.032
4 16 '81	5 9 '81	60.14	0.73	955	0.090
5 5 '81	5 9 '81	60.02	0.79	1,036	0.013
4 9 '81	5 9 '81	59.96	0.68	954	0.118
4 21 '81	5 16 '81	59.89	0.79	1,125	0.110
4 29 '81	5 16 '81	60.14	0.74	1,084	0.044

Table IV-8-2

(2)

Date of Entry	Date of Inspection	DRC	NH_3	MST	VFA No.
4 16 '81	5 16 '81	60.15	0.71	842	0.106
5 5 '81	5 16 '81	60.10	0.78	958	0.018
4 9 '81	5 16 '81	59.96	0.70	864	0.121
4 21 '81	5 20 '81	59.28	0.79	1,142	0.128
4 29 '81	5 20 '81	60.15	0.75	1,066	0.077
4 16 '81	5 20 '81	60.17	0.75	848	0.105
5 5 '81	5 20 '81	59.95	0.78	963	0.024
5 13 '81	5 20 '81	60.19	0.74	652	0.020
4 21 '81	5 20 '81	59.80	0.77	1,135	0.135
4 29 '81	5 20 '81	60.14	0.75	862	0.077
4 16 '81	5 20 '81	60.16	0.74	822	0.105
5 5 '81	5 20 '81	59.96	0.78	972	0.024
5 13 '81	5 20 '81	60.18	0.74	964	0.020
4 9 '81	5 20 '81	59.86	0.75	1,043	0.150
4 29 '81	5 30 '81	60.10	0.75	855	0.099
4 16 '81	5 30 '81	60.15	0.74	856	0.106
5 5 '81	5 30 '81	59.25	0.75	956	0.036
5 13 '81	5 30 '81	60.16	0.74	953	0.024
6 13 '81	6 15 '81	60.05	0.76	853	0.033

Table IV-8-3 VARIATION DATA ON THE SAME LATEX BY DAYS

(3)

Date of Entry	Date of Inspection	DRC	NH_3	HST	VFA No.
4 16 '81	4 18 '81	60.05	0.68	1,255	0.027
	4 23 '81	60.13	0.73	1,027	0.041
	5 2 '81	60.15	0.73	1,034	0.031
	5 9 '81	60.14	0.73	955	0.090
	5 16 '81	60.15	0.71	842	0.106
	5 20 '81	60.17	0.75	848	0.105
	5 23 '81	60.16	0.74	822	0.105
	5 30 '81	60.15	0.74	856	0.106
4 21 '81	4 23 '81	59.88	0.62	685	0.044
	5 2 '81	59.92	0.68	692	0.094
	5 9 '81	59.86	0.69	1,226	0.124
	5 16 '81	59.89	0.79	1,125	0.110
	5 20 '81	59.28	0.79	1,142	0.128
	5 23 '81	59.80	0.77	1,135	0.135

Table IV-8-4 ANALYSIS DATA AT ENTRY TIME

(4)

Date of Entry	DRC	NH_3	HST	VFA No.
11 5 '80	60.90	0.72	788	0.037
12 13 '80	59.98	0.72	1,671	0.033
12 31 '80	60.20	0.75	-	0.056
1 31 '81	60.13	0.72	-	0.041
2 7 '81	59.92	0.72	725	0.063
2 20 '81	59.95	0.70	734	0.079
3 7 '81	60.04	0.73	665	0.073
3 28 '81	60.55	0.73	1,364	0.065
4 23 '81	60.24	0.70	692	0.020
5 2 '81	60.23	0.77	1,296	0.018
5 20 '81	60.22	0.80	1,334	0.017

Table IV-8-5 ANALYSIS DATA IN P.T.P. V

(1)

Date of Entry	Date of Inspection	DRC	NH_3	MST	VFA No.
11 23 '80	11 29 '80	60.50	0.79	1,542	0.044
11 26 '80	11 29 '80	60.68	0.77	1,466	0.035
12 12 '80	12 13 '80	60.80	0.76	1,937	0.031
12 8 '80	12 13 '80	60.76	0.69	1,541	0.049
12 19 '80	12 20 '80	60.10	0.73	1,694	0.043
12 25 '80	12 27 '80	60.40	0.72	1,025	0.044
12 19 '80	12 27 '80	60.05	0.73	1,270	0.069
12 14 '80	12 27 '80	60.60	0.74	1,385	0.060
12 28 '80	12 31 '80	59.91	0.73	1,215	0.049
12 28 '80	12 31 '80	60.37	0.71	965	0.064
12 25 '80	12 31 '80	60.38	0.71	905	0.067
12 31 '80	12 31 '80	60.36	0.73	1,155	0.096
12 28 '80	1 10 '81	59.95	0.75	1,150	0.076
12 28 '80	1 10 '81	60.38	0.73	840	0.088
12 25 '80	1 10 '81	60.37	0.72	790	0.096
1 2 '81	1 10 '81	60.02	0.72	1,150	0.113
1 28 '81	2 7 '81	60.09	0.75	1,165	0.065
2 7 '81	2 14/15 '81	60.27	0.73	1,170	0.097
2 7 '81	2 14/15 '81	60.15	0.72	1,044	0.067
1 28 '81	2 14/15 '81	60.10	0.74	1,278	0.070

Table IV-8-6

(2)

Date of Entry	Date of Inspection	DRC	NH_3	MST	VFA No.
2 7 '81	2 20 '81	60.07	0.71	1.035	0.086
1 28 '81	2 20 '81	59.84	0.71	1,525	0.075
2 7 '81	2 27/28 '81	60.13	0.71	1,105	0.088
1 28 '81	2 27/28 '81	59.60	0.73	1,430	0.079
2 7 '81	3 7 '81	60.11	0.71	1,084	0.089
1 28 '81	3 7 '81	59.64	0.72	1,452	0.080
3 10 '81	3 13/16 '81	60.03	0.77	934	0.081
2 7 '81	3 13/16 '81	60.10	0.75	1,091	0.090
1 28 '81	3 13/16 '81	59.62	0.73	1,437	0.081
3 10 '81	3 28/29 '81	59.90	0.72	1,542	0.084
2 19 '81	3 28/29 '81	59.68	0.71	1.417	0.082
4 15 '81	4 18 '81	60.40	0.68	1,246	0.039
4 15 '81	4 18 '81	60.65	0.69	1,563	0.034
4 2 '81	4 18 '81	60.54	0.70	1,805	0.064
4 6 '81	4 18 '81	60.91	0.73	2,384	0.063
4 11 '81	4 18 '81	60.69	0.72	1,657	0.043
4 15 '81	4 23 '81	60.25	0.69	1,543	0.043
4 15 '81	4 23 '81	60.63	0.70	1,458	0.053
4 1 '81	4 23 '81	60.55	0.73	1,314	0.090
4 8 '81	4 23 '81	60.96	0.69	2,833	0.038

Table IV-8-7

(3)

Date of Entry	Date of Inspection	DRC	NH_3	MST	VFA No.
4 2 '81	4 23 '81	60.52	0.70	1,794	0.075
5 1 '81	4 23 '81	60.30	0.73	1,541	0.032
4 15 '81	5 2 '81	60.23	0.69	1,414	0.046
4 15 '81	5 2 '81	60.61	0.70	1,466	0.052
4 29 '81	5 2 '81	60.90	0.71	1,452	0.091
4 20 '81	5 2 '81	60.39	0.70	1,716	0.038
4 27 '81	5 2 '81	60.87	0.74	1,928	0.017
5 1 '81	5 2 '81	61.52	0.74	1,942	0.029
4 3 '81	5 2 '81	60.56	0.73	1,845	0.062
4 11 '81	5 2 '81	60.69	0.73	1,727	0.048
5 1 '81	5 9 '81	60.27	0.71	1,554	0.035
4 15 '81	5 9 '81	60.24	0.69	1,422	0.061
4 15 '81	5 9 '81	60.60	0.71	1,458	0.085
4 29 '81	5 9 '81	60.92	0.72	1,535	0.032
4 23 '81	5 9 '81	61.49	0.72	1,563	0.022
4 20 '81	5 9 '81	60.40	0.62	1,692	0.058
5 1 '81	5 9 '81	61.02	0.70	1,415	0.021
5 5 '81	5 9 '81	60.65	0.71	1,172	0.029
5 4 '81	5 9 '81	60.96	0.72	1,385	0.037
5 1 '81	5 16 '81	60.28	0.72	1,287	0.071

Table IV-8-8

(4)

Date of Entry	Date of Inspection	DRC	NH_3	MST	VFA No.
4 15 '81	5 16 '81	60.21	0.72	1.377	0.066
4 15 '81	5 16 '81	60.56	0.78	1,489	0.089
4 29 '81	5 16 '81	60.90	0.72	1,466	0.050
4 23 '81	5 16 '81	61.45	0.73	1,686	0.033
4 20 '81	5 16 '81	60.30	0.77	1,454	0.092
5 11 '81	5 16 '81	60.57	0.75	1,186	0.035
4 7 '81	5 16 '81	60.80	0.74	2,008	0.062
5 13 '81	5 16 '81	60.96	0.73	1,607	0.026
5 1 '81	5 16 '81	60.60	0.73	1,388	0.056
5 6 '81	5 16 '81	60.61	0.73	1,372	0.053
4 3 '81	5 16 '81	60.68	0.70	1,689	0.085
5 4 '81	5 16 '81	60.98	0.74	1,392	0.050
5 19 '81	5 20 '81	60.36	0.76	1,285	0.021
4 15 '81	5 20 '81	60.26	0.74	1,342	0.105
4 15 '81	5 20 '81	60.64	0.76	1,371	0.099
4 29 '81	5 20 '81	60.92	0.73	1,474	0.064
4 20 '81	5 20 '81	60.34	0.71	1,444	0.099
5 11 '81	5 20 '81	60.56	0.76	1,191	0.049
5 13 '81	5 20 '81	60.46	0.73	1,594	0.028
5 1 '81	5 20 '81	60.96	0.72	1,372	0.033

Table IV-8-9

(5)

Date of Entry	Date of Inspection	DRC	NH_3	MST	VFA No.
5 16 '81	5 20 '81	60.64	0.76	1,188	0.029
5 5 '81	5 20 '81	60.58	0.72	1,164	0.064
5 6 '81	5 20 '81	60.57	0.73	1,351	0.074
5 4 '81	5 20 '81	60.93	0.72	1,381	0.079
5 19 '81	5 23 '81	60.38	0.75	1,323	0.021
5 1 '81	5 23 '81	60.23	0.70	1,148	0.080
4 15 '81	5 23 '81	60.19	0.71	1,334	0.105
4 15 '81	5 23 '81	60.57	0.74	1,391	0.099
4 29 '81	5 23 '81	60.90	0.71	1,445	0.064
4 23 '81	5 23 '81	61.44	0.72	1,704	0.053
5 11 '81	5 23 '81	60.55	0.75	2,006	0.053
4 7 '81	5 23 '81	60.86	0.73	2,006	0.087
5 13 '81	5 23 '81	60.48	0.74	1,585	0.029
5 1 '81	5 23 '81	60.97	0.71	1,366	0.034
5 5 '81	5 23 '81	60.56	0.72	1,185	0.065
5 6 '81	5 23 '81	60.56	0.72	1,381	0.074
5 4 '81	5 23 '81	60.94	0.73	1,373	0.079
5 26 '81	5 30 '81	60.15	0.72	2,016	0.023
5 19 '81	5 30 '81	60.41	0.77	1,272	0.029
5 1 '81	5 30 '81	60.28	0.72	1,131	0.087

Table IV-8-10

(6)

Date of Entry	Date of Inspection	DRC	NH_3	HST	VFA No.
5 29 '81	5 30 '81	60.24	0.76	1,825	0.036
5 27 '81	5 30 '81	60.23	0.77	1,042	0.029
4 23 '81	5 30 '81	61.40	0.70	1,728	0.052
5 26 '81	5 30 '81	60.22	0.74	1,529	0.026
4 20 '81	5 30 '81	60.41	0.74	1,412	0.101
5 13 '81	5 30 '81	60.47	0.73	1,572	0.032
5 1 '81	5 30 '81	60.95	0.72	1,351	0.036
5 16 '81	5 20 '81	60.64	0.76	1,188	0.029
5 5 '81	5 20 '81	60.58	0.72	1,164	0.064
5 6 '81	5 20 '81	60.57	0.73	1,351	0.074
5 4 '81	5 20 '81	60.93	0.72	1,381	0.079
5 19 '81	5 23 '81	60.38	0.75	1,323	0.021
5 1 '81	5 23 '81	60.23	0.70	1,148	0.080
4 15 '81	5 23 '81	60.19	0.71	1,334	0.105
4 15 '81	5 23 '81	60.57	0.74	1,391	0.099
4 29 '81	5 23 '81	60.90	0.71	1,445	0.064
4 23 '81	5 23 '81	61.44	0.72	1,704	0.053
5 11 '81	5 23 '81	60.55	0.75	1,176	0.050
4 7 '81	5 23 '81	60.86	0.73	2,006	0.087
5 13 '81	5 23 '81	60.48	0.74	1,585	0.029

Table IV-8-11

(7)

Date of Entry	Date of Inspection	DRC	NH_3	MST	VFA No.
5 1 '81	5 23 '81	60.97	0.71	1,366	0.034
5 5 '81	5 23 '81	60.56	0.72	1,185	0.065
5 6 '81	5 23 '81	60.56	0.72	1,381	0.074
5 4 '81	5 23 '81	60.94	0.73	1,373	0.079
5 26 '81	5 30 '81	60.15	0.72	2,016	0.023
5 19 '81	5 30 '81	60.41	0.77	1,272	0.029
5 1 '81	5 30 '81	60.28	0.72	1,131	0.087
5 29 '81	5 30 '81	60.24	0.76	1,825	0.036
5 27 '81	5 30 '81	60.23	0.77	1,042	0.029
4 23 '81	5 30 '81	61.40	0.70	1,728	0.052
5 26 '81	5 30 '81	60.22	0.74	1,529	0.026
4 20 '81	5 30 '81	60.41	0.74	1,412	0.101
5 13 '81	5 30 '81	60.47	0.73	1,572	0.032
5 1 '81	5 30 '81	60.95	0.72	1,351	0.036
5 16 '81	5 30 '81	60.62	0.76	1,194	0.039
5 5 '81	5 30 '81	60.55	0.71	1,171	0.067
5 6 '81	5 30 '81	60.53	0.70	1,366	0.078
5 4 '81	5 30 '81	60.91	0.72	1,342	0.082
5 26 '81	6 6 '81	60.14	0.79	1,695	0.026
5 29 '81	6 6 '81	60.06	0.74	1,843	0.027

Table IV-8-12

(8)

Date of Entry	Date of Inspection	DRC	NH_3	MST	VFA No.
6 2 '81	6 6 '81	60.53	0.73	1,892	0.052
4 20 '81	6 6 '81	60.24	0.73	825	0.102
5 16 '81	6 6 '81	60.60	0.74	1,108	0.047
5 16 '81	6 6 '81	60.60	0.74	1,108	0.041
5 5 '81	6 6 '81	60.15	0.72	872	0.029
6 4 '81	6 15 '81	60.42	0.78	1,756	0.027
5 30 '81	6 15 '81	60.25	0.80	1,804	0.027
5 29 '81	6 15 '81	60.00	0.79	1,866	0.038
6 2 '81	6 15 '81	60.47	0.76	1,812	0.053
6 3 '81	6 15 '81	60.25	0.76	1,592	0.058
6 12 '81	6 15 '81	60.34	0.81	1,741	0.028
4 20 '81	6 15 '81	60.17	0.76	868	0.134
5 16 '81	6 15 '81	60.87	0.77	1,093	0.043
6 13 '81	6 15 '81	59.82	0.76	1,362	0.055

Table IV-8-13 VARIATION DATA OF THE SAME LATEX BY DAYS

(9)

Date of Entry	Date of Inspection	DRC	NH_3	MST	VFA No.
4 20 '81	5 2 '81	60.39	0.70	1,716	0.038
	5 9 '81	60.40	0.62	1,692	0.058
	5 16 '81	60.30	0.77	1,454	0.092
	5 20 '81	60.34	0.71	1,444	0.099
	5 30 '81	60.41	0.74	1,412	0.101
	6 6 '81	60.24	0.73	825	0.102
	6 15 '81	60.17	0.76	868	0.134
5 16 '81	5 20 '81	60.64	0.76	1,188	0.029
	5 30 '81	60.62	0.76	1,194	0.039
	6 6 '81	60.60	0.74	1,108	0.049
	6 15 '81	60.87	0.77	1,092	0.043

Table IV-8-14 ANALYSIS DATA AT THE ENTRY TIME

(10)

Date of Entry	DRC	NH_3	MST	VFA No.
11 5 '80	60.33	0.73	1,565	0.048
11 20 '80	60.75	0.83	1,895	0.028
11 29 '80	60.26	0.74	1,880	0.077
12 13 '80	60.57	0.77	1,675	0.013
12 27 '80	60.16	0.75	-	0.027
12 31 '80	60.33	0.77	-	0.060
2 7 '81	60.43	0.68	1,140	0.103
2 20 '81	60.66	0.73	1,463	0.067
2 22/23 '81	60.65	0.77	1,485	0.079
2 27/28 '81	60.11	0.75	1,608	0.085
3 7 '81	60.34	0.78	1,208	0.081
3 8 '81	60.36	0.74	795	0.057
3 20 '81	60.08	0.76	1,446	0.112
4 10 '81	61.00	0.60	1,986	0.040
4 23 '81	60.73	0.72	1,816	0.029
5 9 '81	60.39	0.68	1,120	0.023
5 30 '81	60.05	0.76	2,000	0.029

1-3-3 Summary of Analytical Study on Indonesian Latex

(1) The latex refined in Java has a high VFA No. and a low MST. The output seems to be not great and the quality differs greatly, depending on the season. The quality check is not systematically conducted and changes in the quality are not properly understood. In order to supply latex to condom manufacturers, a quality check system should be established and the quality of each batch should be categorized. The checking system should be established as soon as possible with the close cooperation of the latex refinery, rubber technology institute.

(2) The output of latex refined in Sumatra, particularly that of P.T.P. V, is great and the products features high MST. But the value of MST varies greatly, depending on the seasons and the term of storage. For a constant and stable supply, the process of the refinery should be improved and quality check system be replenished. The capacities of storage tank at the refinery, port and transportation tank, together with storage term must be carefully improved. For the production of condoms, a quality check should be made not only for the selection and compounding of latex in the field but also for the latex stored for long-term (3-5 weeks) in small lot units (10-20 t), and only selected latex should be put into barrels or containers at the refinery for delivery to the condom manufacturer. For the production of high quality condom, the use of stable and high quality latex is essential. To achieve this target, it is necessary for the latex refinery, rubber researchers and condom manufacturer to cooperate each other.

While efforts are being made for improvement of the quality of latex, it seems necessary to explore the possibility of using foreign latex for some time after production is started at the plant. The use of foreign latex suitable for the production of condoms in the initial phase of the trial production will make it possible to carry out the trial operation in a smooth manner. In another aspect, it will also be made possible to understand the conditions of Indonesian latex more accurately. However, the importation of foreign latex must be minimized to save precious hard currency. The latex being refined in West Java should be used from the standpoint of its convenient location, satisfying the proposed quality standard ultimately.

1-3-4 Development Plan of Indonesian Latex

Present Indonesian latex must be improved and devised to be used for the production of condom from various aspects.

The Ministry of Agriculture which is a supervising authority of latex refinery was called at the time of submitting Progressive Report and discussed at the beginning of September. As a result, the responsible officer in charge of rubber estate and refinery repeatedly assured that improvement of Indonesian latex could be achieved in the name of Minister, only if an application for the improvement would be submitted by BKKBN.

As a result of feasibility study, the feasibility study team found that P.T.P. V (in Sumatra) and P.T.P. XI (in Java) would be the most desirable refineries as supplier of natural rubber latex to the condom production plant. Although P.T.P. V is located far away from proposed factory site, necessary conditions will be fulfilled comparatively in shorter time as the output of latex is large and refining and analytical technique is sophisticated. In case of P.T.P. XI, the output is very small compared to P.T.P. V. However, it is expected to satisfy the requirement earlier than considered, as the Ministry of Agriculture strongly supports and three sets of new centrifuges were installed.

Therefore, a proposal of development plan for Indonesian latex to the Minister containing following matters was agreed to submit between the BKKBN, P.T. Kimia Farma and the representatives of the feasibility team.

Present targets to be fulfilled as a first step to develop Indonesian latex is as follows:

(1) Quality standard of latex for condom as described in Table IV-2 should be satisfied throughout year so that constant procurement of such latex may be assured. A special attention should be paid on the required MST without adjustment of stabilizer.

(2) For the supply to condom production plant, latex of the highest quality lot should be selected out of many lots. However, present analysis is made only on the quality of finished latex, which is insufficient as quality control system for the improvement of latex. The relationship between the nature of field latex and analytical value of latex immediately after centrifuging is the most important factor and must be analyzed in order to improve the quality. Then, analytical data of field latex, latex right after centrifuging and latex of 2-4 weeks after centrifuging must be kept as a initial step. With those detailed data, the direction for basic development or improvement plan will be searched out.

(3) P.T.P. V: Storage condition, anti-deterioration measure during transportation and filling facility to drum should be studied.

P.T.P XI: The method to lower the VFA value and the maintenance of lowered VFA No. must be studied urgently.

CHAPTER 2 COMPOUNDING CHEMICALS AND OTHER MATERIALS

2-1 Compounding Chemicals

The chemicals used for compounding with natural rubber latex generally consist of (1) vulcanizing agent, (2) vulcanization activator, (3) vulcanization accelerator, (4) antioxidant, (5) dispersing agent and (6) stabilizer.

(1) Vulcanizing agent

In general, sulfur is used. This chemical is simple to use and not expensive.

(2) Vulcanization activator

In general, zinc oxide is used. Zinc serves as the activator when rubber is vulcanized with sulfur.

(3) Vulcanization accelerator

The vulcanization accelerator is used to improve the quality of vulcanized rubber by shortening the duration of vulcanization, lowering vulcanizing temperature and reducing sulfur.

A variety of chemicals are used as vulcanization accelerators, and the selection depends on the line of products and technology of each manufacturer.

(4) Antioxidant

The rubber inevitably deteriorates with the passage of time. Various changes and conditions of rubber or rubber latex caused by aging differ in many ways, depending on the type of rubber and the condition of aging. Even for the same type of rubber, the changes are different, depending on conditions of aging.

Therefore, antioxidants are used to maintain a longer life time of the products.

(5) Dispersing Agent

The dispersing agent is a chemical that disperse particles in solid matter and produces a stable colloidal solution.

Once dispersed micro particles should not be concentrated again.

(6) Stabilizer

When latex is added with a compounding agent or compounding chemical is mechanically processed, coagulation is likely to take place. A stabilizer is used to prevent such a possibility. Useful as stabilizer is matter which will maintain or enhance the hydration or the surface layer of particles of latex or increase the negative potential of the latex particles.

Surface active agent and ammonia are known as general stabilizers.

Of the compounding chemicals, only zinc oxide and sulfur are produced in Indonesia. Qualitatively, zinc oxide produced in Indonesia seems usable. The use of Indonesian sulfur for the production of condoms is problematical in terms of granularity and purity.

Table IV-9 HANDLING AGENT OF CHEMICALS IN INDONESIA

	Agent	Manufacturer	Materials
1	P.T. LINSEA	MONSANTO	RUBBER CHEMICALS
2	P.T. KOO KIMIA AGUNG	BAYER	RUBBER CHEMICALS
3	P.T. LAUTAN LUAS	UNI ROYAL	RUBBER CHEMICALS
4	P.T. GALIC BINA MADA	UNI CHENA VULNAX	STEARIC ACID RUBBER CHEMICALS
5	P.T. SARI WARNA	SHELL	PROCESSING OIL

2-2 Other Chemicals

(1) Reagent to be used for entry inspection and analysis of raw latex and compounding chemicals.

(2) Chemicals to be used for the treatment of supply water and waste water.

(3) Chemicals necessary for process inspections.

Almost none of the above chemicals are produced in Indonesia. The chemicals dealt with by Indonesian importers must be purchased from them and those which are not imported at present will have to be imported separately.

2-3 Auxiliary Materials

The stripping agent, stripping powder and antistickiness agent necessary at the time of stripping condoms from moulding glass, and the lubricants, for the lubrication of condoms are not imported in Indonesia and must be newly imported. If these items are dealt with by Indonesian importers, purchases shall be made through them. The items shall be purchased directly from foreign nations, should they not be available from local importers.

CHAPTER 3 PACKING MATERIALS

The packing of condoms is necessary for their preservation, protection of the quality, promotional aspects of distribution and handling convenience. Packing method of condoms are similar and not different from country to country. The packing methods may roughly be classified as follows:

3-1 Packing Tape

There are two methods, the first, each condom is placed in oblong type tape by heat sealing, and the other in square type tape by the same sealing. Generally, the performed heat sealing method prevents humidity, light, heat, shock, insects and so on and preserves the content. BKKBN intents to use oblong type packing.

3-2 Dozen and Gross Box

Dozen box may not be used at the initial stage. Packaging with small attractive design in dozen or quarter dozen box may be adopted in the future at the time of necessity to expand condom user. Though the use of handy 1/4 or 1 dozen box with attractive design together with the printing of instruction manual might possibly be effective in promotion of family planning, such box is not considered to use at the initial stage. Heat sealed condom in polyethylene laminated aluminium foil in two or three pieces unit will be directly packed into paper gross box.

3-3 External Packing Materials

For the transportation, storage and handling of the completed products, external packing is required. Double carton box, water-proof caton box, tri-wall carton box, wooden case, are as outer packing materials. For inland transportation, ordinary double carton boxes will be strong enough but for transportation over the ocean, the packing materials should be carefully selected.

PART V

STUDY OF TECHNICAL ASPECTS RELATED TO THE CONDOM PRODUCTION

PART V STUDY OF TECHNICAL ASPECTS RELATED TO THE CONDOM PRODUCTION

CHAPTER 1 PROPOSED PLANT SITE

1-1 Criteria for the Selection of Proposed Plant Site

The following criteria must be taken into account for the selection of a plant site under this project.

1. Flat with the availability of the necessary acreage for an industrial plant site.

2. Availability of climatic conditions suitable for the production of condoms.

3. Assurance of the necessary quantity and quality of water.

4. Availability of necessary electric power both in quality and quantity. Particularly, there should be no suspension in power supply.

5. Ready accessibility of manpower and talent.

6. Assurance of stable supply of raw materials and resources.

7. Convenient to the shipment of products.

1-2 Conditions of Location for Proposed Sites

The feasibility study team observed three proposed sites including Site A which was earlier visited by the preliminary survey team.

The three sites are referred to as follows;

Site A - Proposed site surveyed by the preliminary survey team (Jalan Banjaran).

Site B - Desa Gmanggu

Site C - Palapasari

The geographical location of the sites is shown in the map at the beginning of this report and in Figs. V-1, V-2 and V-3.

The three sites are located close to one other in Banjaran on the outskirts of Bandung in West Java.

According to the regional development classification map issued by the Bandung Island Land Development Bureau, the Banjaran area consists entirely of tracts of land for agricultural use at present but, according to the development program, is designated for use by dwellings and industry. Banjaran is situated 18 km south of the trunk road leading from Bandung to the foot of Mt. G. Tilu and Lake Situ Cileunca and 700 m above sea level. Banjarang is a moderately sloping area of paddy fields and residential areas stretching toward the mountains in the south and Bandung in the north.

Sites A, B and C are all situated on the terrace of the Cisangkuy River and this terrace extends over the entire area, gently sloping from southeast to northwest.

In addition to this land form, there is a sand layer, 120 m in depth, which is placed in the same conditions as have been found in the trial digging of a deep well by a textile mill (P.T. KTSM), and 1 ℓ/sec of underground water may be obtained with a 6" ϕ pipe. The temperature (20-30°C throughout the year) and humidity (70-100%) in this area are constantly high, so that this area is suitable for textile mills. In fact, many textile mills are concentrated in this area (see Table V-1).

Fig. V-1 SITE A, B & C

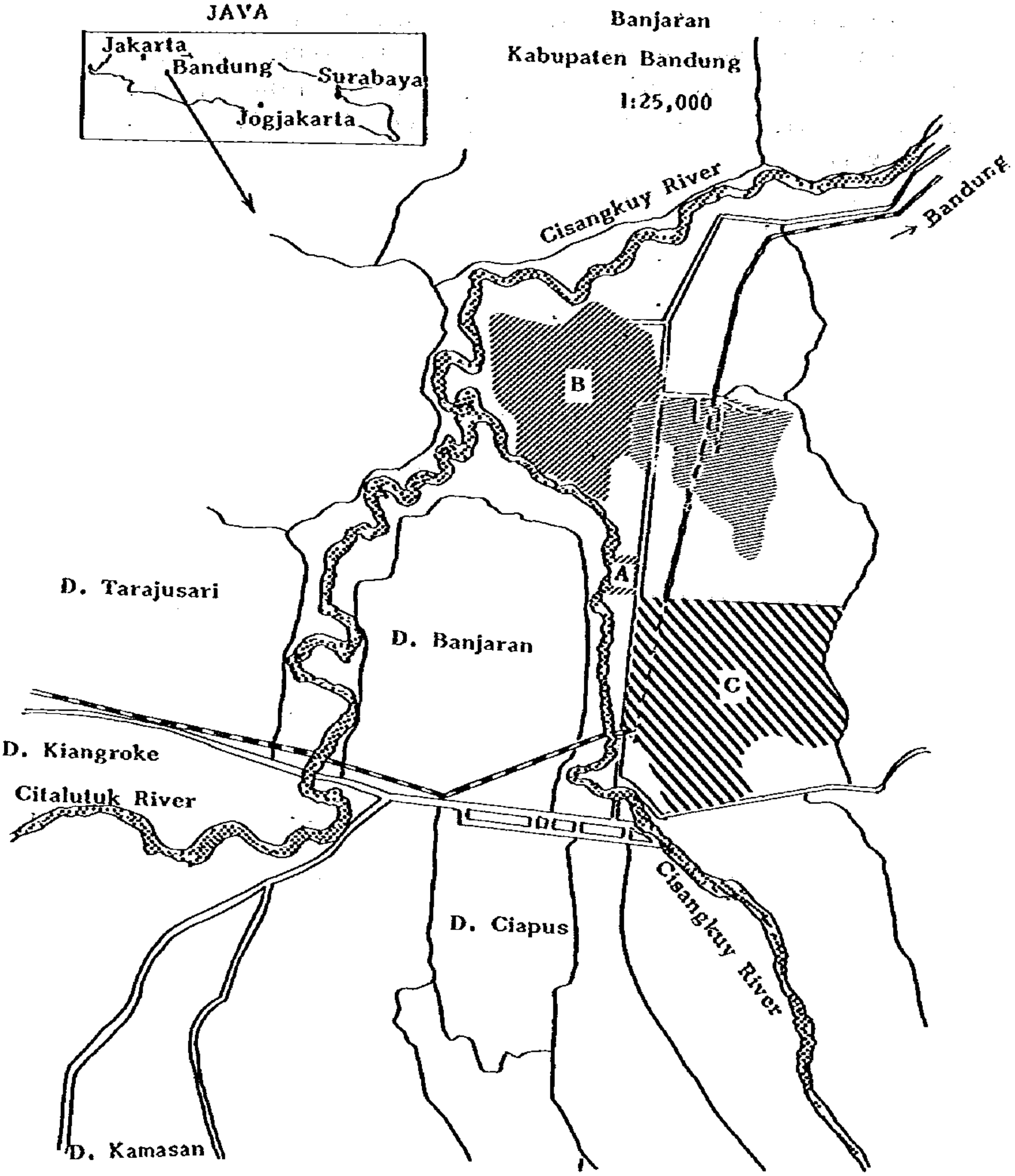


Fig. V-2 SITE A & B

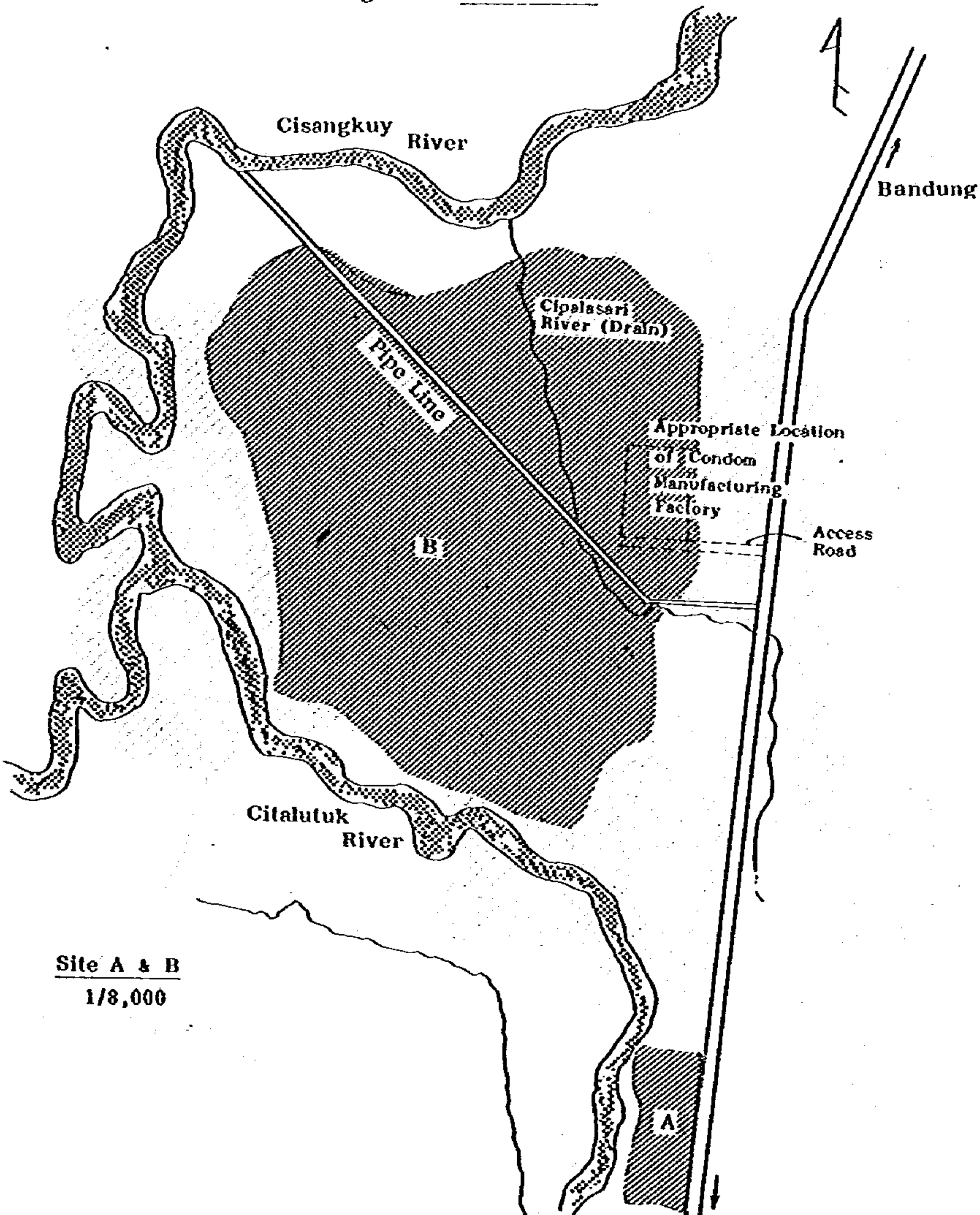
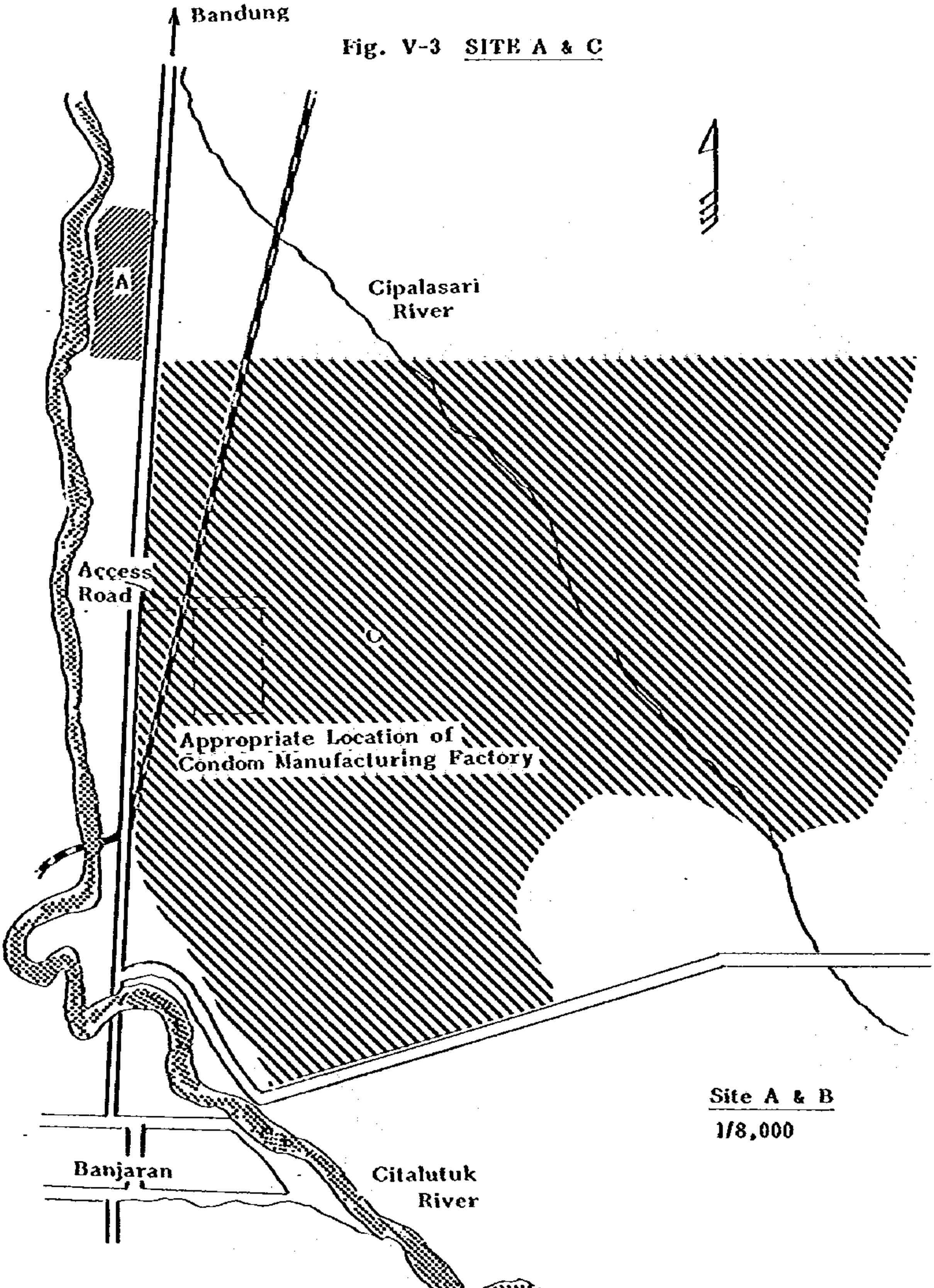


Fig. V-3 SITE A & C



One extraordinary feature of this area is that there are gusts of wind and thunderbolts in the rainy season and it is necessary to work out counter-measures (the plant's structure and lightning arresters). The supply of electric power by P.L.N. to this area is insufficient and many plants have electric generators for their own use. For water supply, there is a need to consider making primary use of river water and secondary use of underground water.

Adequate manpower is available in this area, which is situated close to Banjaran. The findings of a survey conducted on nearby plants indicate that manpower is fully accessible both in terms of quality and quantity.

1-2-1 Site A

This area has been surveyed by the preliminary survey team. As indicated in the supplementary sketch, this area is situated on the west side of the trunk road leading to Bandung and Banjaran. Dwellings are scattered on the north side, a paper mill is situated on the south side and on the west side, there is a tract of land, about 200 m from north to south, about 100-200 m from east to west (with an actually usable width of about 100 m), with an area of about 20,000 m^2, as it is surrounded by the Citaluluk River.

At the center of this area, there is one farm house (the area of which measures about 60 m^2) and the rest consists entirely of paddy fields. Topographically, this area gradually slopes down from east to west with a height difference of about 1.5 m. The Citaluluk River which flows down from south to north on the west measures 10-15 m in width and about 3 m from its bed to the top of its banks. With a discharge of 40 ℓ/sec in the driest season, this river is usable as a source of water. Water for agricultural irrigation is supplied westward through a channel along the road. As for drainage, waste water must not be discharged into the Citaluluk River for other

Table V-1 BANDUNG, 1980AVERAGE TEMP., MOISTURE CONTENT AND RAINFALL PER MONTH

Month	Average Temp.	Average Moisture Content	Average Rainfall
January	22.7°C	81%	119
February	23.1°C	77%	58
March	22.7°C	80%	393
April	23.1°C	82%	274
May	23.4°C	76%	109
June	22.9°C	76%	86
July	22.6°C	75%	119
August	22.2°C	73%	65
September	23.1°C	73%	135
October	22.9°C	79%	287
November	22.9°C	82%	443
December	22.5°C	82%	276

Average Temp. per year = 22.8°C

Average Moisture Content per year= 78%

Average Rainfall per year = 197.0 mm

Datum P.T. Kimia Farma

Jakarta, June 26, 1981

considerations. If this area is selected for the construction of the plant, the ground level should be raised with earth, and a drainway should be extended across the trunk road and linked to the drainway in the northeast.

For land development, it is necessary to raise the ground level and construct retaining walls in the north, south and west. The ground level will have to be raised to a height of 0.5 m in the east and about 2 m in the west.

Power distribution wires are stretched along the west side of Banjaran, but as the capacity is insufficient, there is a need to come out with some measure or the other for electric supply.

1-2-2 Site B

This site is looked upon as the most proposed one by P.T. Kimia Farma in terms of securing the necessary quantity of water.

This site faces dwellings along Banjaran and is hemmed in by the Citaluluk River in the south and the Cisangkuy River in the northwest. The site measures about 800 m from north to south and about 700 m from east to west, covering an area of about 500,000 m^2. P.T. Kimia Farma is scheduled to use a part of its east section with an area of about 150,000 m^2 as its base for the production of contraceptives of which 15,000 m^2 or so for a condom production plant.

As indicated in Fig. V-2, a drainway runs from north to south through the east of the site. Water pipelines are laid toward a textile plant (P.T. ADTEX) from the north center and toward another textile mill (P.T. KTSM) at Bojong Manggu Pameungpeuk.

This area consists entirely of paddy fields, to which irrigation water is supplied northeast to northwest from the Cipalasari River and the water channel which runs on the south side in parallel with this river.

In other words, if the east section of this area is selected for the plant site, the sustainability of this irrigation channel must be taken into account.

For drainage, the Cipalasari River has been designated as the drainway, which may be used. As to water supply, there is a need to supply water from the Citaluluk and Cisangkuy rivers. In terms of discharge, the Cisangkuy, the main stream, must be used. At Desa Cikalong, about 15 km up the river, there is a water catchment dam for the supply of service water, and this dam constantly discharges a fixed quantity of water (1 t/sec) for irrigation.

For the site of the condom plant, the tract of land, about 100 x 150 m (15,000 m^2), which is situated on the west side of hamlet (Des Cimanggu) and hemmed in by the Cipalasari River is scheduled to be used. For this, there will be a need to construct an access road, 20 m wide and 100 m long, from JLN Banjaran.

From whichever river water is taken in, it will be necessary to construct a water supply pipeline, about 500-700 m in length, from the catchment outlet to the plant.

For leveling of the ground, it is necessary to raise the level of the ground by 0.5 - 1.0 m to make the site higher than the surrounding paddy fields.

1-2-3 Site C

Situated on the east side of JLN Banjaran, Site C is close to Banjaran's built-up area. The Cipalasari River runs from south-east to northwest. Of the tract of land, about 1,000 m from north to south and about 1,000 m from east to west, with an area of 1,000,000 m^2, the plot with an area of 150,000 m^2 immediately from the west border is scheduled to be used for the entire program of P.T. Kimia Farma, and a part of the northwest section with an area of 15,000 m^2 is to be used for the site of the condom plant.

A railroad runs from north to south on the east side of JLN Banjaran situated on the west side of the site.

For the plant site, there is a need to construct an access road on the east side of the railroad, or from west to east across the railroad from JLN Banjaran.

At present, this site consists entirely of paddy fields. There is a hill in the southeast and from its foot, a terrace of paddy fields stretches toward the northwest.

As for land development, it will be sufficient to raise the ground level by 0.5 m if an adequate network of drainways is constructed around the plant site.

For water supply, it will require a pipeline of about 400 m in length if it is laid across the JLN Banjaran railroad from the Citaluluk River. Or it will require a pipeline of 700-800 m if water is taken in from the neighborhood of the bridge which spans across Banjaran.

In respect to the selection of the plant site, the feasibility study team considers Site A the most suitable place for the construction of a condom plant but the possibility of its acquisition is extremely slim as P.T. Kimia Farma is pessimistic about this place in terms of (A) management policy, (B) authorization for its acquisition and (C) land price. In contrast, the firm positively intends to acquire Site B or C by the end of 1981. Given either these factors, the feasibility study team considers Site B or C suitable for the site of the condom plant, provided that a 20-meter-wide access road and a necessary water pipeline be installed by P.T. Kimia Farma in advance.

1-3 Decision of Factory Site

The factory site has not been decided while the feasibility study team has been doing study in Indonesia, but at the time of visiting BKKBN with Progress Report on 9th September, P.T. Kimia Farma stated the determination of factory site as Site C and that an application with regard to acquisition of 30,000 m^2 was submitted to the Government of West Java Province. According to P.T. Kimia Farma, it is expected that the permission will be made within 2-3 weeks time and that purchasing of land will be made within 3 months from the date of permission. Area of 15,000 m^2 out of 30,000 m^2 applied this time will be used for condom factory.

CHAPTER 2 INFRASTRUCTURE AND UTILITIES

2-1 Road

To convey machinery and equipment by truck, there are four routes from Tg. Priok in Jakarta to the proposed plant site in Banjaran on the outskirts of Bandung as shown in Fig. V-4.

Route 1 does not allow a long body type for use because of a steep slope and many small radius curves.

Route 2 is the most gentle and appropriate slope for transporting heavy loads, but this route limits the height of truck and load to pass.

Route 3 is being much used for transport by truck. This route runs on the cubic crossing of railway and bears heavy load (20 - 30 t).

Route 4 is good enough to transport heavy load because of few obstacles of its structure, but more than 20 t load needs two head trailers to pull at the steep slope of the route. And also the route should be used in the case of more than 2.45 m height.

2-2 Electric Power Supply

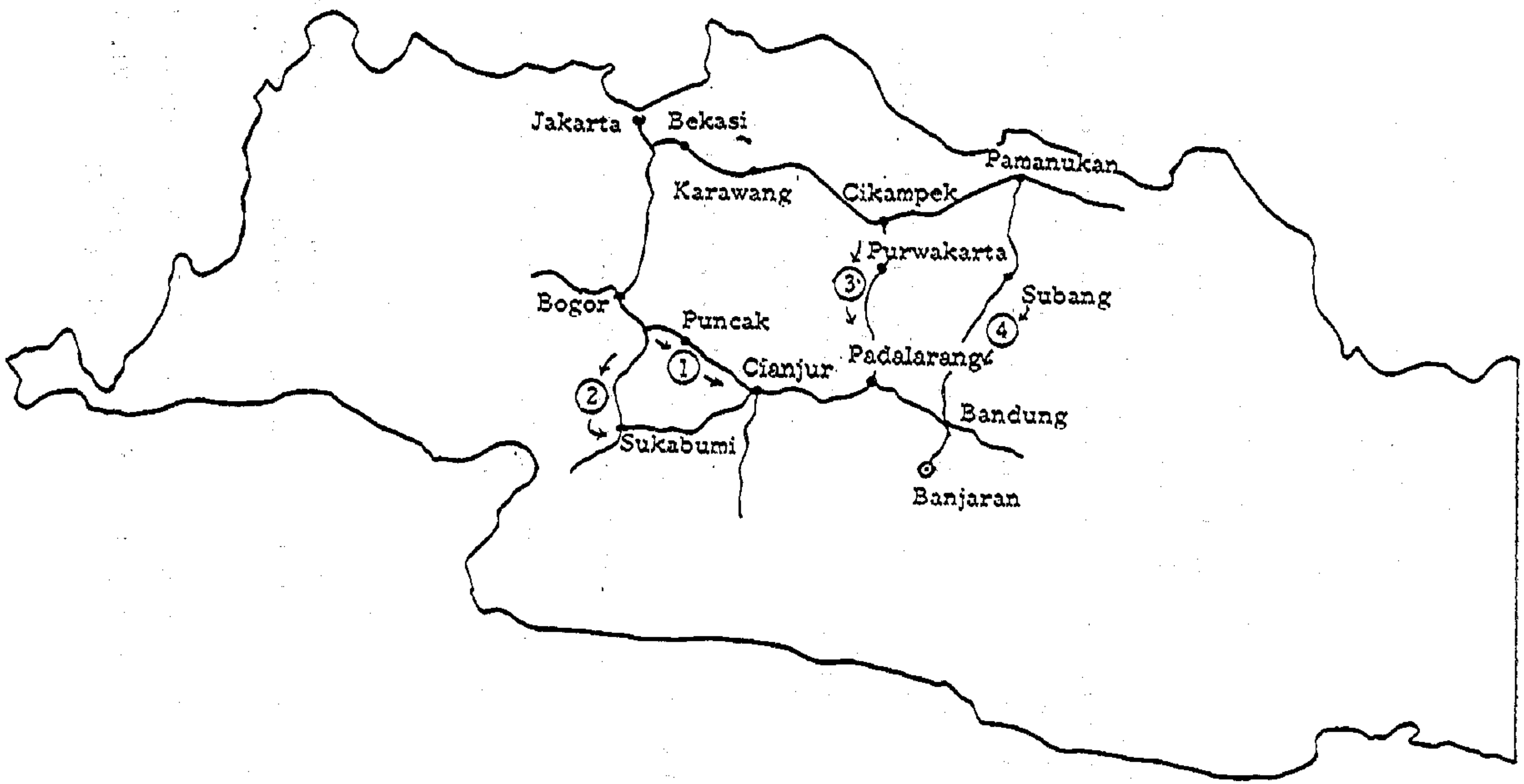
2-2-1 Stability of Electric Power Supply

A stable supply system of electric power has not yet been established in Indonesia, and the government is now developing the supply system as a national project. Three problems remain unsolved:

1) shortage of electric power, 2) frequency of power stoppages, 3) unequality in voltage of supplied electricity. Counter-steps for the shortage of power supply will be described later. The frequency of power interruptions differ considerably from one district to another, ranging from two to three times a day to two to three times a month. This indicates that we should keep in mind that power stoppage may occur at times in Indonesia when the plant is normally being operated.

As to the dispersion in voltage level, the voltage may decrease 20 % or more. Such drops center in the hours after 3 p.m. every day, forcing high-load facilities to discontinue operations and control equipment to malfunction. When these facts are taken into consideration, it will cause many ill-effects to depend solely on power supplied by P.L.N. (power firm-supplied electricity) to operate the plant facilities. Condom production will especially suffer from even an instant power interruption, and as such operation invulnerable to power stoppage will be the most imperative.

Fig. V-4 TRANSPORTATION ROUTE IN WEST JAVA



2-2-2 Construction Cost of Power Sources by P.L.N.

In case where P.L.N.-supplied power as well as generators, are used, the following steps are to be taken as application procedures. Costs are also shown.

First, the user (P.T. Kimia Farma) submits to P.L.N. an application forms with the facility capacity and factory maps. P.L.N., based on the submitted application, figures out the costs for construction, transforming facilities, trunk power lines and surety money, and then presents them to the user. After receipt of payment for all those costs, P.L.N. starts construction works. The construction is planned to last for about five months.

The case of a 690 kVA

Construction	37,950,000 Rp (55,000 Rp/kVA)
Inspection	100,000 Rp
Others	4,140,000 Rp (6,000 Rp/kVA)
Grand total	42,190,000 Rp

The following data issued by P.L.N. in Bandung can be referred to on application procedures.

(SYARAT-SYARAT PENYAMBUNGAN LISTRIK)

A table of electric charges for the Bandung area also will be attached (see Table V-2).

2-2-3 Power Transmission

P.L.N. plans to have a uniformed system for transmitting power to new plants to be built in the Bandung area in the future, as follows.

High-voltage transmission	20 kV, 3-wire system, 50 Hz
Low-voltage transmission	single-phase (220 V), 3-phase wire (380 V)

The following technical guide book issued by P.L.N. in Bandung can be referred to on transmission systems and electric wiring.

(PERATURAN INSTALASI LISTRIK)

2-2-4 Counter-measures for Stable Electric Power Supply

As a national project, Indonesia will construct a substation in Cibiru, 20 km northeast of Banjaran, to step up the country's power-supply capacity. Its projected power-generating capacity is 3,000 kVA. No high-voltage industrial transmission lines are presently available in the Banjaran area where the plant is to be built, and so high-voltage power lines need to be extended from Chakwan, the city nearest to Banjaran. The extension of the power line is to be constructed by P.L.N., but even when this construction is done, it will be necessary to utilize generators to cope with power interruption and voltage decrease.

The generator will be utilized not as an emergency power source, but as a normal power source. In Indonesia, some regulations exist as to installation of a generator, and the users should be authorized by P.L.N. and BKPM. Nevertheless, there will be no serious problems for the regular use of generator, because such regulations do not exist in the Bandung area and because the condom production plant is a national project to be operated by a state-owned company.

2-2-5 Power-generating Facilities

The generators locally produced are all those with a generating capacity of 50 kVA or below, and the import of the models of that class is banned. Indonesia, therefore, depends on foreign countries for the generators capable of producing more than 50 kVA of power. The following points should be taken into consideration for purchasing generators.

(1) The generator will be overhauled every 6,000 hours so thoroughly that its power generation should be made by several generators for maintenance reasons. The plant needs three sets of power-generating equipment, each capable of 250 kVA.

(2) Lower-revolution models (approx. 350 rpm) are advised to be used rather than high-revolution ones (approx. 1,500 rpm) in terms of service life.

Table V-2 BERLAKU DENGAN REKENING BULAN, JULY 1980

TARIP	H-1	H-2 TM	I-1	I-2	I-3 TM	I-4 TT	G-1	G-2 TM
URALAN DAYA	250 VA s/d 200 kVA Rp.	201 kVA keatas Rp.	3.8 kVA s/d 99 kVA Rp.	100 kVA s/d 200 kVA Rp.	201 kVA keatas Rp.	5,000 kVA keatas Rp.	250 VA s/d 200 kVA Rp.	201 kVA keatas Rp.
- Bea Beben tiap kVA	2,800	1,750	1,750	1,750	1,600	1,500	2,800	1,500
- Bea Pemakaian tiap kWH DILUAR WBP. (LW BP = 22.00 - 18.00)	32	23	15	15	15	14	26	17
- Bea Pemakaian tiap kWH DIDALAM WBP. (WBP = 18.00 - 22.00)	-	-	24	24	24	22	-	26
- Tambahan Biaya (TB)	8	6	5	5	5	5	6.50	4.50

UANG JAMINAN LANGGANA

Kode Tarip		Rp. per VA
H-1	=	Rp. 19.-/VA
H-1 TM	=	Rp. 12.-/VA
I-1	=	Rp. 7.-/VA
I-2	=	Rp. 8.-/VA
I-3 TM	=	Rp. 6.-/VA
I-4 TT	=	Sesuai Kontrak
G-1	=	Rp. 17.-/VA
G-2 TM	=	Rp. 9.-/VA
J	=	2 bulan rekaning te tap bulanan

2-3 Supply of Fuel Oil

Types of fuel oil to operate the condom production plant are as follows.

MDF (marine diesel fuel), equivalent to A-heavy oil in Japan, will be used to fuel boilers, while solar oil, equivalent to Japan's light oil, will be for the generator's diesel engine. As of June, 1981, the costs for these fuel oil are as follows.

Gasoline	150	Rp/ℓ
MDF	60	Rp/ℓ
Solar oil	52.5	Rp/ℓ

In order to ensure a stable supply of fuel oil, Indonesia, which now has not enough oil-refining facilities, presently ships crude oil to foreign countries and in return imports some refined petroleum. Under these circumstances, some efficient measures should be taken to cope with the above factors threatening the country's stabilized fuel oil supply.

As is known from the situation at existing plants in that country, the new condom plant will need a stockpile of fuel oil sufficient to last for about one month, and will have to be equipped with the facilities for storing fuel oil. The tank's stockpile capacity is 30 kℓ for MDF and 48 kℓ for solar oil.

2-4 Water Supply

2-4-1 Supply

As will be stated afterwards, the planned condom plant will consume an estimated 14 t of water per hour, which is to be fed from the river and underground. The river water will be used primarily for production processes and the underground water for livelihood water, including drinking water.

River water: Under the present circumstances, the maximum water-feeding capacity of the river is 30 t an hour. The river, average 70 cm depth in the rainy season and 20 cm depth in the dry season, is free from being dried up. The water from this river will be pumped and pipe-fed to the plant site, and will then be processed for industrial purposes.

Underground water: The forecast capacity of underground water supply at the plant site in Banjaran is between 3.6 t per hour and 15 t per hour. The well needs to be 100 m depth or more, and an estimated cost for its digging is Rp 10 million. The underground water also is to be used after treatment.

2-4-2 Water Quality

The analysis data of water available from the river and wells in the neighborhood of Banjaran, the condom plant site, is shown in Table V-3.

A close observation of the river water, brown-colored and turbid, in that district indicates that there exists a high degree of suspension. Removal of this turbidity can be made possible by installing a precipitation bath.

After being treated by the precipitation bath, the river water has to be processed with equipment suited for drinking, glass-mold washing, latex dilution, cooling, boiler operation and general cleaning.

The drinking water is to be given coagulant agents in the coagulator to help its colloidal particles to precipitate. This water should be used after chlorine-sterilization and filtering to be made later. As for the general cleaning water, a precipitation bath treatment through precipitations tank treatment will be sufficient.

Table V-3 ANALYSIS OF WATER AROUND FACTORY SITE

Item	I	II	III
Turbidity as SiO_2 Unit	4	4	9
pH	7.6	7.0	7.2
Total Hardness (as $CaCO_3$)	133	36.8	48.9
Ca Hardness (as $CaCO_3$)	78.2	23.2	29.5
Mg Hardness (as $CaCO_3$)	54.5	13.6	19.4
Permanent Hardness (as $CaCO_3$)	18.4	1.22	8.52
Alkalinity (P)	0.0	0.0	0.0
Alkalinity (M) (as $CaCO_3$)	114	36	40
Cl	30.3	6.07	11.1
SO_4	15	6.9	16
Fe	0.30	0.35	0.70
SiO_2	23	13	15

I : Well water in Banjaran
II : River water in Citalutuk
III : River water in Cisangkuy

The water to dilute latex should be treated for coagulant-precipitation and filtering in first stage, and deaeration treatment and precision filtering in second stage.

As was found in the latest research, it will be possible to obtain purified water for latex dilution by the ion-exchange equipment of a mixed bed tower with strong acidic cation exchange resin and a basic anion exchange resin. For the boiler water, some pre-treatment equipment will be necessary to ensure the supply of at least standard level water.

2-5 Treatment of Waste Water

Waste water can be grouped into four types: 1) wastes from the compounding plant, 2) wastes from the manufacturing plant, 3) wastes from the finishing plant, 4) livelihood wastes. Each waste water has different a criterion. It will be appropriate to broadly devide them into two categories as follows:

(1) Industrial wastes from the latex-compounding plant

(2) Industrial wastes from manufacturing and finishing plants, and livelihood wastes

2-5-1 Treatment of Waste Water from Latex-compounding Plant

The waste water of this group is made up mainly of rubber contents and ammonia. In a two-stage treatment, rubber contents are coagulated in the coagulation bath, and ammonia then is neutralized in the neutralization tank. In the coagulation bath, the rubber contents will be mixed with calcium chloride and are coagulated, taken out of the bath and dried.

Secondly, ammonia will be neutralized (pH-adjusted) with such acids as hydrochloride before being discharged. The coagulated rubber contents are to be taken out properly and dried.

2-5-2 Treatment of Waste Water from Manufacturing and Finishing Plants and Livelihood Wastes

This waste water is composed mainly of surface active agents. The wastes first are stored in the storage tank on a temporary basis for controlling water volume, and then are treated by primary treatment (coagulated pressurization) for a certain amount at a time.

Secondly, biochemical treatment is performed before discharging. The quality of the water processed progressively up to the secondary treatment will be high enough to be used for fish farming.

The coagulant-precipitation formed in this treatment is automatically removed for dehydration and then discharged as sludge.

2-5-3 Standards for Waste Water Quality

In Indonesia, industrial plants, as a principle, discharge their wastes the way they gain water supply. Table V-4 shows the standards for discharging waste water in Indonesia.

2-6 Consumption of Energy Sources

The consumption of energy sources differs according to the types of supplied plant facilities. Energy consumption is shown as reference for the proposed condom plant. These rates were obtained on the assumption that the plant should turn out about 600,000 gross a year.

Vapour consumption	900 - 1,200 kg/H
Fuel oil consumption	80 - 110 ℓ/H (MDF), 90 - 120 ℓ/H (solar oil)
Electric power	
Consumption	300 - 350 kWH
Water supply	12 - 16 t/H

Table V-4 INDONESIAN STANDARDS FOR WASTE WATER DISCHARGE (BY P.T. TAKEDA, INDONESIA)

Item	Indonesian Standards on Wastes Water
Temperature	30°C
pH	6.5 - 8.5
Phenol	0.1 mg/ℓ
Fluorine and its compound	2 "
Mercury, alkyl and their compounds	0.1 "
Cadmium and its compound	1 "
Lead and its compound	1 "
Arsenic and its compound	1 "
Hexachrome compound	0.1 "
Zinc and its compound	1 "
Copper and its compound	1 "
Iron and its compound	1 "
Nickel	2 "
Ammonia	0.1 "
Chloride	0.05 "
Nitrogen dioxide ion	1 "
Sulfur	0.1 "

CHAPTER 3 MAJOR BASIC FACTOR TAKEN FOR EXAMINATION AND CONCEPTUAL DESIGN OF FACILITIES FOR CONDOM PRODUCTION

3-1 Projection of Production

3-1-1 Quantity Required

According to the projected forecast demand shown in Table II-4, the projection of production schedule is as follows. The figures below are based on the 1983/84 fiscal year when the plant will start operation.

1983/84	550,000 gross
1984/85	610,000 gross
1985/86	660,000 gross
1986/87	690,000 gross
1987/88	750,000 gross
1988/89	800,000 gross
1989/90	850,000 gross
1990/91	900,000 gross

3-1-2 Basic Conditions

The basic conditions for production capacity at this plant are shown in the following.

Annual stream days - 240 days (five-working-days/week)
Plant operation rate - 95%
Forecast production yield rate - 80%
Shifts - 1 shift (compounding process),
3 shifts (manufacturing process),
2 shifts (pinhole testing process),
2 shifts (packing process)

Production capacity - basic production capacity,
2,300 gross/day,
550,000 gross/year

production capacity for the 1990/91 fiscal year,
2,730 gross/day,
900,000 gross/year

Therefore, the final production capacity of this plant should be 2,730 gross a day (equivalent to 900,000 gross a year) through efforts over the eight-year period to improve production technology and the quality of latex.

3-1-3 Projection of Production Schedule by Year

1983/84 - Possible under the basic conditions above mentioned.

1984/85 - Daily production level will be set at 2,550 gross.

1985/86 - From this year afterwards, a six-working-day/week will be adopted and annual stream days will be 280 days. Daily production level will be 2,360 gross.

1986/87 - Daily production level will be 2,460 gross.

1987/88 - Daily production level will be 2,680 gross.

1988/89 - From this year afterwards a seven-working-day/week will be adopted (equivalent to 330 days a year), and the daily production level will be 2,430 gross.

1989/90 - Daily production level will be 2,580 gross.

1990/91 - Daily production level will be improved to 2,730 gross by accelerating production speed and increasing production yield rate.

The calculation of the largest annual stream days of 330 is based on the following;

Number of days a year - 365 days

Days off - 12 days (paid holidays)

12 days (national holidays)

10 days, (ramadan fasting)

Total 34 days

The stream days, therefore, will total 330 days.

From the description stated above, the quantities required and the quantities produced will be as follows:

Table V-5 QUANTITY REQUIRED AND PRODUCED

Year	Quantity required	Quantity produced
1983/84	550,000 gross	550,000 gross
1984/85	610,000 gross	610,000 gross
1985/86	660,000 gross	660,000 gross
1986/87	690,000 gross	690,000 gross
1987/88	750,000 gross	750,000 gross
1988/89	800,000 gross	800,000 gross
1989/90	850,000 gross	850,000 gross
1990/91	900,000 gross	900,000 gross

3-2 Production Capacity

3-2-1 System for Annual Production of 550,000 - 900,000 Gross

As stated in CHAPTER 2, PART III, BKKBN estimates the demand of condoms in 1983/84 - 1990/91 at 550,000 - 990,000 gross. On the assumption that the condom plant is to be put into operation in 1983/84, therefore, the plant should have the capacity stated above. Oral pills are also produced by P.T. Kimia Farma, entrusted by BKKBN. In the case of pills, P.T. Kimia Farma works for five days a week and 240 days a year.

As P.T. Kimia Farma is well aware of the necessity of manufacturing condoms on a 24-hours-a-day basis, if three lines will be operated at a yield rate of 80% in the first two years 550,000 gross can be easily manufactured. In case the demand of condoms would be increased properly, production of 660,000 - 900,000 gross from 1985/86 to 1990/91 shall be smoothly succeeded by adopting three shifts on a 4-group basis with operations during seven working days per week.

In three to five years from the start of production, the workers will become skilled, and the yield rate shall be brought up to 90%. At the same time, with accelerating operational speed of plant, 900,000 gross can be manufactured.

3-2-2 Basic Conceptions about Determination of Production Capacity

The Study Team approved the condom requirement 550,000 gross in 1983/84 and 900,000 gross in 1990/91 estimated by the BKKBN in June, 1980.

(1) The future ratio of condom users to total acceptors is expected to exceed 5%, the assumed rate (actually, in the last two years, the rate stood at 6.3% and 6.1%).

(2) The number of persons participating in family planning has increased remarkably.

(3) Condom users increase in proportion to an improvement of the educational level. (Fig. II-1)

(4) Many potential condom users exist.

(5) Considerable number of condoms are already consumed in commercial basis.

(6) Due to shortage of condom supply, the number of condom users is limited.

(7) More men are participating in family planning.

These facts are obtained on the basis of a comprehensive assessment of the collected data and the information gained from the interviews to the clinics and enterprises visited. If the Government would make attractive package and give publicity to male, the acutal demand will exceed the forecast mentioned above.

3-3 Specifications of Condom

The specifications of condom and the testing methods has not yet been available by the Ministry of Health, Indonesia. In talks with BKKBN and P.T. Kimia Farma, the specifications and testing method of the condoms to be manufactured in Indonesia, have been set as follows.

3-3-1 Dimensions

Overall length: Not less than 17 cm

Number of test samples :

10 pieces for every test lot

Measurement:

Prepare a measuring rule (the smallest calibrations in millimeters), 10 mm in width and 30 cm or longer in length, with its ends rounded.

Hold the teat end of a test sample, and insert the rounded end of the rule into the sample from the rim part of the sample to its teat end.

Unroll the test piece, read the calibration when the test piece is fully unrolled. Measure the average length and record it on the test data sheet.

Width: 49 - 52 mm

Number of test samples:

10 pieces for every lot.

Measurement:

Lay a test sample flat over the rule (the smallest calibrations in millimeters) at a point 85 mm from the rim part. Measure the width of the test sample and record the mean value on the test data sheet.

Thickness: 0.05 ± 0.02 mm

Number of test samples:

10 pieces for every test lot.

Measurement:

In advance, adjust the point "0" of the gauge (calibration precision: 0.01 x 10 mm). Put a test sample on the table. Measure the thickness between two opposing points 80 mm from the rolled end and record it on the test data sheet.

3-3-2 Elongation at Break, Tensile Strength and Elongation at Break after Aging

Elongation at Break before Aging	Tensile Strength before Aging	Elongation at Break after Aging
Not less than 600%	Not less than 200 kg/cm^2	Not less than 540%

Number of test samples:

10 pieces for every test lot.

Measurement:

In advance, make sure that the test sample is not scratched. Put the test sample on the cutting table and cut it with a dumbbell cutter (JIS No. 2). Collect two test pieces from each sample condom.

Place a test piece flat on the table and mark index lines with a bench marker.

With a thickness gauge (calibration precision 0.01 x 10 mm), measure the thickness at three points between the index lines marked on the test piece. Consider the lowest value as that of the thickness of the test piece and write it on the test data sheet.

Read the length of the elongation and the load at break and write these values on the test data sheet. Repeat this procedure for the remaining nine test samples.

Aging test:

Number of test samples:

10 pieces for every test lot.

Aging conditions:

With a gear-type aging tester, an air-oven aging test is conducted at $70 \pm 1°C$ for 72 hours.

Leave aged samples in room temperature for a full day and measure samples in the same manner as stated earlier.

Computation methods

$$\text{Elongation}(\%) = \frac{\text{Length of elongation at break} - \text{Original length}}{\text{Original length}} \times 100$$

Note: Original length = 2 cm

$$\text{Tensile strength } (kg/cm^2) = \frac{\text{Load at break}}{\text{Cross-sectional area}}$$

Note: Cross-sectional area:

thickness x width (1 cm)

Summarization of test findings (with two test pieces)

$$T_B \text{ or } B_B = 0.9\, S_1 + 0.1\, S_2 \qquad S_1 \geq S_2$$

3-3-3 Water Leakage Test

AQL (Acceptable Quality Level): 1.0

Number of test samples (n): 200

Number of condom with holes (c):

Up to four condom with holes are acceptable; five and above are unacceptable.

If an ordinary single sampling inspection method is used, acceptance (Ac) = 5, rejection (Re) = 6 with n = 200.

In a more rigid single sampling inspection, acceptance (Ac) = 3, rejection (Re) = 4 with n = 200.

This time, the intermediate value between the rigid and ordinary inspection methods, acceptance (Ac) = 4, rejection (Re) = 5 with n = 200 has been adopted.

Water Leakage Testing Method

Number of samples: 200 pieces for every test lot.

Test: Put a test sample to the sample holder of a water leakage tester, and fill it with 300 mℓ of water.

Detach the test sample from the holder and twist the perimeter of the rim to fasten the rim.

Roll the test sample on a blotter at least twice to see if there is any leakage.

However, any leakage within 25 mm from the rim may be ignored.

Record the frequency of leakages on the test data sheet.

3-3-4 Bursting Strength Test

Number of samples: 50 pieces for every test lot.

Test: Each condom is to be inflated on the metering device that meter air into the codom until it breaks and then the meter is read to determine the volume of air at bursting.

An average air volume must be not less than 25ℓ.

3-4 Specification and Requirement of Natural Rubber Latex and Packing Materials

3-4-1 Natural Rubber Latex

As already described in Part IV, quality of natural rubber latex is extremely importent for the production of high quality condom at high yield rate. Quality standard of the natural rubber latex which have been assumed as the basis is described in Table IV-2.

3-4-2 Packing Tape

Specification of packing tape is described in the following table.

Table V-6 SPECIFICATION OF PACKING TAPE

Type	Material	Width	Quantity to be used
Aluminium Tape	Cellophane PT No. 30, Polyethylene 15 micron, Aluminium 7 micron, Polyethylene 40 micron	72 mm or 144 mm	10m per gross
Poly-cellophane Tape	Cellophane PT No. 300*, Polyethylene 50 micron	72 mm or 144 mm	10m per gross

*The thickenss of cellophane is 20 micron for No. 300.

For the sealing tapes, the Indonesian side hope to have aluminium tapes, 72 mm in width. Aluminium tapes are higher in price than poly-cellophane tapes to some extent, but it should be used for the protection from the deterioration of the quality with due consideration given to the tropical climate.

3-4-3 Requirement of Materials

Following quantity of raw materials shall be required in order to achieve output quantity as described in 3-2 of this CHAPTER.

Table V-7 REQUIREMENT OF MATERIALS

Items		Production Quantity	
		600,000 gross	900,000 gross
1.	Latex	136 t	204 t
2.	Compounding Chemicals	18.32 t	27.48 t
3.	Auxiliary Chemicals	46.72 t	70.08 t
4.	Lubricant	13.09 t	19.63 t
5.	Packaging Materials Tape	6,000,000 m	9,000,000 m
	Grs. box	600,000 pcs	900,000 pcs
	Carton box	12,000 pcs	18,000 pcs

3-5 Climate Condition

The plant is to be located at Site C in the outskirt of Bandung as described in CHAPTER 1, PART V. The climatic condition of Bandung is shown in Table V-1.

Climate condition appropriate for the condom production is described in the following Table V-8. It is the common belief in this busines that tropical zone is not suitable for the production of high quality condom mainly because of its high temperature. As a matter of fact, there is one manufacturer of first grade condom in the zone. From that point of view, it can be said that the expertise and experience of manufacturing condom under the climate condition similar to that of Indonesia is essential.

Table V-8 CLIMATE CONDITION APPROPRIATE FOR THE CONDOM PRODUCTION

Item			Condition
a) Temperature			5°C - 15°C
b) Humidity	:	Monthly Average	85%
		Yearly Average	75%
c) Rainfall	:	Max. per day	50 mm
		Average per month	200 mm

3-6 License for Plant Operation

3-6-1 Electric License

Electrical engineers or workers need to be licensed in Indonesia. The license is issued based on a qualification test conducted by P.L.N. of each district. A licensed electrical engineer, by reporting to P.L.N., is entitled to perform operations in the districts other than his residence. A chief engineer responsible for electrical affairs does not have to be licensed.

3-6-2 License for Boiler Operator

Boiler operator must have license, but regulations differ, depending on district.

3-6-3 Other License

No certificates are now required for a chief engineer handling dangerous or explosive materials, but it is expected that licensing in this field will be reviewed.

CHAPTER 4 CONCEPTUAL DESIGN AND PLAN OF FACILITIES AND RELATED WORK FOR CONDOM PRODUCTION PLANT

4-1 Introduction

The proposed condom manufacturing plant should have a maximum production capacity of 900,000 gross per year. Since required quantity of condom in Indonesia increase year by year, flexible production system adjustable to the demand increase shall be considered. The details of this production system are described in 5-2 and 6-3, but basic maximum output is 2,730 gross per day. Therefore, the capacity of condom production plant should be designed based on this maximum output. If unsophisticated system should be applied, unnecessary too large equipments would be needed in order to achieve this production capacity.

The condom to be manufactured is not permitted to bear pinhole on it from its purpose of use and therefore, capacity of each equipment shall be decided depending on its efficiency and productivity as to pinhole rate and yield rate. In order to maintain high yield rate, it is essential to assure followings:

1) Procurement of high quality natural rubber latex, compounding chemicals and auxiliary materials suitable for condom production.

2) Acquirement of processing technology.

3) Continuous provision of technical assistance and supervision.

Yield rate of the proposed plant will be greatly depending upon the supplier's technical expertise. This concept design of the proposed plant is based on continuous yield rate of more than 80-90%.

Although condom manufacturing plant is not basically different in its principle among manufacturers of condom, each manufacturing process is delicately different and there exist various methods. This variation will bring about the difference on quality, yield rate, capacity of equipment, consumption of energy and investment cost. Following conditions on equipment have to be taken into consideration to satisfy Indonesian proposal.

1) As the required production output increases year by year, plant equipment should correspond to its increase and can produce such required quantity.

2) As large variance on the quality of natural rubber latex is expected at the initial stage, the equipment must be adjustable according to condition of compounded latex.

3) The plant equipment should be durable against high temperature and humidity.

4) To promote use of condom in family planning activity, the plant should be capable of producing different colors and types of condoms simultaneously.

4-2 Production Facilities

The basic manufacturing conditions are as follows.

4-2-1 Compounding Equipments

1) Sulphur vulcanization method to be used.

2) Vulcanization capacity of 1,200 ℓ per day.

3) To be equipped with the facility for maturation.

As the most important key lies on compounding technique and temperature control technology, precise weighing mechanism stirring apparatus and automatic temperature control system meeting to planned compounding process is necessary. To process vulcanized latex in the following automatic moulding section, automatic temperature recording apparatus shall be essential as controlling system.

4-2-2 Full Automatic Moulding Machine

1) Moulding machine should be fully automated.

2) It should be designed to harmonize with the characteristic of vulcanized latex.

3) Room temperature and humidity in the automatic moulding section should be controlled constant at all times.

In this process, the most important and fundamental point is to make uniform film and to produce stable quality in high efficiency without pinhole. Especially, high efficiency rate is greatly depending on drying system and apparatus. Although electricity, steam and hot air can be considered as the source of heat for drying system and apparatus, electric heating should be applied in order to assure high quality products at high efficiency.

4-2-3 Automatic Pinhole Testing Machine

1) Precise detective efficiency.

2) Wet type electronical testing method.

4-2-4 Packing Machine

1) Heat seal packing with laminated aluminium tape.

2) Packing to each gross box without considering packing to dozen box at initial stage.

The condom distributed in Indonesia today is packed in laminated aluminium strip, three pieces in a unit, so-called oblong type packing. Packing should be designed in the same type. Furthermore, to treat lubrication oil, an apparatus is required.

4-2-5 Laboratory Equipments

The plant includes water leakage testing apparatus and bursting volume testing apparatus in order to maintain quality standard provided in this project and for quality check purpose.

1) Water leakage testing apparatus

Multi-type testing appratus with automatic water filling mechanism. Capacity should be minium 2,000 pieces per eight hours, as it is used in process inspection.

2) Digital and multi-type bursting volume testing machine

Digital and multi-type bursting volume testing machine is capable of testing many pieces as process test.
The required capacity is minimum 2,000 pieces per eight hours.

4-3 Utility Facilities

Main equipments are as follows:

- Electric Receiver
- Generator
- Boiler
- Supply and waste water treatment equipment
- Water supply equipment
- Safety equipment

The outline of the above design is explained as follows:

4-3-1 Electric Receiver

The capacity of electric receiver shall be 500 kVA in order to receive electric supply from P.L.N. However, electric supply is not stable and generator shall be actually utilized.

4-3-2 Generator

Generator will be utilized as normal electric supply source, not as emergency requirement. Therefore, the generator should be durable and easy from standpoint of maintenance. As periodical inspection and cleaning is required, smaller capacity is desirable. As required capacity is 500 kVA. It is recommendable to set up three sets of 250 kVA generator.

4-3-3 Boiler

Required capacity is 1,200 kg/H

The pressure is 6 - 8 kg/cm^2

4-3-4 Water Supply Facility

In order to obtain water constantly for the amount of 15 t per hour, pumping and piping works shall be required. Two kinds of pumps for supply from river and well shall become necessary. Pumping condition is explained in 2-4, CHAPTER 2, PART V.

4-3-5 Treatment Facilities for Supply and Waste Water

1) Treatment Facility for Supply Water

Required capacity of water treatment facility for supply water is as follows:

- Concentration and Precipitation Apparatus 30 m^3
- Filtering Apparatus 25 m^3
- Water Softer 1.5 m^3/H
- Demineralizer 0.2 m^3/H

2) Treatment Facility for Industrial Waste Water

Required capacity of treatment facility for waste water is as follows:

- Neutralizing Concentration and Precipitation Apparatus 30 m^3
- Filtering Apparatus 25 m^3

3) Treatment Facility for Livelihood Waste Water

After the temporary storage for controlling water volume, coagulated pressurization is performed for a certain amount at a time. Further, biochemical treatment shall be made.

4-4 Offsite Facilities

The products to be produced by the plant are latex condom. A major portion of raw material for condom is natural rubber latex refined in Indonesia. The condom manufactured in the plant will be delivered through distribution network of BKKBN without longer storage at the factory.

The storage and shipping facilities which the plant should have are described below.

4-4-1 : Storage for Latex, Products and Packing Materials

1) Latex

Due to the reasons of quality and price, latex might be purchased for the larger volume at a time for the production of longer period. Generally, the latex purchased for short period use may be stored in the compounding room. In case of necessity of longer period of storage, natural latex shall be stored in the warehouse of materials and the products. The room for latex storage should be air conditioned at 20 ± 5°C and protect from sunray.

2) Condom

The storage for bulk and packed condom should be protected from direct sunray, heat, humidity and insect. Thus, ventilation, anti-insect net shall be fixed. And the condom should not be piled up. Shelf will be set up.

3) Packing material

As high humidity and temperature might cause stickiness on laminated packing material, ventilation shall be installed.

4-4-2 Maintenance Facility

As each equipment in condom production plant is not so large-scale, only checking and repairing tools at the time of operational time will be required. Large scale utilities will be periodically checked and cleaned by those makers.

4-5 Site Preparation, Access Road and Factory Layout

4-5-1 Site Preparation and Access Road

Decided factory site is a rice field situated at a litte higher level than trunk road. An application for 30,000 m^2 out of 1 million m^2 which is designated as industrial zone have been submitted to the Governor of West Java by P.T. Kimia Farma.

As a condom production factory site, 15,000 m^2 must be levelled. It will be necessary to raise the ground level for about 30 cm. 20m wide access road from trunk road to factory site is planned for construction.

4-5-2 Factory Layout

Factory layout for the production capacity of 600,000 - 900,000 gross is described in Fig. V-5. Required space for the site and factory is as follows, in general.

1) Required Space Area

100 x 150 = 15,000 m^2

2) Space for Building

(A)	Production factory	Total	34 x 75 = 2,500 m^2
(a)	Compounding room		20 x 17 = 340 m^2
(b)	Manufacturing room		40 x 17 = 680 m^2
(c)	Drying room		15 x 17 = 255 m^2
(d)	Testing room		15 x 20 = 300 m^2
(e)	Packing room		15 x 20 = 300 m^2
(f)	Inspection room		15 x 10 = 150 m^2
(g)	Laboratory		15 x 10 = 150 m^2
(h)	Temporary warehouse		15 x 15 = 225 m^2