4－5　現存の設備で将来Serpongで使えると思われる設備リスト

EQUIPMENT LIST

1. AUTOCLAVE WITH CONTROLLER .... 1 set
   OGAWA SEIKI CO., LTD. 500 g
   MODEL, OSK 1714

2. ELECTRIC FURNACE .... 2 sets
   TSH - 635 120 V 6 KVA MAX.TEMP. 1600°C

3. ELECTRICAL FURNACE
   LINDBERG, TYPE 59545, 240 V 6 KVA

4. DISTILLATOR .... 1 set
   AUTO STILL MODEL WS-22

5. ELECTRONIC READING BALANCE
   LIBROR MODEL ED-200 .... 1 set
   LIBROR MODEL EB-H 2000S .... 1 set

6. pH METER .... 1 set
   MODEL, UC-22, DIGITAL pH/ORP METER

7. MICROSCOPE .... 1 set
   OLYMPUS, MODEL POS

8. SHAKER .... 1 set
   IKENOMOTO RIKA KOGYO 100 V, 3 A

9. MUFFLE FURNACE .... 1 set
   NUMBER, MODEL N20H, 220 V,
   MAX.TEMP. 1340°C, 15.7 A, 6 KW

10. PERISTA PUMP .... 2 sets
    ATTO : MODEL SJ-1211

4 － 6　過去５年間の試験結果

General Description on the Experimental Results

A. Mineralogical Studies

A-1 We used the test ore samples from Pomalaa mine. These test ore samples were composited of serpentinic and limonitic ore, and the mixed ore from serpentinic and limonitic ore was utilized for hydrometallurgical investigations.

A-2 As the results obtained from an ethylene glychole leaching test, heating test at 550°C and X-ray diffraction on limonitic ore, it was clarified that clay minerals in limonitic ore is consisted of halloysite, chlorite and montmorillonite.
Clay minerals in serpentinic ore were so scanty that can be neglected.

A-3 Main minerals in limonitic and serpentinic ores were as follows:

A3-1 Limonitic ore
Goethite, Hematite, Magnetite, α-quartz,
gibbsite, Halloysite, Chlorite, Bayerite

A3-2 Serpentinic ore
Antigorite, α-quartz, Clino-enstatite,
Magnetite, Chrysotile

A-4 As the results of heating test, X-ray diffraction and infrared absorption spectrum, antigorite was decomposed and recrystal lization to forsterite was begun at 870-900°C.

B. Reduction Roasting Researches

B-1 When the external iron powder as substitutional reagent was used, many excessive iron oxides remained in the reduction roasted ore and it seemed wustite mainly, and the iron solubility therefore, was kept high level.

B-2 To decrease the solubility of iron, wustite should be transformed to maghemite, hematite and/or magnetite. We adopted, therefore, the reduction-steam reasting-oxidation-autoclave leaching procedure, and by these procedures the solubility of iron could be depressed perfectly.

B-3 To utilize the iron oxide as the substitutional reagent, the iron oxide in which be reduced by the reduction procedure from goethite in limonitic ore was ultimately considered.

B-4 As a hydrometallurgical procedure of serpentinic ore, the use of a small amount of the external additive silica and limonite ore, and the following reduction-steam roasting-autoclave leaching process with diluted sulfuric acid appeared an available procedure. However, solubility problem of magnesium still remained.

B-5 Addition of the combination of calcium chloride and pyrite differed an appearance of extraction curve of nickel.
Notwithstanding pyrite of 1.0 percent was added, extraction of nickel had no-detrioration.

B-6 The combinations of the additive sodium chloride and pyrite were also tested.
Nickel extraction was deteriorated considerably in comparison of the combination of calcium chloride and pyrite. Nickel extraction was deteriorated with increasing of sodium chloride dosage.

B-7 The experimental results were clarified that 0.5% pyrite, 2 to 3% calcium chloride, reduction temperature of 700°C to 800°C and reduction time of 60 minutes were enough.
From these results, new process by the additive calcium chloride and pyrite and ammonia leaching seemed to be applicable procedure to Pomalaa mine ore.

B-8 Reduction gas compositions of hydrogen gas and carbon monoxide gas were also changed in wide range. In spite of variation in the gas composition in wide range, nickel extractions were kept at a certain value.

B-9 Combination tests of Indonesian low sulfur bearing coal and sodium chloride were also carried out for the improvement of nickel extraction. Optimum dosage of sodium chloride was 5.0 percent.

B-10 Australian high sulphur bearing coal consumption of 2 - 3 percent improved nickel and copper extraction.

B-11 Comparison of powder and pellet under using of 10 to 15 percent coal addition was also carried out.
Investigations of pellet reduction under using of 10 to 15 percent coal addition were clarified to be enough as hydrogen and carbon monoxide gas producer.

B-12 We investigated the antogenus reduction process. In using of 10 - 15 percent coal, 2 - 3 percent calcium chloride and pyrite less than 1.0 percent or native sulfur less than 0.5 percent, pellet antogenus reduction process was most applicable for Pomalaa mine ore. This process was not necessitate the external reduction and/or non-reduction gas.

C. Purification of the Ammonia Leached Liquor.

Purification of the ammonia leached liquor by ammonium dihydrogen phosphate was carried out.

The experimental results were statistically analyzed. Magnesium impurity was predominatly rejected.

0.76 equivalent concentration of ammonium dihydrogen phosphate was needed for 80% rejection of magnesium, in that case, nickel and copper rejection were 3% and 1.2% respectively.

D. Solvent Extraction

D-1 Before solvent extraction, the ammonia leached liquor was acrated at 70°C for ammonia stripping and cobalt oxidation.

D-2 Aeration at 70°C and 180 minutes was enough for these purpose.

D-3 Alkyl phosphoric, alkyl phosphoric and carbonic acid extractant were investigated to the ammonia stripped liquor. Alkyl phosphoric extractant was selectively excellent. Ammonia stripping and base metal stripping from the loaded organic phase, however, were very difficult.

D-4 Cobalt complex changed to cobalt (III) after ammonia stripping and oxidation.

Because of it, straight deferential process was ultimately investigated.

In this process, nickel and copper were primarily co-extracted by carbonic acid extractant and that raffinate was then reduced from cobalt (III) to cobalt (II) by cobalt metal.

Ammonia concentration in finally stripped nickel and cobalt electrolyte was negligible and separation of nickel and cobalt was perfect.

This process seemed to be applicable process.

4－7　バンドンにおける今後の試験予定

EXPERIMENTAL SCHEDULE IN NEAR FUTURE

1. Investigation of reduction-roasting and leaching procedure on Gag/Gebe mine ore with small scale electrofurnace.

2. Investigation of autogenus reduction roasting with large scale electrofurnace.

3. Investigation on impurity ions rejection from ammonia leached liquor.

4. Investigation on recrystallization of nickel and cobalt metal from ammonia leached liquor and making of metal oxide powder.

5. Investigation on BNC and following solvent extraction.

6. Investigation on bulk and selective differential solvent extraction from ammonia leached liquor.

7. Investigation on reduction from cobalt (III) to cobalt (II) with cobalt metal shot.

8. Investigation on electrowinning.

4－8　インドネシア共和国低品位ニッケルラテライト鉱研究開発計画基礎資料
（資源エネルギー庁鉱業課編）

インドネシア共和国

低品位ニッケルラテライト鉱研究開発計画基礎資料

昭和６２年１月

通商産業省

資源エネルギー庁鉱業課

1. ラテライトとは？

日本語は紅土。鉄、ニッケル、コバルトを含む地層（土）を指し、世界的にはニューカレドニア、インドネシア、フィリピン、キューバ等の地域に賦存している。ラテライト中には主としてニッケル鉱石（酸化ニッケル鉱）が多量に賦存している。今後の開発利用が期待される重要な資源である。

2. ニッケル鉱石としてどのようなものがあるか？

ニッケル源として硫化鉱（ Sulphide Ore ）及び酸化鉱（ Oxide Ore ）があり、現在ニッケル生産の６０％は硫化鉱を使用している。酸化鉱については、そのほとんどがラテライト中に存在しているが、高品位鉱のみ利用されている。

3. 硫化鉱と酸化鉱の埋蔵量は？

世界の埋蔵量を比較すると、酸化鉱（１５０〜２００×１０　Ni−トン）は硫化鉱（４０〜４５×１０　Ｎｉ−トン）に比べ約４倍量以上のポテンシャルがある。

4. 何故、現在硫化鉱利用が多いのか？

硫化鉱は、選鉱プロセスにより、ニッケル品位を容易に高めたものを製錬原料として使用出来る為、経済的メリットが高い。逆に、酸化鉱は選鉱が出来ない為、製錬原料として低品位のものも多量に扱わねばならず且つ効率の充分に高い処理技術は確立されていない。

5. 将来のニッケル原料予測は？

硫化鉱利用に傾いた開発がなされた為、次第に硫化鉱源の枯渇に拍車をかけており、近い将来酸化鉱への依存が大きく増加する見込である。

6. インドネシアのニッケル資源は？

ニューカレドニア、フィリピン、キューバと共に４大ニッケル資源国として群を抜いており、インドネシアにおいてはその鉱種は全て酸化鉱（ラテライト）である。インドネシアの埋蔵量は（１５〜１８）×１０　Ｎｉ−トンが認められており、これは世界の約１０％に相当する。

7. ラテライト中のニッケル（及びコバルト）品位は？

通常、平均品位2.０％以上を高品位ニッケル鉱と称しそれ以下を低品位ニッケル鉱という。低品位鉱は未探査も多く、一説には無尽蔵ともいわれている。
又、有用副産物であるコバルトの品位は、鉱床により大きくばらつき、0.０１〜0.２０％程度である。

8. 現状のラテライト品位別利用状況は？

高品位鉱のみを選別利用しているのが現状で、殆どの低品位鉱は未利用で放置されている。これら高品位鉱の大半は電気炉（まれに熔鉱炉）を利用した乾式製錬法により、ステンレスに代表される特殊綱用原料となるフェロニッケル（ニッケル品位が２０〜２５％）として回収されているが、この製錬法では低

品位鉱を使用して販売可能なNi品位のフェロニッケルを得ることが技術的にも、経済的にも困難である。

9. ラテライトよりNiを回収する処理技術としてどのような方法があるか？

8項で述べた乾式法、及び湿式法がある。それらの要点は下記の通り。

a．乾式法：
- 2%以上の高品位鉱を利用（低品位鉱では回収効率が湿式法より低い）
- 20～25%Niのフェロニッケルを産品とする。（低品位鉱では販売可能なNi品位のフェロニッケルを得られない）
- エネルギーコストが高い。（23000～25000 KWH/Ni－t）

b．湿式法：
- 低品位鉱も容易に適用可能
- ニッケルとコバルトを分離回収することが出来る。
- エネルギーコストが低い（約6000KWH/Ni－t）
- 製品としてフェロニッケルを必要とする場合、湿式法では得られない。

10. 湿式法とは？

ラテライト鉱石中のニッケル（コバルト）を強還元雰囲気炉で優先的に金属化した後、アンモニア液中で抽出をし、ニッケル（コバルト）を濃縮処理又は、メタルとして回収する方法を云う。……この方法はNicaro Process（又はCoron Process）と呼ばれる。

11. ラテライト処理と湿式法の展望は？

ラテライト鉱床は、地層の深度により高品位、低品位が共存介在分布し、高品位部分のみを取り出すのは無駄が多く、且つ山の寿命を極端に縮めることになる。また、9項で述べたように湿式法は利点も多く今後高効率湿式処理法の技術開発及び実用化が進むことが考えられる。

12. 日本型改良ニカロ法とは？

10項で述べたNicaro Processはキューバに於いて最初に実用化されたプロセスであるが、生産コスト及び総合ニッケル収率の点で充分とは云えず、それをベースに各種の改良法が生まれている。
日本に於いても、その全プロセスの段階的改良を加えた研究が行なわれ、パイロットレベルでの技術的な確立を得た。（昭和50年度には通産省の重要技術研究開発費補助金の交付を受け、「低品位ニッケル鉱の湿式製錬技術に関する工業試験」を実施。その際はSMM法と呼んでいた。）それが日本製改良ニカロ法であり、優れた技術として世界の高い評価を得ている。

13. その特徴と利点は？

①前処理で鉱石の過乾燥、過粉砕が必要でない。
②高価な還元剤(H_2、Coガス)の代りに安価な石炭を使用出来る。
③硫黄系原料の添加により還元性を高め、幅広い鉱種に適用出来る。
④堅型還状キルンの適用により熱効率及び還元率を実用化時極限に迄高めることが出来る。
⑤アンモニア抽出条件の改良により還元されたＮｉの略々100％の抽出を得られる。
⑥Ｍｇ、Ｆｅ、Ｚｎ、Mn等の不純物を系内浄液法で除去出来る。
⑦総合Ｎｉ収率を９２％以上得られる。
（基本ニカロ法は７５％位で、他の改良法も８０～８５％位）
⑧エネルギー原単位の概略は、還元炉部分で約６０ℓ／ＴＤＯ（重油換算）及び全プロセス５０００～６０００KHW/Ni－t と非常に少ない。
例えばニカロ法では前者が約８０ℓ/TDO、後者が約７０００ KWH／Ｎｉ－ｔと云われている。

14. 日本型改良ニカロ法で処理出来るラテライト品位とそれにより得られる製品は何か？

高品位鉱はもちろんのことかなり低い低品位鉱まで使用可能となるが、経済的には市場のNi価格により採算品位は左右される。また、プロダクトはアンモニア抽出後、炭酸ニッケル（ＢＮＣ＝Basic Nickel Carbonate)を得ることも出来るが更に金属ニッケル（９９.９％）及び金属コバルト（９９.９％）を分離回収出来る。

15. それらの製品はどの様に利用されるか？

乾式法により得られるフェロニッケルは、ステンレス系特殊鋼に限られるが、湿式法（日本型改良ニカロ法）により得られるプロダクトの用途は広い。
①金属ニッケル……電気通信機械、電子材料、各種メッキ用高ニッケル特殊鋼、貨幣用等に使用される。
②金属コバルト……航空、宇宙材料、エレクトロニクス、各種メッキ用等超高級特殊鋼として使用される。
③炭酸ニッケル……酸浸出、仮焼等により容易に硫酸ニッケル、酸化ニッケルに転化出来、医薬品、触媒、科学薬品及びその他工業材料として広く使用される。

16. 日本型改良ニカロ法をインドネシアに技術移転する研究テーマとして妥当と考えられるか？

日本型改良ニカロ法は４年間派遣専門家及びカウンターパートであるＬＭＮが実施してきた基礎研究に基本的に合致する方式であり、広くインドネシア産ラテライトに適用可能である。具体的メリットとしては、
①未利用の低品位ラテライトが大量に放置されており、原料コストは極めて低い。
②低品位ラテライトは、大量処理が必要であり、輸送コス

トのかからない山元での処理が有利。

17. 本プロジェクトの資源政策上の意義と効果は？

①従来経済価値が低かった低品位Ni鉱（Ni 2%以下）のメタルを経済的に採取することにより、資源の拡大化、インドネシアの経済自立化の一助となる。また、世界的ニッケル資源の拡大にもなる。
②本協力を通じて日本のニッケル源の将来の有望な供給国として確保出来る。
③本プロジェクトの起業化による雇用の確保
④インドネシアに於ける冶金部門の基礎研究レベルのアップ

18. インドネシアに於けるニッケルの需給は現在どうなっているか？

インドネシアはニッケル原料を輸出する一方でニッケル製品を輸入しているのが現状であり、その数量は下記の通り。

①生　産

	1983年	1984年	1985年	
・Ni鉱石	737,000 t	830,000 t	830,000 t	全量日本向（P.T.アネカタンバン）
・Fe-Ni（Ni純分）	4,855Mt	4,827Mt	4,802Mt	ヨーロッパ及び日本向（P.T.アネカタンバン）
・MATTE（Ni純分）	18,288Mt	22,815Mt	24,946Mt	全量日本向（P.T.インコ・インドネシア）

②消　費

・金属ニッケル	約 3,500Mt/年	全量輸入
・ステンレス鋼	Ave. 9,200Mt/年	全量輸入

19. 日本のニッケル原料及び地金の輸入及び消費の状況は？

①ニッケル鉱の輸入量（×1000トン）

	ニューカレドニア	インドネシア	フィリピン	合計
1983年	2,227	1,497	953	4,677
1984年	2,535	1,781	1,407	5,723
1985年	2,804	1,743	1,484	6,031

②ニッケルマット及び他の中間原料の輸入量（トン）

	インドネシア	オーストラリア	その他	合計
1983年	47,800	35,200	—	83,000
1984年	53,200	41,300	1,700	96,200
1985年	61,500	43,700	1,500	106,700

③金属ニッケルの輸入量と総消費量（トン）

	輸入量	総消費量	輸入先
1983年	26,822	51,286	カナダ、ソ連、ノルウェー、
1984年	31,377	55,344	オーストラリア、ジンバブェ、
1985年	24,690	48,318	フィリピン、USA

④フェロニッケルの輸入量と総消費量（Ni－トン）

1983年	10,008	57,786	ニューカレドニア、ドミニカ
1984年	13,033	65,923	インドネシア、コロンビア
1985年	12,666	67,488	

⑤酸化ニッケルの輸入量と総消費量（トン）

1983年	3,813	16,699	キューバ、カナダ
1984年	2,013	18,562	
1985年	2,359	19,410	

4－9　「イ」側プロジェクト実施計画（案）

RESEARCH AND DEVELOPMENT
OF INDONESIAN LOW GRADE NICKEL LATERITES

IN CONNECTION WITH THE DEVELOPMENT
OF RDCM ACTIVITIES IN PUSPIPTEK SERPONG

RESEARCH AND DEVELOPMENT CENTRE FOR METALLURGY
INDONESIAN INSTITUTE OF SCIENCES

February, 1987

OUTLINE OF THE PROJECT

Project Title :

Research and Development of Indonesian Low Grade Nickel Laterites.

Location :

Puspiptek in Serpong, the Republic of Indonesia.

Executing Agency :

Research and Development Centre for Metallurgy, Indonesian Institute of Sciences

Implementation Time :

5 years (2 years for building and equipment installation).

Project Description :

Research and development and utilization of low grade nickel laterites play a significant role in foreign exchange earnings and contribute in the Indonesian economic development. It is, therefore, immediate supply of a complete set of pilot plant including building is urgently needed.

BACKGROUND OF THE PROJECT

Among Indonesian's abundant natural resources, minerals have become an important and a growing factor in the national development.

Although far from being extensively exploited, minerals have already become one of the main resources for the economic advantages and play a significant part in foreign exchange earnigns.

Nickel laterites is one of the most strategic mineral resources for Indonesia. From the point of view of its nickel reserves, recent calculation shows that Indonesia ranks No.2 in the world. Unfortunately, the utilization of these resources is still limited to the high grade ore (2.0% Ni up), which represents only a small part of the reserves.

The utilization of the low grade part of the deposits will be indispensable to Indonesia for the future. However, this effort of utilization will present many big problems technically as well as economically. To overcome these problems, careful and systematic research and development should be undertaken.

In this Research and Development, investigation of the nature of the ore and the appropriate metallurgical methods of treatment will be the most important subject.

This Research and Development programme should be realized through a cooperation between the Government of Indonesia and an advanced country in the field of nickel-metallurgy, to carry out laboratory experiment as well as pilot plant test.

Since 1981, Indonesia has been performing a basic test on Nickel Laterite in Research and Development Centre for Metallurgy, which gives quite good results and is now in final stage. However, Research and Development Centre for Metallurgy laboratory-analytical equipment is not completed. Therefore, in order to proceed all test quickly and precisely, as well as to set-up basic activities in The Research Centre for Science and Technology Complex, the Puspiptek, in Serpong, complete set of buildings, pilot plant equipment and laboratory are urgently required. In the meantime the RDCM - LIPI has been requesting separately dispatch of Japanese Experts and acceptance of Indonesian counterpart personnel in Japan on this Project.

NICKEL RESERVES IN INDONESIA

Company and deposits	Reserves 1985 Million of DMT (ore)		Reserves 1985 Avg. grade, % Ni	Ni metal content Thousand of MT
PT ANEKA TAMBANG				
Pomalaa	6	(sil)	2.45	147.0
	130	(ox+sil)	1.28	1,664.0
SE Kalimantan	56	(ox+sil)	1.50	840.0
Gebe	90.6		1.47	1,331.8
Obi	87.9	(ox)	1.20	1,054.8
Gag				
- cog : 0.8 %	170.2		1.49	2,536.0
- cog : 1.2 %	122.9		1.71	2,101.6
- cog : 1.4 %	92.8		1.87	1,735.4
- cog : 1.6 %	66.1		2.02	1,335.2
- cog : 1.8 %	46.2		2.21	1,021.0
- cog : 2.0 %	31.8		2.37	753.7
Pakal				
- cog : 1.4 %	5.5		1.77	97.3
PT INTERNATIONAL NICKEL INDONESIA				
Soroako-Sulawesi	180	(sil)	1.68	3,024.0
TOTAL INDONESIA	1.086.0		1.62	17,641.8

Rem. : ox=oxide ore, sil=silicate ore.

OBJECTIVE OF THE PROJECT

The objective of the project is to transfer the appropriate technology for the treatment of Indonesian low grade nickel laterites.

The pilot plant for low grade nickel laterite processing will be built in the Laboratory of Metallurgy in The Research Centre for Science and Technology Complex, the Puspiptek, in Serpong, West Java.

The pilot plant is planned to be able to treat about 1 - 3 tons of low grade ore per day.

The low grade nickel laterite ore will come from the PT Aneka Tambang mine or nickel deposit.

HARDWARE REQUIREMENT

<u>The Equipment of the Pilot Plant</u>

Equipment for the ore Preparation (Cap. 3 t/day)

Equipment for the Reduction Furnace (Cap. 3 t/day)

Equipment for Ammonia leaching (Cap. $5m^3$/day)

Equipment for Basic Nickel Carbonate Recovery (Cap. 90 kgs/day)

Equipment for the Solvent Extraction (Cap. 5 m^3/day Pregnant Solution)

Equipment for Electrowinning for Ni and Co (Cap. 450 litres/day Electrolyte)

<u>The Supporting Equipment (Laboratory Equipment)</u>

Analytical Equipment

Laboratorium Test Equipment

<u>Buildings</u>

Laboratory Building

Pilot Plant Building

Ore Store house

Canteen

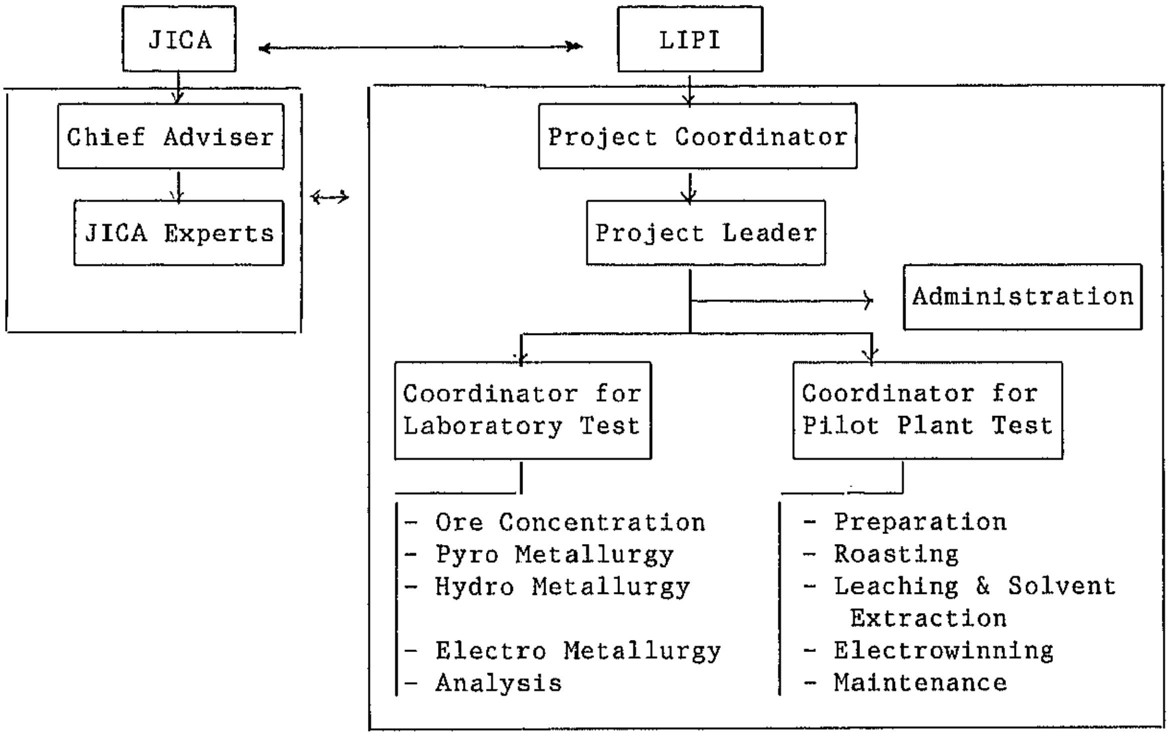
Other Buildings

PROPOSED PROCESS STEP

Ore --> PREPARATION ---> REDUCTION ---> LEACHING --> PURIFICATION AND METAL RECOVERY

PURIFICATION AND METAL RECOVERY --> Ni metal, Co metal

MANAGEMENT SYSTEM FOR OPERATION OF THE PILOT PLAN



PERSONNEL

Project Coordinator	: Head of RDCM
Project Leader	: Head of Extraction Metallurgy Division
Coordinator for Laboratories Test	: 1 person
Coordinator for Pilot Plant Test	: 1 person
Researchers	: 13 - 20 persons
Technicians	: 15 - 25 persons
Administration and Supporting Staff	: 5 - 8 persons

HOUSING

Staff housing : 10
Apartments, total rooms : 15

Those housing are expected to be ready before the completion of the physical construction of the project facilities in Serpong.

INFRASTRUCTURE

- Permanent road
- Electricity
- Gas
- Water
- Telephone

Will be provided and managed by Puspiptek Project.

ESTIMATED OPERATIONAL COST REQUIREMENT

(in thousands Rp)

	Preparation		Operation			Evaluation
Fiscal year / Items	87/88	88/89	89/90	90/91	91/92	92/93
Additional Salary	19,500	30,000	60,000	60,000	40,000	20,000
Material	14,000	40,000	75,000	75,000	40,000	30,000
Travel	1,500	20,000	30,000	30,000	30,000	20,000
Utilities	-	20,000	75,000	75,000	45,000	25,000
Others	500	10,000	30,000	30,000	15,000	5,000
T O T A L	35,500	120,000	270,000	270,000	170,000	100,000

ERSONNEL OF EXTRACTION METALLURGY DIVISION

Head of Extraction Metallurgy Division	: Ir. Yusuf
Head of Ore Concentration Laboratory	: Ir. Kamarijanto
Head of Pyro Metallurgy Laboratory	: Ir. Djusman Sajuti
Head of Hydro Metallurgy Laboratory	: Ir. Arifin Arif
Head of Electro Metallurgy Laboratory	: Ir. Eddy Dwi Tjahjono
Head of Process Development	: Ir. Ronald Nasoetion

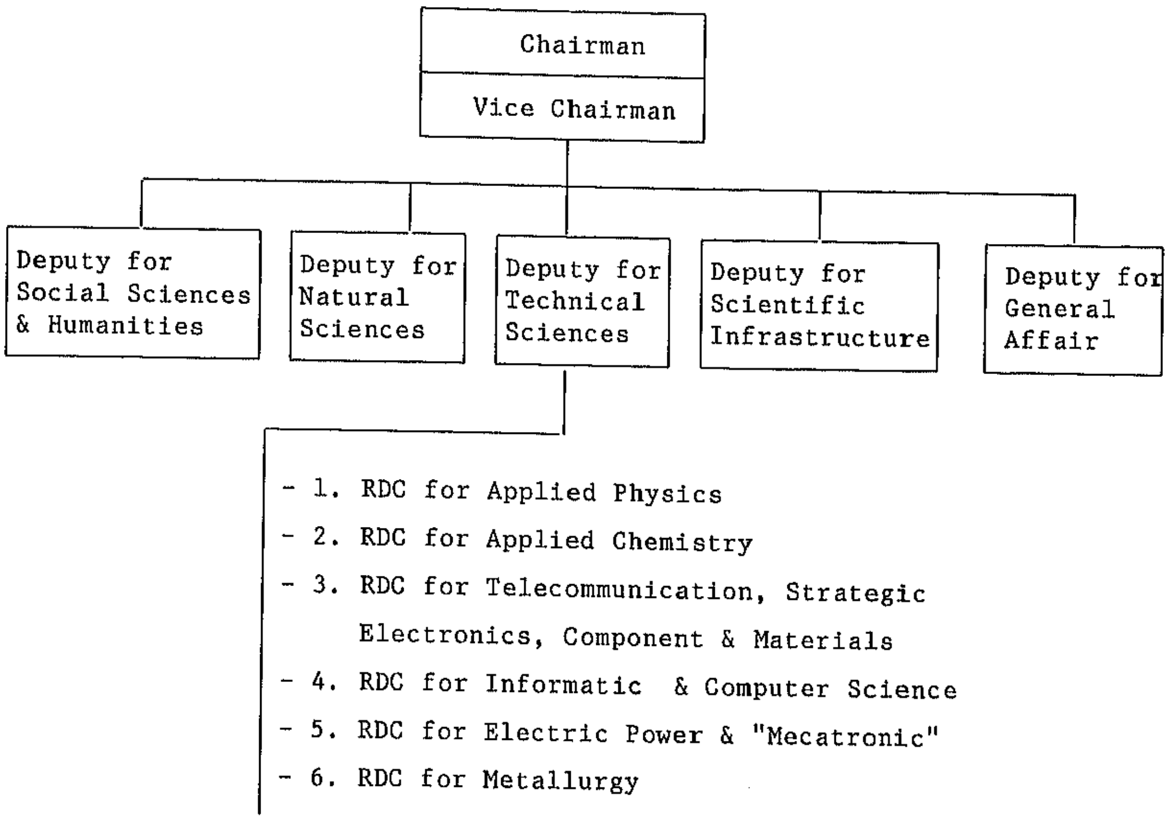
Researchers :

1. Ir. Rustiadi P.
2. Ir. Rahardjo Binudi
3. Ir. Sumantri
4. Ir. Agus Haryono
5. Ir. Puguh Prasetiyo
6. Ir. Asdiman Naibaho
7. Ir. Mining Harsanti
8. Ir. F. Firdiyono
9. Ir. Adil Jamali
10. Ir. Rudy Subagja
11. Ir. Akskadi Djohari
12. Wismail Siregar, B.E.
13. Immanuel Ginting, B.E.
14. Deddy Sufiandi, B.E.
15. Sudarjat, B.E.
16. Suharis, B.E.
17. Ismi Handayani, B.E.

Technicians :

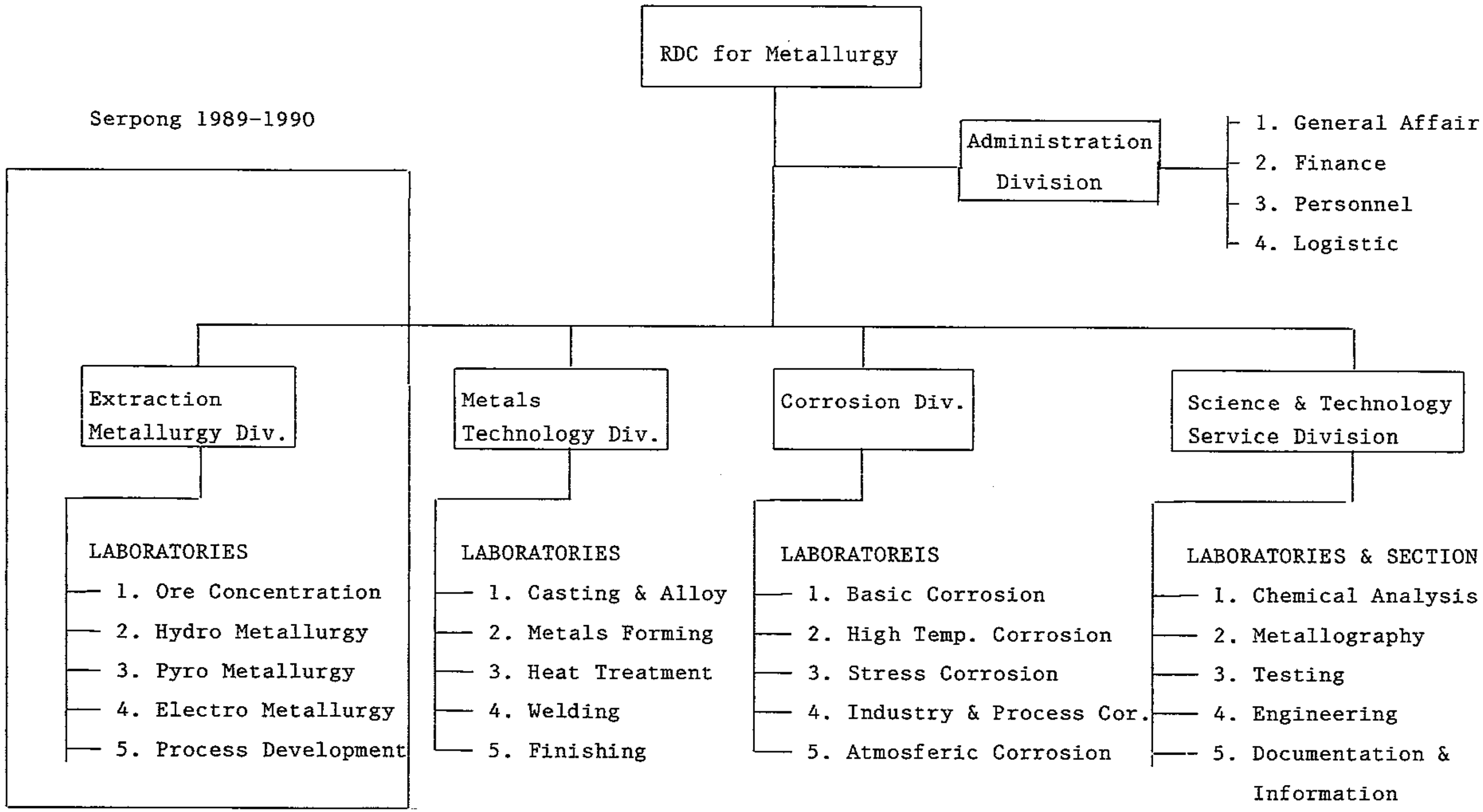
1. Samsu Bekti
2. Gunawan T.D.P.
3. Suhud
4. Mimin Suminar
5. R. Koeswara
6. Dibyo
7. Muhammad Yahya
8. David Herwana
9. Teteng Sobandi
10. Waluyo
11. Memet Slamet
12. Karlan
13. Sukiman
14. Asep Suhana
15. Ngadiyo
16. Yosep E. Kusmayadi
17. Eli Saut L.

INDONESIAN INSTITUTE OF SCIENCES



RESEARCH AND DEVELOPMENT CENTRE FOR METALLURGY

Serpong 1989-1990



THE MAIN OBJECTIVE AND ACTIVITIES OF RESEARCH AND DEVELOPMENT CENTRE FOR METALLURGY

The Research and Development Centre for Metallurgy (RDCM) as one of the government research institutes under the Indonesian Institute of Sciences has main objective to promote the development and dissemination of science and technology in the field of metallurgy. In line with the above objective, the activities of the RDCM cover a.o.:

* Research and development
* Studies
* Dissemination of information
* Technical and consultancy services
    - Contract research
    - Training and courses
    - Consultancy
    - Technical services
    - Information services
    - Etc.

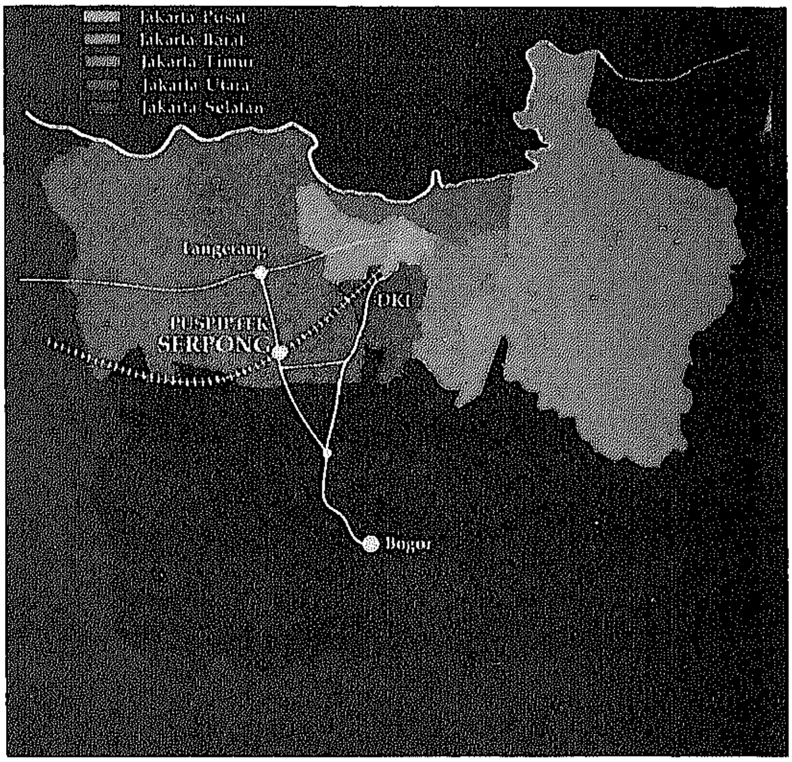
In the field of metallurgy (Extractive Metallurgy, Metal Technology, Corrosion) to public as well as to other government agencies.

RDCM DEVELOPMENT SCHEDULE

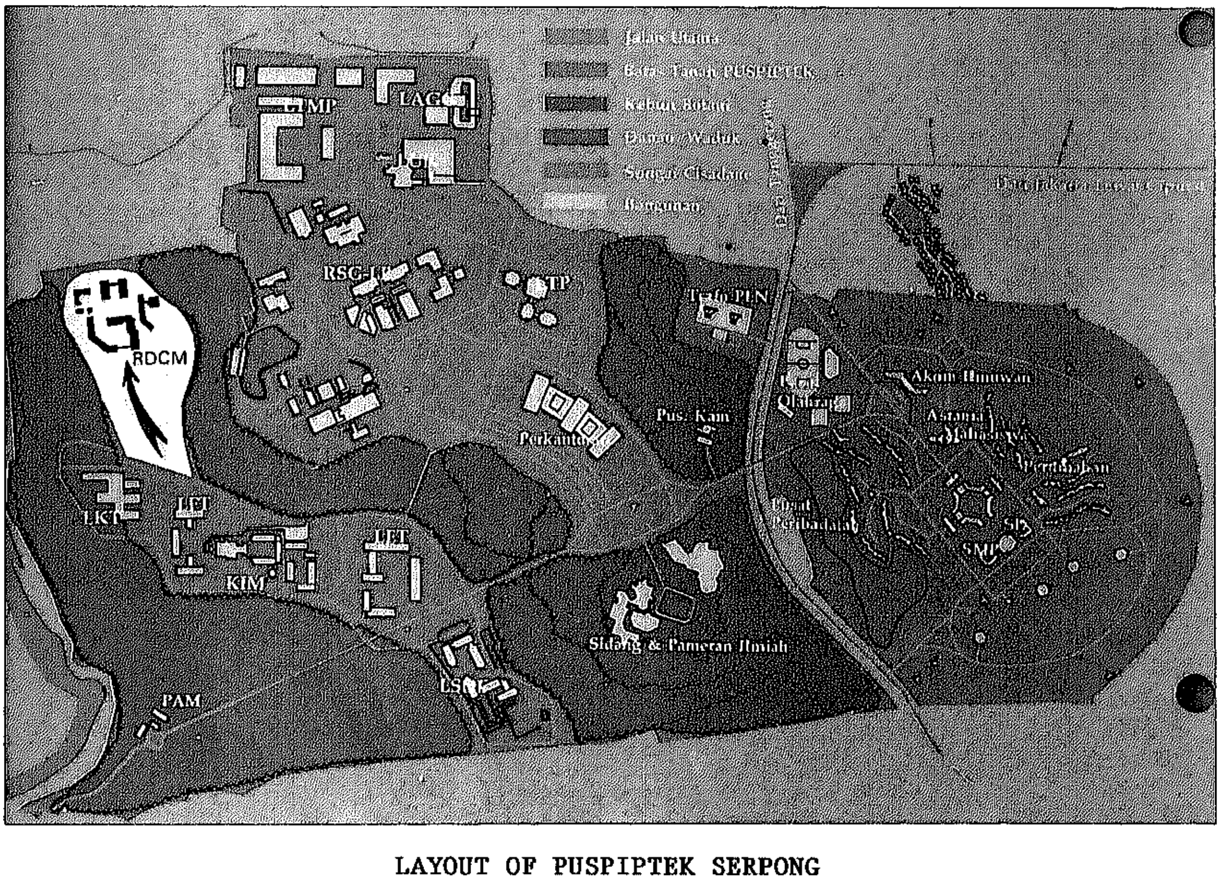
Fiscal Year / Division	87/88	88/89	89/90	90/91	91/92	92/93	93/94	94/95	Floor space
Administration					2500				2500
Science & Technology Service				1500			1500		3000
Corrosion			2250						2250
Metals Technology				1800			2000		3800
Extraction Metallurgy	2100					2000			4100

MANPOWER AND FLOOR SPACE (1994 - 1995)

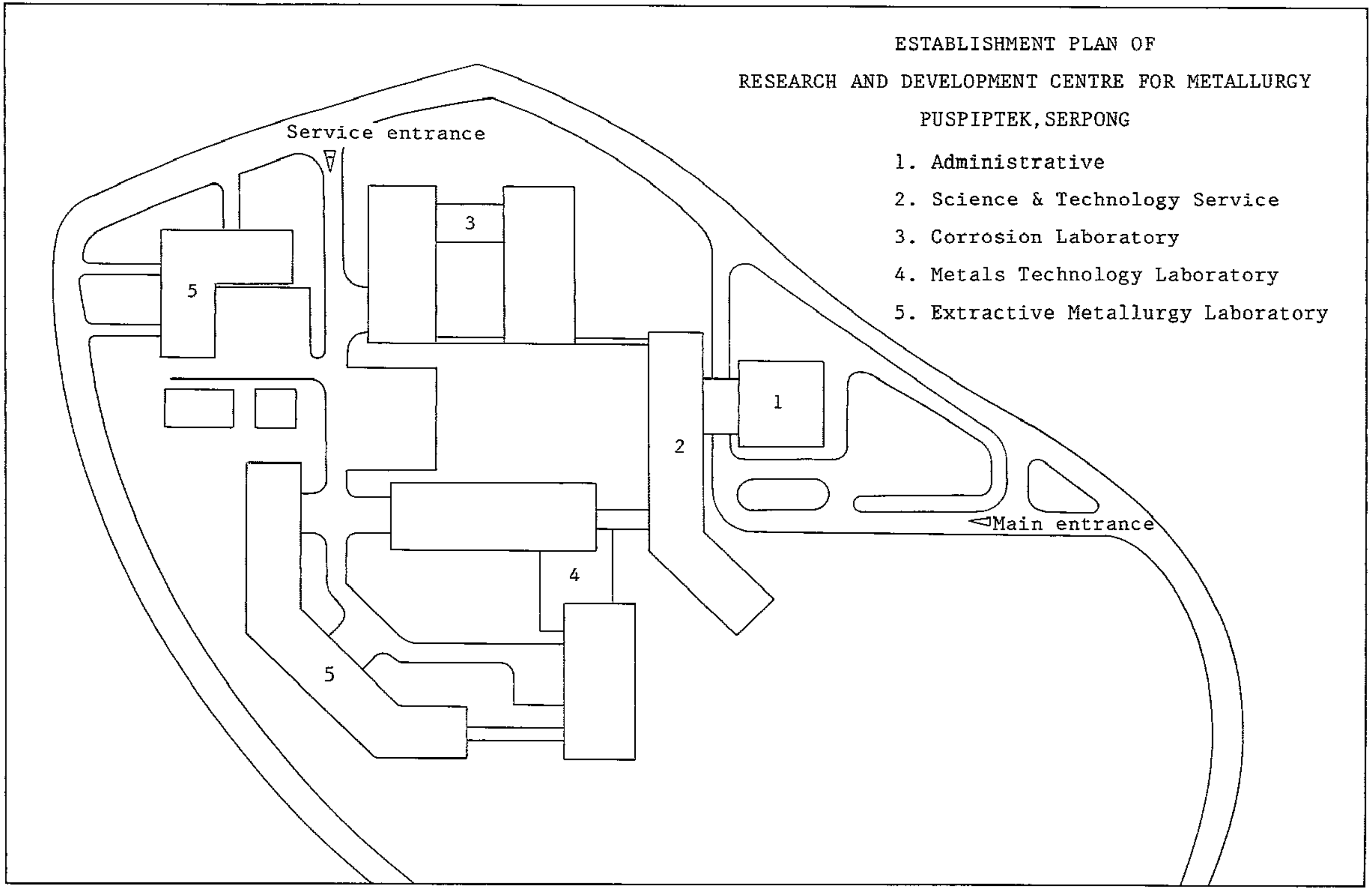
Division	Man Power	Floor Space (M^2)
Administration	51	2500
Science & Technology Service	85	3000
Corrosion	62	2250
Metals Technology	83	3800
Extraction Metallurgy	89	4100
T O T A L	370	15650

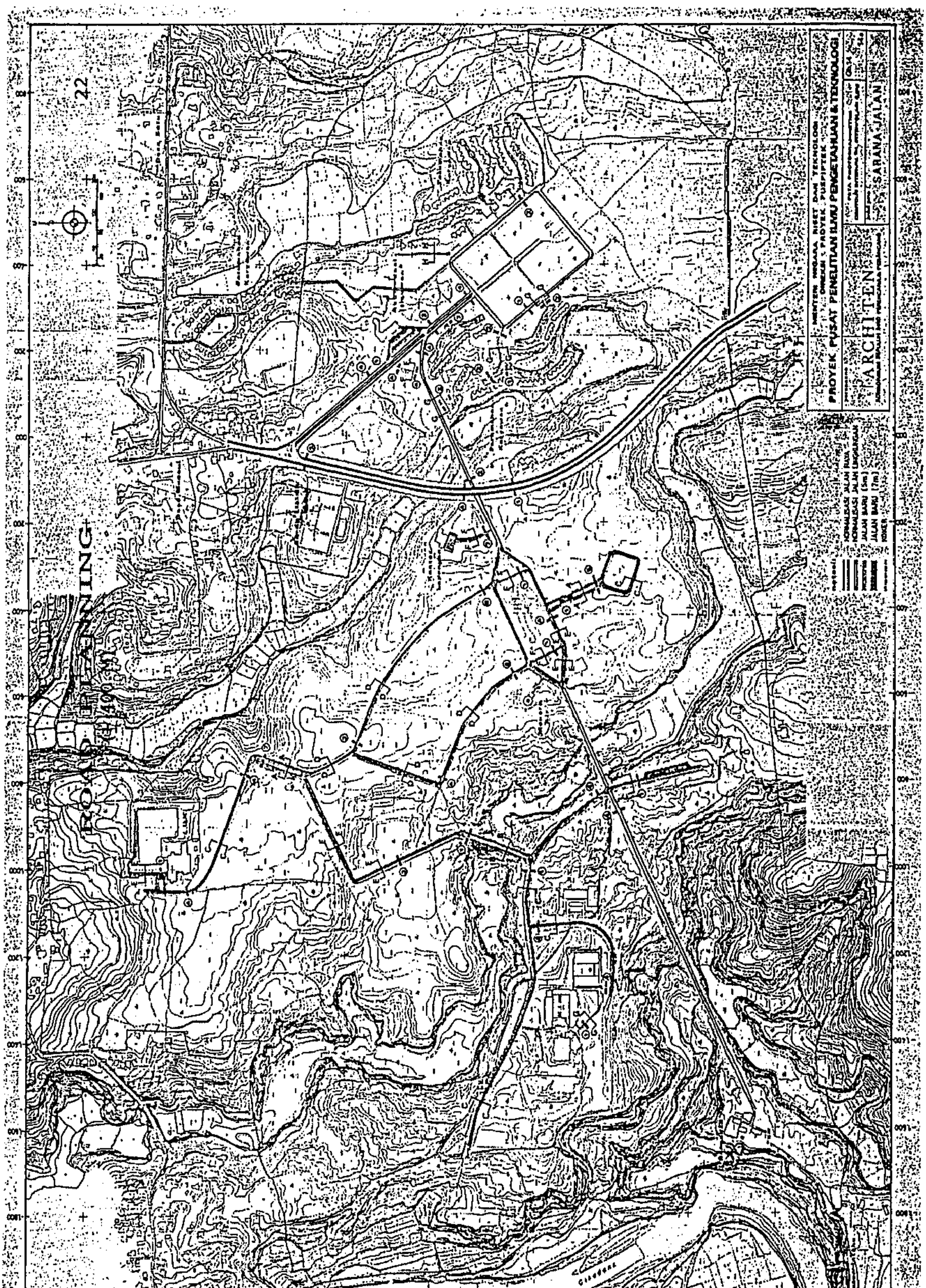


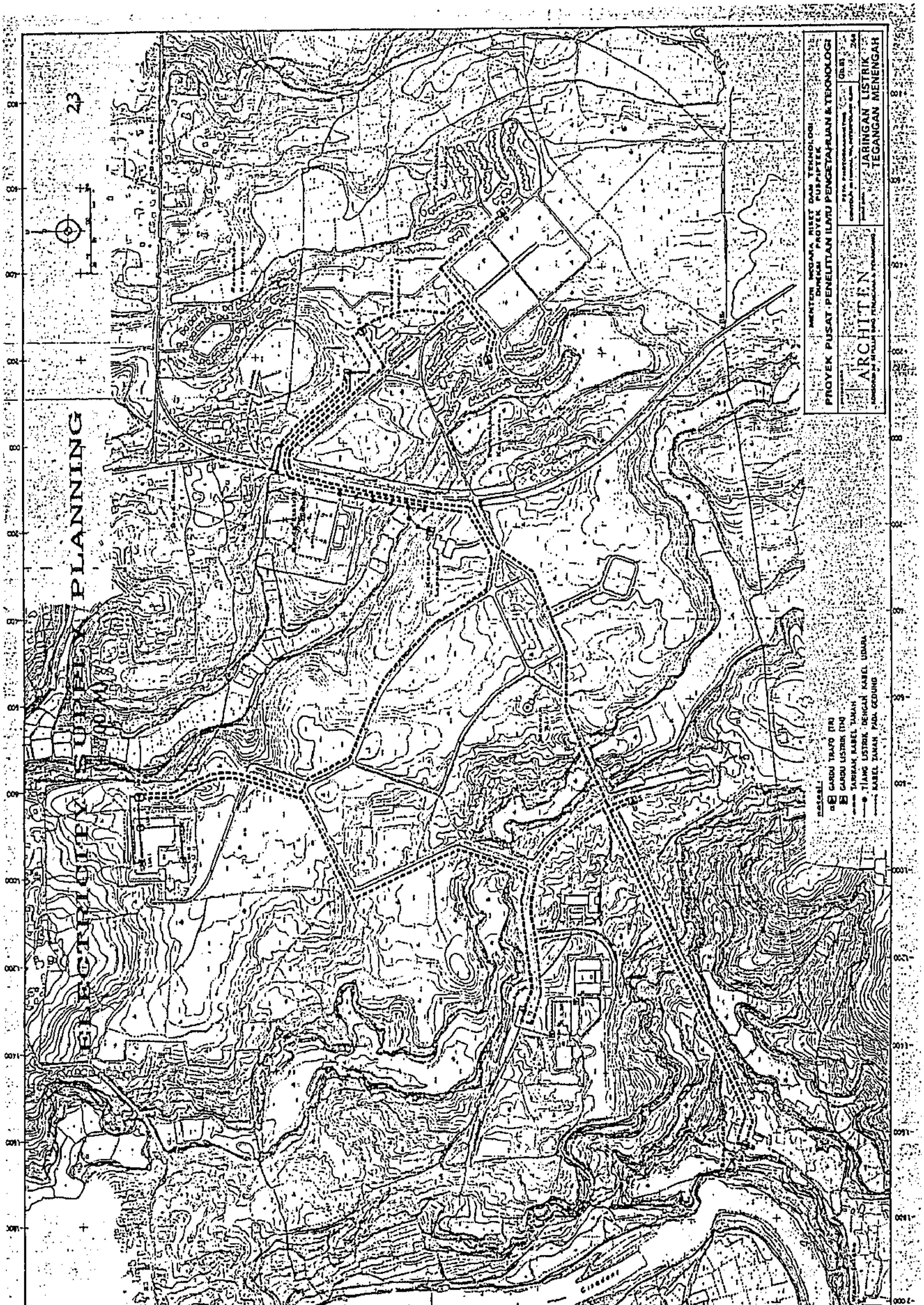
LOCATION OF PUSPIPTEK SERPONG

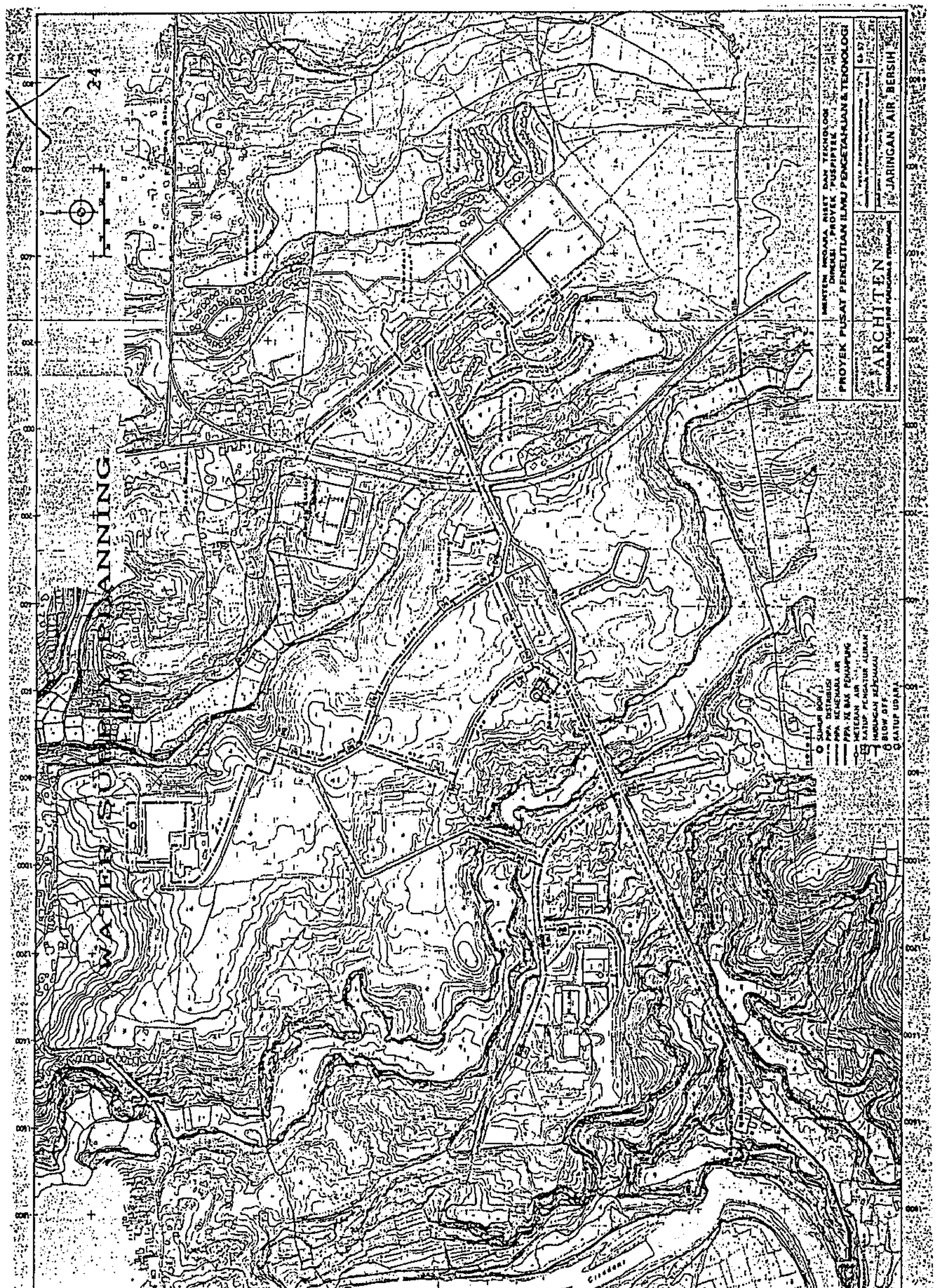


LAYOUT OF PUSPIPTEK SERPONG


ESTABLISHMENT PLAN OF
RESEARCH AND DEVELOPMENT CENTRE FOR METALLURGY
PUSPIPTEK, SERPONG
1. Administrative
2. Science & Technology Service
3. Corrosion Laboratory
4. Metals Technology Laboratory
5. Extractive Metallurgy Laboratory
Service entrance
Main entrance
1
2
3
4
5
5


22
ROAD PLANNING
MENTERI NEGARA RISET DAN TEKNOLOGI
PROYEK PUSAT PENELITIAN ILMU PENGETAHUAN & TEKNOLOGI
ARCHITEN
SARANA-JALAN


ELECTRICITY UTILITY PLANNING
23
MENTERI NEGARA RISET DAN TEKNOLOGI
DINEKSI PROYEK PUSPIPTEK
PROYEK PUSAT PENELITIAN ILMU PENGETAHUAN & TEKNOLOGI
ARCHITEN
JARINGAN LISTRIK
TEGANGAN MENENGAH
GARDU TRAFO (TR)
GARDU LISTRIK (TH)
TARIKAN KABEL TANAH
TIANG LISTRIK DENGAN KABEL UDARA
KABEL TANAH PADA GEDUNG
Cisadane


24
MENTERI NEGARA RISET DAN TEKNOLOGI
DIREKSI PROYEK PUSPIPTEK
PROYEK PUSAT PENELITIAN ILMU PENGETAHUAN & TEKNOLOGI
ARCHITEN
JARINGAN AIR BERSIH
SUMUR BOR
PIPA DISTRIBUSI
PIPA MENARA AIR
PIPA KE BAK PENAMPUNG
METERAN AIR
KATUP PENGATUR ALIRAN
BLOW OFF
KATUP UDARA

IMPORTANCE OF THE PROJECT FOR THE NATIONAL ECONOMIC DEVELOPMENT

1. Development of mineral industries, especially the low grade nickel laterites will improve the Indonesian economic profile in the form of:
    - export earnings
    - supply of raw materials for industries
    - remote area development
    - employment opportunities

2. Research and Development in the mineral processing field and its technology transfer will be very important in the development of Indonesian mineral industries.

3. Pilot plant for nickel laterite processing which covers almost every aspect of mineral processing, a.o : preparation, roasting, leaching, solvent extraction and electrowinning will become a strategic infrastructure for solving the mineral processing problems.

IMPORTANCE OF THE PROJECT FOR THE DEVELOPMENT OF RDCM

1. The project will provide Research and Development Centre for Metallurgy with basic facilities for the Extractive Metallurgy Division of the centre, and will become a fore runner for Research and Development Centre for Metallurgy activities in Serpong.

2. The project will provide Research and Development Centre for Metallurgy personnel with valuable knowledge and experiences necessary for its future development.

3. The project will provide Research and Development Centre for Metallurgy with experiences in the industrial cooperation, both in the national and international level.

JICA