タイ王国鉱工業プロジェクト選定確認
調査報告書(別冊—1)
TISTR関係資料

昭和61年9月

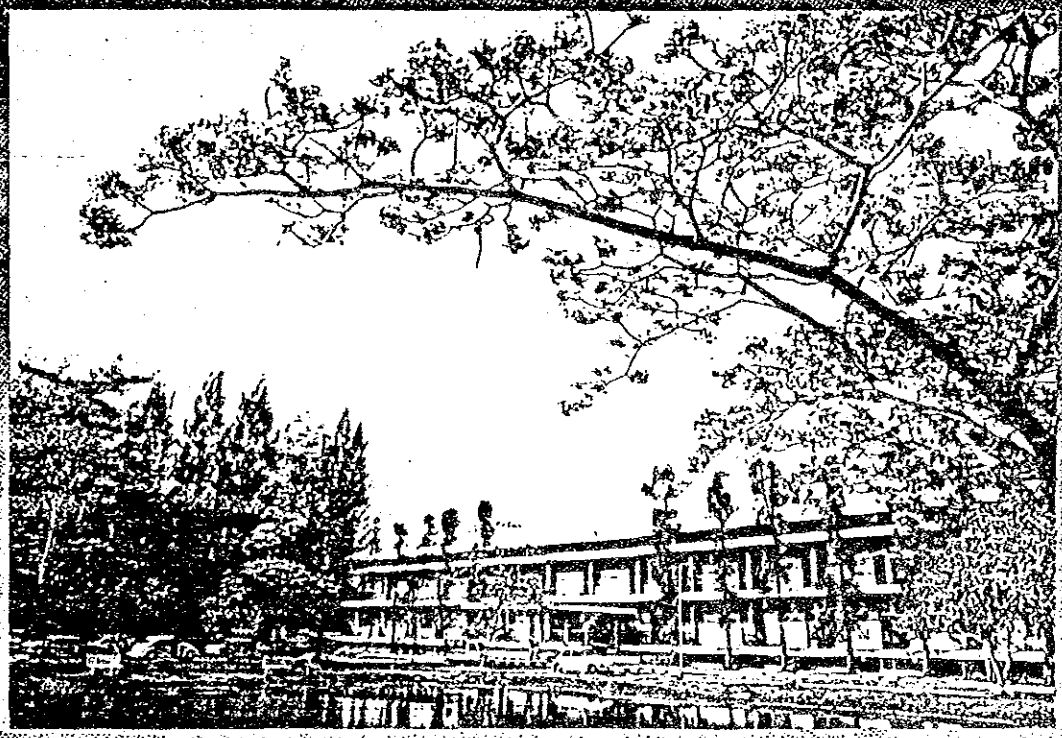
国際協力事業団

タイ王国鉱工業プロジェクト選定確認
調査報告書(別冊―１)
TISTR関係資料

昭和61年９月

国際協力事業団

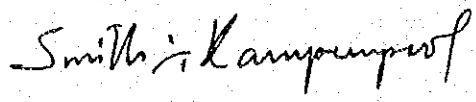
THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH



MINISTRY OF SCIENCE, TECHNOLOGY AND ENERGY

MESSAGE FROM THE GOVERNOR

Having been in existence now for more than two decades, the Thailand Institute of Scientific and Technological Research may be said to have come of age. During the past years, TISTR has re-aligned its R & D priorities in accordance with and in response to the country's needs. In addition to the increases in manpower, financial subsidy as well as other essential facilities, the increased experience and professional skill of our personnel are also vital to the competence of TISTR. It is necessary that TISTR continues to enhance its capability in order to serve the industrial development policy of the Minister of Science, Technology and Energy who has cleary emphasized that the provision of services, the promotion of employment and the important role in national development are the major responsibilities of TISTR



(Dr. Smith Kampempool)
Governor

HISTORY

The Thailand Institute of Scientific and Technological Research (TISTR) is a non-profit making state enterprise under the Ministry of Science, Technology and Energy (MOSTE). TISTR was originally set up by the Applied Scientific Research Corporation of Thailand Act B.E. 2506 (1963) which was repealed and replaced by the Thailand Institute of Scientific and Technological Research Act B.E. 2522 (1979) following the establishment of MOSTE in the same year.

OBJECTIVES

TISTR has the following objectives:

- To initiate and conduct research and to provide scientific and technological services to state agencies and private enterprises for economic and social development of the country;
- To conduct scientific and technological research in order to promote the utilization of natural resources appropriate to the economic conditions, environment, health and welfare of the people;
- To improve productivity in accordance with the Government policies by propagating the results of scientific and technological research to benefit the country in agriculture, industry and commerce;
- To train scientific and technological researchers;
- To provide for the testing and measuring services and other scientific and technological services.

TISTR'S MAIN POLICIES

- To expedite the policies of the Ministry of Science, Technology and Energy dedicated to promoting the country's scientific and technological efficiency with the aim of self-reliance. This will be done by giving encouragement, incentive, assistance and support for the use of the results of research and development to tackle economic and social problems on all fronts.
- To mobilize the country's human resource to work for the development of scientific and technological research in order to effect practical operational results. This includes measures for screening, controlling and distributing technology systematically, and also for encouraging local inventions and high technology productions in future.
- To operate as a "center of excellence" responsible for the provision of scientific and technological services, such as in testing and standards, supply of relevant information and consultation to the government and private sectors, both locally and regionally.
- To work in close cooperation with the private sector engaged in various enterprises and with research and development units in order to build up an atmosphere in which science and technology are seen as means by which the national problems may be solved.

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1963 - 1971

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October 16, 1964 - October 15, 1969

Mr. Insee Chandrastitya — Governor
November 16, 1969 - October 7, 1971

Mr. Tab Nilanidhi — Governor
October 7, 1971 - October 3, 1975

Mr. Wadanyu Nathalang — Governor
October 6, 1975 - June 22, 1979

Mr. Smith Kampempooi — Acting Governor
June 23, 1979 - March 23, 1980

Mr. Smith Kampempool — Governor
March 24, 1980 - Present

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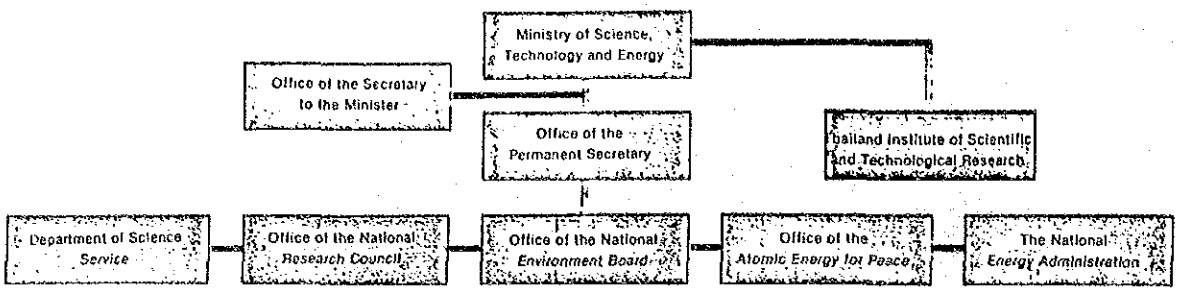
Deputy Governor

Santhad Rojanasoonthon, Ph.D.

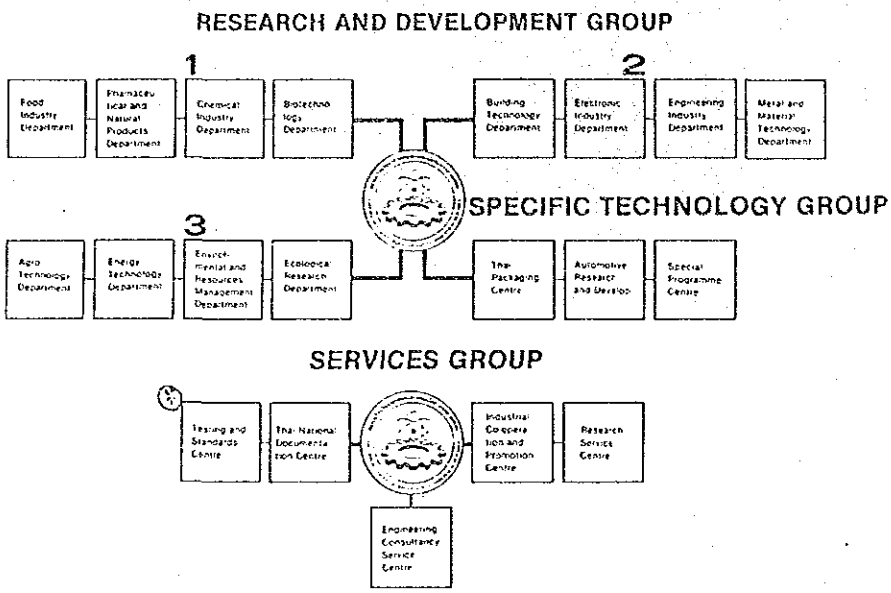
Deputy Governor

Yenchai Laohavanich, Ph.D.

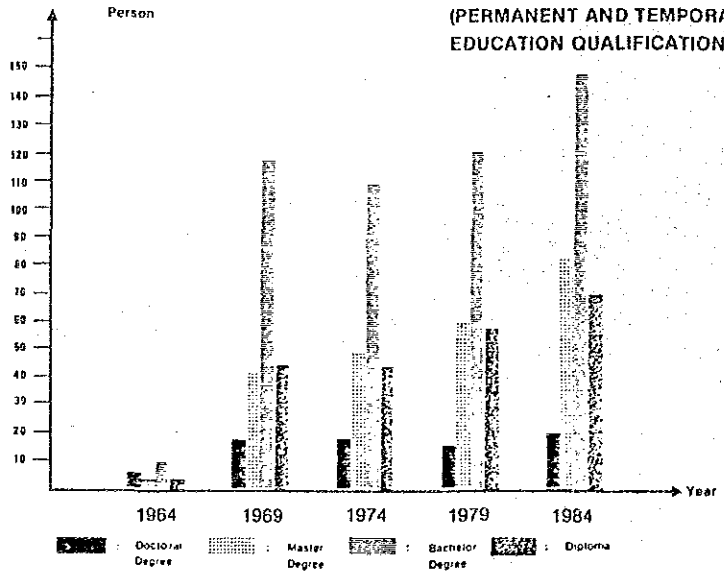
THE MINISTRY OF SCIENCE,TECHNOLOGY AND ENERGY (MOSTE) ORGANIZATION CHART



TISTR ORGANIZATION CHART : RESEARCH AND DEVELOPMENT AND SERVICES

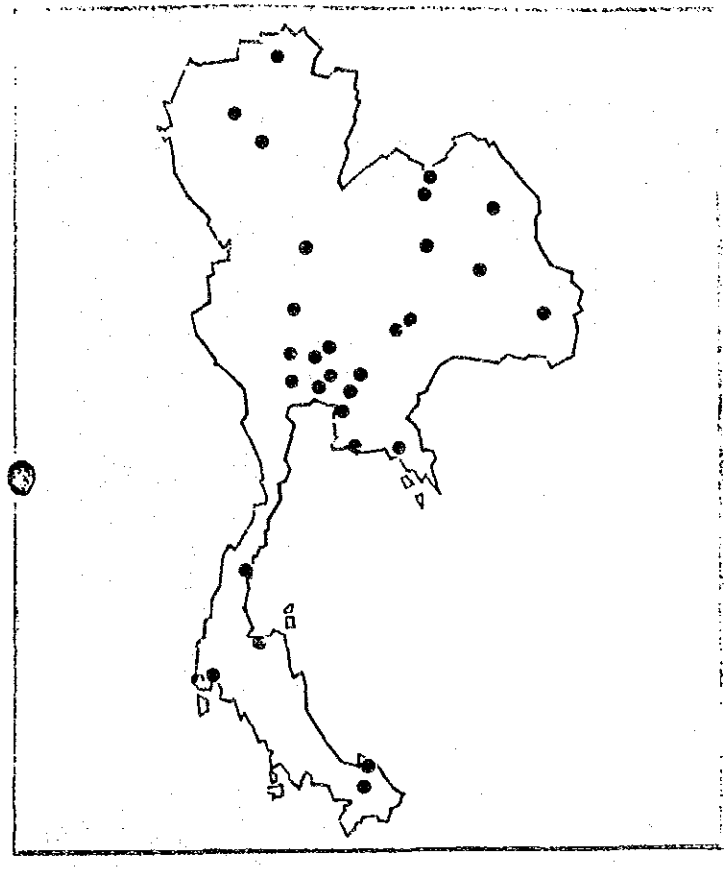


TISTR HUMAN RESOURCES : SCIENCE AND TECHNOLOGY STAFF (PERMANENT AND TEMPORARY) BY EDUCATION QUALIFICATION



ACTIVE RESEARCH AND DEVELOPMENT PROJECTS

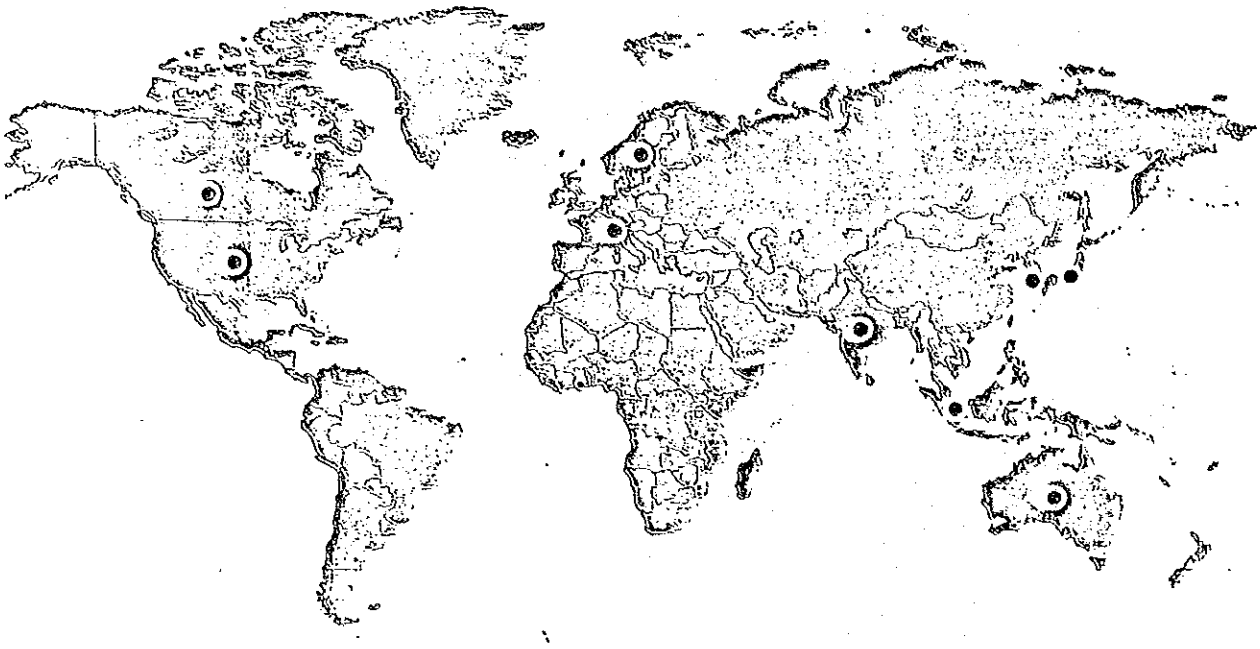
TITLES OF ACTIVE RESEARCH AND DEVELOPMENT PROJECTS BY SOURCES OF FUND



- TISTR FUND
- GOVERNMENT BUDGET
- PRIVATE SECTOR FUND
- OTHER GOVERNMENT AND STATE ENTERPRISES FUND (CONTRACTS)

- Development of Cassava Products
- Research and Technology for Rural Development in Khlong Muang Land Reform Area at Saraburi Province
- Low-Cost Portable Well Drilling Equipment up to 200 ft for Self-Help Village Uses
- Design of Low-Cost Reverse Osmosis Desalination Equipment for Brackish Water
- Process Improvement for Small-Scale Food Industry
- Fruit and Vegetable Postharvest Technology Implementation System
- Pre-Feasibility Studies on Some Potential Industries
- Study on Utilization of Alternative Energy Technologies for Rural Development
- Development of Bamboo Utilization in Rural Housing Construction
- Research and Development in Industrial Production of Essential Oils, Perfumery and Spices
- Pilot Project on Technology Transfer of Shiitake Mushroom Cultivation in the Northern Highlands
- Rural Housing Development of Piedmont Plateau Area of Prachinburi Province
- Development of Agricultural Technology for Coastal Sandy Soil According to His Majesty's Desire
- Establishment of Thai Packaging Centre
- Alcohol Production for Alternative Energy from Agricultural Materials
- Production of Solid Fuel to Substitute Firewood for Rock Salt Industry
- Facial Moisturizing Cream Development
- The Development of Rose Preparations
- Papain Production from Papaya Latex
- The Development of Garlic Natura Coating Tablets
- The Development of Lime Preparations from the Lime Waste
- The Development of Odourless Garlic Natura
- Aloe Preparation
- The Utilization of Papaya Waste
- The Development of Capsicum Oleoresin (Pilot Scale)
- The Development of Cream Mask
- The Development of Cleansing Cream
- Acute Toxicity and Male Sterility Tests of Epibloc on Six Rat Species
- Water Quality Monitoring Programme for Impact Evaluation of the Mining in Mangrove Forest, Bang Nai Si, Ta-kua Pa, Phangnga
- Electronic Smoke Precipitator
- Development on the Industrial Production of Pharmaceuticals from Thai-Traditional Pharmacopoeia
- Feasibility Study on Alcohol Production for Energy Substitution
- Environmental Impact Assessment of SEA PORT and LPG Distribution Depot Project, at Surat Thani Province
- Environmental Impact Assessment of Natural Gas Separation Plant Project, Map Ta Phut, Rayong (Petroleum Authority of Thailand, PTT)
- Environmental Impact Assessment of Offshore Mining, Provincial Administration Organization
- Master Plan for Tourism Development of Surat Thani Province, Tourism Authority of Thailand
- Supervision of Construction of Waste Water Treatment Plant at Ayutthaya Distillery, Liquor Distillery Organization
- The Development of the Production of Protinclure Ginger
- The Study on Anti-fertility Medicinal Plants
- The Development of "H.R.H. Princess Maha Chakri Sirindhorn Medicinal Plant Arboretum" of P.T.T. at Map Kha, Rayong
- Pre-Feasibility Study on Utilization of Alternative Energy for Water Lifting
- Feasibility Study of Biogas Application in Rural Areas
- Collection of Plants and Animals of Thailand
- Dusit Zoo Museum
- Sewage System and Solid Waste Management at Lampang Municipality
- Post Environmental Evaluation of Bang Lang Dam, Electricity Generating Authority of Thailand (EGATT)
- Survey of Priority Products in Chemical and Agro-Based (Food) Industries

OVERSEAS GRANTED RESEARCH PROJECTS



PROJECT TITLE	SOURCE OF FUND
• Fruit and Vegetable Post Harvest Technology Implementation System	IDRC,Canada
• Physiological, Chemical and Storage Characteristics of Mangoes (and some other tropical fruits) in South East Asia	ACIAR, Australia
• Processing and Preservation of — Fruit and Vegetable — Cereal, Legumes	Australian Government (ASEAN)
• Process Improvement in Small Scale Food Industry (Extension) : Mung Bean Noodle Factory	IDRC, Canada
• Study on Grain Amaranth Production in Thailand : Utilization as Food Products	NAS, U.S.A.
• Development of Microbial Culture Collection	UNESCO
• Alcohol Production for Alternative Energy from Agricultural Materials	JSPS, Government of Japan
• JSPS - NRCT Cooperation in Biotechnology	Government of Japan

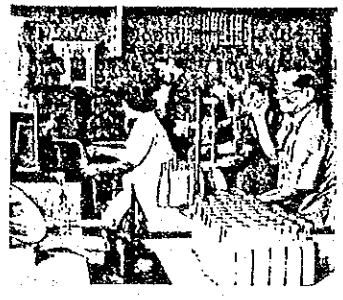
PROJECT TITLE	SOURCE OF FUND
• Development on the Industrial Production of Pharmaceuticals from Thai Traditional Pharmacopoeia	UNIDO
• Study on Vesicular-Arbuscular Mycorrhiza and Their Combined Effects with Nitrogen-Fixing Bacteria in Legumes	IFS, Sweden
• Field Trials and Testing of Selected Species of Fast Growing Nitrogen-Fixing Tree in Thailand	NAS, U.S.A.
• Production of Animal Feed from Cassava and Agricultural By-product in Thailand	KAIST, Korea
• Oil Seed Crops Development Programme	EEC
• Fruit and Vegetable Container (ASEAN Project)	Australian Government
• Winged Bean Seed Multiplication	IBPGR, FAO
• Development of Agricultural Technology for Coastal Sandy Soil According to His Majesty's Desire	FAO/RAPA

FOOD INDUSTRY DEPARTMENT (FID)

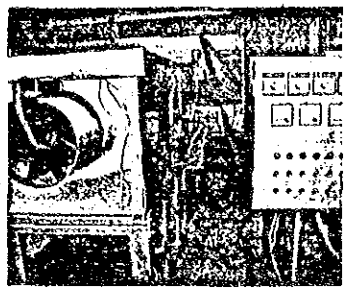
The Food Industry Department (FID) sets targets for research and development of the food industry to serve the demands of local market and/or export - oriented production and to solve problems encountered by industrial entrepreneurs. Operation of the FID includes R,D,E & I facilitating with laboratory and pilot plant; consultations for commercial production; transfer of technology to industrial sectors; and the analysis and testing of food products.

FID places emphasis on the following R & D activities:

- Post-harvest technology of agricultural *produce to reduce loss through handling,* transportation and storage; and to achieve suitable quality for export as primary commodities and for use as raw materials in the food industry;
- Production technology of small - and medium - scale processed food factories in order to achieve quality and efficiency;
- Processing of agricultural produce in order to add to their value and to permit export of processed food products;
- Design of processes, equipment and plant layout.

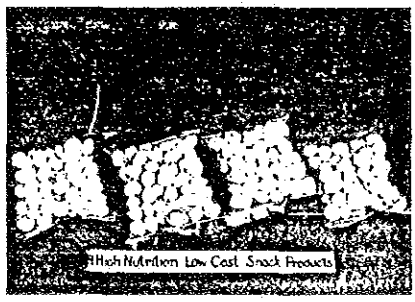


Processing of tangerine juice.



Garifier designed by TISTR for pilot-scale production of Gari.

High nutrition and low cost snack products.



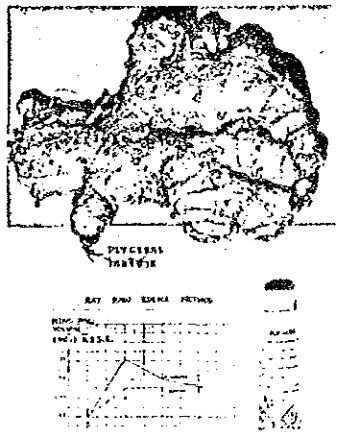
PHARMACEUTICAL AND NATURAL PRODUCTS DEPARTMENT (PND)

The Pharmaceutical and Natural Products Department (PND) carries out research and development activities leading to commercial production of medicinal plants in the form of raw materials, extracts, and drugs; as well as indigenous natural products which include essential oils, perfumeries, cosmetics, cleansing agents, other toiletries, and household preparations. Services for the analysis and testing of products under these categories are also available.

The operation targets of PND are as follows:

- To develop technology for the production of indispensable drugs from indigenous raw materials;
- To develop technology for the production of standard medicinal plants use as raw materials in the drug industry, both for export and for import substitution;
- To develop potential utilization of agricultural and industrial wastes; and
- To promote basic scientific and technological knowledge dealing with pharmacology, toxicology and clinical tests generally.

Ipomea pes-caprae has been proved by pharmacological and toxicological studies plus preliminary clinical test. to possess antagonistic effect against histamine, certain insects bites and jelly-fish burns without side-effects. Production of a drug from this medicinal plant is being developed.



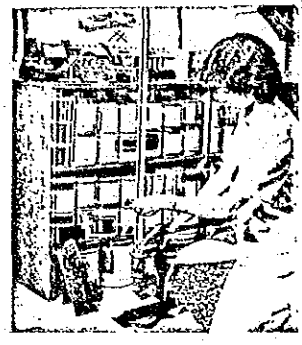
Anti-inflamatory active substance extracted from *Zingiber cassumunar* has been confirmed for its pharmacological property and therapeutic uses without undesirable side effects. Plygesal cream is being developed for economic evaluation and industrial production.

CHEMICAL INDUSTRY DEPARTMENT (CID)

Research and development conducted by the Chemical Industry Department (CID) are aimed at developing commercial products in response to the demands of local and foreign markets. Operations include the potential use of surplus and waste materials from the chemical industry to alleviate problems concerning production cost, process efficiency and pollution abatement, and improvement of existing technology appropriate to local chemical industries, as well as selection and modification of advanced technology for transfer to various industries.

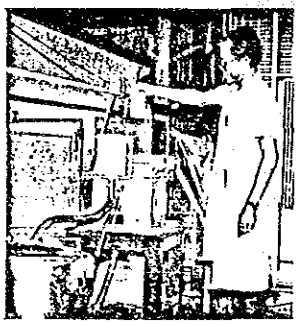
CID places its main emphasis on the following R & D activities:

- Fat and oil industry with special attention on the potential use of oil-bearing vegetables and improvement of processes for vegetable oil industry;
- Chemical industry in relation to fibers and textiles focusing on the potential use of tropical plants in chemical and paper pulp industries;
- Development of chemical formulary and processes; and
- Manufacture of certain products as import substitutes in the chemical industry.



Standard quality test of paints.

Simple process for prevention of aflatoxin in peanut oil by means of activated clay which increases the production cost by only 60 baht per ton of peanut oil.



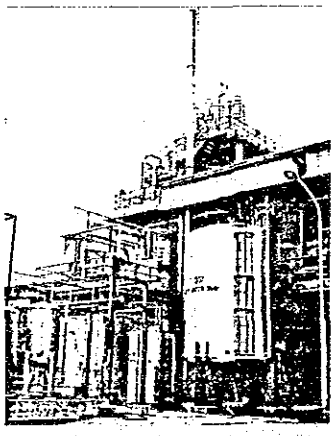
Research on the pulp production from fast growing plants and agricultural wastes

BIOTECHNOLOGY DEPARTMENT (BID)

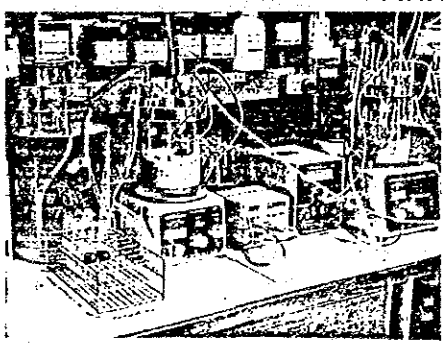
The research and development activities of the Biotechnology Department cover all areas of technology based on biological processes with the main aim to promote industrial application. Services are given in solving the technical and microbiological problems in production processes and quality control. The BID also serves, under the UNEP/UNESCO/ICRO Program, as the Microbiological Resources Center for Southeast Asia (BANGKOK/MIRCEN) in the areas of fermentation, food and waste recycling. The BANGKOK/MIRCEN maintains a collection of bacteria and fungi including yeasts and selected tissue cultures important for industrial use, biotechnological development, applied research and education.

R & D activities of the BID include the following:

- Microbial biomass for feed;
- Enzyme production;
- Production of fuel ethanol from agricultural produce;
- Waste treatment, waste recycling; and
- Scale-up of fermentation process.

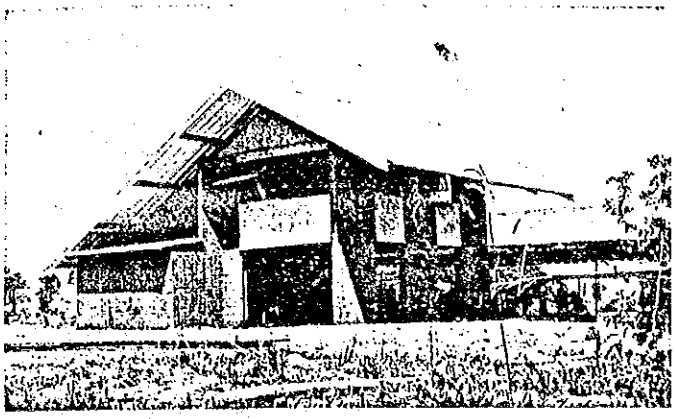


The first alcohol pilot plant from agricultural produce as alternative source of energy is an achievement of the cooperative project between TISTR and the Japanese Association of Industrial Fermentation. The application of innovative technology and sophisticated equipment facilitates energy saving process with the production of 99.5 v/v % ethanol suitable as gasoline substitute for automotive use.



Bioconversion of cellulosic wastes by anaerobic fermentation.

BUILDING TECHNOLOGY DEPARTMENT (BTD)



Soil-cement blocks for low-cost rural housing construction.

Research in the Building Technology Department (BTD) is aimed at solving problems in the building industry. BTD places emphasis on the application of technology for the economical use of labour and materials, for time-saving construction methods, and for the maximum utilization of locally available resources as construction materials.

Project plans of the BTD are:

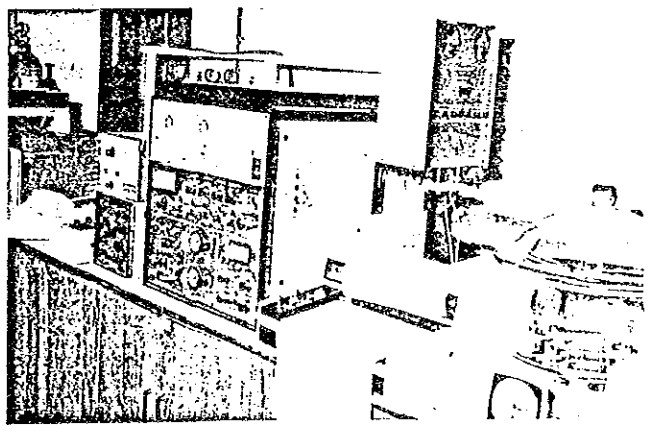
- Research and development of building technology in relation to national development, such as the production of low-cost construction materials from local resources;
- Development of the technology of construction and the design of building components most suitable to the local environment;
- Development of high quality construction materials to encourage local commercial production;
- Transfer of developed technology; and
- Cooperation and coordination with government agencies and the private sector in the development of building technology.

ELECTRONICS INDUSTRY DEPARTMENT (EID)

The Electronics Industry Department (EID) services electronics research and development in order to assist the production and the promotion of electronic devices for local consumption and also for export.

R & D activities of EID are intended to encourage capability in the following categories;

- Manufacturing of electronic products such as microwave ovens, car telephones, electronic control water heaters, electronic control system for industry and electronic distant-measurement meter.
- Manufacturing of electronic components.
- Giving advice on electronic production control in industrial plants.

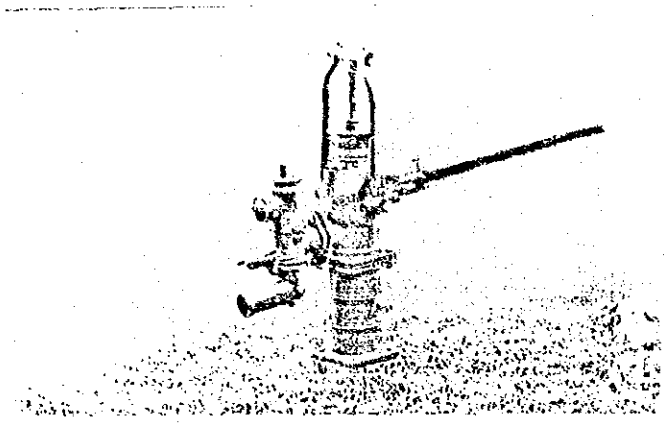


ENGINEERING INDUSTRY DEPARTMENT (END)

The Engineering Industry Department (END) is responsible for research and development of machinery products. Emphasis is placed on high quality products by developing the quality of raw materials and production technology most suitable to the available resources and economic condition of the country.

END is targeted to develop capabilities for effective R & D in the following fields:

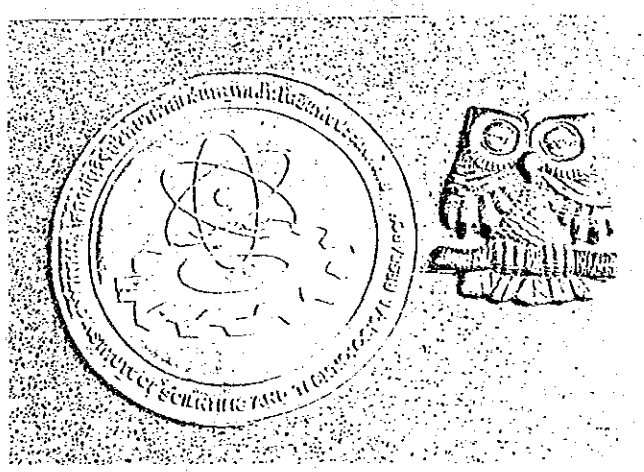
- Special alloy products;
- Machine parts, machine tools and engineering products, etc.;
- Industrial plant machinery and pilot plants.



METAL AND MATERIAL TECHNOLOGY DEPARTMENT (MMTD)

The Metal and Material Technology Department conducts research and development to increase capabilities and performance of the metal and material industry in accordance with:

- The use of local resources and essential imported materials in the production of high quality metal products, machine components and parts for the engineering and electronics industries;
- The effective exploitation of industrial minerals to gain maximum benefit instead of exporting the raw ores;
- The production of ceramic products for use in engineering, electrical and electronics industries, automotive spare parts and construction materials; and
- The analysis and solution to the problems in production technology for metals, minerals and ceramic industries in order to improve the product quality and to minimize the production costs.

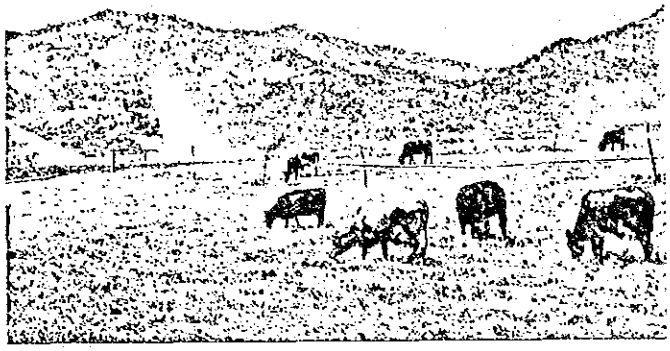


Metal casting by vacuum process moulding technique.

Sewer clay pipes will last longer than the cement pipes.

AGRO-TECHNOLOGY DEPARTMENT (ATD)

The Agro-Technology Department (ATD) carries out multi-disciplinary research on industrial and economic crops in order to develop appropriate technology and to integrate the agro-industry with the large-scale processing of agricultural products. Consultancy services and research by contract are provided for government agencies and private sectors.

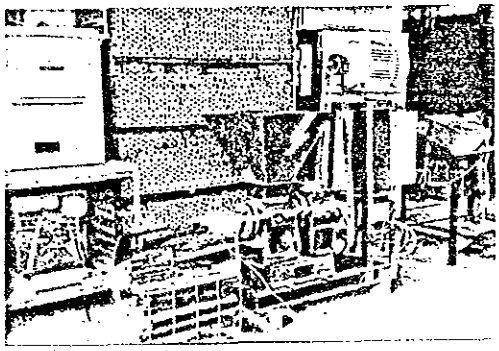


Study of species composition, establishment and management of pasture to ensure the year round high quality animal feeds for the development of dairy cattle husbandry at Lam Phaya Klang in Changwat Saraburi

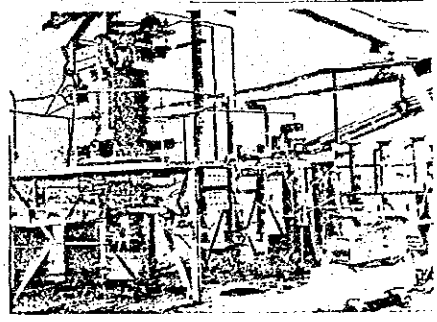
The utilization of improved pasture under coconuts for grazing.

Experiments of cropping system at Lam Phaya Klang to increase farmers' income by developing efficient use of resources.

ENERGY TECHNOLOGY DEPARTMENT (ETD)



Production of industrial solid fuel from agricultural wastes.



Pyrolysis of rice husk demonstration plant at Koocharoen rice mill, Changwat Saraburi

The primary research direction of the Energy Technology Department (ETD) is aimed at efficient utilization of indigenous energy resources as alternative energy to help reduce the country's dependence on imported energy. The emphasis of ETD, therefore, is on research and development of energy technologies in terms of equipment and process design, feasibility study for industrial application, and also formulating policy guidelines for energy research.

ETD is capable to provide the following services:

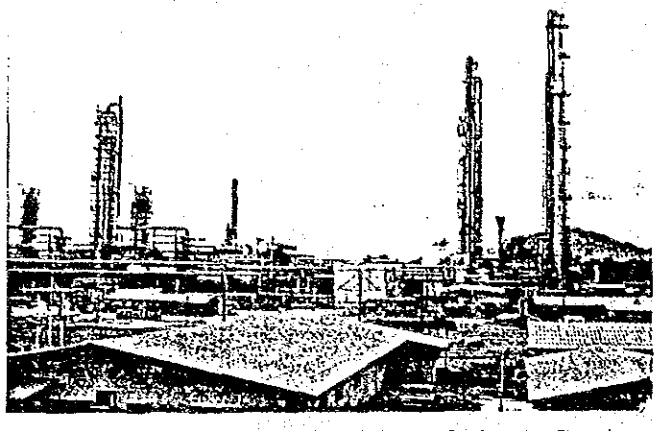
- Research and development on conversion of energy raw materials into utilizable forms of fuel;
- Plant design and installation of synthetic fuels production process;
- Energy consultancy on energy conservation techniques for efficient utilization of energy in industry and building; and
- Fuel property analysis of various fuel materials.

ENVIRONMENTAL AND RESOURCES MANAGEMENT DEPARTMENT (ERMD)

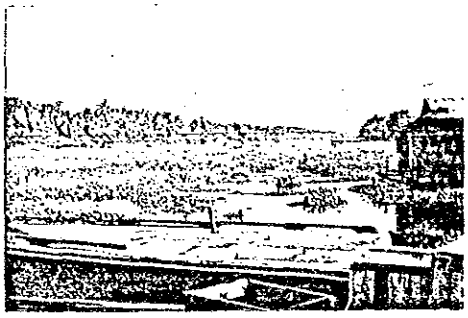
The Environmental and Resources Management Department has the capability to carry out integrated research projects for government agencies and the private sector using the expertise of personnel in multidisciplinary fields such as policy makers, social scientists, geographers, engineers, economists and environmental scientists.

ERMD focuses on services for contract research in the following areas:

- Environmental and resources management plans;
- Research into and evaluation of environmental impacts; and
- Design of pollution control system, especially waste water treatment and garbage disposal.



Study of the environmental impact of the Map Ta Phut Natural Gas Separation Plant of the Petroleum Authority of Thailand in Changwat Rayong.



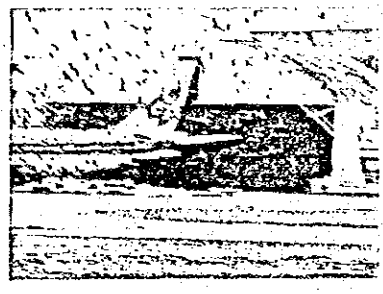
Planning for water quality management in the Tha Chin River, Amphoe Nakhon Chaisi, where widespread growth of water hyacinth is one among several acute problems.

ECOLOGICAL RESEARCH DEPARTMENT (ERD)

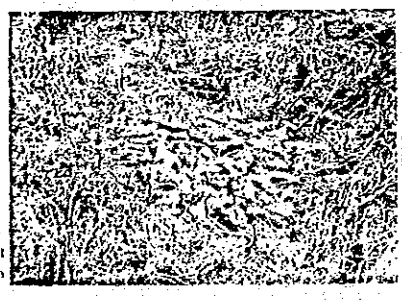
The Ecological Research Department (ERD) aims to identify the structure and the dynamics of the ecosystem. The results of research are applied in minimizing environmental degradation. As such studies have increased, the national socio-economic development has benefited particularly in relation to agricultural activity, energy-technology, medical services, and education.

Operations carried out by the ERD include the following:

- Study of the environmental biology with special attention to environmental quality control and the impact of pollution on living things;
- Study of the structure of the ecosystem as an essential element in effective planning for cultivated crops management, pest control and wild life conservation;
- Seeking solutions to specific environmental problems, such as the prevention of the bird and bat of hazardous to aviation;
- Establishment of the national reference collection of biological specimens for baseline data of ecological research studies and educational purposes, such as natural science museum exhibition.



Study of birds' ecology for preventive planning of aviation accidents at Bangkok International Airport.



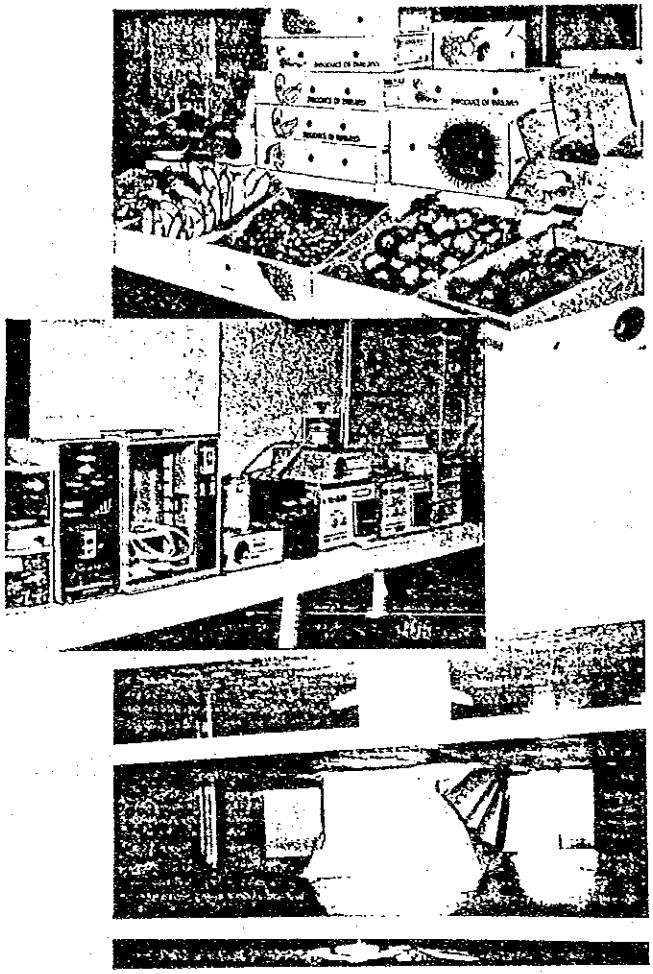
Study of rodents' ecology for pest control planning at Bang Pla Ma in Changwat Suphan Buri.

THAI PACKAGING CENTRE (TPC)

The Thai Packaging Center (TPC) serves as a nucleus for research and development oriented toward the improvement of packaging technology and standards. The goals of the TPC are to minimize economic loss and to promote the export of agricultural commodities and industrial products.

Activities of the TPC focus on the following:

- Research and development on the quality of materials, package design, durability, packaging processes and economic feasibility;
- Services for technical advice, testing and certifying standards to the structure of packages;
- Compilation and dissemination of information on packaging technology; and
- Organization of training sessions, workshops, seminars and exhibitions to upgrade packaging expertise and standards.



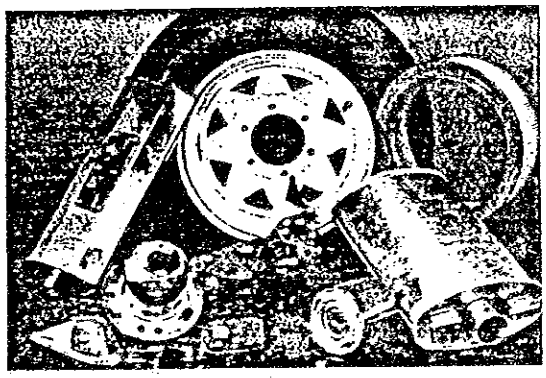
Export package for fresh fruits accepted in foreign markets to minimize loss.

High efficiency analyzer to measure water vapour and gas diffusion rate through plastic films and containers as an indication of suitable plastic types for different product packages.

Compression testing machine for durability test of stacking packages in transportation and storage.

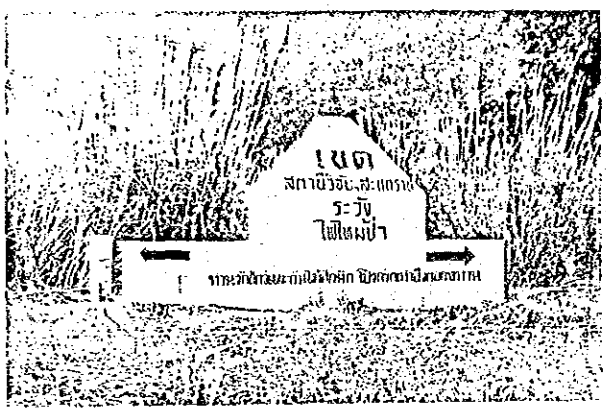
AUTOMOTIVE R & D CENTRE (AUC)

The Automotive R & D Centre (AUC) is responsible for the introduction of innovative technology in the production line and the improvement of quality control to internationally acceptable standards. The functions of AUC also include the inspection and the setting of quality standards for locally produced automotive components and spare parts as well as the provision of services for testing and certification of products.

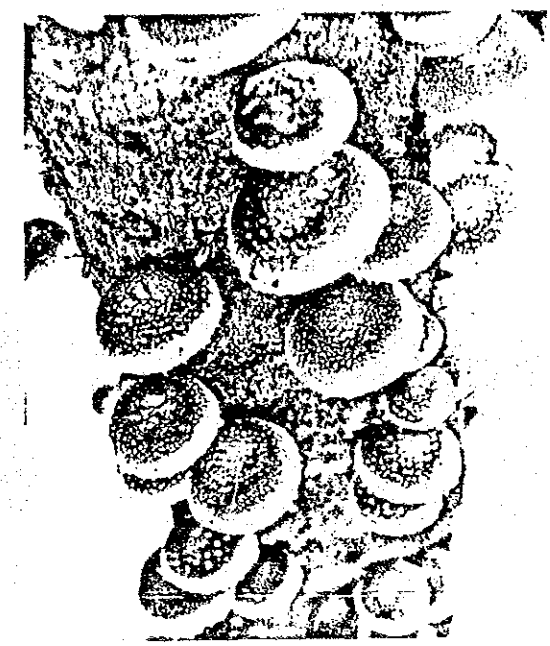


SPECIAL PROGRAMME CENTRE (SPC)

The Special Programme Centre (SPC) is responsible for the operation of special integrated projects using the cooperative efforts of specialized personnel of various research departments and service centres of TISTR. The SPC also supervises the work of the Sakaerat Environmental Research Station which serves research and educational interests in forest ecology.

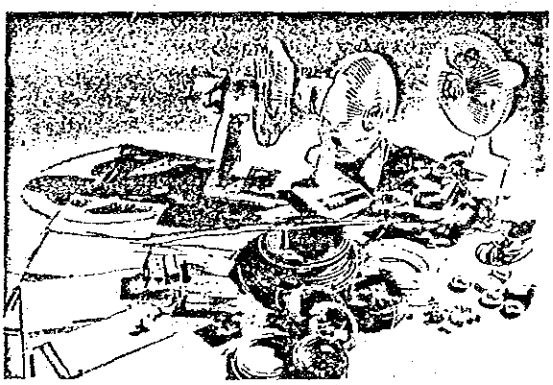


Sakaerat Environmental Research Station.

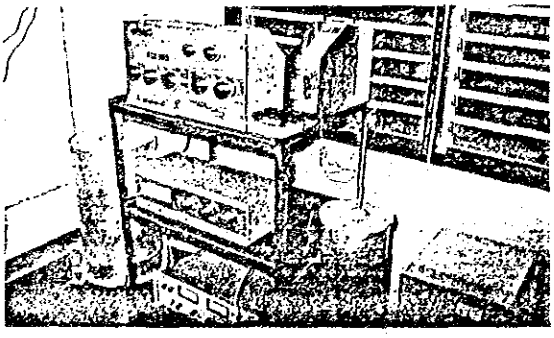


Shiitake mushroom cultivation, a substitute crop to the opium poppy is one of the King's Projects designed to increase income for highland agriculture.

TESTING AND STANDARDS CENTRE (TSC)



Certain industrial products tested by the TSC.



Calibration instrument set for standard thermocouples with reference melting point of pure tin and zinc

The Testing and Standards Centre (TSC) serves as the principal centre for the testing of industrial products, metrology and measurement system in the fields of electrical, mechanical, photometric and thermometric standards. Services of the TSC also include chemical and biochemical analyses, quality control as well as inspection of industrial products.

The emphasis of the TSC is to concentrate on the following categories:

- Products manufactured locally to ensure a supply of satisfactory goods which are in the order of priority of acquisition by government agencies for the promotion of Thai industry.
- Industrial products which meet the required quality standards in order to receive certification from the Thai Industrial Standards Institute (TISI).
- Industrial products eligible for export promotion under privileges granted by the Board of Investment.
- General industrial products.

THAI NATIONAL DOCUMENTATION CENTRE (TNDC)

The Thai National Documentation Centre (TNDC) is the well-established source of scientific and technological information aiming to contribute to the promotion of science and technology in national development.

TNDC is capable to provide the following documentation facilities to scientists, research workers and practitioners:

- Library service for research activities;
- Compilation of bibliography and literature searching services;
- Current awareness and selective dissemination of information services;
- Documents procurement service;
- Translation service; and
- Service for research data analysis by computer.

In addition, the TNDC also maintains a collection of scientific and technological information concerning Thailand. References to such information are published by the TNDC in the forms of abstracts journal and bibliographical series for dissemination and international exchange purposes.

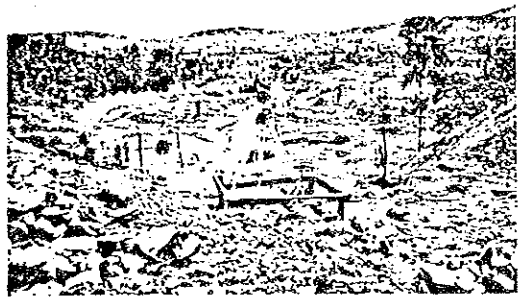
ENGINEERING CONSULTANCY SERVICE CENTRE (ECSC)

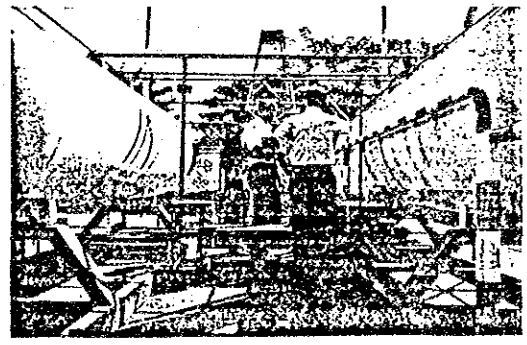
The Engineering Consultancy Service Centre (ECSC) has been established in order to develop and strengthen domestic consultancy services for greater technological self-reliance and improving techno-economic decision making process. The main aim of the ECSC is to enlist experienced consultants of various fields for providing consultancy capabilities and facilities to both government agencies and the private sectors.

The ECSC is capable to participate in the development of infrastructural construction projects and the establishment of intricate industrial plants which require substantive professionalism and expertise.

Activities of the ECSC include :

- Preliminary survey and feasibility study of the project.
- Detailed engineering design and specifications.
- Cost estimation and advice for possible financial sources including loan-agencies.
- Preparation of bidding documents and the design of contract for constructions.





INDUSTRIAL COOPERATION AND PROMOTION CENTRE (ICPC)

Pilot-scale production of high nutrition snack products and pure tangerine juice

The Industrial Cooperation and Promotion Centre (ICPC) has been established to facilitate the transfer of technology developed or improved by TISTR for commercialization.

The principal responsibilities of the ICPC include:

- Provision of the research results of TISTR and operational support facilities such as training, testing, analysis, quality control, as well as the design and installation of equipment and machinery in order to serve the private sector;
- Assistance for urban and rural industrial establishment using the results of research and development carried out by TISTR;
- Provision of services for marketing surveys and feasibility studies; and
- Market trial operation for products developed from prototype on R & D activities of TISTR.

Product samples of garlic natura and dried Chinese chrysanthemum for market trials.

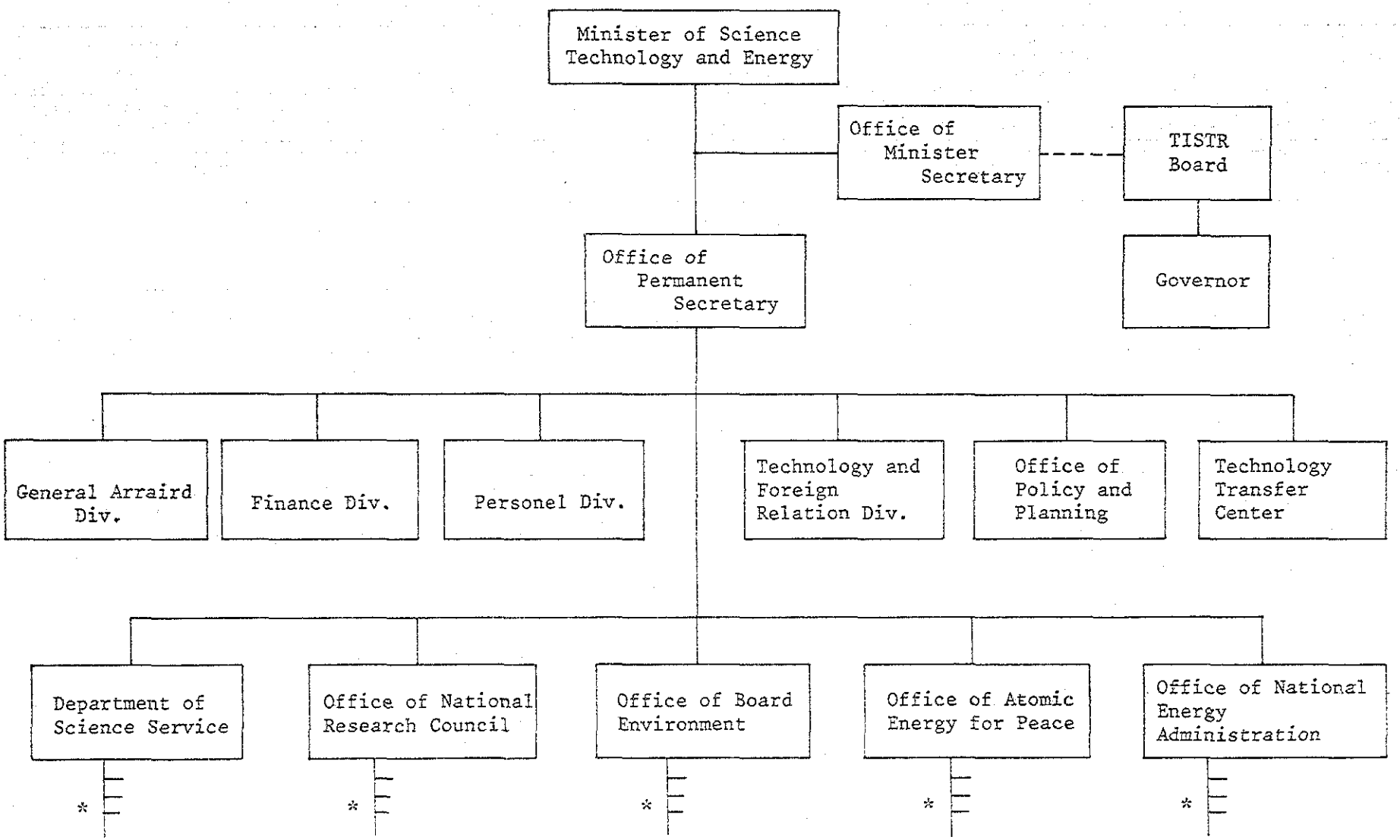
RESEARCH SERVICE CENTRE (RSC)

The Research Service Centre (RSC) is responsible for the arrangement of contract research requested by government agencies and the private sector. To render its services, the RSC coordinates with the various research departments of TISTR to carry out R & D for products innovation, improvement of industrial processes and feasibility studies.

Certain commercial products developed through the services of TISTR.

タイ王国科学技術エネルギイ省組織とタイ科学技術研究所との関係

Organization of Ministry of Science Technology and Energy, and TISTR



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タイ科学技術研究所の組織

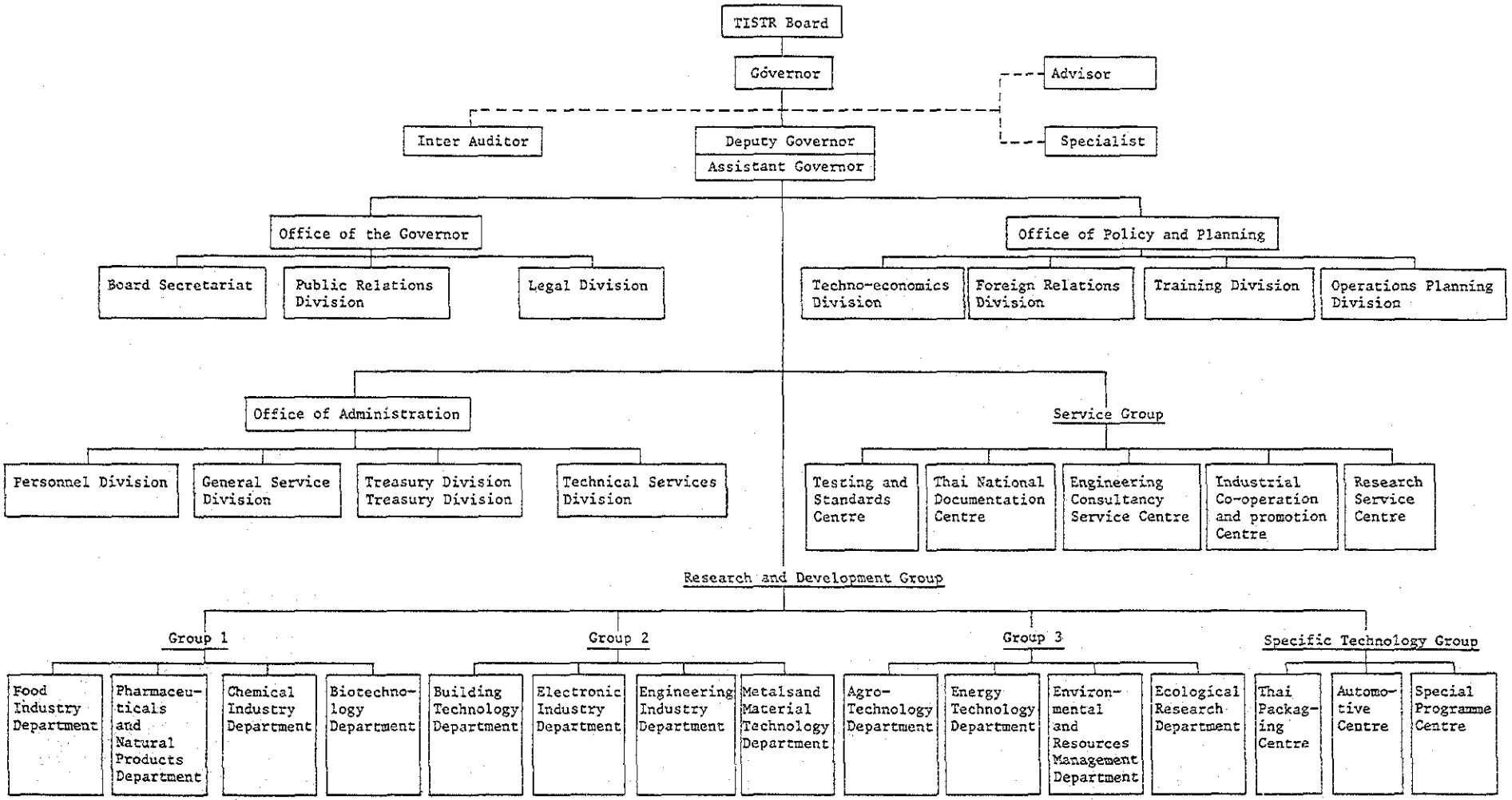
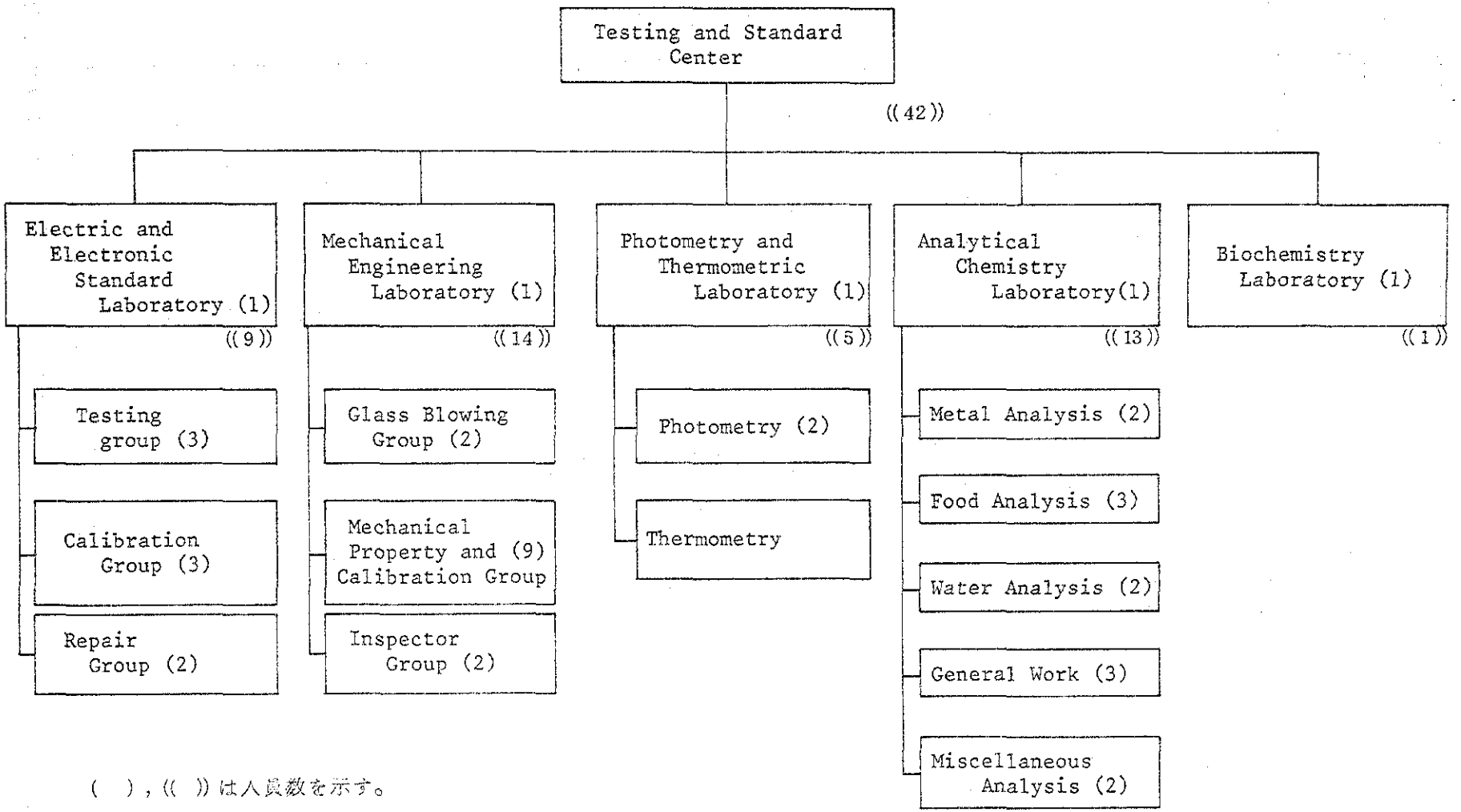


図３－３．３－４　　タイ科学技術研究所　試験・標準センター　組織

Organization of Testing and Standard Center, TISTR



（　），((　)) は人員数を示す。

タイ科学技術研究所の人材構成

Organization of Ability of TISTR

I. 資　格

Qualification	TISTR	TSC
博　士 Doctor	19	
マスター Master	82	4
大　卒 Bachelor	145	16
その他 the others	139	22
合　計 Total	485	(注) 42

II. 技術分野

Technical Field	TISTR
①農　業 Agricultural	36
②化　学 Chemistry	17
③化学工学 Chemical Engineering	11
④医　学 Medical	10
⑤物理学 Physics	9
⑥機械工学 Mechanical Engineering	6
⑦土木建築工学 Civil Constraction Eng.	6
⑧生物学 Biology	6
⑨電気，電子工学 Electric, Electronic Eng.	4
⑩数　学 Mathematic	3

(注)調査の時点が多少父い(1985.12)ので，総数は52名とならない。

試験標準センター配置図

Testing & Standard Center of TISTR

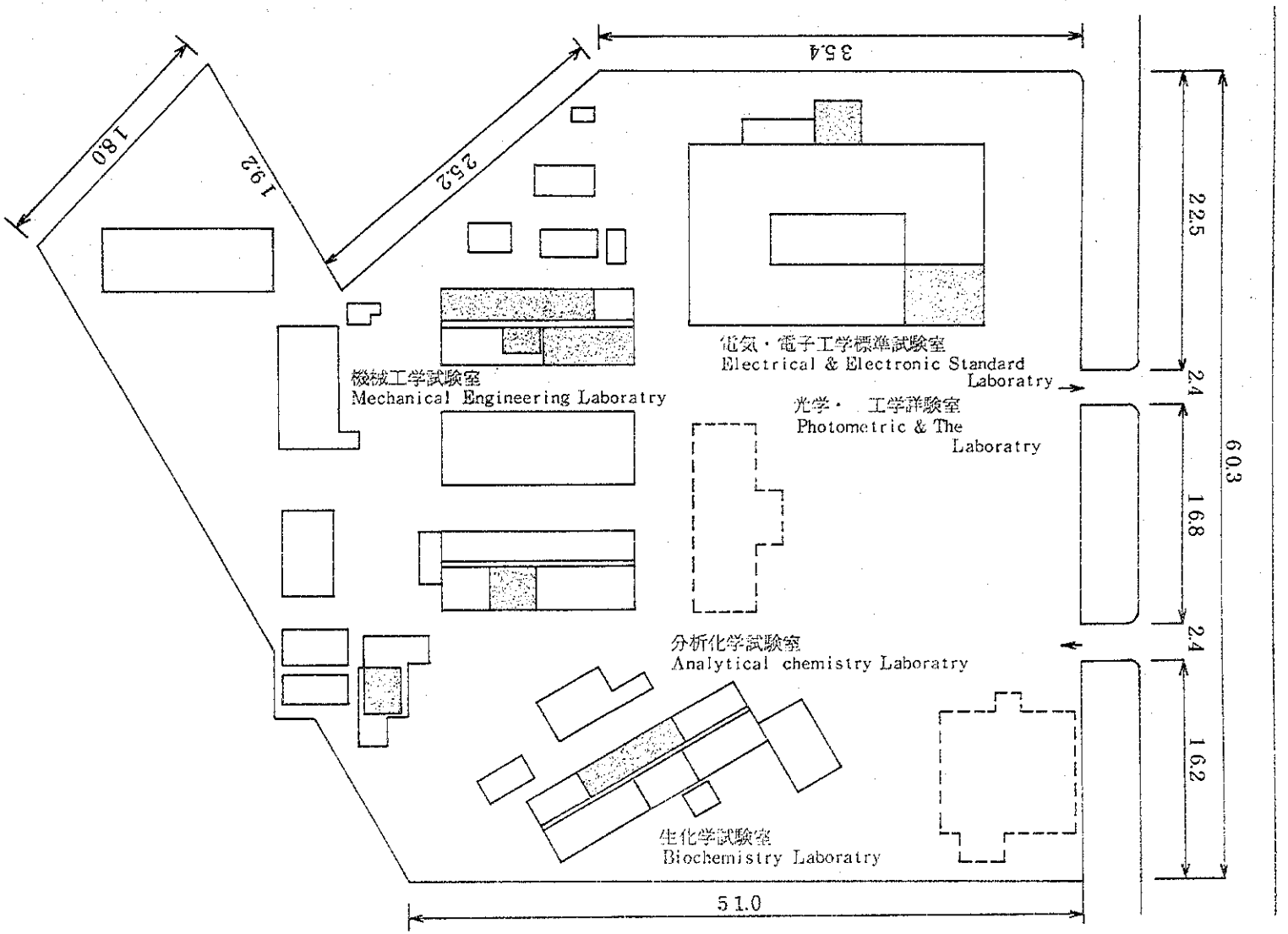


表3－3・3－6

試験・標準センター（ＴＳＣ）にて試験・検査している工業材料，製品リスト

List of Industrial Materials and Products being Tested at TSC

1. Electric and Electronic Standard Laboratory

1) Dry cell (Battery)
2) Contact resistance (HV Cable)
3) Electric iron
4) Electric fan
5) Ballast
6) PVC insulated cable and flexible cords
7) PVC insulator aluminium cable
8) Polyvinyl formal enamelled round copper wires
9) Electric oven

2. Mechanical Engineering Laboratory

1) Cold-rolled tinplate and cold-rolled blackplate
2) Polyvinyl chloride pipes for drining water services
3) Steel bars for reinforced concrete: Round bars
4) Steel bars for reinforced concrete: Deformed bars
5) Liquified petroleum gas cylinder
6) Wall tile
7) Mosaic tile
8) Mild steel for welding rod and welding electrodes
9) Galvanized steel sheet
10) Ordinary glass sheet
11) Filing cabinets
12) White chalks and colour chalks
13) Steel wire for prestressed concrete
14) Vitreous china and earthen ware sanitary appliances
15) Automotive safety glasses: Laminated safety glass
16) Automotive safety glasses: Tempered safety glass
17) Automotive safety glasses: Zone tempered safety glass
18) Zip fasteners: Metallic
19) Clips, paper, wire
20) Steel bars for reinforced concrete: Re-rolled round bars
21) Toilet tissue
22) Facial tissue
23) Gypsum plasterboards
24) Paper towels
25) Table napkins
26) Corrugated sheet steel beams for highway guardrail
27) Vitreous china and earthenware water-closet
28) Bicycle frames
29) Cast iron gate valves
30) Steel pipes
31) Galvanized steel pipes with threaded end
32) Aluminium alloy extruded solid and hollow shapes
33) Hacksaw blades
34) Steel tubes for bicycle purposes
35) Aluminium insect wire screening

36) Self-adhesive plaster
37) Motorcycle chains
38) Exhaust system for automobile include silenser
39) Exhaust system for motercycle
40) Ball-point pens
41) Ball-point pen refills
42) Office steel storage cabinets
43) Liquified petroleum gas cylinder for internal combustion engine
44) Electrical power insulator
45) Guard rail
46) Concrete joint sealer (rubber compaund)
47) Safety shoes
48) Pressure regulator
49) Cemented carbide tip
50) P.V.C. electric tape
51) Conlite neoprene
52) Conlite rubber water stop
53) Cast iron: Butterfly valves
54) Cast iron check valves: swing type
55) Automobile radiators
56) Copper alloy gate valves
57) Gummed paper tape
58) Wooden frame and panel frame for door and window

3. Photometric and Thermometric Laboratory

1) Incandescent lamps (GLP, Special design or purpose)
2) Fluorescent lamps (Tubular, circline, special design)
3) HID lamps
4) Ballast for fluorescent lamps
5) Electric iron (Temp.)
6) P.V.C. pipes for drinking water
7) Safety glass for automobiles
8) Light filters
9) Retoreflectors for Trafic sign

4. Analytical Chemistry Laboratory

1) Soap
2) Garlic
3) Sauce
4) Noodle
5) Food in can
6) Cassava
7) Beans
8) Vegitable oil
9) Sugar, Sugar kane
10) Plastic
11) Melamin
12) Petroleum products
13) Ore
14) Lignite
15) Iron
16) Soda
17) Chemical solution
18) Paint
19) Aluminium
20) Bottle (Glass, Plastic)
21) Metal Alloy
22) Mosquito Protection
23) Wood
24) Bamboo

5. Biochemical Laboratory

1) Food (Vegitable oil, ...)
2) Drink (Tea, ...)
3) Agricultural products (Tapioka, ...)
4) Industrial products (Cosmetic, ...)
5) Supplement food
6) Animal food

表3－3・3－7

試験・標準センター（TSC）にて試験・検査しているテスト項目リスト

List of Testing Items being Tested at TSC

1. Electric and Electronic Standards Laboratory

1) Discharge test (Dry cell - Battery)
2) Four terminal resistance
3) Thermostat
4) Voltage rating
5) Wattage
6) Insulation by H.V. test
7) Heating limitter of insulation
8) Spacing between conductors
9) Mechanical characteristic
10) Electric shock
11) Leakage current
12) Speed
13) Temperature
14) Endurance test for switching
15) Power factor
16) Outlet terminal
17) Starter
18) Heating wire
19) Humidity
20) Resistance
21) Wet insulating testing

2. Mechanical Engineering Laboratory

1) Mechanical characteristic test

Tensile strength
Yield strength
Sharing foce
Compression
Hardness

2) Hydraulic Test

3) Endurance Test

3. Photometric and Thermometric Laboratory

1) Luminous flux
2) Luminous intensity
3) Reflectance
4) Transmittance
5) Color of light sources
6) Color of materials
7) Temperature rise
8) Endurance
9) Electrical Characteristic
10) Life
11) Resistance to temperature, boiling water, UV,
12) Distortion of image
13) Lamp capacity
14) Transparence
15) Chromaticity coordination
16) Reflection intensity at specified angle

4. Analytical Chemistry Laboratory

1) Chemical characteristics test

5. Bio Chemical Laboratory

1) Bio chemical characteristics test

(1) Additive

- Colours
- Preservative
- Anti foam
- Anti oxidant

(2) Flavours

(3) Vitamins

(4) Contaminanats

- Micro organism
- Yeast and yeast like fungi
- Bacteria, coliform
- Mycotoxin aflatoxin
- Cyanogenic comp.
- Pesticide residue
- Herbicide residue

(5) Enzyme

- Papain
- Trypsin
- Bromelain
- Amylase

表3－3・3－8

試験・標準センター（TSC）にて試験・検査している輸出製品リスト

List of Export Products being Tested at TSC

1. Mechanical Engineering Laboratory

1) Vitreous china and earthen ware sanitary appliances (TIS)
2) Vitreous china and earthen war water closet (TIS)
3) Wall tile (TIS)
4) Floor tile (TIS)
5) Mosaic tile (TIS)
6) Gypsum plaster boards (TIS)
7) Liquefied petroleum gas cylinders (TIS)
8) Steel pipe (TIS)
9) Galvanized steel pipe with threaded end (BSI, TIS, ASTM)
10) Bolts & nuts (TIS)
11) Hackwaw and handsaw blades (TIS)
12) Electrical power insulator (ASTM, ANSI)
13) Liquefied petroleum gas cylinder for internal combustion engine (TIS)
14) Zip fasteners, Metallic (TIS)
15) Footstrip for windsurf board (Customer's Specification)
16) Bicycle frame (TIS)
17) Ball-point pens, Ball-point pen refills (TIS)
18) Steel bars for reinforced concrete: Round & Deformed bars (TIS)
19) Mild steel covered are welding electrodes (Lloyd's Register of Shipbuilding)
20) Safety shoes (SS)

表3－3・3－9

試験・標準センター（TSC）にて断ったテスト項目又は将来実施したいテスト項目リスト

List of Testing Items was refused and/or being planned in Future at TSC.

1. Mechanical Engieering Laboratory

1) HR other than HRB HRC & Low Superficial
2) Micro HV
3) High temp test
4) Very Low temptest
5) Fatique test
6) Creep test
7) Damping test for absorber
8) Stress-strain, poisson's ratio properties for high strength machine parts.
9) Flexing test for high strength material
10) Rubber tests
11) Miniature article test
12) High pressure test & calibration
13) Aging, special conditions test
14) Low pressure test
15) Vacuum test
16) Engine tests (Automobile)
17) High precision measurement for length, mass
18) Specific gravily
19) Gravitational acceleration
20) Mechanical efficiency measurement
21) Torsional test
22) Portable non destructive test for welding
23) Life test
24) Portective coating evaluation test
25) Flow measurement
26) Weighing machine test
27) Pump test
28) Compressor test
29) Bearing test

2. Photometric and Thermometric Laboratory

1) Luminaire testing
2) Lamp holder testing
3) Performance test on gas appliances and components
4) Determination of thermal properties of materials
   - 4.1) Thermal conductivity
   - 4.2) Thermal expansion
   - 4.3) Specific and latent heat
5) Fire test on building materials (Combustibility, flamability, early fire hazard properties and fire resistance)
6) Performance test on solar appliances and components
7) Performance tests on air-conditioning units and components

表３－3.3－１０　　タイ科学技術研究所－試験・標準センター仕事量分析

Analysis of Work Load at TSC of TISTR

客先 Client ＼ 試験室 Lab. 人 Person	電気・電子工学試験室 EEL 9	機械工学試験室 MEL 14	光学・熱工学 PTL 5	分析化学試験室 ACL 13	生化学試験室 BCL 1	合計 TOTAL 42
タイ工業省工業規格研究所 TISI	1.8 (20%)	9.8 (70%)	1.35 (27%)	3.432 (26.5%)	0.2 (20%)	16.582 (39.5%)
政府系機関 Gov. Agency	0.9 (10%)	0.28 (2%)	0.05 (1%)	—	—	1.23 (2.9%)
民間企業 Private Co.	4.77 (53%)	3.36 (24%)	3.5 (70%)	4.589 (35.3%)	0.1 (10%)	16.319 (38.9%)
教育系機関 Educational Agency	0.18 (2%)	0.28 (2%)	0.05 (1%)	—	—	0.51 (1.2%)
タイ科学技術研究所 TISTR	1.35 (15%)	0.28 (2%)	0.05 (1%)	4.979 (38.3%)	0.7 (70%)	7.359 (17.5%)

EEL : Electric and Electronic Standard Laboratory

MEL : Mechanical Engineering Laboratory

PTL : Photometric and Thermometric Laboratory

ACL : Analytical Chemistry Laboratory

BCL : Biochemistry Laboratory

TISI: Thi Industrial Standards Institute

TISTR: Thailand Institute of Scientific and Technological Research

表３－３.３－１１　タイ科学技術研究所－試験・標準センター　使用規格分析（百分率）

Analysis of Industrial Standards at TSC of TIST (%)

試験室 Lab. / 工業規格 Ind.Std.	電気・電子工学試験室 EEL	機械工学試験室 MEL	光学・熱工学試験室 PTL	分析化学・生化学試験室 ACL, BCL
タイ工業規格 TIS	90	50	50	5
米国材料規格 ASTM	10	30	15	20
国際電気規格 IEC	25			
日本工業規格 JIS	20	18	30	
英国規格 BS	1	1	2-3	
西独工業規格 DIN		1	2-3	
国際工業規格 ISO				10
米国化学分析法 AOAC				40
米国連邦標準試験法 FTMS				20
米国薬局方 USP				3
国際基本・応用化学組合 IUPAC				2

EEL : Electric and Electronic Standard Laboratory
MEL : Mechanical Engineering Laboratory
PTL : Photometric and Thermometric Laboratory
ACL : Analytical Chemistry Laboratory
BCL : Biochemistry Laboratory
TIS : Thai Industrial Standard
ASTM : American Society for Testing and Materials
IEC : International Electrotechnical Commission
JIS : Japanese Industrial Standard
BS : British Standard
DIN : Deutsche Industrie-Normung
ISO : International Standard Organization
AOSC : Association of Official Analytical Chemical
FTMS : Federal Test Method Standard
USP : United State Pharmacopeia
IUPAC : International Union of Pure and Applied Chemistry

表3－3.3－12－¼　試験標準センターの仕事のマクロ分析

Macro Analysis of TSC's Work

		1977	1978	1979	1980	1981	1982	1983	1984
試験件数 Items	所内 Inner	4867	7003	5220	7486	5647	6287	5991	5582
	所外 Outer	1513	4939	5047	7423	7048	7433	8878	11107
収　入 Incomes ($)	所内 Inner	321873	497641	796566	949790	621351	848162	862434	747555
	所外 Outer	322666	548636	597164	757412	1038091	1313625	1769360	1823110
合計試験件数 Total items		6460	11942	10267	14909	12695	13720	14869	16689
合　計　収　入($) Total income		644439	1046277	1393730	1707202	1659442	2161787	2631749	2670665

(注: reference)

Inner : Inner Work of TISIR

Outer : Outer Work of TISIR

TISTR : Thailand Institute of Scientific & Technological Research

TSC : Testing & Standard Center in TISIR

表３－3.3－１２－¾　試験標準センターの試験件数の推移

Transition of Items on Testing of TSC

試験件数（items）

	1977	1978	1979	1980	1981	1982	1983	1984
電気関連 EEL	462	502	604	617	603	574	527	559
機械関連 MEL	389	2142	2500	4546	3644	5651	5006	7219
光学関連 MEL	89	47	31	140	201	175	158	312
化学関連 ACL	5220	9251	7132	9606	8247	7320	9178	8599
合　計 Total	6460	11942	10267	14909	12695	13720	14869	16689

表３－3.3－12－¾　試験標準センターの収入の推移

Transition of Income of TSC

収入(income $)

	1977	1978	1979	1980	1981	1982	1983	1984
電気関連 EEL	118887	132020	498854	429393	409149	299062	299029	347655
機械関連 MEL	73962	179380	191460	217749	293143	528100	558515	56660
光学関連 PTL				42275	53600	146700	194450	243750
化学関連 ACL	217690	671055	690941	992860	858175	1187925	1579800	1412600
合　計 TOTAL	644435	1046277	1393730	1707202	1659442	2161787	2631749	2670665

表３－３･３－１２－４/４　試験標準センターの活動の推移

Transition of Activity of Testing & Standard Center

TISTR（タイ科学技術研究所）TSC（試験・標準センター）現有機器一覧

No.	装置・計測器等の名称	台数	経年	標準	試験	
I	電気・電子工学標準試験室 Electrical & Electronic Standard Lab.	88		25	63	
1	ポテンショメータ Potentiometer	2	1965	●		Leed & Northrup (L & N)
3	標準電池 Standard Cell	1	1972	●		Eppley
4	標準電池用槽 Standard Cell Air Bath	1	1976		●	Yew
5	カドミューム標準電池 Cadmium Standard Cell	1	1970	●		Pye
6	DC 電圧電流計 Voltage Current Calibrator	1	1976		●	Yew
7	DC 電圧電流計 Voltage Calibrator	1	1979		●	Fluke
8	DC 精密電源 DC Precision Current Supply	1	1978	●	●	Yew
9	電子検流計 Electronic Galvanometer	1	1978	●	●	Yew
10	無効電流計 Verispot Galvanometer	1	1970		●	Serfram
11	DC 無効電流計 DC Null Detector	2	1969		●	L & N
13	電圧分割器 Reference Voltage Divider	1	1979		●	Fluke
14	標準電圧調圧器 Standard Volt Ratuo Box	1	1979	●		Yew
15	精密ホイートストンブリッジ Precision Wheatstone Bridge	1	1980	●		Yew
16	電圧変圧器 Double Ratio Set	1	1969		●	L & N
17	電圧変換器 Volt Ratio Box	1	1978		●	Yew
18	1Ω - 1KΩ 標準抵抗器 1Ω - 1KΩ Standard Resistor	6	1979	●		Yew

24	AC - DC標準抵抗器(100 - 100KΩ) AC - DC Decade Resistor	10	1974	●		Cambridge
25	万能ブリッジ Universal Bridge	1	1969		●	L & N
26	デジタル検流計 Digital Multimeter	1	1976		●	Fluken
27	ＡＣ電圧安定器 Electronic Voltage Stabilizer	1	1970	●	●	Stabilac
28	ＡＣ用熱変換器 Thermal Transfer Standard	1	1979	●		Fluke
29	キャパシタンス　ブリッジ Capacitance Bridge	1	1971	●		GR
30	インダクタンス　ブリッジ Inductance Bridge	1	1971	●		GR
31	標準　キャパシター Standard Capacitor	2	1971	●		GR
32	標準　インダクター Standard Inductor	2	1971		●	GR
35	AC／DC精密比較測定器 AC/DC to DC Comparator	9	1971		●	Weston Rotex
36	時刻計 Time Mark Generator	1	1979		●	HP
37	天秤 Balance	1	1970	●		Shimadzu
38	標準分銅 Standard Weight	1	1970		●	Analyte
39	湿度計 Hygrometer Calibrator	1	1970		●	
40	ＡＣ変換器 Variac Zenith	1	1970		●	Zenith
41	スライダック Slide Regulator	1	1970		●	Zenith
42	高電圧変圧器 High Voltage Transformer	1	1980		●	Yew
43	電気絶縁テスト装置 Insulation Test	1	1981		●	Yew
44	電気絶縁連続テスト装置 Insulation Continuity Tester	1	1972		●	Megger

45	AC 電圧計 AC Voltmeter	2	1980		●	Yew
47	携帯用標準電流計 Portable Standard Calvanemeter	1		●		
48	DC 電圧計 DC Voltmeter	1	1970		●	Yew
49	携帯用ワットメーター Portable Single Phase Wattmeter	1	1978		●	Yew
50	携帯用電力効率計 Portable Power Factor Meter	1	1978		●	Yew
51	携帯用ルックス メーター Portable Lux Meter	1	1978		●	Yew
52	表面温度計 Sureface Thermometer	1	1978		●	Yew
53	スライダックス Slide Resister	1	1978		●	Yew
54	可変抵抗器 Rheostat	6	1978		●	Yew
60	標準 バラスト Reference Ballast	1	1974	●		BBC (Germany)
61	キャパシタンス ボックス Capacitor Substitution Box	1	1974	●		Heath Built
62	バルブ特性試験器 Valve Characteristic Meter	1	1971		●	Avo (England)
63	ストロボ Stroboscope	1	1971		●	Philip
64	オシロスコープ Oscilloscope	3	1977		●	HP
67	電子計測器 Electronic Counter	1	1977		●	HP
68	振幅計測器 Frequency Meter	1	1976		●	HP
69	四角波発生機 Square Wave Generator	1	1972		●	HP
70	オッシレーター Oscillator	1	1972		●	Khorn-Hil
71	信号発信機 Signal Generator	1	1984		●	Anritsu (Japan)

72	V・Ω・A メーター Volt-Ohm-milliammeter	1	1971		●	Simpson
73	マルチ テスター Multitester	1	1979		●	Trio
74	発電機 Power Supply	1	1979		●	HP
75	調整用発電機 Power Supply	2	1971		●	HP
77	バッテリー チャージャー Battery Charger	1	1970		●	
78	グラインダー Mortor Grinding Machine	1	1970		●	
79	携帯用鋲打ち機 Hand Rivet	1	1971		●	Losster
80	定格調整作業台 Rating Adjustable Work	1			●	
81	アンプローブ電流計 Amprobe	1	1971		●	Amprobe
82	記録計 Six Point Recorder	1	1972		●	Kent
85	電圧計 Volt Meter	1	1978		●	Yew
86	キャブレーションシステム AC Calibration System	1	1978		●	Yew
87	カーブ トレーサー リーダー Curve tracer Leader	1	1987		●	Leader
88	真空式電圧計 Vacuum Tube Voltmeter	1	1970		●	HP

機械工学試験室

List of equipments of Mechanical Engineering Laboratory

Item	Description	Manufacturer	Year
1	Universal Testing Machine, Cap 50 ton	Denison, England	1967
2	Compression Testing Machine, Cap. 300 ton	Maruto, Japan	1967
3	Vickers Hardness Tester	Vickers-Amstrong, England	1967
4	Rockwell Hardness Tester (Superficial)	Wilson, U.S.A.	1967
5	Rockwell Hardness Tester (Regular)	Wilson, U.S.A.	1978
6	Brinell Hardness Tester	Torsee, Japan	1980
7	Impact Testing Machine	Every, England	1967
8	Abraser Standard Abrasion Tester	Teledyne Taber, U.S.A.	1978
9	Glass Cutting Machine	Heathway Machinery, England	1967
10	Universal Glass Working Lathe	Herbert Arnold, Germany	1967
11	Glass Annealing Furnace, Cap. 800°C	B+C Boepple & Cokg, W. Germany	1970
12	Glass Drilling Machine	B+C Boepple & Cokg, W. Germany	1970
13	Optical Strain/Stress Tester	Dr. Steeg & Reuter, W. Germany	1978
14	Proving Ring (Tension/Compression), 5 tonf	EMEC, England	1978
15	Proving Ring, Cap. 20 tonf 50 tonf	Torsee, Japan	1980
16	Deadweight Tester, Max. Cap. 10,000 psi	Ashcroft, U.S.A.	1980
17	Deadweight Tester, Max. Cap. 8000 psi.	Budenberg, England	1982
18	Black Granite Surface Plate	Mitutoyo, Japan	1983
19	Oven Max Cap. 270°C	Grieve, U.S.A.	1979
20	Profile Projector (bench model)	Mitutoyo, Japan	1977

21	Air Operating Pump. Cap. 1000psi	Hydro-Test Product Inc. U.S.A.	1980
22	Volumetric Expansion Hydrostatic Test	Hydro-test Product Inc. U.S.A.	1980
23	Gloss Meter	Gardner Instrument, U.S.A.	1982
24	Shore Hardness Tester for rubber	Blue steel Engineering, Ltd., India	1978
25	Water bath		1978
26	Neo-Derm for non-magnetic Coatings	Mitutoyo, Japan	1978
27	Neo-Derm for non-conductive Coatings	Mitutoyo, Japan	1981
28	Digit Height Gage, range 1000mm	Mitutoyo, Japan	1979
29	Digit Height Gage, range 600 mm	Mitutoyo, Japan	1979
30	Moisture Meter		
31	Vernier Caliper, rang 1000 mm	Mitutoyo, Japan	1980
32	Vernier Caliper, rang 200 mm. 4 units	Mitutoyo, Japan	1979
33	Digit Dial Caliper, range, 200mm 3 units	Mitutoyo, Japan	1980
34	Dial Thickness Gauge, acc. .01mm rang 10 mm	Mitutoyo, Japan	1981
35	Digital Outside Micrometer, 0-1000 mm.	Mitutoyo, Japan	1982
36	Dial Gauge, acc. .01mm, 4 units	Mitutoyo, Japan	1982
37	Digital Hand Tackometer	One sokki, Japan	1981
38	Thernohygrometer	Durotherm, Germany	1980
39	Control Square 1 set	Mitutoyo, Japan	1979
40	Water Bath	Memmert Germany	1980
41	Depth Gaugue Micrometer 2 units	Moore & Wright, England	1979
42	Radius Gauge set	Mitutoyo,Japan	1981
43	Granite Surface Plate	Mitutoyo, Japan	1981
44	Tubular Inside Micrometer	TESA, Switzerland	1981
45	Gauge Blocks, Grade A	Mitutoyo, Japan	1982

46	Screw Pitch Gauge	Mitutoyo, Japan	1982
47	Combination Square Set	Mitutoyo, Japan	1982
48	Pana-Micrometer Set	Mitutoyo, Japan	1983
49	Prisision Square	Mitutoyo, Japan	1983
50	Dial Caliper Gauge	Mitutoyo, Japan	1983
51	Knife Edge Straight Edge	Mitutoyo, Japan	1983
52	Digital Vernier Caliper, range 200 mm.	TESA, Switzerland	1984
53	Magnetic Stand 3 sets	Mitutoyo, Japan	1980

光学・熱工学試験室

Equipment for Temperature Measurement

Item No.	Description	Quantity	Maker	Age	Capacity
1	Fixed point furnace of tin & zinc with temperature controller	1	NRLM	4	
2	Fixed point furnace of silver	1	TISTR	3	
3	Crucible assemblies of pure tin and zinc	2	NRLM	4	
4	Melting point furnace of gold with temperature controller	1	JMM England	4	
5	Comparison furnace for thermocouples with temperature controller	1	NML Australia	12	
6	Water bath	1	NML Australia	5	
7	Oil and salt bath combination	1	IRVING & Son, England	6	
8	Triple point of water cell	1	Trans-Sonics England	12	
9	Automatic AC bridge, Accuracy 1 mK	1	ASL	2	4 K to 600°C
10	Potentiometer Type K-4	1	L & N Australia	5	-500uV to .016105V
11	DC Null detector	1	L & N	6	+2.5uV to 2.5mV
12	Kelvin bridge	1	Biddle U.S.A.	6	0.01u to 1111.1 7 ranges
13	Portable potentiometer	1	Foster England	12	
14	Portable potentiometer	1	Cambridge England	12	
15	Portable AC bridge	1	L & N Australia	6	
16	Strip lamps for calibration of Optical pyrometer	5	GEC	4-10	800 - 2500°C
17	DC voltage regulator		Hewlett Packard U.S.A.	6	20 V, 20 A
18	Ice point reference chamber	1	Omega	5	6 points
19	Reference standard thermocouples	2	NML Australia	12	0 - 1200°C
20	Working standard thermocouples	1	NML Australia	12	0 - 1200°C
21	Reference standard resistance	2	NML Australia	1-12	0 - 600°C
22	Working standard resistance	2	NML Australia	12	0 - 600°C
23	Furnace for endurance test of ballasts for fluorescent lamps	1	TISTR	5	4 sets of samples, (21 pieces)
24	Furnace for endurance test of ballasts for fluorescent lamps	1	TISTR	4	1 set of samples, (7 pieces)
25	AC watt meter, 0.5 class	1	YEW Japan	6	1200 Watts

26	Optical pyrometer	1	YEW Japan	12	800 - 2500°C
27	Strip chart temperature recorder 6 points	1	SHINKO Japan	4	0 - 200°C
28	Strip chart temperature recorder 6 points	1	CHINO Japan	6	0 - 400°C
29	Portable Indicating Pyrometer	1	YEW Japan	5	0 - 1200°C
30	Temperature & Humidity Test Chamber	1	Tabai Mfg. Japan	5	50x60x40 cm

NRLM = National Research Laboratory of Metrology, Japan
NML = National Measurement Laboratory, Australia
TISTR = Thailand Institute of Scientific and Technological Research, Thailand
ASL = Automatic Systems Laboratories Ltd., England

Equipment for Photometric Stan

Equipment for Photometric Standards

Item No.	Details	Quantity	Maker	Age	Capacity
1	Reference standard lamp for luminous intensity	2	ETL Japan	6	904 cd
2	Reference standard lamp for	3	ETL Japan	6	2580 to 2840 Lm
3	Integrating sphere, Dia. 1.5m	1	Toa Dengyo Japan	6	Diameter 1.50 m
4	Photometer use with Integrating sphere	1	Topcon Japan	6	
5	Photometric bench	1	Toa Dengyo	5	3.50 m long
6	Photometer use with photometric bench	1	Topcon Japan	6	
7	AC wattmeter, 0.5% class	1	YEW	6	120 watts
8	AC voltmeter, 0.5% class	2	YEW	6	300 volts
9	AC ammeter, 0.5% class	1	YEW Japan	6	100 mA
10	Digital Multimeter, type 2052 with true rms card	1	YEW Japan	6	0.02% accuracy
11	Digital Multimeter, type 3465A		Hewlett Packard, USA	5	0.05% accuracy
12	Monochromator	1 set	Atago Bussan Japan	6	0 to 999 nm
13	DC voltage stabilizer, 0.01%	1	Evertron Japan	6	0 - 250 VDC 20 A
14	AC voltage regulator, 0.3%	1	Nippon Makisen Kogyo, Japan	6	0 - 300 VAC
15	Illumination meter	2	Toshiba Japan	6	3000 lx
16	Digital illumination meter	1	Tektronix USA	5	0.199 to 1990 ft-cd
17	Distribution temperature meter	1	Toa Dengyo Japan	6	
18	Luminance meter	1	Minolta	4	0.01 to 99,900 ft-L
19	Chromameter	1	Minolta Japan	5	1600 to 40,000 K 10 to 200,000 lx
20	Reference ballast 20 watts	2	Toshiba	6	IEC rating
21	Reference ballast 40 watts	2	Toshiba Japan	6	IEC rating
22	Strip chart voltage recorder	3	NFE Corp. England	6	95 - 270 VAC
23	AC voltage regulator, 0.5%	1	Irem Italy	2	100-250 VAC 16 KVA

YEW = Yokogawa Electric Works, Japan

ETL = Electrotechnical Laboratory, Japan

Examine date: December 1986

No.	装置・計測器等の名称	台数	経年	標準	試験	
IV.	分析化学・生化学試験室 Analytical & Biochemistry Lab.	33		0	33	
1	天秤 Balance	2	1968		●	Mattler
3	化学天秤 Chemical Balance	2	1968		●	Mattler
5	イオン交換　純粋装置 Pure Water Demineralizer	1	1977		●	I.T. Lab.
6	蒸溜水製造装置 Pure Water Distillation Apparatus	1	1982		●	Sybren/Barnsread
7	冷水槽 Cool Water Bath	2	1979		●	Lauda
9	遠心分離機 Low Speed Centrifugal Machine	1	1966		●	Griffin
10	振とう器 Shaking Machine	1	1976		●	Cuvtin. Sci.
11	グラインダー Grinding Machine	1	1984		●	Rersch
12	真空乾燥器 Vacuum Oven	1	1966		●	
13	燃焼器 Muffle Furnace	1	1970		●	Griffin
14	恒温槽 Water Bath	1	1977		●	Karlkolb
15	粘度計 Viscosity Analysis	1	1970		●	Hoake
16	Ph 計 Ph Meter	1	1975		●	Backman
17	カーボン／イオウ分析装置 Carbon/Sulpher Analysis	1	1967		●	Sfrchlelm
18	カラー チェック Colour Checker	1	1968		●	Lovibond
19	色調検査器 Tint Merter	1	1968		●	Lovibond
20	分光分析計 Spectrophotometer	1	1966		●	Coloman
21	螢光光度計 Fluorometer	1	1976		●	Coleman

22	紫外線分析計 Ultraviolet Analysis	1	1977		●	Thomas
23	電気分析計 Electrolysis Analysis	1	1975		●	CKA-Germ
24	原子吸光光度計 Atomic Absorption Spectrophotometer	1	1966		●	Techtron
25	水銀分析計 Mercury Analysizer	1	1979		●	Coleman
26	沸点測定器 Flash Point Apparatus	1	1978		●	Stanhepe Bel
27	蛋白質分析器 Protein Analyzer	2	1978		●	Karlkolb
29	N分析計（ミクロ） Nitrogen Analysis	1	1976		●	Local
30	N分析計（マクロ） Nitrogen Analysis	1	1976		●	Local
31	真空蒸留装置 Vacuum Distiller	1	1980		●	Karlkolb
32	繊維素分析 Crude Fiber Apparatus	1	1976		●	Lab. Concc
33	抽出装置 Extractor	1	1976		●	Lab. Concc