7) Medical Entomology

8) Medicinal Plant Research

9) Environmental Health Science Research

10) Biomedical Research in Food

11) Pharmaceutical Sciences

3-3-1 Research Activities Plan

The following are the research activities and method of research at each unit.

(1) Virology

1) Research Activities

a. Research on arboviruses (Japanese encephalitis, dengue hemorrhagic fever, etc.)

b. Research on enteroviruses (Polio, Coxsackie-virus, Echovirus, Rota virus, etc.)

c. Research on respiratory viruses

d. Research on hepatitis virus

e. Research on rabies virus

f. Research on tumor virus (oncogenic virus)

g. Research on rickettsial diseases (epidemic typhus, scrub typhus, etc.)

h. Roles as WHO National Center of Influenza and National Center of Viral Hepatitis

i. Serum bank

2) Method of Research

a. Physical and morphological researches on virions (utilizing transmission and scanning electron microscopes, ultracentrifugal analysis, etc.)

b. Biochemical researches to facilitate the explication of chemical and antigenic composition of virions and virus genoms.

c. Biological and genetic researches on virus multiplication.

d. Immunological analysis of host-virus relationship, utilizing monoclonal antibodies.

e. Pathological analyses of virus infections establishing animal experiment model.

f. Development of standard measures for diagnosis, prophylaxis, and control of virus infections.

g. Establishment of a data base system to facilitate virological researches.

(2) **Bacteriology**

1) Research Activities

a. Research on intestinal infection by bacteria.

b. Research on drug-resistant bacteria.

c. Research on acute bacterial infection of respiratory tract.

d. Epidemiological research of etiological agents of intestinal infections.

e. Research on infectious diseases caused by anaerobes (tetanus, botulism, gasphregmones, etc.)

f. Research on acute respiratory infections caused by the organisms recently recognized; such as mycoplasma, etc.

g. Functions as reference center such as standardization of culture method and maintenance of bacterial strains, etc.

h. Supply of anti-serum and antigen for diagnosis.

2) Research Method

Animal experiments and tissue culture will be used in addition to general microbiological research method in order to carry out comprehensive research of pathogenic organisms, including applied as well as basic researches. The research of pathogenicity may involve physico-chemical and biological studies of microbial toxins and other biologically active substances. In order to ensure reliable research results, various methods shall be standardized concretely and precisely; these involve, proper and appropriate culture method, separation and identification of pathogenic agents, and phage-typing of some bacteria.

(3) **Mycology**

1) Research Activities

a. Etiological research on mycological infectious diseases.

b. Research on the effect of eumycetes on food.

c. Research on cryptococcosis (skin blastomycosis, erosio-interdigitalis blastomycetica, etc.)

d. Etiological research on deep seated mycosis.

2) Research Method

In general, the same methods as those of other bacteriology areas are adopted. The joint researches are to be made with Food Analysis division regarding fermented food relevant to the daily diet. The joint researches are to be performed with Pharmaceutical Science division in the case of diseases caused by treatment with some drugs such as antibiotics; such example is so called optimistic infection caused by normal flora.

(4) **Parasitology**

1) Research Activities

a. Epidemiological researches on parasite infestations.

b. Research on pathogenesis and prophylaxis of prevalent parasitic infestations.

c. Research of parasitic zoonosis, such as trichinellosis.

d. Research on malaria plasmodia.

2) Research Method

To make researches on the mechanism of parasitic infestations such as parasite host specificity and parasite location (in system or organ) specifity. To make researches on malaria plasmodia applying in vitro culture method for the sake of epidemilogy and establishment of prevention. To adopt a research method that gives priority on the establishment of appropriate standard measures for the diagnosis of parasitic diseases and upholding preventive activities.

(5) Immunology

1) Research Activities

a. Establishment of data base in regard to immunity of infections prevalent in Thailand.

b. Research on immunological reactions in vitro.

c. Research on cellular immunity.

d. Research on histocompatibility (HLA antigens)

e. Joint research on various problems related to immunity in respective fields.

f. Research on immuno-deficiency.

2) Research Methods

Recent remarkable progress in immunological studies has brought about fruitful results in the prevention and treatment of various diseases. Recently developed techniques in this new field should therefore be urgently adopted for studying the immunological features of infections prevalent in Thailand. This is one essential foundation not only for infection researchers, but also for the future development of medical sciences in general.

(6) Development and Control of Biological Products

1) Research Activities

a. Research and development of new biological products required in Thailand such as Japanese encephalitis vaccine, rabies anti-serum and immune globulin for hepatitis, etc.

b. Setting up the system and method for quality control of vaccines and sera including both domestic and imported products.

c. Development of national standards and reference preparations for quality control of biological products.

d. Research on the stability and checking of the "cold chain system" to ensure the potency of vaccines from storage points throughout the country.

e. Role as WHO National Control Laboratory for Biological Products.

2) Research Method

Research and development of biological products should be conducted in line with researches at the Immunology unit and other units related to microbiology. Collaboration with Government Pharmaceutical Organizations (G.P.O.), manufacturer of vaccines and serums, should also be taken into account as an important factor. The nature of the researches calls for large dependency on animal experiments.

(7) **Medical Entomology**

1). Research Activities

a. Research on medical important insects and rodent as vector of infectious diseases hazardous to human health (mosquito, fly, cockroach, mite, etc.).

b. Research on the classification, physiology, biology and ecology of above insects.

c. Research and development of chemical insecticide for those insects.

d. Research on efficacy of biological agents against medical important insects.

e. Research on vecotr-borne disease control.

2) Research Method

Collaboration, in research and experiments, with virology, bacteriology and mycology units will be vital regarding the mechanism of transmission of pathogenic agents by the vectors. Breeding insects are necessary for the purpose of studies on their physiology and ecology as well as classification.

(8) *Medicinal Plant Research*

1) Research Activities

a. Research and promotion of domestic cultivation and production of medicinal plants.

b. Research on pharmacological process and chemical analysis of domestically produced crude drugs.

c. Research to set up quality control of Thai medicinal plants.

d. Research on medicinal plants used for primary health care for local common diseases.

e. Research on medicinal plants used for chronic diseases such as diabetes and asthma, cardiotonics, anthelmintics, etc.

2) Research Methods

From old times, the use of medicinal plants, orally transmitted among its people, has been popular in Thailand, and an effective utilization of medicinal plants is called for, also in terms of

making the most of domestic resources. To accommodate to this plan, there is an urgent need for reinforcing researches in ecology, with focus on the cultivation and classification of plants, and in pharmacology which consists of pharmaco-chemical studies combining extraction, isolaton and purification of effective substances of plants, as well as the confirmation by pathological studies of the effects and safety of the plants. Future issues in this area include the joint research with the Pharmaceutical Sciences unit on the identification of the effective components of medicinal plants analyzed through extraction and refinement.

(9) **Environmental Health Science Research**

1) Research Activities

a. Research on prevention of environmental toxic substances.

b. Pathological studies on environmental toxic substances.

c. Studies on anti-pollution standards and regulations.

2) Research Methods

Research will be focused on chemical and biological experiments consisting of evaluation tests on environmental toxic substances concerning to studies of poisonous substances and appraisal of their safety. Regular methods will use experimental animals for evaluating the effect and safety of the toxic substances to human beings, and the main target is to make pathological deductions. A particularly close collaboration with the Food unit, which has direct relations with Environmental Health Sciences Research unit is required for making studies on toxic substances.

(10) **Biomedical Research in Food**

1) Research Activities

a. Research on the quality and safety of food additives.

b. Research on chemical and microbiological contaminants in food, mainly pesticide residues, heavy metals and mycotoxins.

c. Research on the food testing methods adopted in local health laboratories.

d. Research in the establishment of safety standards for food.

2) Research Methods

General testing and routine examination of food shall be conducted in the existing facilities of DMS, while NIH will mainly be responsible for the studies listed above. Chemical and instrumentation analysis through decomposition and extraction are the most common used methods in this area. The studies and experiments related to toxity and microbiological safety shall be conducted as a joint research with the Environmental Health Science Research and other related units.

(11) **Pharmaceutical Sciences**

1) Research Activities

a. Research on pharmaceutical chemistry.

b. Research on the efficacy and safety of drugs.

2) Research Methods

Research will be conducted through in vitro and in vivo experiments. The detection and analysis of drug components in blood serum, in

pharmaceutical preparations and its bio-availability are determined by means of physico-chemical assay method. The biological and microbiological studies will be carried out through experimental animals. Incidentally, experiments using radioimmunoassay methods shall be conducted in the Radioisotope laboratory provided as a common facility.

3-3-2 Common-Use Facilties and Equipment

(1) Common-Use of Research Equipment

1) Activities and Functions

a. To make an effective use of equipment by sharing the sophisticated and large research equipment.

b. To establish a centralized system for managing and maintaining the above equipment.

c. To develop appropriate technics and skill through the use of those equipment.

d. To play the role of maintenance and quality control for research equipment utilized in each unit.

e. To act as a service center for scientific photography.

f. To establish computer network for data management and automation control.

2) Common-Use Research Equipment

a. Electron microscopes and related equipment for ultrastructure studies on virus, bacteria, and other microscopic materials.

b. Ultracentrifuge, high performance liquid chromatograph, amino acide analyser and other equipment for studies at molecular level.

c. Spectroscopy instrument such as infrared spectrophotometer, atomic absorption, UV-VIS spectrophotometer and ultraviolet ray spectrophotometer.

d. Electronic balance for accurate analysis and measurement.

e. Multipurpose computer system for appropriate application that will be run by every unit in NIH.

f. Desktop lathe, drilling machine, electric welding machine, circuit tester, digital voltameter, oscilloscope and tool set for maintenance, inspection and repair of research equipment in each unit.

g. Micro- and macro-photo stand, dark room equipment set, film dryer, slide making machine and enlarger, etc.

h. Equipment for the preparation of audio-visual training materials.

(2) Joint Experiments

1) Facilities for Joint Experiments

a. Radioisotope (RI) Laboratory

- Research and experiments using Radioisotope in the area of Virology, Mycology, Immunology, Parasitology, Development and Control of Biological Products and Biomedical Research in Food.

- Research and experiments by methods using radioimmunoassay, in the area of thyroid stimulating hormone, and steroid hormone, etc.

b. Biohazard Laboratory

- Infectious and genetic research in Virology, Bacteriology, Mycology and unknown infective agents that call for biological safety.

2) Research Method

It is necessary to adhere to an international standard to ensure the safety of researchers involved in radioisotope and biohazard experiments and to prevent external contamination. The utmost safety measures are therefore called for.

(3) Animal Experiments

1) Keeping Animals

a. Raising and breeding normal animals - mice, that are used in large numbers, are purchased from the Animal Center of Mahidol University, but the required number of some special mice including baby mice shall be secured at NIH.

b. Raising and keeping experimental and infectious animals.

c. Quarantine of various animals brought in from the outside.

d. Kinds of animals to be raised - white mouse, white mouse suckling, rat, rabbit, guinea pig, goose, fowl, dog, hamster, cat, monkey, sheep, goat.

2) Research Activities

a. Research and experiment in Microbiology - Proliferation of microbes that cannot be artificially cultured, determining the toxicity of pathogenic organisms, assaying the effects of drugs and vaccines, etc.

b. Pathological analysis of diseases in infection models.

c. Physiological, biochemical and pharmacological experiments including pyrogen test.

d. Preparation of immune serum.

e. The kinds of animals to be used in each unit are as shown in the following table.

Unit	White Mouse	W.M. Sukkling	Rat	Rabbit	Guinea Pig	Goose	Fowl	Dog	Hamster	Cat	Monkey	Sheep	Goat
Virology	o	o		o	o	o	o	o	o		o		
Bacteriology, Mycology	o			o	o		o						
Immunology	o	o		o	o	o	o		o		o		
Development and control of Biological Products	o			o	o								
Medical Entomology	o												
Medicinal Plant	o		o	o	o			o					
Environmental Health Science Research	o		o	o	o								
Biomedical Research in Food	o												
Pharmaceutical Science	o		o	o	o					o	o	o	o

Table 3-3-2 Kinds of Animals to be used in Each Unit

(4) Central Sterile Supply Center

a. Central washing, sterilizing and preparation of research apparatus to be used in each research unit.

b. Purchase and management of consumables like reagents and glassware to be used in each unit.

c. Preparing and supplying simpler salt solutions, media, etc. to be used in each research unit.

3-3-3 Training and Administration Activities Plan

(1) Training Activities

a. Training for researchers - On the job training at research laboratories of each division.

b. Training of scientists stationed at the Regional Medical Sciences Centers to be able to train and guide technicians in charge of the diagnostic laboratories from 72 provinces.

c. Technical cooperations and joint researches with guest researchers from abroad.

d. Exchange of information and technology through scientific conventions among ASEAN countries and other international meetings (symposium, seminar, workshop)

(2) Information Activities (including Library)

a. References, collection and provision services for information regarding health sciences.

b. Compilation and publication of reports of the research.

c. Interchange of informations with other related organizations.

(3) Administrative Activities

a. Accounting work such as drafting of budget, paying and receiving, settlement of accounts and provision of supplies.

b. General-affair activities at NIH such as personnel administration and preparing salary of the staff.

c. Maintenance, repair, cleaning and security activities of facilities and equipment.

d. Welfare activities for the staff (such as catering for the staff because of the lack of appropriate urban facilities in surrounding areas).

(4) Filing and Keeping Records

a. Documentation, filing, keeping official records are systematically performed which will lead to computerized system.

3-4 ORGANIZATION AND PERSONNEL PLAN

3-4-1 Organization

NIH will be established by those sections which are related to research activities in the existing divisions in DMS on health sciences. However, NIH will belong to DMS in terms of organization.

The internal reorganization of DMS is expected to be considered by the authorities of Thailand. The inter-relations between the organization of DMS and that of NIH is tentatively shown as follows:

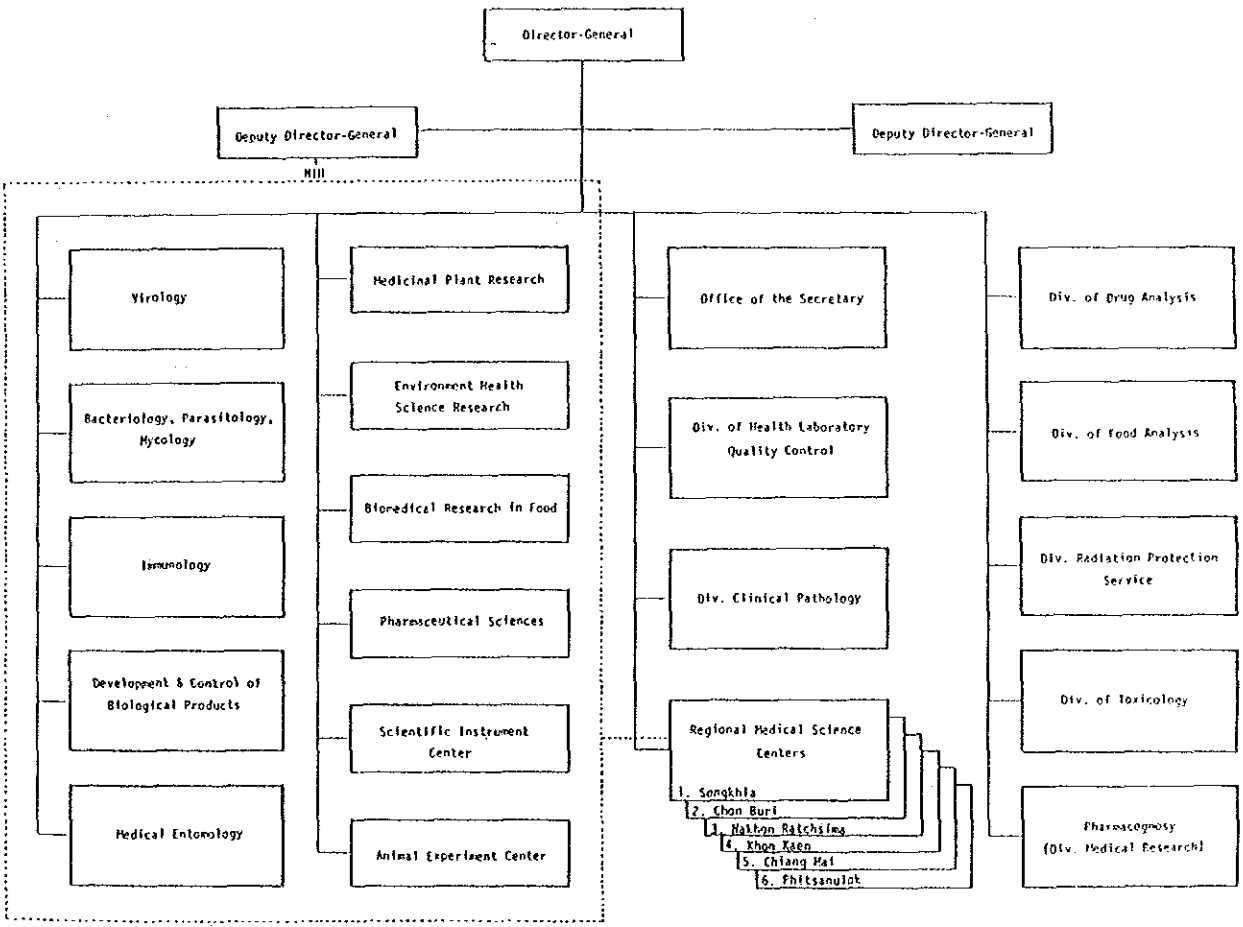


Fig. 3-4-1 Tentative Organization for NIH

3-4-2 Staffing

The projected staffing of each unit at the time of the establishment of NIH is as indicated in the Table 3-4-2. Consultations and investigations with the party concerned led to the conclusion that the urgent training of researchers by the time of the establishment if necessary in the fields of Immunology, Animal Experiments, Computer Science, Statistics, etc. It was also concluded that, in special fields such as RI Experiment and Biohazard Experiment, etc., definite assignments of personnel responsible for safety control was indispensable in order to establish an appropriate supervisory condition.

Category		Researchers	Assistants	Workers	Administrative Staffs	Technicians	Total
Research Laboratories	Virology	27	23	31	-	-	81
	Bacteriology	14	9	10	-	-	33
	Mycology	4	3	2	-	-	9
	Parasitology	4	2	2	-	-	8
	Immunology	(5)	(5)	(4)	-	-	(14)
	Development and Control of Biological Products	13	2	5	-	-	20
	Medical Entomology	16	14	32	-	-	62
	Medicinal Plant Research	57	11	10	-	-	78
	Environmental Health Science Research	(8)	(6)	(5)	-	-	(19)
	Biomedical Research in Food	(5)	(4)	(4)	-	-	(13)
	Pharmaceutical Science	(11)	(7)	(6)	-	-	(24)
	Sub-Total	164	86	111	-	-	361
Common-Use Facilities	Science Equipment center	5	2	5	-	-	12
	RI, Bio-hazard Laboratories	-	-	-	-	-	-
	Central Sterile Supply Center	-	(2)	(6)	-	-	(8)
	Animal Experiment Center	(vet.) 1	(10)	(9)	-	-	(20)
	Sub-Total	6	14	20	-	-	40
Training/Administration		-	-	-	(38)	(6)	(44)
TOTAL		170	100	131	38	6	445

(Notes) 1: ( ): estimates

2: Researchers are those with Ph.D. and M.Sc. qualifications, while Assistant Researchers are those with B.Sc. qualifications who help Researchers.

Table 3-4-2 Projected Staffing

3-5 NECESSARY FACILITIES AND EQUIPMENT

3-5-1 Necessary Facilities

Having studied the above-mentioned activities and staffing for NIH, the Team discussed and confirmed with related parties in Thailand on the following facilities:

- o Research Laboratories
- o Scientific Equipment Center
- o Animal Experiment Center
- o Training and Administration
- o Others

The appropriate size of each of the above facilities will be determined later so as to fit within the framework of the objectives of the Project, with consideration on the modes of operation, maintenance and management as well as the efficient utilization by means of centralized and common usage of facilities and equipment. Please refer to 4-2-3 "Facility Size" and 4-3-2 "Architectural Design" for details.

Utility service systems necessary for daily operations of the above-mentioned facilities, such as electrical, plumbing, airconditioning and ventilation and other special facilities will also be determined later. Please refer to 4-3-4 "Utility Design" for details.

3-5-2 Necessary Equipment

The Team discussed, in view of the smooth and efficient activities of NIH, and confirmed with related parties in Thailand regarding the equipment necessary for the Project as follows:

- Equipment for Research Laboratories
- Equipment for Scientific Equipment Center
- Equipment for Animal Experiment Center
- Equipment for Training and Others

Please refer to 4-3-5 "Equipment Plan" for details. It was also agreed that those equipment currently belonging to DMS which can be transferred to NIH should be utilized as efficiently as possible to save the expenditure for new equipment.

CHAPTER 4: BASIC DESIGN

CHAPTER 4: BASIC DESIGN

4-1 CONDITIONS OF THE PROJECT SITE

4-1-1 Location and Current Conditions of the Project Site

(1) Location

The projected site of NIH is in Nontaburi Province, about a half hour's drive from central Bangkok. The major means of transportation is by bus, however, the traffic situation is by no means convenient since the Project Site is located a little away from the trunk roads and in quite a distance from the nearest bus-stop. The projected site is located in one corner of the vast 2,000 ha site owned by the Ministry of Public Health. The current existing fa-

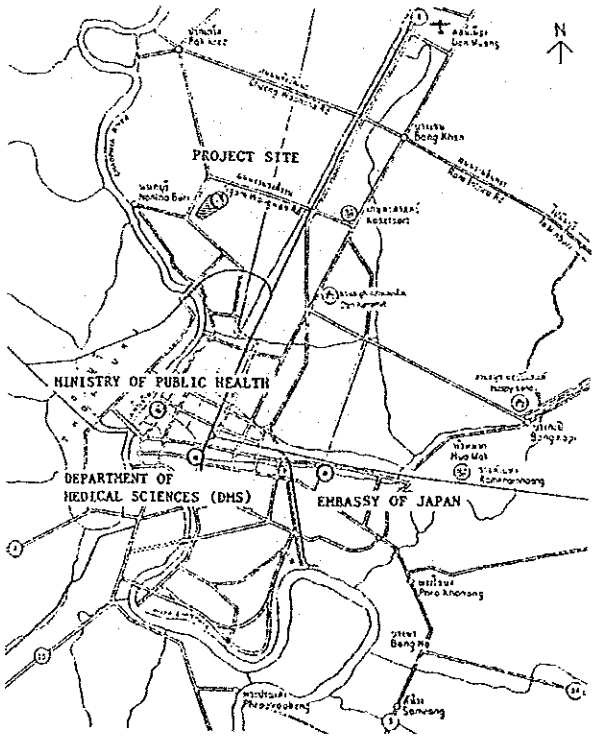


Fig. 4-1-1(a) Map of Bangkok

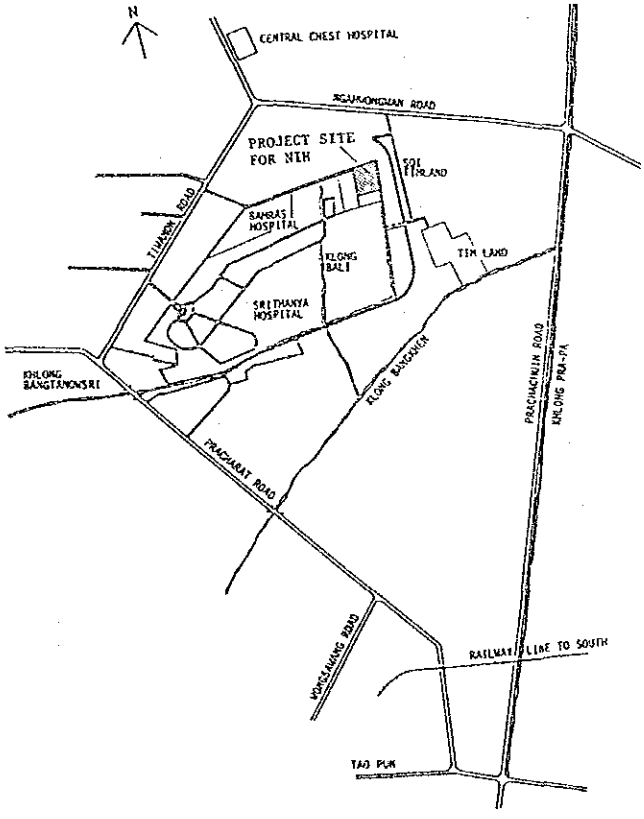


Fig. 4-1-1(b) Location Map

cilities on the site are the National Srithanya Hospital of Mental Health and the Bamras naradoon Hospital of Infectious Diseases, and there are future plan for Medical Complex of the Ministry of Public Health. The site is equipped with all the necessary condition for NIH, for which a land area of 48,000 m^2 will be allocated to DMS.

(2) Access road

Construction of an access road leading to the Project Site will be necessary for implementation of the Project, since there is no such road at present. The Team discussed with DMS the feasibility of the following three proposed routes based on their Site Survey.

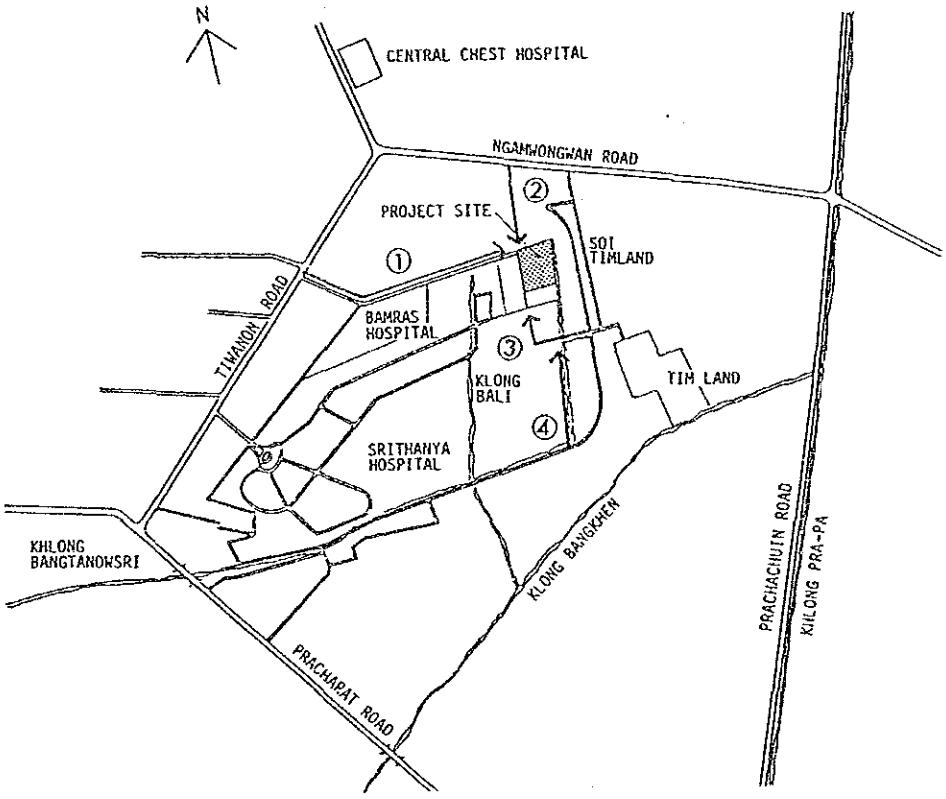


Fig. 4-1-1(c) Access Road to the Project Site

Route (1) is a little distant from the trunk roads and will therefore require a fairly large amount of construction cost.
The route is with in the land area owned by the Ministry of Public Health, however, so that the procedures for using the land for access road will be carried out without trouble. In this case the approach to the Bamras naradoon Hospital will be shared by those going to NIH, so the road will have to be reinforced.

Route (2) is the most ideal access road for the Project, providing a direct access from the trunk road to the Project site, but it will call for purchasing of a larger area of private-owned land.

Route (3) is the shortest out of all, both in terms of the distance from the trunk roads and in terms of the access to the Project site. However, this route will also call for purchase of private-owned land and the widening and reinforcement of Soi Timland Road.

After discussions with DMS, the Team accepted the request of DMS to propose Route (1), the most realistic plan, as the access Road to the Project site, but also solicited them to re-consider the possibilities for Route (2) and Route (3).

Meanwhile, Route (4) will be constructed by the Thai Government, as a temporary road to be used for landfill and leveling of the Project site which will be undertaken by the Thai Government, and also for the construction work for the Project.

(3) Selection of the Project Site

In line with the location of the access road, the Team discussed with DMS the selection of the site most suitable for the Project. The final location of the Project site is as shown in Fig. 4-1-1(d).

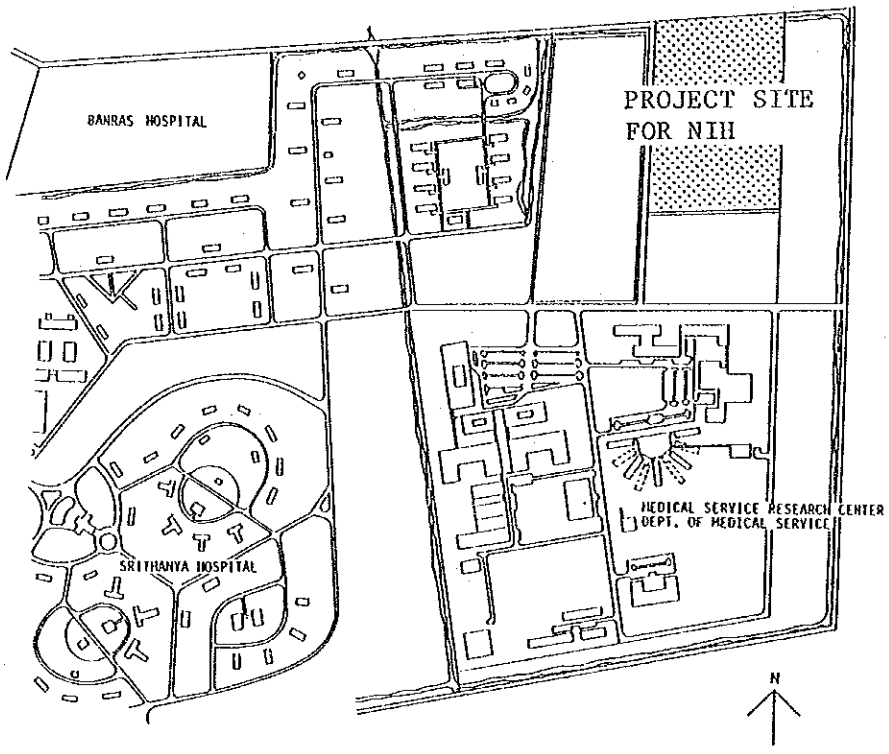


Fig. 4-1-1(d) Selection of the Project Site

(4) Conditions of the Project Site

The area on and around the Project site is a swampy, depressed ground covered with reed, which will be entirely covered by water during the rainy season. This calls for filling and grading of the land. After discussions by both parties, it was decided that the Thai Government will provide the work for filling the land so that it will become 1.55m higher than the current level.

Photo 4-1-1 Project Site

(5) Geological Conditions

The Chaophya plains where Bangkok is located is founded on alluvial strata of repeated accumulation of sand carried from the upper banks of the Chaophya river. As a result, a major part of Bangkok rests on alluvial strata originating from the accumulated delta of the Chaophya river. Incidentally, and land in and around Bangkok is depressed ground of about 1.5 m above the sea-level.

The alluvial strata of the Bangkok area in general is constructed of alternate layers of soft sand, sandy clay, clay and silt, and the water level is high. Because the ground is of soft loose strata of N-value 0 up to GL-15 m, the pressure and density causes subsidence of ground of as much as 10 cm per year.

The geological features of the Project site is expected to be more or less the same as explained above, the further evidence will be gleaned from the survey on foundation ground including boring tests in three places which the Team has requested DMS to undertake.

(6) Earthquakes

Earthquakes in Thailand is rare, since the country is not included in the Circum-Pacific belt and Alps-Himalaya belt. Although Thailand has recorded earthquakes detectable by human senses in the past, it can be considered almost free from damages by earthquakes.

(7) Meteorological Conditions

In the absence of available data for the particular district, the data for the nearest Don Muang is referred to. The conditions are as summarized below:

1) The temperature throughout the year is quite high, at an average of 28.2°C. The highest and lowest temperature recorded in the past 30 years are 40.0°C and 10.0°C, respectively.

2) Humidity is also quite high, at an average of 75.0% throughout the year.

3) There is a great disparity in the amount of rainfalls in the rainy season (May to October) and the dry season.

4) The direction of the wind is mainly South Wind from February to September and North Wind from October to January.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Temperature (°C.)													
Mean	26.2	27.7	29.1	30.1	29.5	29.1	28.6	28.4	28.2	28.1	27.3	25.7	28.2
Mean Max.	31.9	33.0	34.3	35.3	34.3	33.3	32.8	32.4	32.0	31.6	31.0	30.8	32.7
Mean Min.	20.2	22.0	23.8	25.1	25.3	25.2	25.0	25.0	24.8	24.9	23.5	20.9	23.8
Relative Humidity (%)													
Mean	70.0	73.0	74.0	74.0	77.0	76.0	78.0	78.0	80.0	78.0	75.0	72.0	75.0
Wind (Knots)													
Prevailing wind	E	S	S	S	S	S	S	S	S	N	N	N	-
Mean wind speed	5.5	6.9	7.5	7.5	7.0	6.8	6.5	6.8	6.2	5.6	5.8	5.5	-
Rainfall (mm.)													
Mean	7.4	20.1	32.2	59.1	160.4	154.2	167.2	212.7	291.2	217.8	34.6	15.1	1372.0

Table 4-1-1 Meteorological Data in Dan Muang

4-1-2 Infrastructure around the Project Site

As a part of the site survey, the Team met and confirmed the following contents with the related parties in Thailand.

(1) Electrical power

The 12,000 volt high-voltage wire along the trunk roads around the Project site will provide the following three routes from which electrical power can be led into the Project site.

(1) New route from Tiwanon Road

(2) A route prepared by increasing the number of existing lines leading to the National Srithanya Hospital

(3) New route from the Soi Timland Road

The final route will be determined after discussions between the Ministry of Public Health and the Metropolitan Electricity Authority (M.E.A.) after further studies on the location of the access road, siting of facilities, location of the Electrical Room, etc. The temporary electrical power required for the construction works can be supplied by extending to the projected site facilities the low-voltage main line leading to the National Srithanya Hospital.

(2) Telephone

A sufficient number of trunk lines are already installed along the trunk roads surrounding the Project site. The route for drawing telephone lines into the Project site should be considered in accordance with the route for drawing in the electric power. According to the Telephone Authority (T.A.) of Thailand, approximately 20 telephone lines can be supplied for the Project by the time the facilities are completed. As to the temporary telephone installation, several lines leading to the National Srithanya Hospital can be extended to serve this purpose.

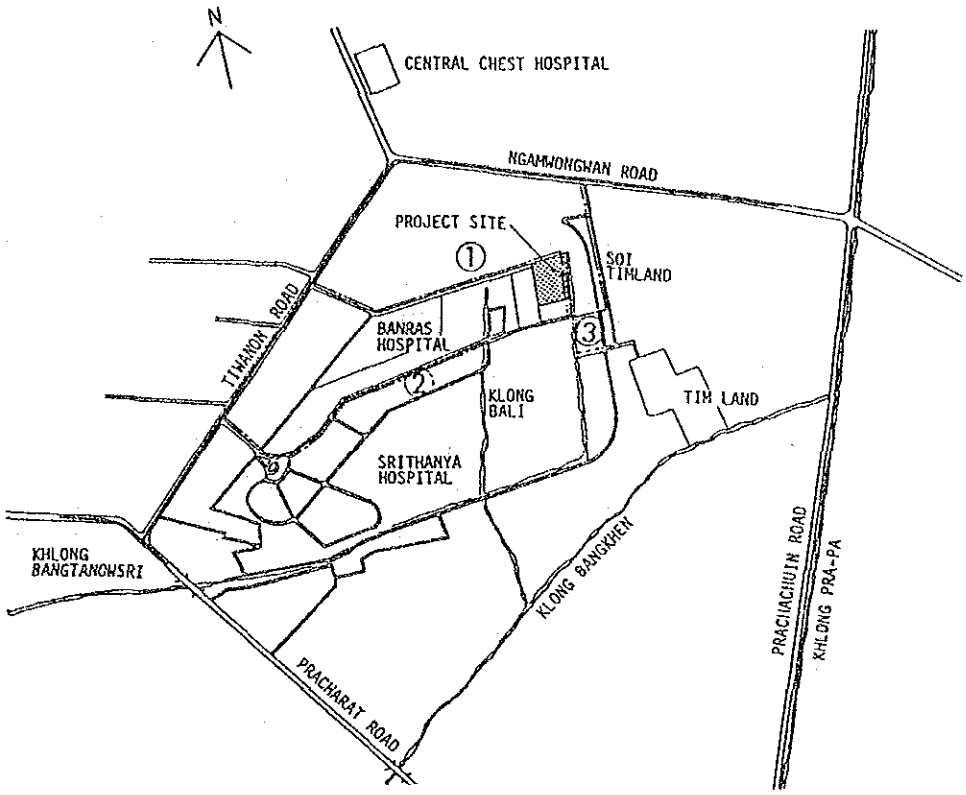


Fig. 4-1-2(a) Drawing Plan of Electrical Power and Telephone

(3) Water Supply

Main pipes for providing city water are buried along the trunk roads around the Project site to ensure the required water supply for NIH (230 m^3/day, by calculating the total floor area of the facilities at 14,200 m^2)

The following three routes are proposed as a draw-in route and the following points were confirmed through discussions with the Metropolitan Water Works Authority (N.W.W.A.)

(1) Tiwanon Road, a route that extends from the existing main pipe (radius 700 mm, water pressure 1.1 kg/cm^2) to the access road to the north of the Bamrus naradoon Hospital.

(2) A draw-in route directly branched from the Ngamwongwan Road (same as (3))

(3) Ngamwongwan Road (a plan for installing a main pipe with radius of 800 mm and water pressure 2.0 kg/cm^2 is already decided upon, to be completed in June 1984) to extend to Soi Timland Road.

The water quality at the Bangkhen purification plant is fit for drinking. However, because of contamination on its way, the water is not potable by the time it reaches the Project site. When the plan for installing a main pipe along the Ngamwongwan Road is executed, the quality of water will be fit for drinking.

The final draw-in route will be determined after discussions between the Ministry of Public Health and the M.W.W.A. The temporary water supply for construction works can be provided by extending to the Project site the water supply line within the National Srithanya Hospital.

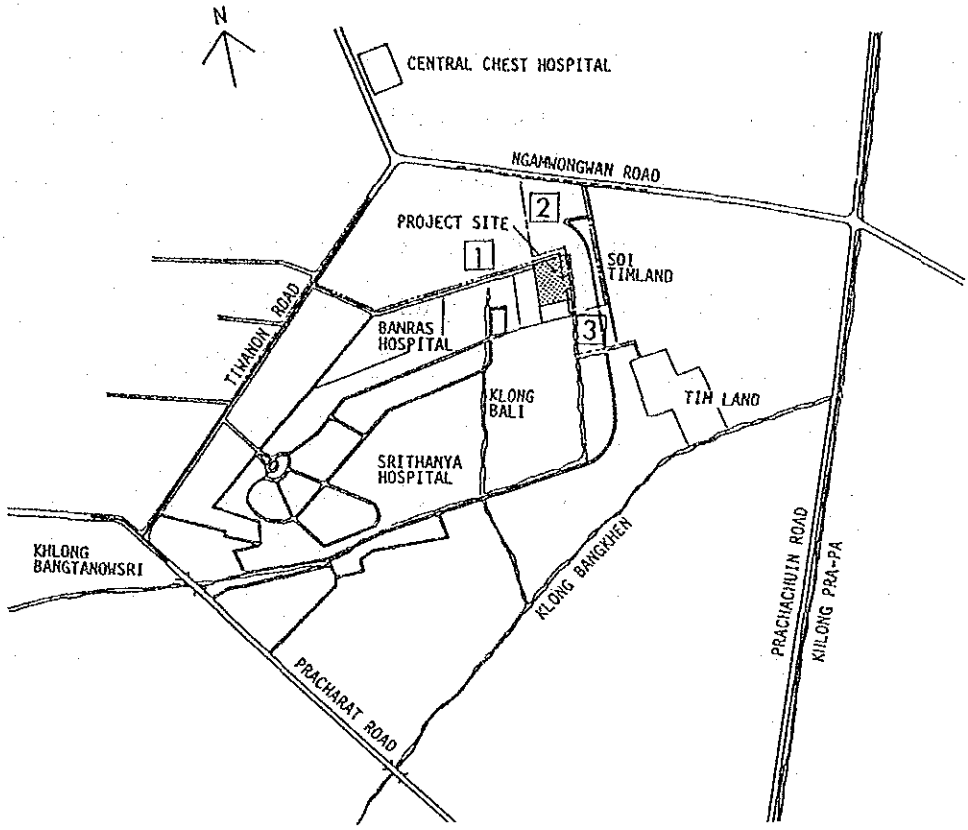


Fig. 4-1-2(b) Drawing Plan of City Water

(4) Drainage

Water drained from the NIH will be discharged to the reservoir pond on the eastern side of the Project Site and, finally, into the nearby Krong. Water drainage regulations in Thailand are provided in Factories Act that are already being applied, however, legal control is not yet executed to research facilities. The Environmental Health Div., Health Dept. of the Ministry of Public Health is providing guidelines for drainage treatment according to each facility, calling out for a standard of BOD 20 - 40 PPM, SS 30 - 50 PPM which should be maintained by sterilization before the water is discharged. The standard in Factories Act will also be

applied for chemical substances used in the experiment rooms. Oxidation Ditch and Waste Stabilization Pond are commonly used in Thailand for water drainage, and the Contact Aeration Method provided by the Japanese Building Code has also been approved. For treatment of the pull-out sludge, however, drying in open air within the site should be done before the waste is disposed of outside the site. An independent system should be considered for waste water from radioisotope experiments.

The approved amount of water to be consumed per day per person is 400 l/day, person for researchers and 120 l/day, person for general administrative staff.

(5) Gas

LPG cylinder is used in place of city gas, which is not yet available around the Project site.

(6) Waste Disposal

General waste around the Project site are collected by garbage trucks. However, wastes related to microbiological experiments should be burnt with in the facility of NIH, and an independent system should be considered for disposal of waste related to Radioisotope experiments.

4-2 DESIGN PRINCIPLES

4-2-1 Basic Design Policies

As described in 3-1 "Objectives of the Project", the Establishment Project of NIH was drawn up on the understanding that "reinforcement of research activities on a central level is indispensable to the effective prevention of diseases and improvement of public health in Thailand". The Team has fully recognized the background, situations, objectives and functions of the Project in drawing up Basic Design with the following basic design policies so that the facilities and equipment may be used effectively and in a convenient way.

(1) A plan that is aligned with the current circumstances of the structure of diseases in Thailand, and meets the urgent demands for public health activities.

(2) A plan that introduce common-use facilities that would promote efficiency in research activities, upgraded technics in research, security of safety for researchers and centralized control of research equipment.

(3) A plan for facilities and equipment conforming to the economic and technical circumstances in Thailand, based on the understanding of the objectives, activities and method of research to be carried out at NIH.

(4) A plan that sufficiently answers to the request of users.

(5) A plan that gives sufficient thought to the meteorological conditions, living customes and other conditions unique to the district where the Project is located. To cope with the hot and humid climate characterized by heavy rainfalls in the rainy season, the floor height of the first floor will be high enough to prevent the floor from flooding, and a system for utilizing natural ventilation and drafting, and controlled natural lighting will be adopted. The facilities are also designed to ensure guard against thefts.

(6) A plan that takes into account the technics, materials and methods of construction in Thailand, for facilities and equipment that are both easy to use and maintain and economical in terms of energy and maintenance.

(7) A plan that maintains harmony with the natural and physical environment around the Project site, with due consideration on its master plan as a medical complex for the Ministry of Public Health.

(8) A plan characterized by its adaptability and flexibility that leaves space to accommodate future changes according to the progress and development of research activities, in the form of partial remodeling, extention of research or divisions, establishment of new research divisions and expansion of the facility in general.

4-2-2 Outline of the Project

Project Name : National Institute of Health - NIH

Objectives : 1) To aim at high grade of research on a central level with focus on basic research related to infections disease control

2) To aim at expansion of public health activities through investigation and anaysis of food, drugs and toxic substances

3) To extend to local districts the activities for prevention, diagnosis and treatment of diseases through regional medical science Centers

4) To train and to develop specialized researchers indispensable to such researches

Research Areas : Virology

Bacteriology

Mycology

Parasitology

Immunology

Development and Control of Biological Products

Medical Entomology

Medicinal Plant Research

Environmental Health Science Research

Biomedical Research in Food

Pharmaceutical Science

Executing Agency : Department of Medical Sciences (DMS), Ministry of Public Health

Project Site : Nonthaburi, Nonthaburi Province

Located in one corner of the prospected Medical Complex owned by the Ministry of Health which will be allocated to DMS.

Site Area : 48,000 m^2

Outline of Facilities :

Research Laboratory (2 blocks)	- 3-storied reinforced concrete	7,038 m^2
Scientific Equipment Center/ Animal Experiment Center Block	- 3-storied reinforced concrete	3,618 m^2
Training/Administration Block	- 3-storied reinforced concrete	1,800 m^2
Large Conference Room Block	- partly 2-storied reinforced concrete	449 m^2
Cafeteria Block	- 1-storied reinforced concrete	260 m^2
Service Facilities Block (2 blocks)	- 1-storied reinforced concrete	360 m^2
Connecting Corridors	- 3-storied reinforced concrete	774 m^2

	Outdoor Facilities	- Sewage treatment facilities, incinerator, waste disposal stock, oil tank, animal house, etc. Total area 14,299 m^2 (including connecting corridors and excluding outdoor facilities)

Outline of Equipment : Equipment for Research Laboratories

Equipment for Scientific Equipment Center

Equipment for Animal Experiment Center

Equipment for Training and Others

4-2-3 Facility Size

(1) Determining the Size of the Facilities

Based on the results of the Basic Design Study on the research activities, research areas, room names, required number of units and staffing, as well as comparison studies with similar facilities in Japan and checkups based on data both in Thailand and Japan to calculate the adequate facility size, the Team has made the following proposal regarding the adequate size of the facilities of NIH.

Category of Facility	Research Unit	No. of Researchers (incl. Assistants & Workers)	Proposed Adequate Facility Size		Result of Basic Design Floor Area (m^2)
			No. of Units (6x6M Unit)	Floor Area (m^2)	
Research Laboratories	Virology	81	26	936	936
	Bacteriology	33	11	396	396
	Mycology	9	3	108	108
	Parasitology	8	4	144	144
	Immunology	(14)	6	216	216
	Development and Control of Biological Products	20	10	360	360
	Medical Entomology	62	20	720	720
	Medicinal Plant Research	78	20	720	720
	Environmental Health Science Research	(19)	6	216	216
	Biomedical Research in Food	(13)	6	216	216
	Pharmaceutical Science	(24)	8	288	288
	Sub-total	361	120	4,320	4,320
	Scientific Equipment Center	(20)	26	936	936
	Animal Experiment Center	(20)	37.5	1,350	1,350
	Total	401	183.5	6,606	6,606
Training/Administration		Administrative staff 38	-	1,608	1,699
Service Facilities (Machine Rooms, etc.)		Technical staff 6	-	801	887
Others (Corridors, Staircases, Storages, Toilets, Hall, Lobby, Connecting Corridor,)		-	-	4,785	5,107
Grand Total		445	-	13,800	14,299

Table 4-2-3 Proposed Adequate Facility Size

(2) Determining the Stories of the Facilities

Based on discussions with DMS, it was decided that the facilities will be arranged in three floors, with the following points taken into account.

1) The Project site has a wide area of 48,000 m^2 with no other building nearby, so there is sufficient space for future land utilization even after facilities of medium height.

2) A high-rise structure will only bring demerits, in architectural and utility design, to facilities like a research institute which have to fulfill several different functions.

3) It is more effective to design facilities of medium height devided by blocks according to function, in order to promote smooth administration, secure communication between similar research units and to clarify the circulation of the researchers. It will also ensure more safety for the research facilities.

4) Medium-height buildings are more economical in both construction cost and running cost for the facilities, and the period of construction is also shorter, compared with high-rise buildings.

4-3 BASIC DESIGN

4-3-1 Block Layout

(1) Access Road to the Project Site

An access road leading to Project site, which currently does not exist, should be prepared for implementing the Project.

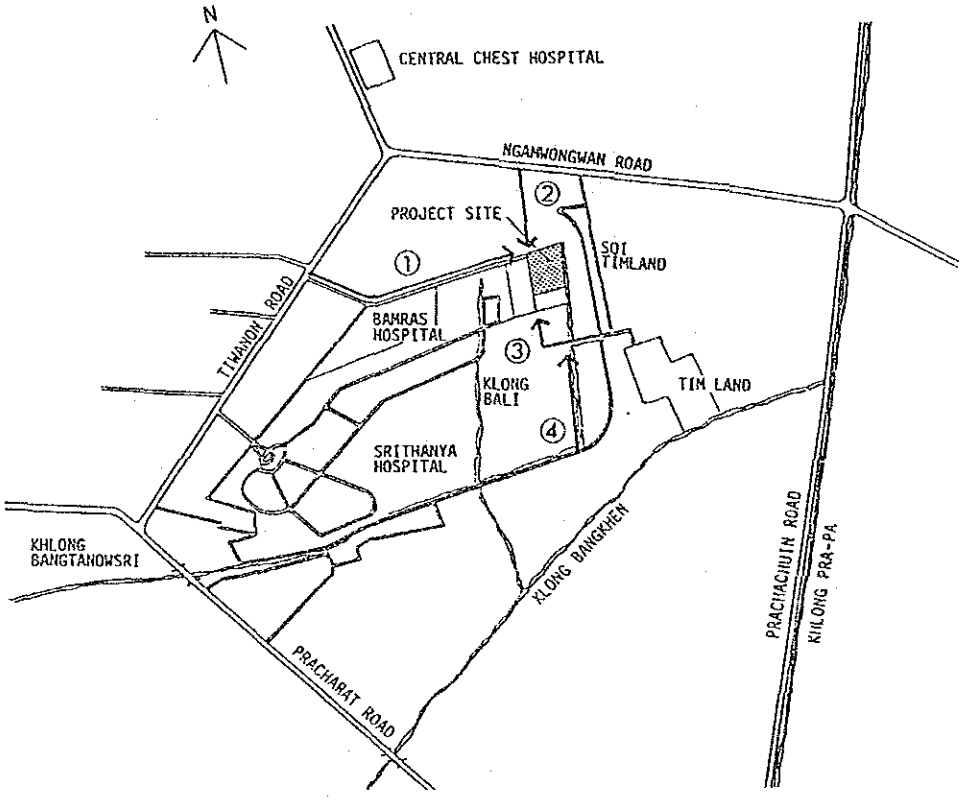


Fig. 4-3-1(a) Access Road to the Project Site

There are three proposed routes for the access road, the most probable of which is Route (1). The block layout in the Basic Design should therefore be adopted to Route (1).

(2) Layout of Facilities

The facilities will be accommodated in the Northern half of the site which is nearer to the access road (Route 1), whereas the Southern half of the site will be left as reserve space for future expansion of the facilities. An approach will be provided from the Western side of the site, branching southward from the access road. The research facilities will be arranged on the East-West axis of the site with consideration on sunlight and the direction of the wind. This seems to be an ideal arrangement, since the site itself extends in the East-West directions. Service facilities like machine rooms, sewage treatment facilities and incinerator will be accommodated in the eastern part of the site facing the reservoir pond, and a service road connecting the approach to the service facilities will be prepared to the north of the site.

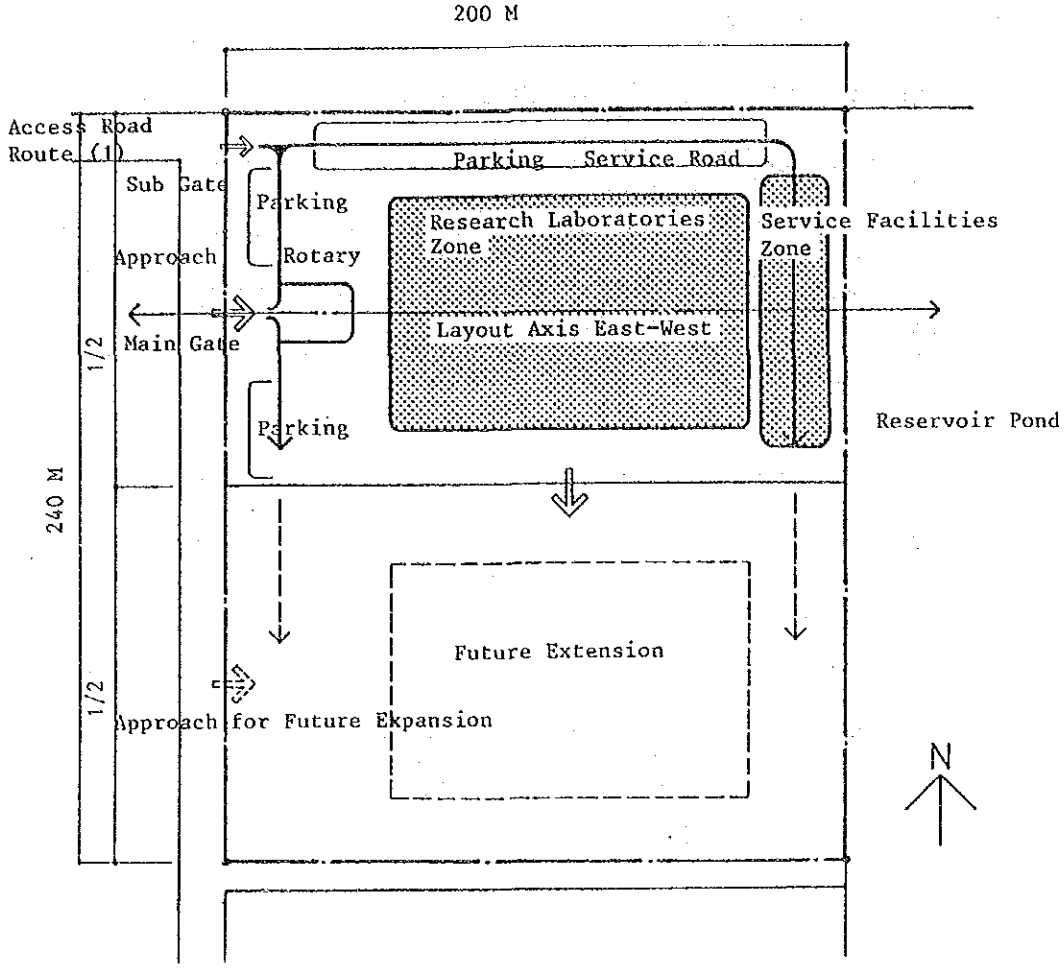


Fig. 4-3-1(b) Land Utilization Plan

(3) Block Layout

The facilities can be divided into six major blocks, according to their functions, how they are to be used (common or independent facilities), their size and floor area, and the nature of required volume (whether or not the volume is durable for multi-storied). The six major blocks will be arranged as shown in Fig. 4-3-1(c), with regard to the layout of the facilities and future expansion plans.

1) Research Laboratory Block (2-blocks)

The facilities will be divided by functions into two Blocks, according to the type of research activities involved; one is for preventive medicine against infectious diseases --(North Block), and the other is for hygienic sciences --(South Block). The Blocks will be located on either side of the East-West axis.

2) Scientific Equipment Center/Animal Experiment Center Block

Although quite difference in functions, both Centers are to be used as common-use facilities and will therefore be incorporated into the same block. The Block will be located on the eastern side between the two Research Laboratory Blocks.

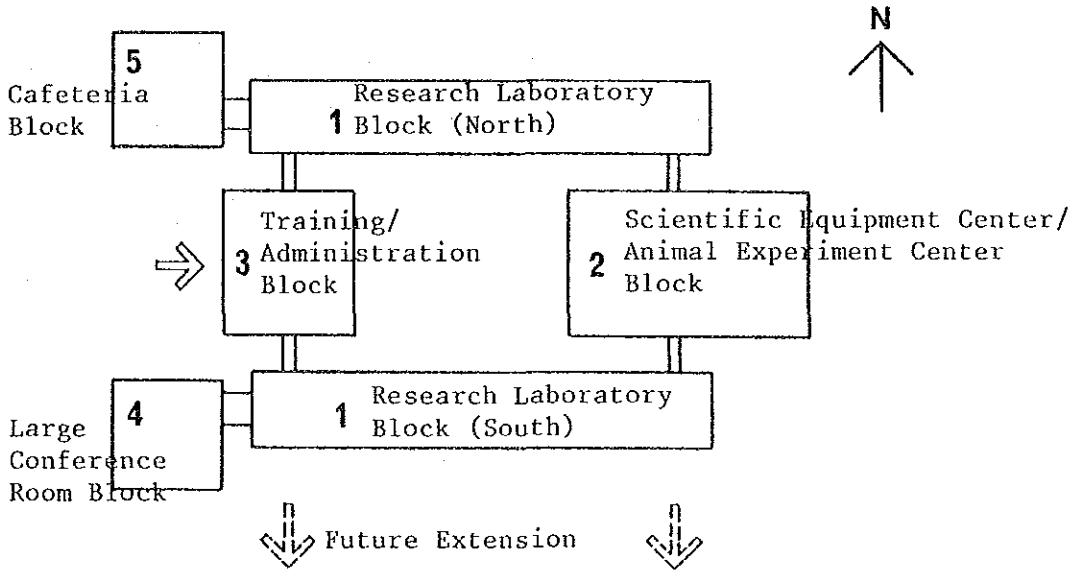


Fig. 4-3-1(c) Block Layout

3) Training/Administration Block

The Training/Administration Block will be located in front of the approach to the facilities, and will function as the main entrance to the facilities. The location of the Block will be on the western side between the two Research Laboratory Blocks so as to maximize the use of its common-use facilities such as Conference Rooms and Library.

4) Large Conference Room Block

5) Cafeteria Block

From the large space and volume they require, their special functions and usages, the Large Conference Room and Cafeteria cannot be easily incorporated into other Blocks. They will therefore be located as separate blocks to the west of the two Research Laboratory Blocks. This location will enable an easy access from the entrance hall, thus providing convenience to the research staff who will use the facilities.

4-3-2 Architectural Design

(1) Floor Planning

1). Research Laboratory Block

a. Research Office and Experiment Room

From the current circumstances of research activities carried out in experiment rooms at DMS, Research Experiment Rooms will be designed for this Project, instead of separate research offices and experiment rooms. However, Staff Rooms and Seminar Rooms for the research staff, will be provided in each unit apart from their research laboratories.

b. Determining the Standard Research Experiment Room

A Standard Research Experiment Room (6 m x 6 m Unit) was established at the stage of the Basic Design Study, so as to promote smooth discussions between the Team and DMS, and also as a help for determining the necessary number of units, planning of each blocks and necessary rooms. Through its module planning and standardization of experiment rooms this will result in efficiency and rationalization of design and construction works for major research facilities. It will also prove effective in securing flexibilities and adaptability in case of progress and upgrading in the research activities and remodelling of the facilities in future.

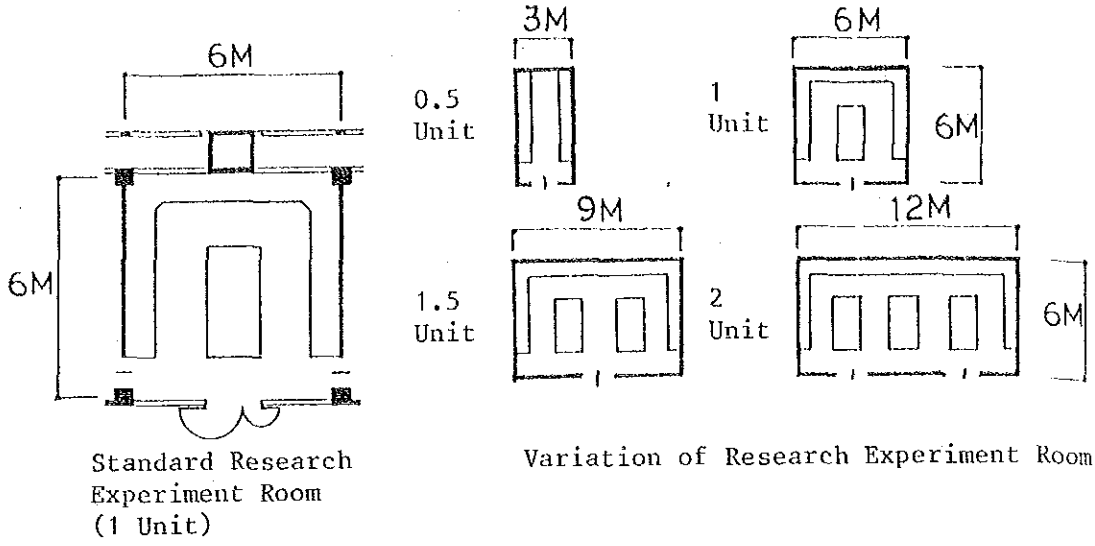


Fig. 4-3-2(a) Standard Research Experiment Room in NIH

This module for the Standard Research Experiment Room will be determined after further investigations on the current conditions under which the existing research facilities of DMS are being used, with reference to the research activities of NIH. Adjustment will then be made for incorporating the Research Experiment Rooms within the proposed adequate facility size of the Basic Design.

c. Block Planning

While there are many composition forms for research experiement room and corridors, they are divided into two basic forms, namely, the moddle-corridor type and the side-corridor type, the features for each of which are as described in the table 4-3-2(a). Most of the governmental facilities in Thailand adopt the side-corridor type, which is open to the air facilitates natural ventilation in a climate characterized by high temperature and humidity.

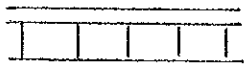
Types / Items	Middle-Corridor Type 	Side-Corridor Type 
Area Efficiency ratio	High	Low
Centralization of Research Laboratories	Possible	Impossible
Utility Service Efficiency	High	Low
Openness	Low	High
Natural Lighting	Not suited for corridor	Good
Natural Ventilation	Not suited for corridor	Good

Table 4-3-2(a) Comparison of Corridor Type

However, research facilities in general adopt the middle-corridor type because of the area efficiency ratio, centralization of research offices and experiment rooms and facility efficiency to maintain the high quality of utility services demanded by the research activities. This tendency can be confirmed by the fact that the middle-corridor type is adopted in the comparatively new research facilities of DMS. The middle-corridor type will be adopted for the NIH project, and the focus of the planning will be laid on countering the drawbacks of the middle-corridor type be securing openness, natural lighting in corridors and natural ventilation in rooms.

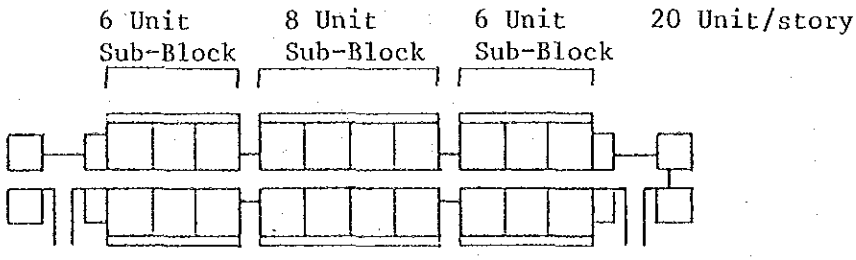


Fig. 4-3-2(b) Block Planning -Research Laboratory Block

In order to avoid the closed-type plan caused by long corridors, the research laboratories will be divided into three sub blocks, each consisting of a group of 6 to 8 units, which will be connected together with balconies directly exposed to outdoor air, thus forming an open, naturally well lighted and ventilated block as a whole.

d. Floor and Sectional Planning

As explained in c. "Block Planning", the Research Laboratory Block will basically consist of 20 units/story Standard Research Experiment Rooms along the middle-corridor. Research Laboratory Block consists of two blocks, that is, the North Block and the South Block, both of which will contain the same number of units, since the research activities in the eleven research areas can also be roughly divided into two functions.

The 60 units for the Research Laboratory Block (North) will be mainly used for preventive medicine for infectious desease.

Virology	(26 units)
Bacteriology	(11 units)
Mycology	(3 units)
Parasitology Dept.	(4 units)
Immunology	(6 units)
Development and Control of Biological Products	(10 units)

The 60 units for Research Laboratory Block (South) will be mainly used for hygienic sciences.

Medical Entomology	(20 units)
Medicinal Plant Research	(20 units)
Environmental Health Science Research	(6 units)
Biomedical Research in Food	(6 units)
Pharmaceutical Science	(8 units)

The layout for each story of the respective research areas are as shown in Fig. 4-3-2(c)

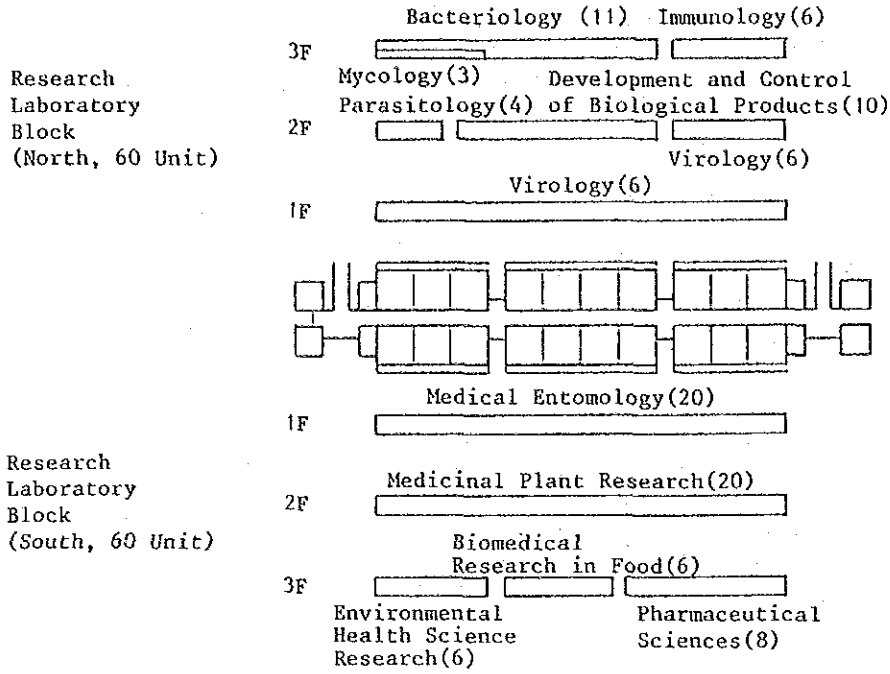


Fig. 4-3-2(c) Floor Allocation of Each Research Unit

2) Scientific Equipment Center/Animal Experiment Center Block

a. Composition of the Block

This common-use facility block will be composed of two facilities with separate functions connected by a corridor extended, to form a square, from connecting corridors which connected the South and North Blocks of the Research Laboratories.

The Animal Experiment Center will be located on the eastern side, nearer to the service facilities and away from other blocks, while the Scientific Equipment Center will be located on the western side.

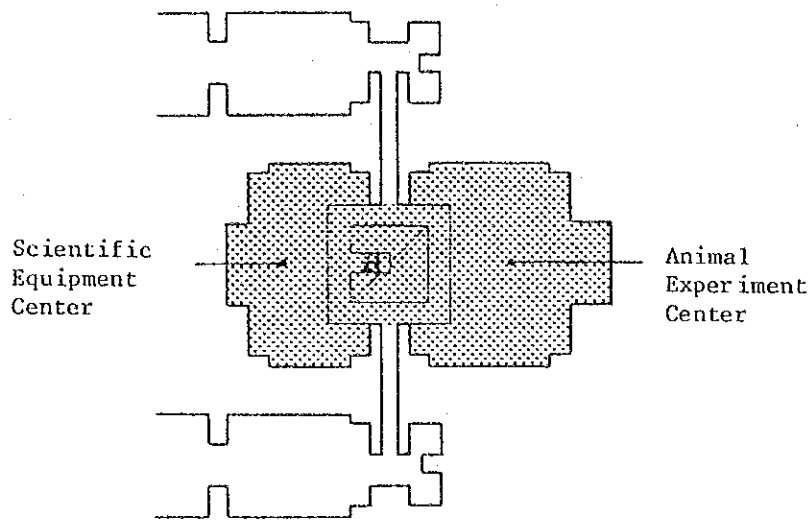


Fig. 4-3-2 (d) Composition of Scientific Equipment Center/ Animal Experiment Center Block

b. Floor and Sectional Planning

From the nature of the facilities, the Scientific Equipment Center and Animal Experiment Center require high grade of utility services to prevent cross-contamination and temperature/humidity control, for which a compact floor plan using a middle-corridor will be adopted. The ends of the corridor, however, will be faced to the outside, to facilitate natural light, ventilation and draft.

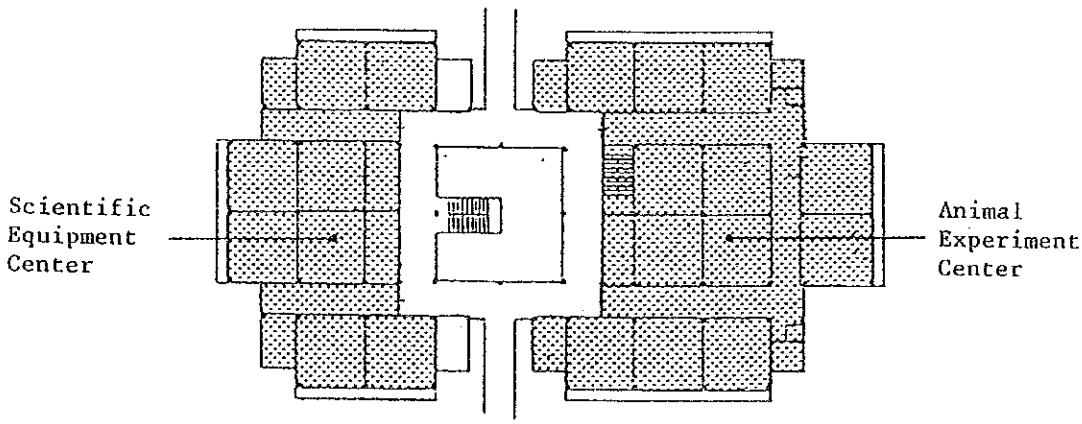


Fig. 4-3-2(e) Floor Plan

The first floor of the Scientific Equipment Center will be devoted to Biohazard Laborarory and Radioisotope Laboratory that require a safety zone, and the second floor will accommodate the Equipment Pool, Scientific Photograph Center and Workshop-1,2. The Central sterile Supply Center, Workshop-3, Research & Development Room and Computor Room will be located on the third floor.

The doorway of the first floor of the Animal Experiment Center will be used for carrying animals and their food, cages and beds in and out of the building. The first floor will also have rooms for general administration, such as an Administration Office, Washing, Sterilizing and Receiving Room, Animal Quaratine Room, etc., and a part of the floor will be used for keeping insects for Medical Entomology unit will have a doorway for exclusive use. The second floor, which will provide a doorway for research staffs, will have Normal Animal Rooms with an attached Changing Room equipped with toilets and showers. The third floor will have Animal Experiment Rooms, and a part of the floor will be isolated from one another devoted to Experiment Rooms for Infected Animals. The doorway on the second floor will be used as the sole doorway for research staffs entering and departing the facility, so as to make clear the operations and administrations of the Animal Experiment Center.

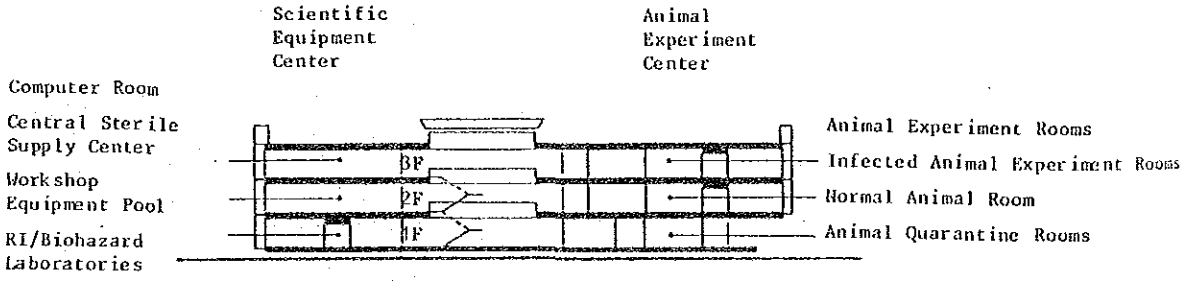


Fig. 4-3-2(f) Section

3) Training/Administration Block

a. Composition of Block

The facilities for the Training/Administration Block will be arranged along the side-corridors extending, to form a square, from the connecting corridors which connected the North and South Blocks of the Research Laboratories. The space surrounded by the side corridors arranged to form a square will be a 3-storied void. The top floor will have a roof, thus composing a comprehensive inner space consisting of an Entrance Hall and Lobby as well as common-use facilities such as the training facilities. The roof of the building, however, will be designed so as to enable sufficient lighting and ventilation.

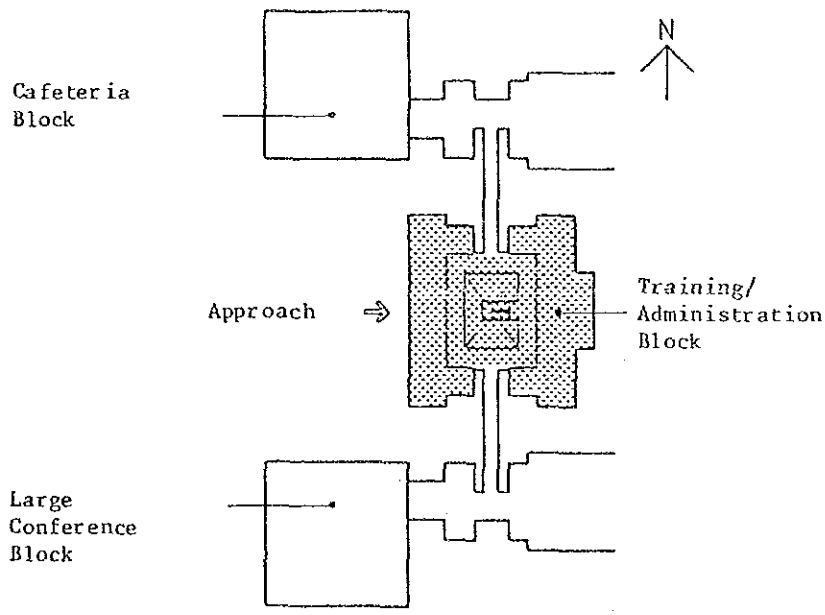


Fig. 4-3-2(g) Training/Administration Block

b. Floor and Sectional Planning

An open, side-corridor type plan will be adopted for the Training/Administration Block which will not requires high grade of utility services. In addition to the Entrance Hall and Lobby, the first floor will have administration rooms such as Administration Office, Commodity, Night Duty Room and Information & Corresponding Office.

The second floor will consist of rooms for training and administration rooms such as 2 Conference Rooms, Library, Printing Room and Health Clinic & Rest Room, while the third floor will be devoted to administration rooms like the Director Room, Deputy Director Room, Reception Room, Meeting Room and Expert Rooms.

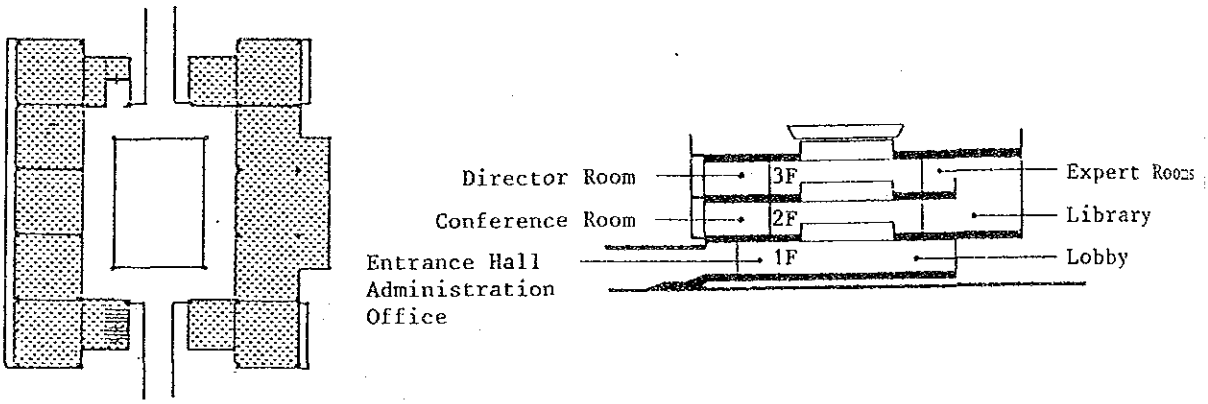


Fig. 4-3-2(h) Floor Plan and Section

4) Large Conference Room Block

The Large Conference Room Block will be located on the extension line of the South Block of the Research Laboratory, near the Training/Administration Block which provides an entrance to the facilities. The location is also convenient for visitors from the outside.

The Large Conference Room will be a stepped-floor type auditorium with fixed stage and seats accommodating 200 people and will be used for seminars, symposiums and conferences on public health. The first floor will have a Rest Room for lectureres and a Storage besides the stage and the audience seats. The second floor will be equipped with a Control Room for projection and audio-visual control and Machine Room for air-conditioning.

5) Cafeteria Block

The Cafeteria Block will be located on the opposite side of the Large Conference Room Block, on the extension line of the North Block of the Research Laboratory. The location is regarded as appropriate, also from the viewpoint of securing a direct traffic line from the service road planned on the northern side of the Project Site to the Kitchen, thus facilitating a smooth delivery of food and waste disposal.

The self-service Cafeteria will seat 120 people (serving a total of 300 employees excluding workers in 2.5 shifts), and the size of the Kitchen will be determined by the number of people using the Cafeteria.

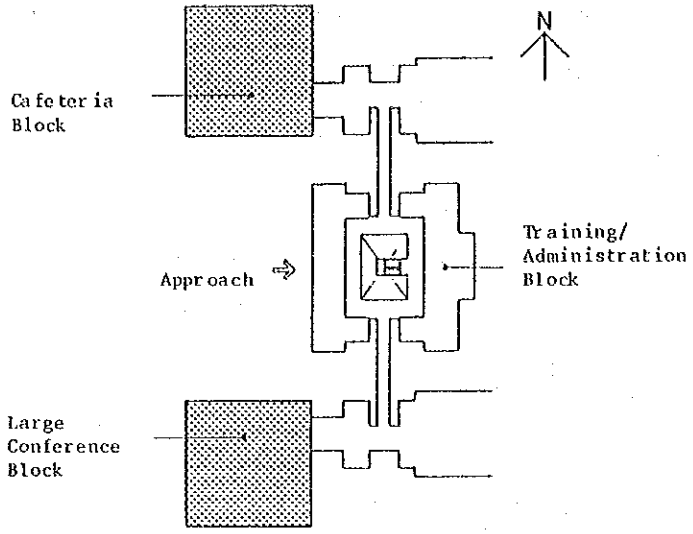


Fig. 4-3-2(i) Composition of Large Conference Room Block and Cateria Block

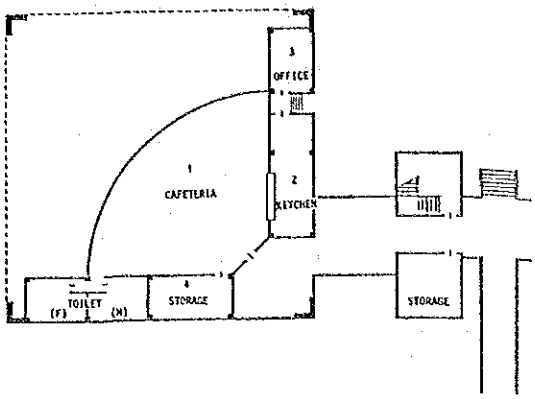


Fig. 4-3-2(j) Plan of Cafeteria Block

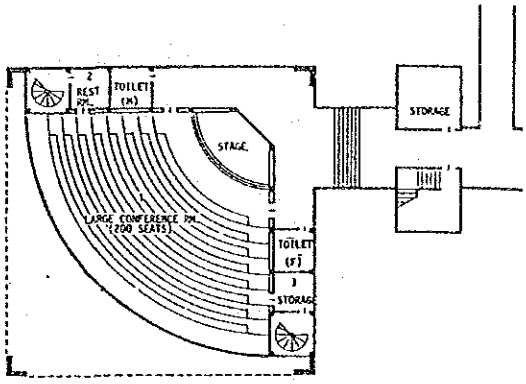


Fig. 4-3-2(k) Plan of Large Conference Room Block

(2) Sectional Planning

1) Floor Height of the First Floor

The Project site currently rests in the swamps and, although the Thai Government will conduct landfilling and grading of the ground, the floor height of the first floor should be set at 1.5 meters above the landfilled ground, to guard against flooding and humidity from heavy rainfalls in the rainy season, and also to leave sufficient space for plumbing installations.

2) Floor Height and Ceiling Height of Each Floor

The floor height and ceiling height of the facilities of NIH should be determined with respect to those of the Research Laboratory Block owing to the fact that many of them are to be used for research activities. According to the "By-Laws of the Bangkok Metropilis, Re: Control of the Construction of Buildings", the minimum required height of the ceilings is 2.4 meters with, and 3 meters without, air-conditioning. It is also required ceiling, since many of the facilities are to be used for biological experiments and research and should be free from dust or dirt, and the space in between will be used for plumbing and ducting installations. Many of the research experiment rooms will have air-conditioning installations, however, they will be used only part of the time depending on the research activities, cut-down policy of running costs as a public facility, the actual temperature and humidity, etc., and so the building should be basically designed to utilize natural ventilation and draft which will require a ceiling height of 3 meters. As

a result, the height of each floor after adding the sealed space of 0.8 meters to the ceiling height of 3 meters should be around 3.8 meters. Incidentally, the ceiling height of the middle-corridor will be 2.4 meters, and the sealed space will be used as room for plumbing and ducting installations.

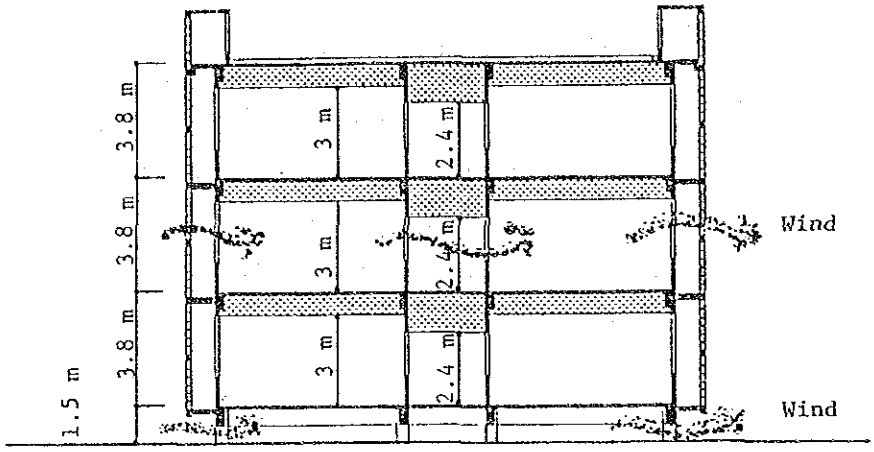


Fig. 4-3-2 (1) Section of Research Laboratory Block

3) Design of Elements

a. Roof

The roof will be a flat roof slab covered with heat insulation blocks of precast concrete to guard against strong rays of the sun and heavy rainfalls and to secure sufficient heat insulation.

b. Exterior Walls

The exterior walls along the frontage of the building will be equipped with a balcony and will have an open structure with a louver of hollow concrete block so that the surface of wall and wall facing the room will be free from the direct rays of the sun and guarded against crimes at the same time. The exterior wall

inside the balcony will have a large opening, with considerations on natural ventilation and draft using casement windows and jalousies. The exterior walls along the depth of the building will be of double bricks to ensure sufficient heat insulation and walls of staircases and toilets will be of ventilating blocks which will enable an open structure with natural ventilation and draft.

c. Interior Walls

The interior walls will be of single bricks. The interior will facing the middle-corridor will have an opening from the waist height up, with fixed windows and jalousies to secure natural lighting, ventilation and draft to the corridor.

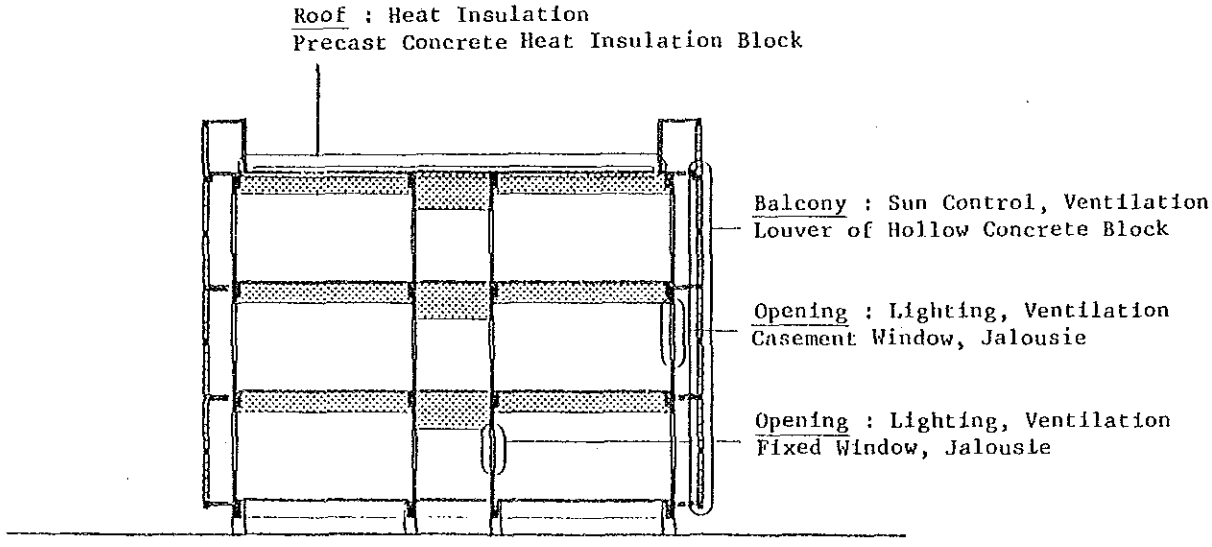


Fig. 4-3-2(m) Design of Elements

(3) Finishing Plan

Materials easy to maintain and high in cost performance will be selected for interior and exterior finishing, with due respect on local circumstances of construction, site conditions of the facilities, environment around the Project site and the usage and function of each facility and room.

NIH being a research institute, the following areas should be considered in particular.

a. To have the composure and dignity of a public research institute.
b. To satisfy the needs and functions required of a research institute.
c. To be durable against weather, chemicals, water, shock, etc.
d. To be easy in daily maintenance (simple to maintain its sanitary environment).
e. To be simple in future replacing and remodeling (to conform to future replacing and remodeling facilities).

1) Exterior Finishing

Roof	: Membrane waterproofing + Precast concrete heat insulating block
Exterior Wall	: Washed terrazzo, Brick, Concrete block, Ventilating block
Door and windows	: Plywood flash door, Aluminum window, Aluminum jalousie
Louver	: Precast hollow concrete block

2) Interior Finishing

Room Name	Floor	Baseboard	Wall	Ceiling
Research Experiment Room	Vinyl sheet	Plastic baseboard	Mortar painted	Plaster board painted
Sterile Room	Ditto	Ditto	Ditto	Ditto
Equipment Pool	Ditto	Ditto	Ditto	Ditto
Animal Experiment Room	Ditto	Ditto	Ditto	Ditto
RI Laboratory	Ditto	Ditto	Ditto	Ditto
Biohazard Laboratory	Ditto	Ditto	Ditto	Ditto
Administration Office	Ditto	Vinyl baseboard	Ditto	Ditto
Conference Room	Vinyl tile	Ditto	Ditto	Rockwool acoustic board
Library	Needle punch carpet	Wood baseboard	Ditto	Ditto
Director Room	Ditto	Ditto	Ditto	Ditto
Cafeteria	Parquet block	Ditto	Ditto	Ditto
Large Conference Room	Needle punch carpet	Ditto	Acoustic particle board	Acoustic particle board
Toilet	Mosaic tile	Tile	Tile	Asbect board painted
Corridor, Hall	Polished terrazzo	Terrazzo block	Mortar painted	Plaster board painted

Doors and Windows: Plywood flash door, Wooden window, Aluminum jalousie

Table 4-3-2(b) Interior Finishing Schedule

(4) Exterior Planning

The following Exterior Planning has been made in line with the Block Layout.

1) Service Roads and Side-walks

For reasons of management and crime prevention, the entrance road into the Project site should be limited to the two as main and sub gates on the West side. The service road will be used as an approach to the facilities and will have a rotary in front of the Training/Administration Block to enable an approach by cars. A side-walk from the entrance road along the rotary will provide a traffic line for pedestrians. The service road will be located to turn to the North side of the site and connect the Service Facilities in the East side of the site. The service road will be 6 meters wide, and paved.

2) Parking Space

Parking space will be provided for an estimated number of 30% of the total staff working at NIH. There will be a total parking space for 136 cars; for 24 cars on one side of the service road on the West side of the site, 100 cars on both sides of the service road on the North side, and 12 cars on one side of the service road on the East side.

3) Exterior Facilities

The gates and a Guard House will be located off beside the entrance road to the Project site, and a fence for a total length of at least 640 meters will be necessary to surround approximately half

of the land on the Project site. Sign posts and lamp posts will also be necessary along the service road.

4) Landscaping

Research facilities should be free of sand, dirt and dust, so a lawn as ground cover is necessary, at least for the unpaved ground around the facilities. Tall trees should be planted near the parking space, so that cars will not be exposed to direct sunlight.

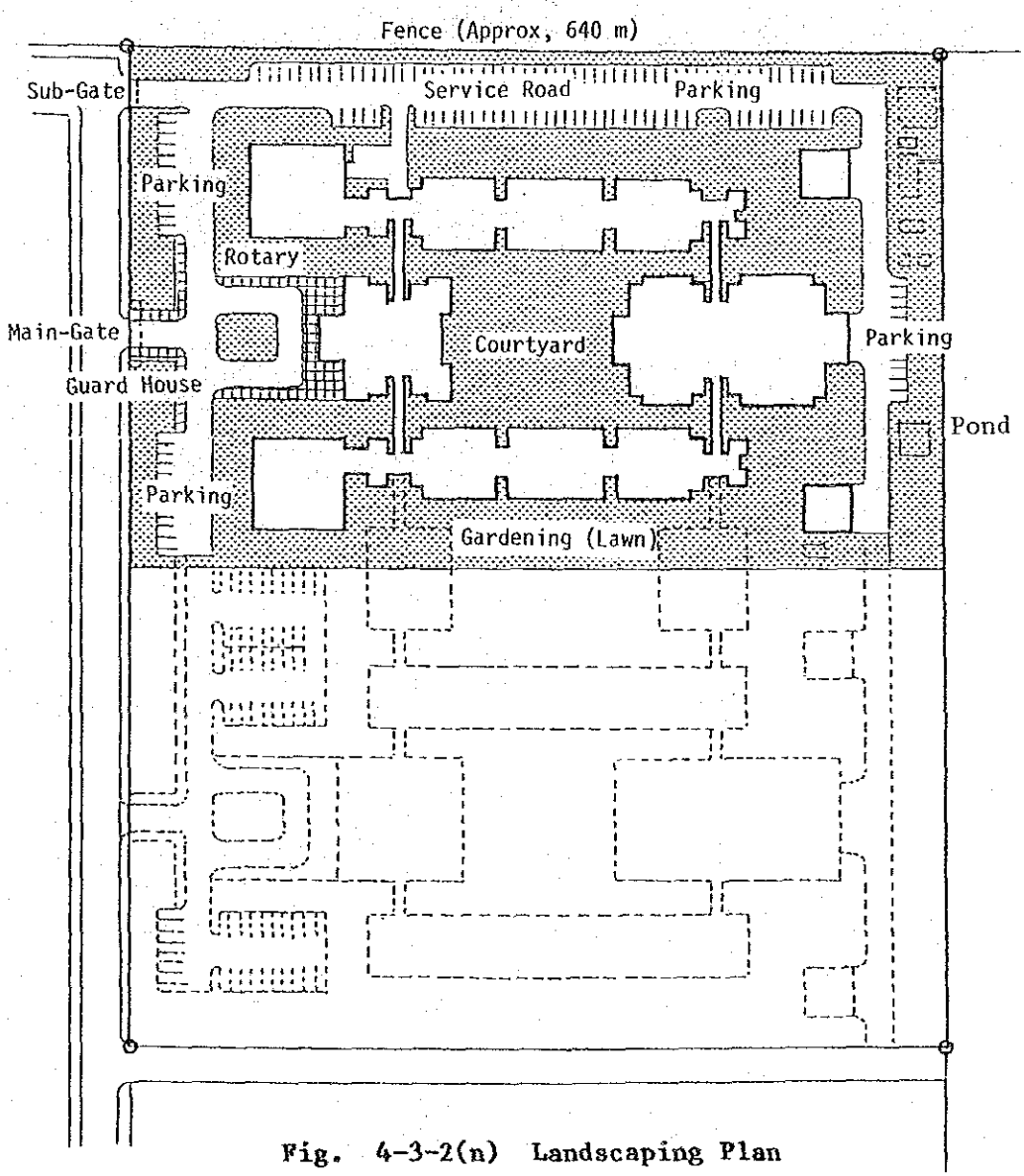


Fig. 4-3-2(n) Landscaping Plan

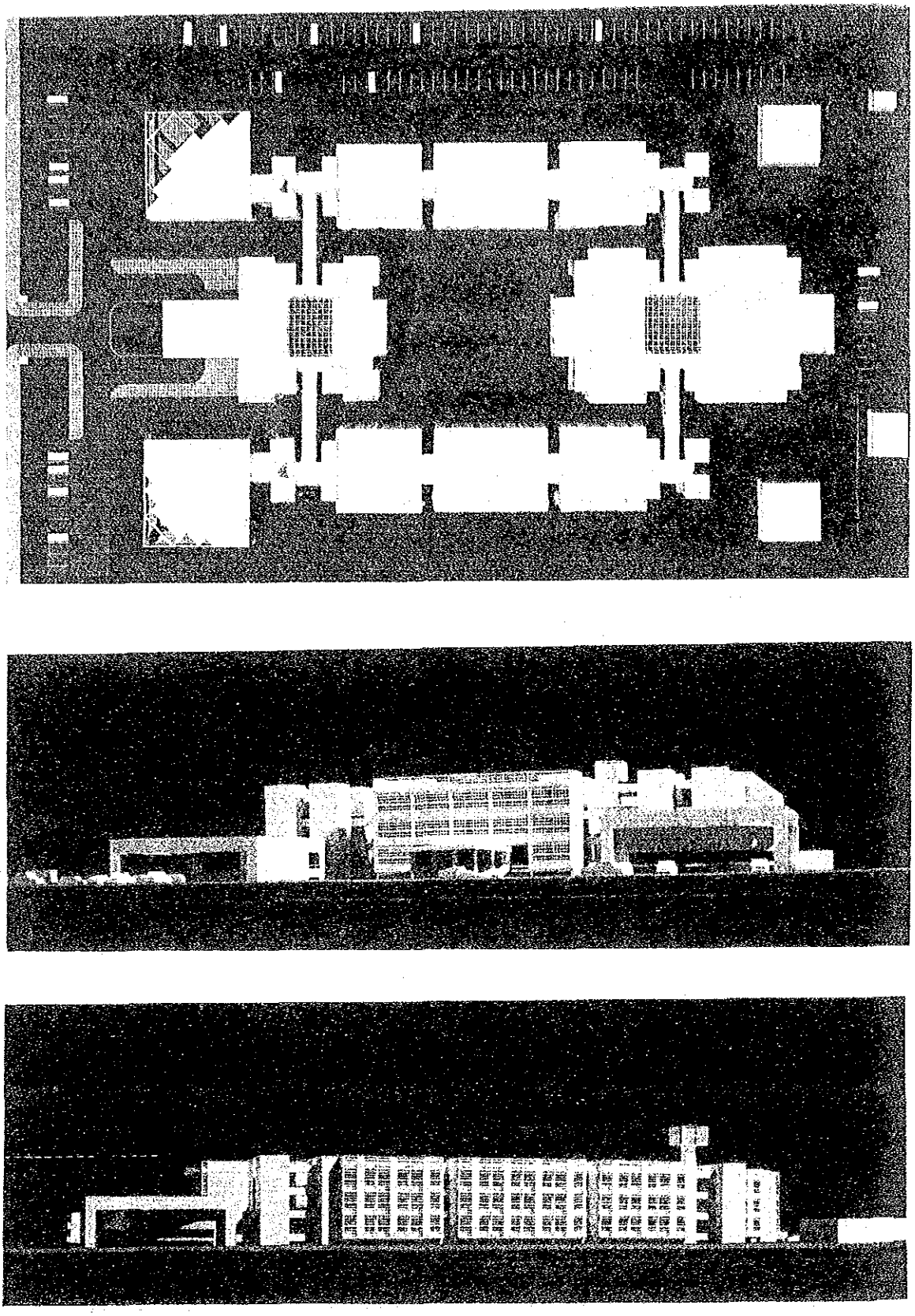


Photo 4-3-2 Study Model

4-3-3 Structural Design

(1) Basic Policies

1) Structural system should suit the size, layout and mode of use of the building facilities, all in relation to the physical conditions in Thailand.

2) Structural system should be adaptable to the locally available materials and their quality and construction technics, and preference be given to the local products and methods unless special problems are involved.

3) Structural system should be economical yet durable.

(2) Design of Structures

1) For structural design, reinforced concrete rigid frame commonly used in Thailand will be used as a rule. Walls will be of bricks and concrete blocks piled in the frames.

2) Foundation

In view of the unfavorable condition of ground around Bangkok, a pile foundation will be adopted. The length and durable stress of the piles will be determined after boring tests on the Project site and confirmation of building weight established for the detail design.

3) The structural calculation will be based on the working stress design method conforming to the various standards of the Architectural Institute of Japan. The standards in Thailand and Japan

should be considered for determining the allowable structural materials, and the local workmanship and irregularity in quality of materials should also be considered.

(3) Design Loads

The design loads will comply with the Article 63 of the By-Laws of the Bangkok Metropolis, Re: Control of the Construction of Building, 1979.

1) Dead Loads

a.	Reinforced concrete	2.4 t/m^3
b.	Structural steel	7.85 t/m^3
c.	Brick and concrete block	1.9 t/m^3

d. Dead weight of other materials and finishing materials will be evaluated in the detail design stage.

2) Live Loads

a.	Roof (general)	50 kg/m^2
b.	Roof (concrete overhung)	100 kg/m^2
c.	Toilet	150 kg/m^2
d.	Office, Conference Room Corridor, Staircase	300 kg/m^2
e.	Auditorium, Research Experiment Room	400 kg/m^2
f.	Library, Storage, Machine Room, Workshop	500 kg/m2

g. Details will be determined in the detail design stage for the live loads of water tanks, machines and research equipment on which heavy loads will be imposed, or which should be free from vibration.

(3) Wind Loads

The standard provided by the By-Laws of Bangkok Metropolis will be adopted.

Height	Wind Pressure
Less than 10 m	50 kg/m^2
10 m - 20 m	80 kg/m^2
20 m - 40 m	120 kg/m^2

Wind loads in Thailand is about one third of that in Japan, small enough to be disregarded for this Project, at most 3 floors high.

(4) Seismic Load

In the absence of any major earthquake in the past in Thailand, the effects of earthquakes can be disregarded for this Project.

(5) Structural Materials

Major construction materials will be designated as follows:

1) Reinforcing Bars : Deformed Bar SD 30 (TIS)
2) Concrete : Fc = 210 kg/cm^2
   (Cylinder test for 4-week strength)
3) Cement : Normal Portland Cement (ASTM)
4) Structural Steel : SS41 (JIS) or equivalent
5) Pile : Precast concrete product

4-3-4 Utility Design

(1) Basic policies

1) To provide an environment where researches can be carried out in safety.

2) To provide an environment where researches can be carried out accurately and effectively.

3) To provide functional utility services which meets the diversified needs of researches ranging from general to high-level studies.

4) To provide utility services which will be maintained perfectly in both technical and economical terms.

5) To promote utility design which can conform itself to future development and extension of research activities.

6) To promote utility design which will economize the construction and operation and maintenance costs.

7) To provide utility services which will be easy to operate and maintain.

8) To promote utility design using standardized equipment and materials as much as possible so that replacement of parts and repairs will be easy.

9) To use equipment and materials conforming to TIS and JIS in general, specifically for equipment and materials provided from Japan.

(2) Electrical System

1) Power Supply and Design Loads

Power will be supplied by the Thai Government, from the 12,000-volt high-voltage line of the trunk roads surrounding the Project site to the receiving transformer. From thereon, an electric cable will transmit power to the distribution panels in the Electrical Room.

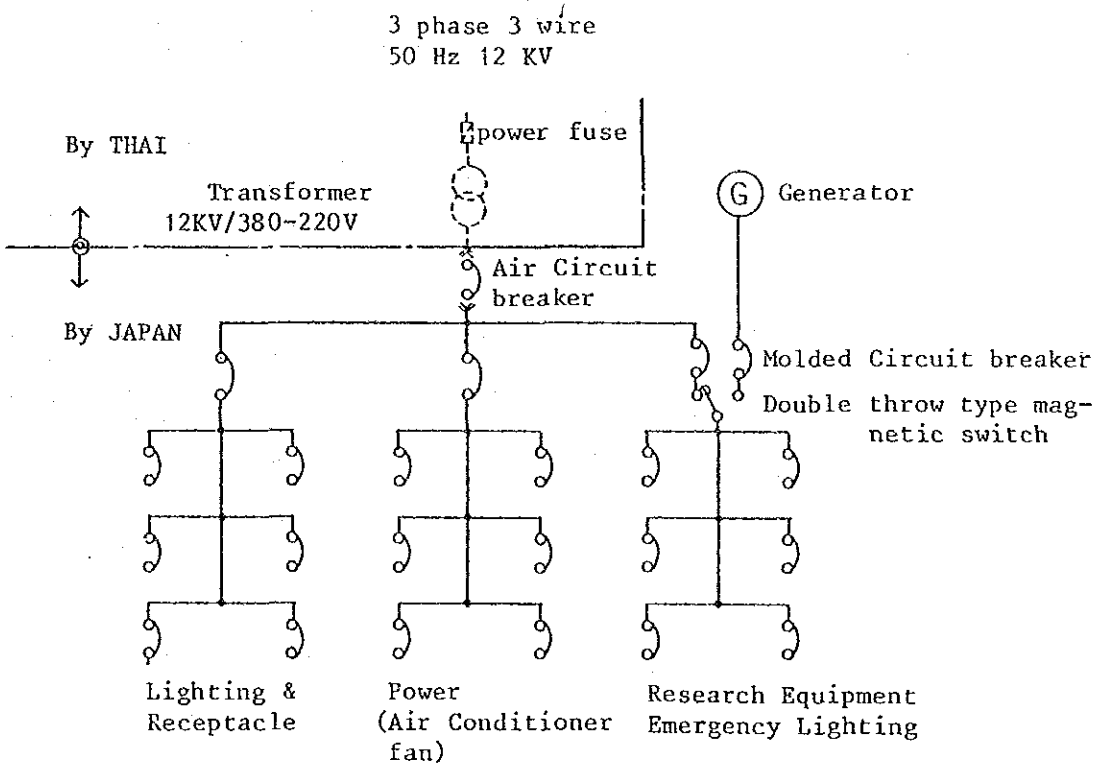


Fig. 4-3-4(a) Power Supply Single Line Diagram

The total capacity of the facilities to be installed is estimated to be about 1,450 kVA, the breakdown of which is as follows. The actual demand for electricity will be around 800 kVA.

Lighting/Receptacle	240 kVA
Research Equipment	450 kVA

Airconditioning/Ventilating/ Pumps	760 kVA

2) Receiving Transformer

Receiving transformers with a capacity of around 1,500 KVA will be installed inside the facilities, as a rule, close to the Electrical Room which will be equipped with power board for distributing electricity to each facility. The transformer will provide secondary voltage of 3-phase 4-line 380-220V, and will supply electricity of 3-phase 380V for air-conditioning packages and single-phase 220 v for receptacles.

3) Generator

A diesel generator will be installed in the Generator Room as a stand-by service in case of power failure. The capacity of the generator will be around 200 KVA to 300 KVA. The generator will provide power for fire-fighting pumps, emergency lighting, thermostatic devices such as refrigerators and freezers, air-conditioning and ventilating for Radioisotope and Biohazard Laboratories, some of the research equipment, as well as for securing electric power in case of blackouts.

4) Low Voltage Main Line and Wirings

CV cable will be used for the main line extending from the transformer to the lighting panels and power control panel boards, etc. which will be installed on a cable racks to facilitate easy maintenance and inspection in future. Incidentally, future needs are taken into account for determining the main line power capacity to

be distributed to each lighting panels and power control panel boards.

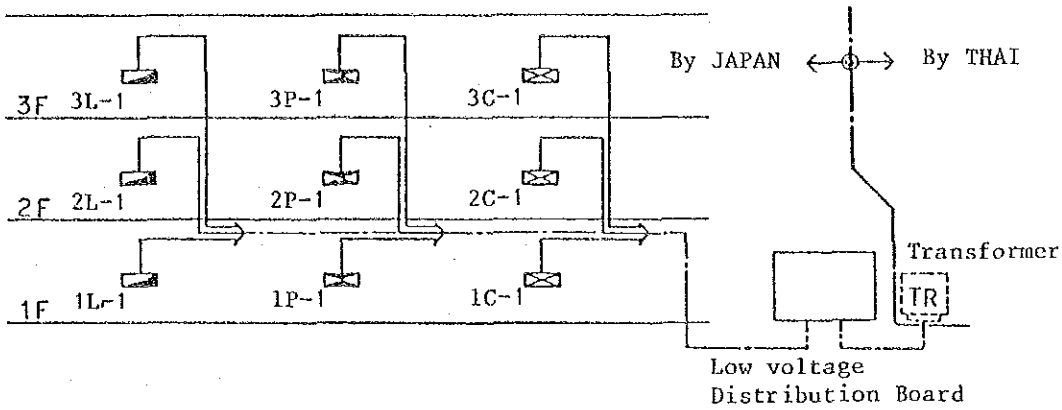


Fig. 4-3-4(b) Distribution Diagram for Main Power Line

5) Indoor Wirings

Receptacles for the research equipment will be located on the case-way attached to the surrounding walls of the research experiment rooms. The receptacles will have earth electrodes with voltage of 1ϕ 220V. For the research equipment that require stabilized electricity, individual CVCF devices will be installed near each one. 3ϕ 380V electric power will be supplied to major devices.

6) Lighting and Receptacles

As a rule, lighting equipment for Research Experiment Room and other major facilities will be fluorescent lamps with louver with average illuminance of 400 lux. The effective 40W type is generally used for fluorescent lamps. The following are the average illuminance required for major rooms:

Research Experiment Room	400 lux
Administration Office	300 lux
Library	400 lux
Conference Room	300 lux
Animal Room	100 lux
Toilet, Corridor	100 lux

Receptacles for cleaning machines will be installed at random in the corridors and halls.

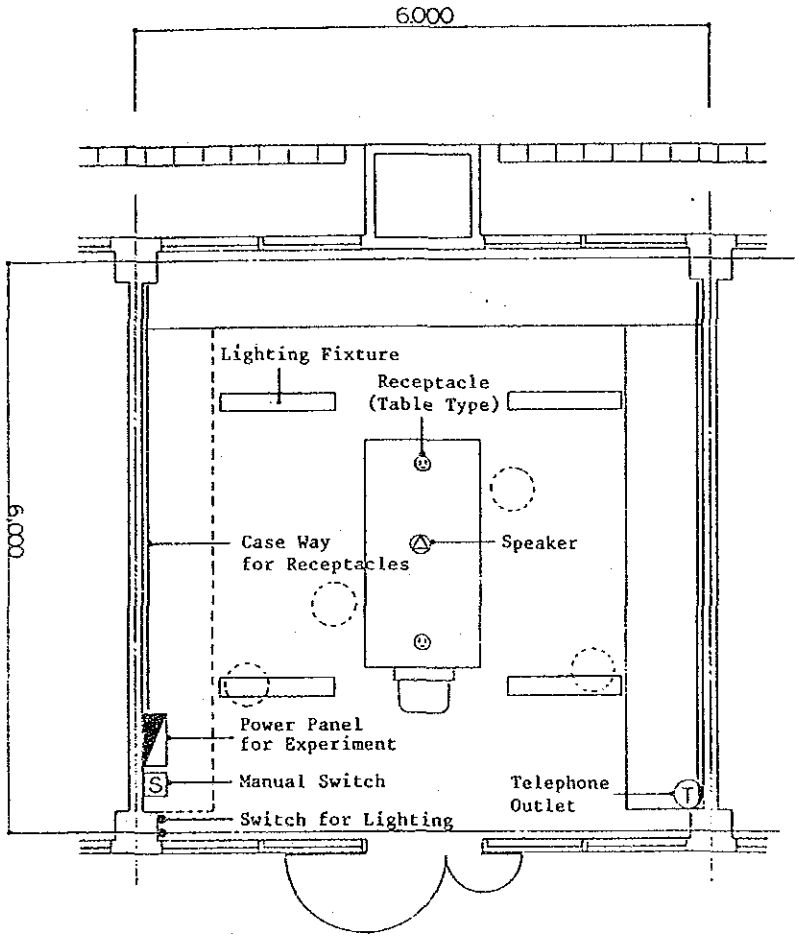


Fig. 4-3-4(c) Indoor Wiring Diagram for a Standard Research Experiment Room

7) Power Installations

Power control panel boards will be installed in key points of the air-conditioning/ventilating devices, plumbing, fans, pumps and elevators. Power source will be 3ϕ 3W, 380V for general types and 1ϕ 2W, 220V for smaller types.

8) Automatic Fire Alarm

As a rule, heat detectors will be installed where necessary and smoke detectors will be placed along the escape routes. Gas detectors will be installed in areas where inflammable gas will be used, and fire alarms should be located in the corridors of each floor.

9) Public Address System

Broadcasting speakers will be placed in the major rooms of each facility to enable public address. Microphones and amplifiers will be installed in the Administration Office on the first floor.

10) Audio-Visual Devices

Loud speaker, acoustic devices and projectors will be installed in Large Conference Room, etc. Outlets will be provided in room that use TV or radio. Antennas for TV and for wireless telephone will be mounted on the roof.

11) Telephone Installations

The Thai Government will provide the work for drawing in 20 trunk lines up to the terminal board in side the building. As electronic exchange equipment will be installed to enable connection within

the facility and inside the city. A relaying device will be installed in the Administration Office on the first floor. The capacity of the exchange device will be 120 extension lines and 20 station lines. Wiring connections for microcomputer system will also be provided. Outlets for telephones will be prepared in the major rooms and halls.

12) Lightning Rod

A system that consists of a lightning rod mounted on the roof, conductor and earth poles will be installed, to guard against disasters by lightning.

13) Elevator and Dumbwaiters

An elevator for cargo and passenger use and dumbwaiters for animals with the following capacity will be provided.

Elevator	: Capacity	: Load 1600 kg or No. of passengers 24 persons
	Speed	: 45 m/min., 3 stops, 1 set
Dumbwaiters	: Capacity	: 500 kg
	Speed	: 20 m/min., 3 stops, 2 sets
	interior lined with stainless steel sheets	

(3) Plumbing System

1) Water Supply System

Treated Water and general-purpose water will be supplied.

a. Treated Water

Treated water, which is filtered and chlorinated city water, will be used as row water for sterilized water, pure water and soft water for experiments, and supplied for steam generator, hot water supply system, raising experiment animals, laboratory sinks, wash basins, cooling-water make up. A filter, chemical feeders, a water reservoir and an elevated water tank will be installed, and water will be supplied to necessary places by means of gravity.

b. General-Purpose Water

General-purpose water will be supplied from city water for washing closets and urinals, cleanings, spray water, washing vehicles, etc. Water will be pumped from the water reservoir up to the elevated water tank and will be supplied to necessary places by means of gravity.

c. Piping Materials

Treated water line:	Unplasticized polyvinyl chloride lining carbon steel pipe
General-purpose water line:	Galvanized steel pipe

d. Projected water supply capacity is as shown in the Table 4-3-4.

e. Water supply system is as shown in the Fig. 4-3-4(d).

1) Domestic-use Water

Researcher	170 x 0.12 m^3/person, day = 20.4 m^3/day
Assistant Researcher	100 x 0.12 m^3/person, day = 12.0 m^3/day
Worker	131 x 0.12 m^3/person, day = 15.7 m^3/day
Administrative staff	44 x 0.12 m^3/person, day = 5.3 m^3/day
Visitor	220 x 0.12 m^3/person, day = 26.4 m^3/day
Sub Total:	79.8 m^3/day (treated 31.9, general 47.9)

2) Experiment Water

Researcher	170 x 0.28 m^3/person, day = 47.6 m^3
Assistant Researcher	100 x 0.28 m^3/person, day = 28.0 m^3
Invited Researcher	20 x 0.28 m^3/person, day = 5.6 m^3
Sub Total:	81.2 m^3/day (treated 81.2, general -)

3) Make up Water for Cooling Tower

50 USRT x 0.015 m^3/USRT, hour x 24 hours/day = 18.0

Sub Total:	18.0 m^3/day (treated 18.0, general -)

4) Experimental Animals

Automatic Feeder	10 sets x 0.002 m^3/set, min x 60 min/hr x 24 hrs/day = 28.8
Cage Washing	2 sets x 0.010 m^3/set, min x 60 min/hr x 5 hrs/day = 6.0
Autoclave, Cleaning, etc.	= 5.0
Sub Total:	39.8 m^3/day (treated 39.8, general -)

5) Spraying Water, etc.	5.0	
Sub Total	5.0 m^3/day	(treated - , general 5.0)
Grand Total:	223.8 m^3/day	
	(treated water:	170.9 m^3/day)
	(general-purpose water:	52.9 m^3/day)

Table 4-3-4 Estimated Water Supply Volume

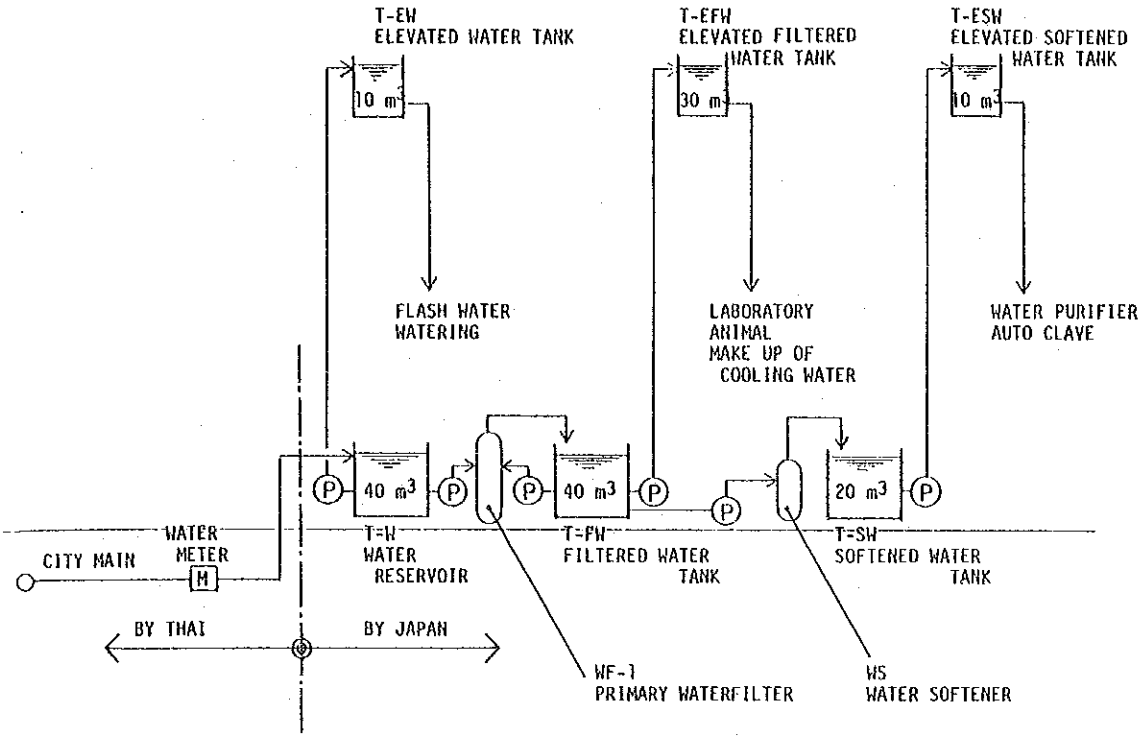


Fig. 4-3-4(d) Water Supply System Flow

2) Hot Water Supply System

a. Hot water will be supplied for washing animal cages at the Animal Experiment Center and washing research apparatus at the Scientific Equipment Center. Hot water will be supplied at 80°C, at least. Oil-heating boilers and solar heating devices will be installed.

b. Kettles placed over electric hot plate in the Kitchenette will provide potable hot water.

c. Hot water will be locally supplied by an electric water heater for showers to be used by researchers in Infected Animal Experiment Rooms.

d. Copper pipes will be used for piping.

3) Drainage

The drainage system within the building consists of general waste water, laboratory waste water, RI waste water and animal waste water. After treatment in the waste water treatment tank, waste water will be discharged to the Reservoir Pond in the East side of the Project site to be prepared by the Thai Government.

a. Drainage of Domestic-Use Water

The drainage system within the building will handle soil sewage and waste water sewage separately.

b. Drainage of Water for Experiment

Substances like acid and solvent that may cause erosion and deformation of drain pipes, and cyan and heavy metals leading to environmental pollution should be carefully recovered into the specified containers by researchers inside the Research Experiment Rooms before waste water is discharged down the drain pipes. Unnecessary upgrading of the drainage system should be avoided, in order to keep down the costs. Special considerations should also be made for cutting down to the minimum the outflow of substances that may cause environmental pollution. Material for drain pipes should be selected from the viewpoint of durability and easy maintenance, although it is difficult to find a material that provide complete guard against both acids and solvents and are, moreover, easy to install. The infected waste water should be sterilized by the researchers before it is discharged.

c. RI Drainage System

Waste water from RI laboratory will be preserved in the reservoir until it reaches a certain level, when it is checked and drained down the system. The water is diluted, if necessary, before it is discharged. Infected waste water should be sterilized by researchers before it is discharged down the drain pipes.

d. Animal Waste Water

Infected waste water will be drained independently and will be joined with non-infected waste water after it is sterilized.

e. Material for Drain Pipes

For soil water	: Cast iron pipe
For waste water	: Galvanized steel pipe
For vent.	: Galvanized steel pipe
For experiment waste water	: Unplasticized polyvinyl chloride lining carbon steel pipe
For RI waste water	: Stainless steel pipe, cast-iron pipe
For animal waste water	: Cast-iron pipe

f. Flow diagram of drainage and waste is as shown in the Fig. 4-3-4(e).

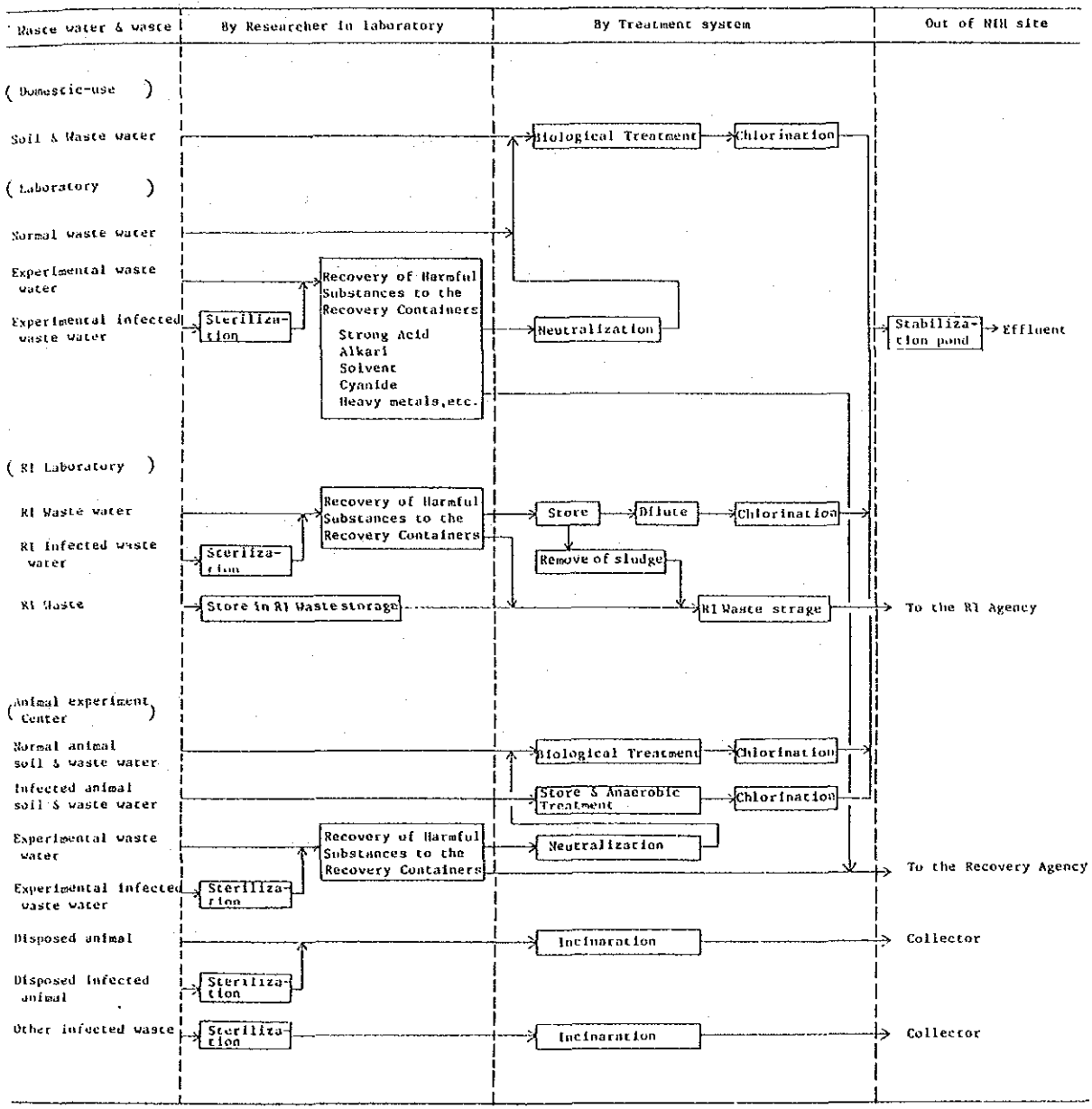


Fig. 4-3-4(e) Flow Diagram of Drainage and Waste

4) Sanitary Fixtures

a. Wash basins, mirrors, service sinks, closets and urinals will be installed in toilets.

b. The wastern type of closets will be installed, as a rule.

5) LPG Supply (Liquified Petroleum Gas)

a. LPG will be provided for laboratories and kitchen.

b. Separate pipes will be installed for providing LPG to laboratories and to kitchen.

c. Alarms to guard against gas leaks will be installed.

6) Kitchen Equipment

a. Kitchen equipment will be installed for serving lunch to the staff of NIH (approximately 360 servings/day).

b. The equipment will include gas range, cooking tables, kitchen sinks, refrigerator, and sterilizing cabinet and cupboards for tableware.

7) Fire-Fighting Equipment

a. Indoor fire hydrant will be installed inside the buildings, abiding by the regulations in Thailand.

b. Fire extinguishers will also be prepared.

c. Buckets containing fire-fighting dry sand will also be provided for.

(4) Air-Conditioning and Ventilation System

1) Heat Source Equipment

a. Air-handling unit will be supplied with chilled water by means of air-cooled chilling unit.

b. All fresh air type packaged air-conditioners will be supplied with cooling water from cooling tower.

2) Air-Conditioning System

Temperature control, humidity control, air current and purity control will be carried out in compliance with the requirements from utility purpose of rooms.

a. Room Air-Conditioner

Applicable to rooms that do not require accurate temperature and humidity control but are nevertheless in need of general cooling and dehumidification of air.

Design Temperature : About 28°C, however, in case of outdoor temperature exceeding 36°C, about 8°C lower than outdoor temperature.

Design Temperature : Required humidity is between 40% and 60%, but above requirements for temperature and humidity are subject to fluctuations to some degree.

Rooms Applicable : Conference Rooms, Library, some of the Research Experiment Rooms, etc.

b. Packaged Air-Conditioner

Applicable to some of the rooms applicable to a), with large cooling load. Duct connections are to be made, as occasion demands.

c. Packaged Air-Conditioner with Reheater

Applicable to rooms where temperature and humidity of room air must be kept within certain limits.

Design Temperature	$28^{\circ}C \pm 1^{\circ}C$: Above standard is subject to change when necessary.
Design Humidity	45%±5% : Above standard is subject to change when necessary.
Rooms Applicable	Analytical Apparatus Room, Electron Microscope Room, etc.

d. All Fresh Air Type Packaged Air-Conditioner

Applicable to rooms requiring all fresh air operations such as prevention of cross-contamination. Reheating coils are to be attached where necessary.

Design Temperature	$28^{\circ}C \pm 1^{\circ}C$: Above standard is subject to change when necessary.
Design Humidity	45%±5% : Above standard is subject to change when necessary.

Rooms Applicable	: Some of the Animal Rooms and Animal Experiment Rooms at the Animal Experiment Center and some of the rooms in RI Laboratory, etc.

e. Air-Handling Unit

Applicable to rooms requiring exact control of temperature and humidity and also rooms requiring all fresh air with large cooling load.

Design Temperature	$28^{\circ}C \pm 1^{\circ}C$: Above standard is subject to change when necessary
Design Humidity	$45\% \pm 2\%$: Above standard is subject to change when necessary.
Rooms Applicable	: Biohazard Laboratory, some of the Animal Rooms and Animal Experiement Rooms at the Animal experiment Center

3) Ventilation System

a. The best use of natural ventilation is to be made for general ventilation in rooms such as Machine Rooms, Electrical Room, Generator Room and Toilets, while air supply and air exhaust are to be carried out mechanically in case of insufficient air displacement.

b. Poisonous gas from laboratories and other dangerous air exhaust are to be released from the roof of the buildings by means of fume hoods and safety cabinets.

4) Air-conditioning and ventilation system for each room are shown in 4-4-1 "Room Schedule".

(5) **Special Facility**

1) Soft Water Supply System

For sterilizing and distillating devices for water to be used for experiments, steam generator and hot water supply system, water softener, reservoir and water supply system for those use will be installed.

2) Drainage System for Water Used for Experiments

A system will be installed for neutralization and treatment of waste water from experiments.

3) Drainage System for Water Used for RI Experiments

A water tank, diluting tank and supervisory device for water-level will be installed for waste water from RI experiments.

4) Drainage System for Water Used for Animal Experiments

A biological treatment system will be installed for waste water from animal experiments.

Method	: Contact aeration method
Quality of treated water	: BOD 30 PPM, SS 40 PPM

5) Drainage System for Domestic-Use Water

A biological treatment system will be installed for domestic-use water.

Method	: Contact aeration method
Quality of treated water	: BOD 30 PPM, SS 40 PPM

6) Drying System for Pull-Out Sludge

A drying deck utilizing solar heat will be installed for drying the sludge pulled out of the water drainage system.

7) Incinerator

An incinerator for general waste and an incinerator for disposed experiment animals will be installed.

8) Oil Tank

A tank will be installed for diesel oil to be used as fuel for incinerator, hot water boiler, emergency generator and steam generator.

9) Steam Generator

A high-pressure steam generator for large autoclaves will be installed.

10) Bio-Clean Room

A bio-clean room will be prepared for experiment for development and improvement of biological products.

11) High-Safety Experiment Room (Biohazard Laboratory)

A common-use high-safety laboratory will be prepared for researches in microbial disease which handle the microbes classified as 3b on the basis of hazard in the Safety Control Standard by the National Institute of Helth in Japan.

12) Special Ventilating Installations

a. High-performance filters (80% or more by DOP Method) will be installed to air supply fan for laboratories using safety cabinets.

b. Air from fume hood and safety cabinet will be lifted up to the roof where it will be exhausted.

c. Air for RI laboratory will be lifted up to the roof through HEPA filters and activated charcoal filters where it will be exhausted according to regulations.

13) Walk-In Refregerators, Walk-In Freezers and Cold Rooms

Rooms will be constructed by pre-fabricated panel and brine cooling unit will be installed.

4-3-5 Equipment Plan

(1) Basic Policies

1) Equipment plan for the Project will cover the equipment for new NIH.

2) Equipment to be selected will be limited to those aligned with the activities, methods and organization of research at NIH, to be used immediately after completion of the facilities. Equipment necessary for future research activities that are not scheduled to be used immediately is excluded.

3) Existing equipment that can be relocated to NIH will be utilized as much as possible, in order to minimize the procurement of new equipment. The procurement should be limited to indispensable equipment.

4) Equipment for specialized experiments and research that require high-level operating technics and a high maintenance costs will be installed in the Scientific Equipment Center and Animal Experiment Center to be used effectively as common-use equipment under proper systems for operation and maintenance.

5) For general-purpose research equipment, those that are durable and easy to maintain and repair will be selected.

6) Standardized products will be used as much as possible for general-purpose research equipment so that parts can be easily replaced when the equipment are repaired.

7) Maintenance system should be set up by NIH with supporting technics so that routine inspection and maintenance, as well as repair and

improvement to some extent, can be conducted over the general-purpose research equipment.

(2) Equipment Plan

1) Equipment for Research Laboratories

a. **Virology**

Among current infections in Thailand, virus diseases occupy big portion. This research field especially requires strengthening of fundamental research technology. Research methods in up-to-date virology are essentially dependent on cell culture methods, serological methods and immunological technics. At same time, the promotion of the researches in this field requires basic physical and chemical methods.

The equipment planned for Virology, including those to be relocated to NIH, are as follows:

1. Electron and optical microscopes, and related equipment for morphological research.
2. Centrifuges for studying virus purification.
3. Ultra-centrifuge for concentration and fractionation of virus protein, chromatography, electrophoresis apparatus and UV spectrophotometer.
4. CO_2 Incubator for cell culture
5. Deep freezer for preserving serum and specimen.
6. Cold room for low-temperature experiments.
7. Equipment for microtiration and flourescent microscope for immunoservological study.
8. Clean bench, safety cabinet and autoclave for preventing contamination.

New Item	Relocation
Deep freezer (-70°C)	Glassware
Freezer (-20°C)	Microscopes
Ultra centrifuge	Other laboratory equipment for general use
PH meter	
Spectrophotometer	
Walk-in refrigerator	
CO_2 Incubator	
Deionizer	
Water filter for tissue culture	
Liquid N_2 tank (capacity 50 lit.)	
Clean benches	

b. Bacteriology

To achieve its main target of establishing a counter-measure for preventing diseases and investigating the cause of diarrhoea, researches should be made by animal experiments and tissue culture in addition to general bacteriological method.

The equipment planned for Bacteriology, including those to be relocated to NIH, are as follows:

1. Clean bench, distillater, balance and autoclave indispensable to ensure cultivation of bacteria that call for precision.
2. UV Spectrophotometer, water bath, centrifuge, refrigerated centrifuge and liquid chromatography apparatus necessary for physical and chemical studies on the biologically active substances.
3. Fluorescent microscope and optical microscope for identification of the various kinds of bacteria.
4. Common equipment such as incubator, low temperature incubator, anaerobic incubator and CO_2 incubator.
5. Freezer for preserving anti-serum.
6. Autoclave for ensuring the effects of sterilization.

New Item	Relocation
Low temperature incubator	Refrigerator
Clean bench	Incubator
Liquid chromatography apparatus	Mixer
Autoclave	Centrifuge
Water bath	Hot-air oven
Refrigerated centrifuge	Electrical balance
Fluorescent microscope	Desiccator
Chromatography apparatus with fraction colelctor	Water bath
	Autoclave
CO_2 Incubator	Auto pipette washer
	Balance
	Magnetic stirrer
	Test tube washing machine
	Centrifuge
	Colony counter
	Lyophilizer
	Secondary dryer
	Anaerobic incubator
	Fluorescent microscope
	Microscope
	Stereo microscope
	Bacticinerator
	PH meter
	Freezer

c. Mycology

The organism belong to the microbe similar to virus and bacteria and therefore the research methods are more or less the same as those for virology and bacteriology. Because of its unique features, however, mycology is also closely associated with Biomedical Research in Food, Development and Control of Biological Products, Medicinal Plant Research and Pharmaceutical Science. Selection should be made of equipment so that the data of experiments could be compared with the studies of other research units.

The equipment planned for Mycology, including those to be relocated to NIH, are as follows. Equipment installed at the Scientific Equipment Center and Animal Experiment Center should be utilized for joint researches with other units, and the results of such studies should be also shared.

1. Basic research equipment consisting of microscope, centrifuge, incubator, low temperature incubator, equipment for preparing medium, clean bench, and freezer.
2. Microtome and equipment related to pathological research
3. UV Spectrophotometer and water bath for biochemical research

New Item	Relocation
Microscope	Refrigerator
Clean bench	Centrifuge
Low-temperature incubator	Water bath
	Microscope
	Ultraviolet hood
	Hot plate
	Mixer
	Balance
	Incubator
	Histopathologic study equipment

d. Parasitology

The wide variety of parasites in Thailand is the cause of many kinds of diseases. In particular, malaria and intestinal parasitic infestation are serious threat to public health. Researches are to be made to elucidate the mechanism of parasitism such as parasite host specifity and parasite location specifity.

The equipment planned for Parasitology, including those to be relocated to NIH, are as follows:

1. Basic research equipment such as microscope, centrifuge and membrane percolator.
2. Refrigerated centrifuge, microtiter apparatus, electrophoresis apparatus, freeze-dry device, etc. for immunological research.

3. Clean bench, autoclave, hot-air oven, water bath, distillater, etc. necessary for accurate isolation and identification.

New Item	Relocation
Clean bench	Refrigerator
Water bath	Centrifuge
Electrical balance	Hot-air oven
	Incubator
	Microscope

e. Immunology

This Unit will be newly established to promote comprehensive studies in immunology, which was heretofore carried out separately but imperfectly by each division, with a purpose of conducting basic research to resolve the mysteries of immunological phenomenan, ultimately leading to prevention of diseases. Selection should be made of equipment so that the data of experiments could be compared with the studies of other research units.

The equipment planned for Immunology are as follows:

1. Various optical microscopes, gas chromatography, thin-layer chromatography apparatus, liquid chromatography and electrophoresis apparatus for elucidation of immunological phenomena.
2. Centrifuge, high speed centrifuge and their accessories to be used for research in antigen and antibody.

3. UV monitor apparatus and fluorescent spectrophotometer for biochemical research in immunology.
4. Various incubators, equipment for producing culture medium, distillator, autoclave, clean bench, etc. for research related to cultivation.

New Items

High speed centrifute	Autoclave
Refrigerated centrifuge	Peristalsis pump
Electrophoresis apparatus	Filtering apparatus
Incubator	Refregerator
Fraction collector	Deep freezer
Water bath	Clean bench
UV monitor apparatus	CO_2 Incubator
Spectrophotometer	Chromatograph chamber
Biological microscope	Program freezer ($-180^{o}C$)
Inverted microscope	

f. **Development and Control of Biological Products**

Research for biological products will be carried out in line with the research in Immunology and other units engaged in microbiological studies. Priority for this unit should be laid on preventing cross-contamination in order to ensure the precision of data gleaned from researches. Selection should also be made of equipment so that the data of experiments could be compared with

the studies of other research units. The equipment planned for Development and Control of Biological Products, including those to be relocated to NIH, are as follows:

New Item	Relocation
Hot-air oven	Clean bench
Incubator	Microscope
Vacuum oven	Inverted microscope
Clean bench	Deep freezer (-70°C)
Refrigerator	Liquid N2 tank
Fume hood	Autoclave
Kjeldahl apparatus	Analytical balance
PH meter	Technical balance
Electrophoresis apparatus	Spectrophotometer
Blood cell counter	Water bath
	Small freezing dryer
	Glass distiller
	Low-temperature incubator
	Deionizer
	Rotary shaker
	CO_2 incubator

g. **Medical Entomology**

The major objectives of this Division is to make ecological and pathological research on insects that act as a vector for infectious diseases of human beings.

1. Microscope, centrifuge, incubator, refrigerator, water bath and autoclave for researches in the mechanisms of microbiology.
2. Insectarium for ecological studies.
3. Equipment related to extermination of noxious insects and infectious diseases control, and equipment for chemical studies on drugs.

The equipment planned for Medical Entomology is as follows, all of which will be relocated to NIH.

Relocation Item

Centrifuge	Water still
Refrigerated centrifuge	Microtiter apparatus
Incubator	Electrophoresis apparatus
Low-temperature incubator	Fraction collector
Autoclave	Clean bench
Drying oven	Refrigerator
Photo-electric colorimeter	Deep freezer
Spectrophotometer	Freezing microtome
Biological microscope	Microtome apparatus
Analytical balance	Insectarium
Sterilizer	

h. **Medicinal Plant Research**

Research will be made on medicinal plants in Thailand with focus on confirming their medicinal effects and safety, aiming at their effective utilization. The equipment planned for the wide area of Medicinal Plant Research, including those to be relocated to NIH, are as follows:

1. Microscopes and stereo microscopes for morphological research based on the classificatory work of plants.
2. Equipment for pharmaco-chemical researches mainly for extraction, isolation, dehydration and purification such as rotary evaporator, grinder, centrifuge, vacuum oven, fraction collector, flame photometer, spectrophotometer, IR spectrophotometer, analytical balance, etc.
3. Equipment for research on pharmacological reactions are to be facilitated at the Animal Experiments Center for joint utilization.
4. Equipment for pathological research such as clean bench, autoclave, incubator, histpathological equipment, microtome, freezing microtome and Refrigerator.
5. Equipment for identification of ingredients by means of extraction and purification, such as nuclear magnetic resonance apparatus, x-ray spectrometer, mass spectrometer, amino-acid analyzer, etc. are to be provided in future.

New Item	Relocation	
Histopathological study equipment	Microscope	Vaccum oven
Incubator	Refrigerator	Muffle furnace
Autoclave	Freeze dryer	Centrifuges
Clean bench	UV Spectrophotometer	Absorption simulator
Fume hood	IR Spectrophotometer	Fume hood
Vacuum cleaner	Freezing microtome	Solubility simulator
	Slide microtome	Flame photometer
	Analytical balances	Fumigating apparatus
	Extraction apparatus	Crude drug cutter
	Distillater	Granulating machine
	Fraction collectors	Capsule filter
	Vacuume evaporators	Tableting machine
	Shaking machines	Coating machine
	Hot-air ovens	Grinder
		Mixer

i. **Environmental Health Science Research**

With transitions in social structure and way of life, the living environments of human beings have also changed, resulting in serious problems for health and sanitation caused by the many hazardous phenomena. The activities of this Unit are confined to the research on the poisonous substances which are especially closely connected with the human life.

The equipment planned for Environmental Health Science Research are as follows:

1. Equipment for experiments for determining environmental poison, research and surveillance on poisonous substances, safety evaluation etc. such as UV detector, centrifuge, evaporator, water bath, hot-air oven, and refrigerator.
2. Microscopes and sample cabinets for pathological studies on environmental poison.

New Items

Microscope	Water bath
Slide cabinet	Refrigerator
Hot plate	Shaker
Timer	Muffle furnace
Blender	Vortex mixer
Top loading balance	Centrifuge (5 - 25 ml)
UV lamp (with short and long wave)	Centrifuge (50 - 100 ml)
Air blower (hair blower)	Hot-air oven
Vacuum evaporator	Bunsen burner

j. **Biomedical Research in Food**

To carry out research, succeeding the existing Food Analysis Division, but confining to the biomedical fields that play an important role in public health. The equipment planned for Biomedical Research in Food, including those to be relocated to NIH, are as follows:

1. Decompositioning and extracting apparatus for chemical experiments, such as rotary evaporator, analytical balance, muffle furnace, gas-chromatography set, water bath, refrigerator, mercury analyzer, UV lamp, fume hood, etc.
2. Animal Experiments are to be carried out at Animal Experiment Center.

New Item	Relocation
PH meter	Refrigerator
Fume hood	
Rotary evaporator	
T.L.C. kit	
UV lamp	
Balance	
Muffle furnace	
Hotplate with stirrer	
Mercury analyzer	
Heating mantle	
Shaker	
Gas-chromatography set	
Hot-air oven	
Water bath	

k. **Pharmaceutical Science**

Research will be carried out succeeding the existing Drug Analysis Division, but confining to researches on effectiveness and safety of medicines and pharmacological researches by means of animal experiments playing an important role in public health.

The equipment planned for Pharmaceutical Science are as follows:

1. Equipment for chemical analytical experiments such as rotary evaporator, high performance liquid chromatography set, thin-layer chromatography set, temperature-controlled oven, refrigerator, desiccator.
2. Animal experiments are to be carried out at Animal Experiment Center.
3. Radio-immunoassay experiments are to be carried out at Radio-isotope Laboratory.

New Items

Rotary evaporator	Balance
Refrigerator	Deep freezer
Desiccator	Dry-bath incubator
High performance liquid chromatography set	Ultra-sonic cleaner
Thin-layer chromatography set	Refrigerated centrifuge
Temperature-controlled oven	Freeze dryer
California fume hood	Hot-air overn
Fraction collector	Dry ice maker
Refrigerator	Ice maker
Tube mixer	Water bath

2) Equipment for Scientific Equipment Center

The Scientific Equipment Center was established for the purpose of facilitating daily inspection and maintenance, through centralized control, of high performance equipment, large equipment and those that require specialized technics for operation, thus promoting effective utilization among research units of common-use equipment and developing new and appropriate methods of research. The establishment of the Scientific Equipment Center is expected to clear away barriers that exist between research units, facilitating smooth exchange of technical skills among researchers and accelerating the training of specialized researchers.

The following research equipment are planned for this purpose:

a. Scientific Equipment Center

Multiprocessor microcomputer system

Atomic absorption spectrophotometer

T.L.C. densitometer

High performance liquid chromatography set

Ultra high-speed centrifuge

Infrared spectrophotometer

Histopathological study equipment

Electron microscopy (with ultra-microtome, scanning electron microscope and transmission electron microscope)

Gas chromatography set

UV-VIS spectrophotometer

Amino acid analizer

b. Radioisotope Laboratory

New Item	Relocation
Scintillation spectrometer	LKB β counter
Survex meter	LKB γ counter
RI monitoring system	
California fume hood	

c. Biohazard Laboratory

Biohazard cabinet

Autoclave

Biohazard equipment

d. Scientific Photograph Center

Slide making machine

Enlarger

Film dryer

Dark room equipment set

Micro- and macro-photo apparatus

Equipment for preparation of audio-visual training materials

e. Workshop

Desk-top lathe

Drill machine

Oscilloscope

Circuit tester

Digital voltameter

Welding machine

Tool set

f. Central Sterile Supply Center

Autoclave (large size)

Hot-air sterilizer

Ultra-sonic cleaner

3) Equipment for Animal Experiment Center

Animal experiment is indispensable for the research in the field of medical sciences. The objectives of the Animal Experiment Center is to carry out experiments for establishing standardized and reference system for prevention of diseases and promotion of public health mainly through researches in microbiology, immunology and toxicology. The equipment to ensure precision of the studies should therefore be selected. The equipment will be necessary for breeding, isolation of infected animals, quarantine of animals that would be brought in from the outside, for breeding insects, and for infected and non-infected animal experiments.

a. Equipment related to breeding of animals

Breeding shelf

Cage

Infectional breeding unit with cage & control unit

Clean bench

Vinyl isolator

Autoclave (for vinyl isolator)

Autoclave

E.O.G. sterilizer

Cage washer

Food container

Animal transport vehicle

b. Equipment related to animal experiments

Animal operating table

Operation light (stand-type)

Animal holder set
(dog, cat, rabbit, mouse)

Refrigeration cabinet
(pre-fabricated type)

Sterile box (stainless steel)

Digital balance for animal

Syringe pump

Pyrogen test equipment

Low-temperature incubator

Incubator

Polygraphy machine

Vertical autoclave

Analytical balance

Deep freezer

Microscope

Refrigerator

Kymograph

Centrifuge

Hematocrit centrifuge

4) Equipment for Training and Others

The major objectives of this Project is to upgrade the quality of researchers and technical staffs engaged in public health through education and training. For this purpose, it is necessary to set up programs for educating researchers on a high level and to train technical staffs of the Regional Medical Sciences Centers on the technics for routine test, examination and research. It is also necessary to prepare equipment that would enable researchers to

self-educate themselves in the form of retrieving and collecting information on medical sciences and public health and publishing academic papers in these areas. The equipment to be provided for these activities are as follows:

Movie projector (16 mm)

Slide projectors

Video system

Sound system

Copy machine

Typewriter (electric)

Calculator

Stencil machine

(3) Utility Design Related to the Equipment

The following utility design has been required, with considerations on the fact that so-called hazardous medium such as microbes and their vectors will be used for experiments at NIH and that equipment with accurate function are required, since the experiments themselfes will call for high-precision.

1) Appropriate air-conditioning and ventilation systems will be required where necessary to prevent infections and contamination by microbes.

2) Air-conditioning and ventilation systems abiding by the regulations will be required for the hazardous area, to secure the safety of researchers.

3) Treated water will be prepared where necessary since the quality of water is very important for experiments.

4) Sufficient consideration will be given on waste disposal, drainage and exhaust, so that chemical substances discharged from the facilities will not cause pollution.

5) Appropriate utility services will be provided according to the required environment for breeding animals, and the kind of experiments for which those animals will be used, so that it will not largely affect the results of the experiments.

6) Electrical power will be supplied through plug receptacle with earth electrode for voltage of 1ϕ 220V for general research equipment, and through exclusive circuit of 3ϕ 380V for large equipment.

7) Individual CVCF devices will be installed for equipment that require stabilized power source.

8) Power will be supplied by stand-by generator for facilities and equipment related to experiments that cannot stand against power failure for a long period.

9) Cylinders for special gas to be used for experiments will be installed near the laboratories where they will be used, and will have appropriate detectors or alarm systems.

10) Utility services for electricity and water supply, drainage, air-conditioning and ventilation related to relocation of equipment will be covered by the Project. Details will be determined through discussions with DMS at detail design stage.

4-4 BASIC DESIGN DRAWINGS

4-4-1 Room Schedule

Legend

RA	:	Room air-conditioner
PAC	:	Packaged air-conditioner
AHU	:	Air-handling unit
CF	:	Ceiling fan
L	:	Low performance filter (Weight method 80%)
M	:	Middle performance filter (DST method 80%)
H	:	High performance filter (DOP method 99.97%)
F	:	Fresh air intake
E	:	Exhaust air
All Fresh	:	All fresh air intake
FH	:	Fume hood
CB	:	Crean bench
SC	:	Safety cabinet

Note : Design criteria of temperature and humidity show in case of hot summer, they can be made lower depending upon mean temperature in each season. And they can also be changed when necessary.

RESEARCH LABORATORY BLOCK (NORTH) - 1

Floor Rm. No.	Room Name	No. of Units (6x6M Unit)	Floor Area (m^2)	Design Criteria			Air-conditioner			Ceiling Fan	Ventilation		Facility			Remarks
				Cooling (°C)	Temp. Control (°C)	Humidity (%)	Kind	Filter	Fresh Air Intake		Fresh Air Intake	Exhaust	Fume Hood	Clean Bench	Safety Cabinet	
	VIROLOGY	**26**	**936**													
1F 1	Adenovirus, Herpesvirus Lab.	3/4	27	28			RA				F/L	E		CB		
2	Sterile Rm.	1/4	9	26			RA				F/L	E				Tissue Culture
3	Hepatitis Virus Vaccine Research Lab.	3/4	27	28			PAC	L,M	F			E			SC	
4	Walk-in Refrigerator	1/4	9		4											
5	Hepatitis Virus Lab. (WHO Hepatitis Virus Center)	1	36	28			PAC	L,M	F			E			SC	
6	Enterovirus Lab.	3/4	27	28			PAC	L,M	F			E				
7	Stevile Rm.	1/4	9	28			RA					E			SC	Tissue Culture
8	Arbovirus Isolation Lab.	3/4	27	28			RA					E				
9	Sterile Rm.	1/4	9	28			RA				F/L	E		CB		Tissue Culture
10	Arbovirus Antigen Prep. Rm.	1	36	28			RA				F/L	E		CB		
11	Arbovirus Selorogy Lab.	1-3/4	63	28			RA					E				
12	Respiratory Lab. (Paraflu, R.S., Measle)	1-1/4	45	28			RA					E		CB		
13	Respiratory Lab. (WHO Influenza Center)	3/4	27	28			RA				F/L	E		CB		
14	Dark Rm.	1/4	9	28			RA					E				
15	Glassware Washing Rm.	1	36							CF		E				

Floor Rm. No.	Room Name	No. of Units (6x6M Unit)	Floor Area (m^2)	Design Criteria			Air-conditioner			Ceiling Fan	Ventilation		Facility			Remarks
				Cooling (^oC)	Temp. Control (^oC)	Humidity (%)	Kind	Filter	Fresh Air Intake		Fresh Air Intake	Exhaust	Fume Hood	Clean Bench	Safety Cabinet	
16	Rabies-Serology & Vaccine Research Lab.	3/4	27	28			PAC	L,M	F			E			SC	Tissue Culture
17	Sterile Rm.	1/4	9	28			PAC	L,M	F			E			SC	
18	Rabies Diagnosis Lab.	3/4	27	28			PAC	L,M	F			E			SC	
19	Dark Rm.	1/4	9	28			RA					E				
20	Media & Reagent Prep. Rm.	1	36	28			RA					E				
21	Walk-in Refrigerator	1	36		4±1											
22	Walk-in Freezer	1	36		-20±1											
23	Rubella Serology Lab.	1	36	28			RA					E				
2F 24	E.M. Specimen Prep. Rm.	1	36													
25	Serum Bank	3/4	27		24±1	45±5	PAC	L			F	E				
26	Sterile Rm.	1/4	9	28			RA				F/L	E		CB		
27	Oncogenic Virus Lab.	3/4	27	28			RA				F/L	E		CB		Tissue Culture
28	Sterile Rm.	1/4	9	28			RA				F/L	E		CB		Tissue Culture
29	Rickettsia Lab.	3/4	27	28			PAC	L,M	F			E		CB		
30	Dark Rm.	1/4	9	28			RA					E				
31	Mycoplasma Lab.	3/4	27	28			RA					E				
32	Dark Rm.	1/4	9	28			RA					E				Tissue Culture
33	Clamydia Lab.	1	36	28			PAC	L,M	F			E			SC	

RESEARCH LABORATORY BLOCK (NORTH) - 3

Floor Rm. No.	Room Name	No.of Units (6x6M Unit)	Floor Area (m^2)	Design Criteria			Air-conditioner			Ceiling Fan	Ventilation		Facility			Remarks
				Cooling (°C)	Temp. Control (°C)	Humidity (%)	Kind	Filter	Fresh Air Intake		Fresh Air Intake	Exhaust	Fume Hood	Clean Bench	Safety Cabinet	
1F 34	Director Rm.	1	36	28			RA			CF						
35	Data processing, Staff Rm.	1	36							CF						
36	Seminar Rm.	1	36	28			RA									
	DEVELOPMENT AND CONTROL OF BIOLOGICAL PRODUCTS	10	360													
2F 1	Change Rm.	1/6	6									E				
2	Live Bacterial Vaccine Lab.	3/4	27	28			RA					E				
3	Sterile & Dark Rm.	1/6	6	28			RA				F/L	E		CB		
4	Killed Bacterial Vaccine Lab.	3/4	27	28			RA					E				
5	Sterile Rm.	1/6	6	28			RA				F/L	E		CB		
6	Change Rm.	1/6	6									E				
7	Live Viral Vaccine Lab.	3/4	27	28			RA					E				
8	Sterile Rm.	1/6	6	28			RA				F/L	E		CB		
9	Killed Viral Vaccine Lab.	3/4	27	28			RA					E				
10	Sterile Rm.	1/6	6	28			RA				F/L	E		CB		
11	Change Rm.	1/6	6									E				
12	Toxoid Lab.	3/4	27	28			RA				F/L	E		CB		
13	Sterile Rm.	1/6	6	28			RA				F/L	E				
14	Sera & Antitoxin Lab.	3/4	27	28			RA				F/L	E		CB		

Floor Rm. No.	Room Name	No. of Units (6x6M Unit)	Floor Area (m^2)	Design Criteria			Air-conditioner			Ceiling Fan	Ventilation		Facility			Remarks
				Cooling (°C)	Temp. Control (°C)	Humidity (%)	Kind	Filter	Fresh Air Intake		Fresh Air Intake	Exhaust	Fume Hood	Clean Bench	Safety Cabinet	
15	Sterile Rm.	1/6	6	28			RA				F/L	E				
16	Change Rm.	1/6	6									E				
17	Standard & Reference Prep. & Development Lab.	3/4	27	28			RA				F/L	E		CB		
18	Sterile Rm.	1/6	6	28			RA				F/L	E		CB		
19	Chemical Test Rm.	11/12	33	28			RA					E	FH			
20	Change Rm.	1/6	6									E				
21	Sterility Test Rm.	0.5	18	28			RA				F/L	E		CB		
22	Walk-in Incubator	1/6	6		37±1											
23	Walk-in Refrigerator	1/6	6		2 to 8											
24	Data Processing & Staff Rm.	0.5	18							CF						
25	Seminar Rm.	0.5	18	28			RA									
	Clean Rm.	(1)	(36)		28±1	45±5	PAC	L,M,H	F					CB		
	PARASITOLOGY	4	144													
2F 1	Collection of Parasite Rm.	1	36							CF						
2	Helminth Lab.	1	36							CF						
3	Distomata Lab.	3/4	27	28			RA					E				
4	Sterile Rm.	1/4	9	28			RA					E				
5	Protozoa & Malaria Culture Lab.	3/4	27	28			RA					E				
6	Sterile Rm.	1/4	9	28			RA				F/L	E		CB		

RESERARCH LABORATORY BLOCK (NORTH) - 6

Floor Rm. No.	Room Name	No.of Units (6x6M Unit)	Floor Area (m^2)	Design Criteria			Air-conditioner			Ceiling Fan	Ventilation		Facility			Remarks
				Cooling (^oC)	Temp. Control (^oC)	Humidity (%)	Kind	Filter	Fresh Air Intake		Fresh Air Intake	Exhaust	Fume Hood	Clean Bench	Safety Cabinet	
	MYCOLOGY	3	108													
3F 1	Examination, Isolation & Identification Lab.	1	36	28			RA				F/L	E		CB		
2	Histopathology Lab.	1	36	28			PAC	L,M	F			E			SC	
3	Cryptococcosis Research Lab.	1	36	28			RA					E				
	IMMUNOLOGY	6	216													
3F 1	HLA Research Lab.	1	36	28			RA					E				
2	Bacteria Immunology Lab.	1	36	28			RA				F/L	E		CB		
3	Virus Immunology Lab.	1	36	28			RA					E				
4	Immunochemistry Lab.-1	1	36	28			RA					E				
5	Immunochemistry Lab.-2	1	36	28			RA					E				
6	Data Processing & Staff Rm.	0.4	18							CF						
7	Seminar Rm.	0.5	18	28			RA									

Floor Rm. No.	Room Name	No.of Units (6x6M Unit)	Floor Area (m^2)	Design Criteria			Air-conditioner			Ceiling Fan	Ventilation		Facility			Remarks
				Cooling (°C)	Temp. Control (°C)	Humidity (%)	Kind	Filter	Fresh Air Intake		Fresh Air Intake	Exhaust	Fume Hood	Clean Bench	Safety Cabinet	
	BACTERIOLOGY	11	396													
3F 1	National Phage Typing Center	1	36	28			RA				F/L	E		CB		
2	National Salmonella & Shigella Center	2	72	28			RA					E				
3	Antisera & Antigen Production Rm.	1-1/4	45	28			RA					E				
4	Sterile Rm.	1/4	9	28			RA				F/L	E				
5	Media Prep. Rm.	1-1/4	45							CF		E				
6	Sterile Rm.	1/4	9	28			RA				F/L	E		CB		
7	Miscellaneous Bacteria Culture Collection Rm.	1-1/4	45	28			RA				F/L	E		CB		
8	Dark Rm.	1/6	6	28			RA					E				
9	Anaerobe Lab.	1-1/4	45	28			RA					E				
10	Sterile Rm.	1/6	6	28			RA				F/L	E		CB		
11	Sterile Rm.	1/6	6	28			PAC	L,M	F			E			SC	
12	Stock Rm.	1/2	18							CF						
13	Walk-in Refrigerator	1/4	9		4 ± 1											
14	Walk-in Incubator	1/4	9		35 to 37											
15	Director Rm.	0.5	18	28			RA			CF						
16	Data Processing & Staff Rm.	0.5	18							CF						

RESEARCH LABORATORY BLOCK (SOUTH) - 1

Floor Rm. No.	Room Name	No.of Units (6x6M Unit)	Floor Area (m^2)	Design Criteria			Air-conditioner			Ceil-ing Fan	Ventilation		Facility			Remarks
				Cool-ing (^oC)	Temp. Control (^oC)	Humi-dity (%)	Kind	Filter	Fresh Air Intake		Fresh Air Intake	Ex-haust	Fume Hood	Clean Bench	Safety Cabinet	
	MEDICAL ENTOMOLOGY	20	720													
1F 1	Collection of Vectors	1	36									E				
2	Parmanent Specimen Prep. Rm.	1	36	28			RA					E				
3	Identification Lab.	1	36									E				
4	Biology & Ecology of Vectors Laboratory-1	1	36	28		De-humi-difier	RA					E				
5	Biology & Ecology of Vectors Laboratory-2	1	36									E				
6	Biology & Ecology of Vectors Test Rm.	1	36	28		70	PAC					E	FH			
7	Ectoparasite Lab.-1	1	36								(Cabinet) F	E				
8	Ectoparasite Lab.-2	1	36							CF		E				
9	Biological Control & Insect Pathology Lab.-1	1	36	28			RA				F	E				
10	Biological Control & Insect Pathology Lab.-2	1	36							CF		E				
11	Biological Control & Insect Pathology Media Prep. Rm.	1	36							CF		E				
12	Rodent Bite Lab.	1	36								F	E				
13	Chemical Control & Droplet Testing Lab.-1	1	36							CF		E				
14	Chemical Control & Droplet Testing Lab.-2	1	36							CF		E				

Floor Rm. No.	Room Name	No.of Units (6x6M Unit)	Floor Area (m^2)	Design Criteria			Air-conditioner			Ceiling Fan	Ventilation		Facility			Remarks
				Cooling (°C)	Temp. Control (°C)	Humidity (%)	Kind	Filter	Fresh Air Intake		Fresh Air Intake	Exhaust	Fume Hood	Clean Bench	Safety Cabinet	
15	Chemical Control Insecticide Testing Lab.-1	3/4	27	28			RA					E				
16	Chemical Control Insecticide Testing Lab.-2	3/4	27							CF		E				
17	Chemical Control Bioefficiency Testing Lab.-1	3/4	27	28		70	PAC				F/L	E		CB		
18	Chemical Control Bioefficiency Testing Lab.-2	3/4	27	28		70	PAC					E				
19	Director Rm.	1	36	28			RA			CF						
20	Data Processing & Staff Rm.	1	36							CF						
21	Seminar Rm.	1	36	28			RA									
	MEDICINAL PLANT RESEARCH	20	720													
2F 1	Harbarium & Crude Drug Specimen Rm.	1	36		28±1	45±5	PAC					E				
2	Botanical Identification Rm.	1-1/4	45							CF		E				
3	Medicinal Plant Lab.	0.5	18		28±1	45±5	PAC					E				
4	Fumigating Rm.	1/4	9									E				
5	Synthesis of Active Principles & Structure Elucidation Lab.-1	3/4	27							CF		E				
6	Synthesis of Active Principles & Structure Elucidation Lab.-2	3/4	27							CF		E				

RESEARCH LABORATORY BLOCK (SOUTH) - 3

Floor Rm. No.	Room Name	No.of Units (6x6M Unit)	Floor Area (m^2)	Design Criteria			Air-conditioner			Ceiling Fan	Ventilation		Facility			Remarks
				Cooling (°C)	Temp. Control (°C)	Humidity (%)	Kind	Filter	Fresh Air Intake		Fresh Air Intake	Exhaust	Fume Hood	Clean Bench	Safety Cabinet	
7	Drug Absorption, Metabolism & Excretion Lab.-1	3/4	27		24±1		PAC									
8	Drug Absorption, Metabolism & Excretion Lab.-2	3/4	27		24±1		PAC					E				
9	Medicinal Plants & Traditional Medicine Information Center	1	36	28			RA					E				
10	Quality Control Lab.	1	36							CF		E	FH			
11	Chemical Identification & Purification Lab.	1	36							CF		E				
12	Extraction, Isolation & Purification Lab.	1	36							CF		E	FH			
13	Sample Prep. for Chemical Work Lab.	1	36							CF		E	FH			
14	Microbiological Study Lab.	3/4	27	28			PAC	L,M	F			E			SC	
15	Sterile Rm.	1/4	9	28			RA				F/L	E		CB		
16	Histopathological Study Lab.	3/4	27	28			RA					E				
17	Specimen Rm.	1/4	9									E				
18	Biochemisty Study Lab.	1	36	28			RA					E	FH			
19	Technology for Traditional Medicine Production Lab.-1	3/4	27							CF		E				Dust Control
20	Technology for Traditional Medicine Production Lab.-2	3/4	27							CF		E				Dust Control

RESEARCH LABORATORY BLOCK (SOUTH) - 4

Floor Rm. No.	Room Name	No.of Units (6x6M Unit)	Floor Area (m^2)	Design Criteria			Air-conditioner			Ceiling Fan	Ventilation		Facility			Remarks
				Cooling (^oC)	Temp. Control (^oC)	Humidity (%)	Kind	Filter	Fresh Air Intake		Fresh Air Intake	Exhaust	Fume Hood	Clean Bench	Safety Cabinet	
21	Sample Prep. for Pharmacological Study	3/4	36		24±1		PAC					E				
22	Pharmacological Study Lab.	3/4	27		24±1		PAC					E				
23	Chemical Study Lab.	1	36	28			RA					E	FH			
24	Director Rm.	0.5	18	28			RA			CF						
25	Data Processing & Staff Rm.	0.5	18							CF						
26	Seminar Rm.	1	36	28			RA									
	ENVIRONMENTAL HEALTH SCIENCE RESEARCH	6	216													
3F 1	Pollutant Surveillance Lab.	1	36							CF		E	FH			
2	Environmental Toxicologic Evaluation Lab.	1.5	54							CF		E	FH			
3	Stock Rm.	0.5	18									E				
4	Walk-in Refrigerator	1/4	9		4±1											
5	Walk-in Freezer	1/4	9		-20±1											
6	Histology Lab.	1	36	28			RA			CF		E	FH			
7	Toxin Evaluation & Safety Monitoring	1	36									E	FH			
8	Data Processing & Staff Rm.	0.5	18							CF		E				

RESEARCH LABORATORY BLOCK (SOUTH) - 5

Floor Rm. No.	Room Name	No. of Units (6x6M Unit)	Floor Area (m^2)	Design Criteria			Air-conditioner			Ceiling Fan	Ventilation		Facility			Remarks
				Cooling (°C)	Temp. Control (°C)	Humidity (%)	Kind	Filter	Fresh Air Intake		Fresh Air Intake	Exhaust	Fume Hood	Clean Bench	Safety Cabinet	
	BIOMEDICAL RESEARCH IN FOOD	6	216													
3F 1	Sample Prep. Rm.	1.5	54													With flexible exhaust duct
2	Fungus Toxin Research Lab.	1	36									E	FH			
3	Chemical Lab.-1 (Food Contaminants)	1	36	28			RA					E	FH			Gas Chromatograph
4	Chemical Lab.-2 (Pesticide residues)	1	36									E	FH			
5	Chemical Lab.-3 (Heavy Metal)	1	36									E	FH			
6	Data Processing & Staff Rm.	0.5	18							CF						
	PHARMACEUTICAL SCIENCE	8	288													
3F 1	Chemical Lab.-1	1.5	54							CF		E	FH			
2	Chemical Lab.-2	0.5	18		24±1	45±5	PAC					E				
3	Bacterial Endotoxin Test Lab.	0.5	18	28			PAC	L,M	F			E			SC	
4	Heparin, Protamin Test Lab.	0.5	18	28			RA				F/L	E		CB		
5	Pharm., Chem.- Radioimmunoassay lab.	1	36							CF		E				
6	Microbiological Assay Lab.-1	1	36								F/L, M	E			SC	
7	Microbiological Assay Lab.-2	0.5	18		24±1		RA					E				

RESEARCH LABORATORY BLOCK (SOUTH) - 6

Floor Rm. No.	Room Name	No.of Units (6x6M Unit)	Floor Area (m^2)	Design Criteria			Air-conditioner			Ceiling Fan	Ventilation			Facility		Remarks
				Cooling (°C)	Temp. Control (°C)	Humidity (%)	Kind	Filter	Fresh Air Intake		Fresh Air Intake	Exhaust	Fume Hood	Clean Bench	Safety Cabinet	
8	Cold Rm.	1/4	9		4 to 10									CB		
9	Storage	1/4	9	28			RA									
10	Director Rm.	0.5	18	28			RA			CF						
11	Data Processing & Staff Rm.	0.5	18							CF						
12	Seminar Rm.	1	36	28			RA			CF						

SCIENTIFIC EQUIPMENT CENTER - 1

Floor	Rm. No.	Room Name	No. of Units (6x6M Unit)	Floor Area (m^2)	Design Criteria			Air-conditioner			Ceiling Fan	Ventilation		Facility			Remarks
					Cooling (°C)	Temp. Control (°C)	Humidity (%)	Kind	Filter	Fresh Air Intake		Fresh Air Intake	Exhaust	Fume Hood	Clean Bench	Safety Cabinet	
		SCIENTIFIC EQUIPMENT CENTER	13	468													
2F	1	Equipment Pool-1 (Electron Microscopy)	2.5	90		28±1	45±2	PAC	L,M	F			Dark Rm. E				Incl. Sample Prep. Rm. Dark Rm.
	2	Equipment Pool-2	1.5	54		28±1	45±2	PAC	L,M	F							
	3	Equipment Pool-3	2	72		28±1	45±2	PAC	L,M	F							
	4	Scientific Photograph Center	1	36	28			RA	L,M	F			Dark Rm. E				Incl. Dark Rm.
	5	Workshop-1 (Electronic)	1	36		28±1	45±5	PAC	L,M	F			E				
	6	Workshop-2 (Mechanical)	1	36							CF		E				
3F	7	Workshop-3 (Optical)	1	36							CF		E				
	8	Research & Development Lab.	1	36		28±1	45±2	PAC	L,M	F							
	9	Computor Rm.	1	36		28±1	50±5	PAC	L,M	F							
	10	Staff Rm.	1	36							CF						
		BIOHAZARD LABORATORY	2	72													Level P-3
1F	1	Biohazard Ante Rm.	0.5	18		28±1	45±1	PAC	L,M,H	All Fresh			E/L, H				
	2	Biohazard Lab.	1.5	54		28±1	45±1	PAC	L,M,H	All Fresh			E/L, H			SC Class II-b	

Floor Rm. No.	Room Name	No.of Units (6x6M Unit)	Floor Area (m^2)	Design Criteria			Air-conditioner			Ceil-ing Fan	Ventilation		Facility			Remarks
				Cool-ing (°C)	Temp. Control (°C)	Humi-dity (%)	Kind	Filter	Fresh Air Intake		Fresh Air Intake	Ex-haust	Fume Hood	Clean Bench	Safety Cabinet	
	RI LABORATORY	6	216													
1F 1	Change Rm.	0.5	18									E				
2	I125 Prep. Rm (Clinical Path., Toxicology)	0.5	18		28	50±5	PAC	L,M	All Fresh			E/L, H	FH	CB		
3	I125,H3 Prep. Rm. (Microbiology)	0.5	18		28	50±5	PAC	L,M	All Fresh			E/L, H	FH	CB		
4	I125, H3 Prep. Rm. (Drug)	1	36		28	50±5	PAC	L,M	All Fresh			E/L, H	FH	CB		
5	Walk-in Ref. Rm.	1/4	9		-10 to -20									CB		
6	Weighing Rm.	1/4	9		28±1	45±2	PAC	L,M	All Fresh			E/L, H		CB		
7	Common Facilities Rm.	0.5	18		28	50±5	PAC	L,M	All Fresh			E		CB		
8	Instrument Rm.	0.5	18		28±1	45±2	PAC	L,M	All Fresh			E/L, H	FH	CB		
9	Tracer Prep. Rm.	0.5	18		28	50±5	PAC	L,M	All Fresh			E/L H	FH	CB		
10	Washing Rm.	1	36								F/L	E		CB		
11	Drying Rm.	0.5	18								F/L	E		CB		
	CENTRAL STERILE SUPPLY CENTER	5	180													
3F 1	Central Sterile Supply Center	5	180	28		45±5	PAC	L,M	F			E				

ANIMAL EXPERIMENT CENTER - 1

Floor Rm. No.	Room Name	No.of Units (6x6M Unit)	Floor Area (m^2)	Design Criteria			Air-conditioner			Ceiling Fan	Ventilation		Facility			Remarks
				Cooling (°C)	Temp. Control (°C)	Humidity (%)	Kind	Filter	Fresh Air Intake		Fresh Air Intake	Exhaust	Fume Hood	Clean Bench	Safety Cabinet	
	ANIMAL EXPERIMENT CENTER	**37.5**	**1,350**													
1F 1	Office-1	0.5	18							CF						
2	Change Rm.	0.5	18									E				Incl. Toilets, Shower Rm.
3	Storage	0.5	18									E				
4	Food Prep. Rm.	0.5	18									E				
5	Food Storage	0.5	18									E				
6	Bedding Material Storage	0.5	18													
7	Washing, Sterilizing & Receiving Rm.	2	72								F	E				
8	Cage Storage	1	36													
9	Machine Rm.	1	36									E				Steam Supply
10	Service Deck	0.5	36													
11	Quarantine Animal Rm.	2	72	28			RA				F	E				Cooling in Summer
12	Animal Experiment Rm. (Medical Entomology)	1	36	28							F	E				Cooling in Summer
13	Animal Experiment Rm. (Medical Entomology)	2	72								F	E				
2F 14	Change Rm.	1	36									E				Incl. Toilets, Shower Rm.
15	Office-2	0.5	18							CF						

Floor Rm. No.	Room Name	No.of Units (6x6M Unit)	Floor Area (m^2)	Design Criteria			Air-conditioner			Ceiling Fan	Ventilation		Facility			Remarks
				Cooling (°C)	Temp. Control (°C)	Humidity (%)	Kind	Filter	Fresh Air Intake		Fresh Air Intake	Exhaust	Fume Hood	Clean Bench	Safety Cabinet	
16	Normal Animal Rm. (Mouse)	2	72		28±1	50±5	AHU	L,M	All Fresh		F					
17	Normal Animal Rm. (Mouse)	3	108		28		RA				F	E				Cooling in summer
18	Normal Animal Rm. (Isolated Mouse)	2	72		28±1	50±5	AHU	L,M,H	All Fresh							
19	Normal Animal Rm. (Rat)	1	36	28			RA				F	E				Cooling in summer
20	Normal Animal Rm. (Rat)	1	36	28			RA				F	E				Independent ventilation cooling in summer
21	Normal Animal Rm. (Monkey)	1	36	28			RA				F	E				Independent ventilation cooling in summer
22	Normal Animal Rm. (Cat)	1	36	28			RA				F	E				Independent ventilation cooling in summer
23	Animal Exp. Lab. (Chemistry)	1	36	28			RA				F	E				Independent ventilation cooling in summer
24	Animal Exp. Lab. (Pyrogen)	1	36		28±1	50±1	AHU	L,M	All Fresh							
25	Animal Exp. Lab. (Autopsy)	1	36	28			RA				F	E				
26	Animal Exp. Lab (Drug)	1	36	28			PAC	L,M	F			E			SC	Independent ventilation
27	Animal Exp. Lab. (Medicinal Plant)	2	72	28			RA				F	E				

ANIMAL EXPERIMENT CENTER - 3

Floor Rm. No.	Room Name	No.of Units (6x6M Unit)	Floor Area (m^2)	Design Criteria			Air-conditioner			Ceil-ing Fan	Ventilation		Facility			Remarks
				Cool-ing (°C)	Temp. Control (°C)	Humi-dity (%)	Kind	Filter	Fresh Air Intake		Fresh Air Intake	Ex-haust	Fume Hood	Clean Bench	Safety Cabinet	
28	Animal Exp. Lab. (Immunity)	1	36	28			RA				F	E				
29	Infected Animal Exp. Lab. (Virology)	3	108	28			PAC	L,M,H	All Fresh			E/L, H				Cooling in summer
30	Infected Animal Exp. Lab. (Virology)	1	36		28±1	50±5	AHU	L,M,H	All Fresh			E/L, H				
30	Infected Animal Exp. Lab. (Biological Products)	1	36		28±1	50±5	AHU	L,M,H	All Fresh			E/L, H			SC	With steri-lizer for filter exchange
30	Infected Animal Exp. Lab. (Bacteriology)	0.5	18		28±1	50±5	AHU	L,M,H	All Fresh			E/L, H			Total 3 sets	

TRAINING/ADMINISTRATION BLOCK

Floor Rm. No.	Room Name	No.of Units (6x6M Unit)	Floor Area (m^2)	Design Criteria			Air-conditioner			Ceil-ing Fan	Ventilation		Facility			Remarks
				Cool-ing (^oC)	Temp. Control (^oC)	Humi-dity (%)	Kind	Filter	Fresh Air Intake		Fresh Air Intake	Ex-haust	Fume Hood	Clean Bench	Safety Cabinet	
1F 1	General Office-1	-	54							CF						
2	General Office-2	-	54							CF						
3	Night Duty Rm.	-	13.5							CF						
4	Commodity	-	54							CF						
5	Information & Corres-ponding Office	-	54							CF						
2F 6	Health Clinic & Rest Rm.	-	49.5	28			RA									
7	Conference Rm.-1	-	72	28			RA									
8	Conference Rm.-2	-	72	28			RA									
9	Library	-	216	28			RA									2nd., 3rd. Floor
10	Printing Rm.	-	36													
3F 11	Director Rm.	-	36	28			RA			CF						
12	Secretary Rm.	-	36							CF						
13	Deputy Director Rm.	-	36	28			RA			CF						
14	Reception Rm.	-	49.5							CF						
15	Meeting Rm.	-	49.5	28			RA									
16	Expert Rm.-1	-	54	28			RA			CF						
17	Expert Rm.-2	-	54	28			RA			CF						

LARGE CONFERENCE ROOM BLOCK

Floor Rm. No.	Room Name	No.of Units (6x6M Unit)	Floor Area (m^2)	Design Criteria			Air-conditioner			Ceil-ing Fan	Ventilation		Facility			Remarks
				Cool-ing (^oC)	Temp. Control (^oC)	Humi-dity (%)	Kind	Filter	Fresh Air Intake		Fresh Air Intake	Ex-haust	Fume Hood	Clean Bench	Safety Cabinet	
1F 1	Large Conference Rm.	-	250	28			PAC		F							200 sears with stage
2	Rest Rm.	-	9	28			RA									
3	Storage	-	9							CF						
2F 4	Control Rm.	-	26	28			RA									

CAFETERIA BLOCK

Floor Rm. No.	Room Name	No.of Units (6x6M Unit)	Floor Area (m^2)	Design Criteria			Air-conditioner			Ceil-ing Fan	Ventilation		Facility			Remarks
				Cool-ing (^oC)	Temp. Control (^oC)	Humi-dity (%)	Kind	Filter	Fresh Air Intake		Fresh Air Intake	Ex-haust	Fume Hood	Clean Bench	Safety Cabinet	
1F 1	Cafeteria	-	138.5							CF		E				
2	Kitchen	-	31.5							CF		E/L				
3	Office	-	13.5							CF						
4	Storage	-	18							CF						