No.

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR FOUNDING
A COLLABORATIVE DIARRHEAL DISEASE RESEARCH
AND CONTROL CENTER
IN
INDIA

MAY 2004

JAPAN INTERNATIONAL COOPERATION AGENCY

NIHON SEKKEI, INC.

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PREFACE

In response to a request from the Government of India, the Government of Japan decided to conduct a basic design study on the Project for Founding a Collaborative Diarrheal Disease Research and Control Center and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to India a study team from November 27th to December 27th, 2003.

The team held discussions with the officials concerned of the Government of India, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to India in order to discuss a draft basic design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of India for their close cooperation extended to the teams.

May 2004

Yasuo Matsui
Vice President
Japan International Cooperation Agency

May 2004

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Founding a Collaborative Diarrheal Disease Research and Control Center in India.

This study was conducted by Nihon Sekkei, Inc., under a contract to JICA, during the period from November, 2003 to May, 2004. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of India and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Takeshi Endo
Project Manager

Basic Design Study Team on
the Project for Founding a Collaborative Diarrheal Disease Research and Control Center

Nihon Sekkei, Inc.

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ABBREVIATION

A/P	Authorization to Pay
AVR	Automatic Voltage Regulation
B/A	Banking Arrangement
BS	British Standard
CESC	Calcutta Electric Service Company
CPWD	Central Public Works Department
E/N	Exchange of Notes
HEPA	High Efficiency Particulate Air Filter
I.D.	Infectious Diseases Hospital, West Bengal
ICMR	Indian Council of Medical Research
IS	Indian Standard
JASS	Japanese Architectural Standard Specification
JIS	Japan Industrial Standard
MDF	Main Distribution Frame
MOF	Ministry of Finance
MOH	Ministry of Health & Family Welfare
NBC	National Building Code of India 1983
NIC	National Informatics Centre
NICED	National Institute of Cholera and Enteric Diseases
WHO	World Health Organization

Summary

The infant mortality rate in India is 67 per thousand people (The State of the World's Children 2003), which is higher than in Sri Lanka, with an infant mortality rate of 17, and the Philippines, with 19. The Government of India has set a goal of reducing the infant mortality rate to 45 per thousand people by 2007 and 28 per thousand by 2012 in the health care field objectives of the 10th National Five Year Plan (2002 - 2007) published in 2002.

There is a need to acquire the technology for rapid and accurate classification and analysis of diarrheal diseases caused by a wide variety of viruses and bacteria for diagnosis, medical treatment, containment of infectious contagion and prevention of diarrheal diseases. Furthermore, recent years have seen the appearance of new problems, such as the emergence of a new type of cholera bacteria and drug-tolerant dysentery bacillus. Therefore, classification and analysis require more accurate diagnostic techniques conducted at the molecular level.

The Government of India has requested the Government of Japan for technical cooperation in improvement diagnostic techniques since Japan is widely recognized as one of the most advanced countries in the field of diagnosis, medical treatment and prevention of diarrheal disorders.

Following the request, Japan International Cooperation Agency (JICA) carried out the "Project for Prevention of Emerging Diarrheal Diseases in India" from February 1998 to January 2003 through which transfer of technologies for the study of diarrheal disorders was conducted along with procurement of basic equipment and materials at the National Institute of Cholera and Enteric Diseases (NICED). The " Technical Cooperation for the Project for Prevention of Diarrheal Diseases in India (Phase 2)" (hereinafter "T.C Phase 2"), which is scheduled to be implemented from 2003 to 2008, to provide technical transfer of more sophisticated diagnostic techniques for diarrheal diseases at the molecular-biological level, including procurement of equipment and materials for study and diagnosis has commenced.

However, it was concluded by the Indian side that the existing NICED laboratory lacked sufficient space and did not provide a suitable environment for high accuracy molecular-biological research activities to be carried out in T.C Phase 2. The Indian side drafted plans for construction of new research facilities and procurement of equipment. However it was not realized due to financial difficulties and the Government of India requested the Government of Japan for Grant Aid to implement the required facilities.

Following the request, the Government of Japan conducted a preliminary study by JICA in July 2003. The Preliminary Study Team confirmed the necessity of the Project facilities and equipment procurement for the implementation of T.C Phase 2 and prepared a Preliminary Design plan and equipment list based on an agreement between the two sides and brought back to Japan for further study.

After further studies in Japan, the Government of Japan decided to conduct a Basic Design Study. JICA sent the Basic Design Study team from November to December 2003. The Team conducted field studies of related facilities, collected necessary reference material and held discussions with the Indian side based on the preliminary design plan.
The basic design team proposed alterations to the Preliminary Design Plans as follows.

1. The height of the building shall be changed from 6 to 4 stories in height.
2. Animal House shall be relocated from top floor to ground floor level.
3. Additional project site shall be acquired for waste water treatment and incinerator facility.
4. Additional project site shall be acquired for Parking lot.

Item 1 mentioned in above, will reduce total number of stories and floor area of building. Item 2 will reduce the floor area required for elevator shaft for clean and dirty circulation for the Animal House, as well as one number of elevator machine. This is considered a reasonable alteration in view of construction cost and reduced operational costs. The reduction in floor area applies only to common spaces such as staircases and there is no reduction of laboratory spaces or any effect on T.C Phase 2 research activities. Furthermore, surplus floor areas are allocated to rooms not considered in the preliminary study such as switch gear room and water treatment room. As a consequence there is virtually no change in total floor area compared with preliminary design plan prepared by JICA preliminary study team.
It was confirmed that an additional project site was needed to accommodate the facilities in item 3 and 4 based on basic design study results. The Indian side accepted this conclusion and commenced proceedings to acquire the additional site. It was confirmed that provision of parking facilities for the Project would be borne by the Indian side.

As a result, the major components and schedule of the Project for the Founding a Collaborative Diarrheal Disease Research and Control Center in India were confirmed as below;

Responsible Organization: Ministry of Health, Family and Welfare (MOH)
Implementation Organization: Indian Council of Medical Research (ICMR) and National Institute of Cholera and Enteric Diseases (NICED)
Project Schedule: The project schedule is estimated to be 21.5 months from signing of E/N to the completion of construction of the Project. The estimated terms necessary are 2 months for detailed design stage, 2.5 months for tender stage and 17 months for construction stage.
Construction Site: New project site located within Infectious Disease Hospital Compound, West Bengal

Building Structure: Laboratory (New construction):
Reinforced concrete structure with 4 stories (including Animal House) and 1 Penthouse Machine Room
Generator House, Incinerator, Waste Water Treatment Plant (New construction):
Single story concrete block structure

Floor Area:
Laboratory 6.652 m² (Site Area : 3,288 m²)
Generator House, Incinerator, Waste Water Treatment Plant 154 m² (Site Area : 800 m²)
Total Floor Area 6,806 m²

Contents of the Project

Construction of Building	Laboratory Penthouse floor: Fan room, Elevator Machine Room, Elevated Water Tank 3rd floor : Molecular Biochemistry, Molecular Parasitology, Molecular Microbiology laboratories 2nd floor : Molecular Virology, Molecular Pathophisiology, Molecular Immunology, Epidemiology laboratories First floor : Electron Microscope and Atomic-force Microscope Room, Administration room, Seminar room, Surveillance Network centre, Reference room, and others Ground floor: Entrance Hall, Animal House , Central Machine room Annex buildings (Single story buildings) Generator House, Incinerator room, Sewage Treatment Plant Pump House
Procurement of Equipment	The Equipment necessary for operation of above laboratory Atomic-force Microscope, Inverted Fluorescence Phase Contrast Microscope, Scanning Electron Microscope, Multi Angle Laser Light Scattering (MALLS) Photometer, Protein Purification System (High Performance Liquid Chromatograph), Spectrofluorometer UV/VIS , FTIR Spectrophotometer, UV/VIS Spectrophotometer, Differential Scanning and Titration Calorimeter, Protein Purification System (FPLC), PCR, others

The total project cost of the Project is estimated at 2,156.75 million yen (2,134.4 million yen for the Japanese portion and 22.35 million yen for the Indian portion)

The operation and maintenance cost after completion of this project is estimated to be approximately 21 million Indian Rupee (hereinafter referred to as Rs) per year. Of this amount, the operation and maintenance cost for the facilities is 6 million Rs, and 3 million Rs. for the equipment. The maintenance contract cost with local agent for equipment is 6 million Rs and outsourcing cost is 6 million Rs.

The total cost for the operation and maintenance is equivalent to 23 percent of the total annual budget of NICED for fiscal year 2002/2003 (90 million Rs). The responsible agency MOH and the implementing organization ICMR have given assurance for the necessary budgetary measures and no problem is foreseen.

Implementation of this project (including the Japanese and Indian scope of works) is expected to bring about the following direct merits.

1. Increase in number of diarrheal cases identified at the molecular level
   The Project will provide efficient examination and diagnosis at the molecular level for scientists, thereby increasing the number of identified cases and strengthening of immunological surveillance of disease pathogens.
2. Increase in number of persons acquiring diagnostic technology
   The Project will enable conducting training for identification and diagnosis at the molecular level for domestic researchers and students from throughout India. Number of training programs and trainees will also increase due to the new training facilities included in the Project.
3. Increase in number of diagnostic sera and strain specimens and incorporation into database
   The Project will provide dramatic increase in storage capacity for diagnostic sera and strain specimens. This will enhance the establishment of a database and increase the speed of identification and diagnosis.

Implementation of the Project is expected to bring about the following indirect merits.

1. The Project will provide facility for information network by enabling information linking between NICED and domestic research centers. This will enable constant immunological surveillance of disease pathogens.
2. Provide improvement of technology for infectious disease researchers throughout India.
3. Increase the number of trainees coming from neighbouring countries. This will help to enable further promotion of control measures for infectious diseases in South Asia and South East Asia through promulgation of disease control measures developed at the Project facilities.
4. Enable shortening of time required to prescribe appropriate medicine according to prompt identification and diagnosis.

Implementation of this project will intensify control measures for infectious diarrheal diseases not only for Indian, with a population of about 1.045 billion, but also for neighboring countries, with a population amounting to about 480 million. In this context, implementation of this project under Japan’s grant aid programme is worthwhile, and the adequacy and necessity of this project are justifiable with a high decree of certainty.

It is essential that the Indian scope of works is completed in a timely manner in accordance with the schedule of the Project facilities. Such works as legal acquisition of additional project site, provision of temporary site for construction and approval for detour road for ID Hospital must be completed before the works of the Japanese side can be commenced. Moreover, lead-in work for electricity, water supply, drainage and telephone lines must be coordinated with Japanese construction schedule.

In order for the facilities and equipment to be provided by the Project to be smoothly and effectively managed, it is recommended that the following improvements or arrangements be made by Indian side.

1. It is recommended that necessary number of staff must be assigned in order to maintain good condition of facilities and equipment.
2. In order to maintain facilities and equipment in best condition and ensure continuous high performance for research、it is recommended to establish a maintenance organization and promote activities to enhance technical levels of maintenance staff.
3. The Equipment Supplier, at the time of commissioning, must provide technical guidance for operation of the equipment in addition to explanation of the maintenance/inspection manual, operation manual, circuit diagram and others. Furthermore, the Supplier must provide instructions on the effective use of the manuals for the effective maintenance of the equipment.
4. It is recommended to keep track of dates of delivery, frequency of use, repair history, etc. and record these events on a ledger (record book) for each piece of equipment. It is also recommended to formulate a spare part purchase plan and equipment renewal plan, and to formulate long- and medium-range budgets based on these plans.
5. It is recommended that, after completion of the project, an annual report be prepared every year on the management and operation of the Project. The preparation of the annual report will help appraisal of the management and operation of the Project facilities and will serve as a reference in the planning of improvements in operation of the facilities.

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Chapter 1. Background of the Project

CHAPTER 1. BACKGROUND OF THE PROJECT

The National Institute of Cholera and Enteric Diseases (NICED) was established in 1963 adjacent to the Infectious Diseases (ID) Hospital of the State of West Bengal in Kolkata City (formerly called Calcutta), as an institute for diarrheal research under Indian Council of Medical Research (ICMR).

This institute develops analytic, research, prevention and treatment techniques for various kinds of diarrheal disorders, and supplies reagents for diagnosis, antibodies and antiserum.

The Government of India requested the Government of Japan for technical cooperation including staff training in the fields of molecular biology and epidemiology, improvement of equipment and materials for study, and promotion of collaborative research. In response, the Government of Japan carried out the "Project for Prevention of Emerging Diarrheal Diseases in India" from February 1998 to January 2003 and provided a technical transfer program for study of diarrheal disorders and procurement of basic equipment and materials.

The " Technical Cooperation for the Project for Prevention of Diarrheal Diseases in India (Phase 2)" (hereinafter "T.C Phase 2"), which is scheduled to be implemented from 2003 to 2008, to provide technical transfer of more sophisticated diagnostic techniques for diarrheal diseases at the molecular-biological level, including procurement of equipment and materials for study and diagnosis has been commenced.

The present facilities of NICED, which were constructed more than twenty years ago, has only 6.5 sqm per each researcher, which is much smaller than the area of 20 to 25 sqm, common internationally. The facilities are not designed functionally for any separation of clean and dirty zones and did not provide a suitable environment for molecular-biological research activities requiring high degrees of accuracy planned for T. C. Phase 2. Therefore, the Indian side drafted plans for construction of new research facilities and procurement of equipment for the planned activities. However it was not realized due to financial difficulties and the Government of India requested the Government of Japan for Grant Aid to implement the required facilities.

Following the request, the Government of Japan, entrusted JICA to dispatch a preliminary study team in July 2003. The Preliminary Study Team held discussions with the Indian side to confirm the contents of the Request. The Indian side had already acquired a suitable site for the Project and the Preliminary Study team discussed with the Indian side on the minimum necessary facilities and equipment for T. C. Phase 2 and prepared a preliminary design plan and equipment list. Based on the Plan, the GOJ decided to dispatch a Basic Design Study Team in December 2003.

The Basic Design Study team conducted field surveys of related facilities, collected necessary reference material and held discussions with the Indian side based on the preliminary design and finally agreed that the components of the request by the Government of India for construction of facilities and procurement of equipment was as shown below:

Table 1-1 Outline of Cooperation Project

Category	Name of Room	Remarks
Laboratories	Molecular microbiology laboratory Molecular biochemistry laboratory Molecular parasitology laboratory Molecular virology laboratory Molecular immunology laboratory Epidemiology laboratory Molecular pathophisiology laboratory Electron microscope and atomic-force microscope room	
Common laboratories	Rooms for equipment and materials in common use, incubators, freezer/cold storage, meeting room, JICA's expert office	
Animal house	For the breeding department, 2 infected- breeding rooms and 4 normal breeding rooms; 6 in total. Preparation room, sterilizing room, operation room, animal house laboratory, storage room, changing room, etc.	
Education and training	Seminar room	
Surveillance network	Network centre, server machine room, reference room	
Administration	Director room, administration room, security, drivers room	
Common area	Changing room, lavatory, shower room, corridor, stairs, hall	
Mechanical/Electrical	Air conditioner room, Fan room, pump room, elevator machine room, MDF, Switch gear room, electric room, LPG supply room, laboratory gas room	
Annex buildings	Generator room, incinerator, sewage treatment plant pump house	Except underground sewage treatment tank

Chapter 2. Contents of the Project

CHAPTER 2. CONTENT OF THE PROJECT

2-1 Basic Concept of the Project

(1) Overall Goal and Objectives of the Project

The infant mortality rate in India is 67 per thousand people (UNICEF 2003), which is far higher than in Japan, where the rate is 3, and even higher than in Sri Lanka, with a rate of 17, and the Philippines, with a rate of 19. The total number of infant mortality is about 2.4 million per year.

The Government of India has set a goal of reducing the infant mortality rate to 45 per thousand people by 2007 and 28 per thousand by 2012 in the health care field of the 10th Five Year Plan (2002 - 2007), under the slogan of "Health for All". The Government of India is introducing measures to halve the mortality rate from infectious diseases and to reduce morbidity rate of infectious diseases.

The main cause for the high infant mortality rate is water-borne diarrheal diseases. It is imperative to develop quick and reliable diagnostic /analytic techniques for the numerous diarrheal diseases caused by viruses and bacteria, in order to diagnose, treat, contain contagion and establish preventive strategies.

Therefore, this project is anticipated to reduce the infant mortality due to diarrheal diseases in India through the improvement of the diarrheal disease diagnostic capabilities of NICED, the sole dedicated research institute for diarrheal diseases in India, and to establish a surveillance network between NICED and other hospitals.

(2) Basic Concept of the Project

The Project will provide facilities and equipments in order to smoothly transfer technology for improved accuracy in diagnosis of infectious disease at the molecular level for the Japanese technical cooperation project, T.C Phase 2.

Table 2-1 Outline of Cooperation Project

Construction of Building	Laboratory (4 stories/ 6,652 ㎡) Penthouse floor : Fan room, Elevator Machine Room, Elevated Water Tank 3rd floor : Molecular Biochemistry, Molecular Parasitology, Molecular Microbiology laboratories 2nd floor : Molecular Virology, Molecular Pathophisiology, Molecular Immunology, Epidemiology laboratories 1st floor : Electron Microscope and Atomic-force Microscope Room, Administration room, Seminar room, Surveillance Network centre, Reference room, and others Ground floor: Entrance Hall, Animal House , Central Machine room
Annex buildings	(Single story buildings, 154 ㎡) Generator House, Incinerator room, Sewage Treatment Plant Pump House
Procurement of Equipment	The Equipment necessary for operation of above laboratory Atomic-force Microscope, Inverted Fluorescence Phase Contrast Microscope, Scanning Electron Microscope, Multi Angle Laser Light Scattering (MALLS) Photometer, Protein Purification System (High Performance Liquid Chromatograph), Spectrofluorometer UV/VIS , FTIR Spectrophotometer, UV/VIS Spectrophotometer, Differential Scanning and Titration Calorimeter, Protein Purification System (FPLC), PCR, others

2-2 Basic Design of the Requested Japanese Cooperation

2-2-1 Design Policy

(1) Basic Policy

1) T.C Phase 2 has already commenced at NICED. Therefore, the Basic Design for the Project facilities and equipment must be co-ordinated with the activities of T.C Phase 2, such as the activities plan, the expert-dispatch plan and the implementation schedule.
2) In formulating the procurement plan for equipment, it shall be confirmed that equipment and materials to be procured under the Project do not duplicate those which have been already procured or are planned to be procured under the T.C Phase 2 and ensure that the basic design procurement plan will allow equipment and materials for both projects to be used rationally and efficiently.
3) A plan shall be formulated for relocating suitable existing equipment and materials to the Project building which will be moved from the existing NICED building for activities to be conducted in the new laboratory building under T.C Phase 2.
4) In formulating the basic design, the role of each of the three facilities, namely the new laboratory to be constructed under the Project, a new building under construction by NICED and the existing facilities, shall be clarified so that there are no duplication of functions of the Project facilities and equipment with others and will enable rational and efficient operation and management of the three facilities for NICED as a whole.
5) In formulating the basic design, it shall be intended to reduce administrative and maintenance expense for facilities, equipment and consumables with consideration given to NICED's operational and maintenance capabilities (such as the number of full-time staff including additional staff, the level of technical capability, financial capability, maintenance of consumable articles, and the situation for procurement of spare parts). At the same time, the plan will attempt to contribute to self sustainable technical and economical development.
6) GLP standards are not required for the Project facilities, as they are not used as a factory for manufacturing drugs or chemicals. However, there are various laboratories, such as the animal house which require a degree of cleanliness to enable cell research at a molecular level. Furthermore, the Project facilities will be designed for a suitable level for indoor environmental conditions appropriate for an organization designated as a collaborative laboratory of WHO.
7) The project site is located within the I.D. Hospital compound and is used as a playground by families visiting the hospital. Therefore, the new laboratory will be designed for security and to prevent children from entering the premises.

8) The building will be designed to provide a suitable grade of facilities for the activities for training, seminars and other programs of molecular level technical training and improvement of technical skills for domestic and third country scientists and technicians. Large seminar facilities, which were initially requested, shall be provided by efficient usage of existing conference hall located in existing NICED building.

9) The building will be designed to minimize adverse environmental effects to the surrounding areas from sewage, smell, ventilation from the Project facilities and smoke from the incinerator.

(2) Policy regarding natural conditions

1) Air temperature and Humidity

Annual average temperature and average humidity in Kolkata is very high, approximately 27^{o}C and 70%, respectively. The average maximum temperature from March to May is approximately 27 - 30^{o}C, the hottest months of the year and humidity is also high. The period between June and September is said to be uncomfortable, since it is the rainy season and humidity is higher, although temperatures are similar. The period between October and February is the dry season, and particularly from December to February, the average minimum temperature is low, being approximately 15^{o}C.

Most of the rooms in the Project facility require air conditioning and mechanical ventilation systems. In addition to cooling, the Animal House will need a heating system.

Other rooms will have operable windows to allow natural ventilation as much as possible.

Table 2-2 Temperature Record at Kolkata

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Mean
Monthly average minimum temperature (℃)	13.9	16.9	21.7	25.1	26.4	26.5	26.1	26.1	25.8	24.0	18.9	14.3	22.1
Monthly average maximum temperature (℃)	26.6	29.7	34.0	36.3	36.0	34.1	32.2	32.0	32.2	31.9	29.8	27.0	31.8
Precipitation (mm)	16.8	32.8	32.8	47.7	101.7	259.9	331.8	328.8	295.9	151.3	17.2	7.4	1624.1

(World Meteorological Organization, 2003)

2) Precipitation

Annual precipitation in Kolkata is around 1,600 mm on the average, which is similar to Tokyo, which has 1,500 mm. The average monthly precipitation is 260 to 330 mm in the rainy season from June to September, and about 75% of the annual precipitation occurs during this period. Therefore, in the design for the drainage from roof and outside ditches, volumes for increased rainfall intensity of 50% above normal shall be used because it is necessary to consider concentrated heavy rain of around 100 mm/hour.

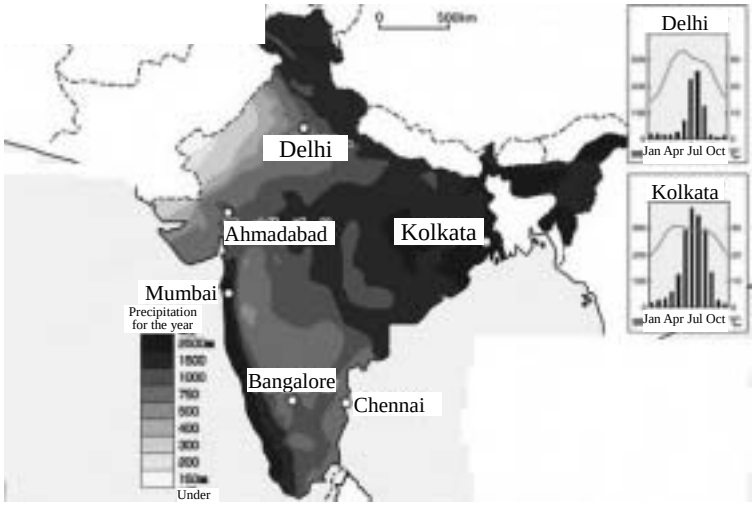


Figure 2-1 Distribution of Monthly Average Precipitation in India

3) Wind and cyclones

Cyclones, which generally generate mainly over the Bay of Bengal, are accompanied by winds of 17 - 35 m/sec. in mean wind speed. Three cyclones have affected West Bengal Province in the last five years, two of which passed over Kolkata City. By regulations in the India National Building Code ("NBC"), the wind pressure performance of 160kg/sqm or more is necessary for outside windows and doors of buildings, wind driven rainfall is to be considered in the design of doors, such as an entrance of a building and in the design of storm drainage.

Routes of cyclones which have developed over the Bay of Bengal and the Indian Ocean in the past five years are shown below.

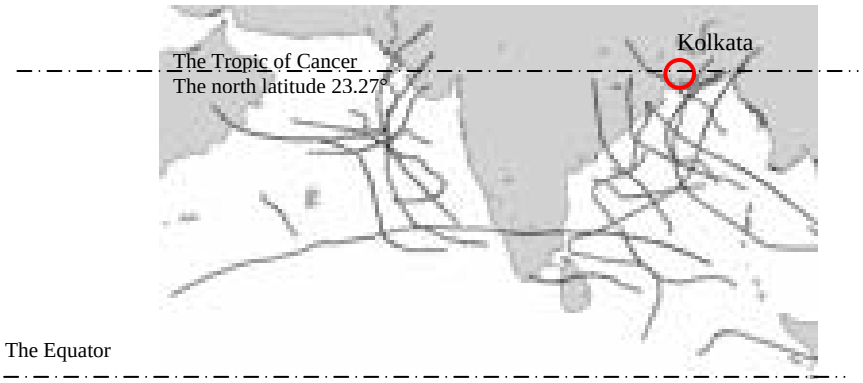


Figure 2-2 Trajectories of Cyclones over the Indian Ocean from 1998 to 2002

4) Daylighting

Kolkata is located in the northern hemisphere at approximately latitude 23°N and sun altitude is high. Therefore, it is necessary to take into account the sunlight coming from directly above the building and in particular from east and west sides. The design shall incorporate thermal insulation of roofs and measures against the low angle sunlight from the east and west sides.

(3) Policy regarding social and economic conditions

The Project site is located in Kolkata, West Bengal State, which has been ruled by the Communist Party for more than twenty years. The state government has recently changed their policies and commenced economical reformation of the area, inviting foreign companies to do business in the state and promoting the redevelopment of the city of Kolkata. Following this change, economical activity has shown a marked increase. Therefore, market prices for construction materials are expected to increase.

Building projects in Kolkata require standby well water as well as generators to supply water and electricity in case of stoppage of city water supply and power failure in consideration of strained utility infrastructure of the city.

(4) Policy regarding construction/procurement circumstances or special circumstances/ commercial practices in the construction industry

The general construction market situation in India is highly active, with many improvement projects for infrastructure under execution. The prices in the construction market are generally increasing around 4 to 7% per year. It is comparatively easy for contractors to employ normal construction workers. However it will be necessary to provide for higher wages for engineers or technicians with skill levels required for this Project.

Most of materials necessary for building construction are available for purchase on the local market. However it is necessary to import high quality materials such as aluminium sash and semi air-tight type steel door etc. from third countries such as Singapore.

Formwork carpenters and steel re-bar workers shall carry out construction work under tight quality control management based on the Consultant’s standard. Judging from ability of local workers, their work efficiency appears to be lower than Japan and therefore more manpower for worker must be provided compared with Japanese norms.

(5) Policy regarding utilization of local companies

In the execution of Japanese Grant Aid scheme, a general contractor which is a Japanese national shall employ local companies as subcontractors. It is necessary to choose among

comparatively large local companies whose standards of execution capabilities are also high to meet the high quality standards of the Project.

Normally, confirmation of the basic wage is required by a local labour union for employment of local staff. In placing orders to Japan or any other third country, it is necessary to take into consideration that there are cases where higher wages have been established.

(6) Policy regarding operational and management capabilities of the implementing organization

The Project facilities and the new building under construction by NICED are more than 600 m away from the existing NICED research institute. Therefore, the Indian side must assign the maintenance staff with required technological capabilities in order to carry out maintenance and operational management of these three facilities.

(7) Policy regarding setting of the grade of facilities and equipment.

1) Facilities plan

The Project facilities will be designed to the following grades;

① The facility planning will be of a standard that will meet the requirements for cleanliness in ambient environment and performance for the research programs required to pursue diarrheal disease diagnosis at the molecular level to be implemented under T.C Phase 2.

② The facilities will be designed for easy maintenance and administration by the Indian side and seek to minimize the operational costs as much as possible.

③ The planning for the Serum Bank will be of the required environment, performance and space for stocking the diagnostic sera and bacterial strains.

④ Necessary space shall be secured for activities to be practiced in the facilities involved in this plan, including space for equipment and materials to be relocated from the existing facilities.

2) Equipment Procurement plan

The project equipment will be planned to the following grades;

① Equipment and materials shall be of minimum specifications and quantity required for the transfer of molecular level technology for diagnosis and classification to be conducted under T.C Phase 2.

② Specifications and quantity shall be determined after confirming equipment and materials which have already been procured in the T.C Phase 2 or are planned to be procured.

③ Those to be used in common among research departments shall be put in common rooms as shared equipment and material whenever feasible, so as to facilitate efficiency and to reduce administrative and maintenance expenses by reducing equipment and consumables.

(8) Policy regarding construction/procurement methods and the construction schedule

1) Policy regarding construction

In designing facilities, preference shall be made for a locally common construction methods and construction materials which can be locally procured, whenever feasible. If materials have properties requiring importation from a third country or Japan, a design that will allow the material to be locally repaired shall be utilized whenever possible.

2) Policy regarding procurement methods

In the selection of the construction supplies for the Project facilities and equipment, basic criteria shall be for durability, ease of maintenance, low procurement cost and running cost and preference for utilizing locally procured materials as much as possible. However, as locally-made products often have somewhat lower quality and there are wide variations in quality among delivered products, quality and dimensions of delivered products must be strictly confirmed. It takes two or three months after ordering to obtain imported articles available on the local market, because local suppliers keep small inventories. Therefore, procurement of such items shall be planned so that construction schedule will not be adversely affected, after confirmation of quality and quantity of supply.

3) Policy regarding the Construction Schedule

The construction schedule for the implementation schedule of the project shall be determined to allow appropriate and reliable quality control and safety management. An appropriate staff assignment and rational temporary construction plan will be formulated.

Based on the results of the soil survey, ground condition of the construction site of this project is poor and piling work is necessary due to the fact that bearing ground of the building has been ascertained to be at about 35 m below ground from the present ground level. On site cast-in-place concrete pile is the most reliable construction method, but with this construction method, quality control plan during construction stage is extremely important. It is necessary to allow for sufficient time for piling works in the construction schedule.

2-2-2 Basic Plan (Facility Plan/Equipment Plan)

2-2-2-1 Overall Project Description (Study of the Request)

(1) Background of request and history

The Indian Government has set a goal of reducing the infant mortality rate to 45 per thousand people by 2007 and 28 per thousand by 2012 in the health care field of the 10th National Five Year Plan (2002 - 2007), published in 2002. The major cause of infant death is acute infectious diarrheal caused by impure water. Furthermore, new problems have appeared, such as emergence of a new type of cholera bacteria and drug-tolerant dysentery bacillus.

The Indian Government requested the Government of Japan for technical cooperation since Japan is widely regarded to be one of the most advanced countries in technology in research, diagnosis and classification of diarrheal diseases and medical treatment and prevention of diarrheal disorders.

Following the request, Japan carried out the "Project for Prevention of Emerging Diarrheal Diseases in India" from February 1998 to January 2003 and provided a technical transfer program for study of diarrheal disorders and basic equipment and materials to the National Institute of Cholera and Enteric Diseases (NICED). The " Technical Cooperation for the Project for Prevention of Diarrheal Diseases in India (Phase 2)" (hereinafter "T.C Phase 2"), which is scheduled from July 2003 to June 2008, is being carried out, and technical transfer is planned for more sophisticated diagnostic techniques for diarrheal diseases at the molecular-biological level, including procurement of equipment and materials for study and diagnosis.

However, it was concluded that the existing facility is not suitable for molecular-biological research activities to be carried out in the T.C Phase 2. The Indian side planned a new research facility. However it was not realized due to financial difficulties. Therefore, the Government of India requested the Government of Japan grant aid for the Project, including both construction of research facility and procurement of equipment which are necessary to carry out T.C. Phase 2 activities.

(2) Field study and the Final Request

JICA Preliminary study was carried out by GOJ in July 2003 prior to basic design study and a Preliminary Design was agreed upon. The Basic Design Study team was then dispatched to conduct field survey and discussion with concerned parties. Items altered in Basic Design are listed as follows.

Table 2-3 Changes to Original Request

Alteration	Description	Remark
Area of the planned site	- Land required for wastewater treatment and incinerator facilities shall be secured.	- The NICED shall newly purchase ground of 800 sqm in the neighbourhood of the planned site
Substation for the new building	- Construction area is limited to 10 x 18 m.	- The Indian side will deal with this matter.
Parking lot	- A parking lot for 65 cars which is obligated by the law is necessary.	- The NICED will construct it outside the site.
Passage for a fire crew in the area surrounding buildings	- To be secured in the surrounding area outside the planned site	- Site perimeter fences will be constructed by the NICED. - Design shall allow a fire to be extinguished from the outside.
Installation of well facilities	- To be installed according to circumstances of water supply	- To be constructed within the NICED site

Table 2-4 Summary of the Result of the Examination of Requests

Category	Request	Summary of the Result of the Examination	
Laboratories	Molecular virology laboratory	Making a facilities plan including minimum and required space indispensable to activities covered by the T.C Phase 2 and space for installation of equipment.	○
	Molecular immunology laboratory	Same as above	○
	Molecular parasitology laboratory	Same as above	○
	Molecular biochemistry laboratory	Same as above	○
	Molecular pathophysiology laboratory	Same as above	○
	Epidemiology laboratory	Same as above	○
	Molecular microbiology laboratory	Same as above	○
	Electronic microscope room	A plan will be made for facilities where atomic-force microscopes in the existing research institute which were purchased by the Indian side will be placed besides electron microscopes indispensable to study at the molecular biological level.	○
Common laboratories	Common equipment room (serum bank, sera storage, strain storage, common cold room, common incubator room, common laboratory, common kitchen)	Among equipment and materials requested for each research room, those which can be shared will be installed in common area of each laboratory floor.	○
	Expert research room	Rooms indispensable to activities of experts in the T.C Phase 2	○
	JICA's expert room	Same as above	○
	Conference room	For regular meetings of researchers and small meetings of domestic and foreign researchers	○
Surveillance network	Network centre, reference room, server room	Minimum facilities to be constructed which are required for introduction of IT facilities and which have the size that can realize NICED's plan to link to 16 centres across the country.	○

Category	Request	Summary of the Result of the Examination	
Mechanical/Electrical	Electricity-receiving room, LPG room, gas room for laboratory	It is absolutely necessary from the viewpoint of planning to receive electric power exclusively by means of this plan, instead of using the new substation building being constructed by the Indian side.	○
		LPG Gas indispensable to research shall be centralized and then supplied in a safe manner.	○
	Sewage treatment plant pump room, incinerator	Facilities absolutely necessary for activities of this laboratory	○
	Electric room, generator room, air conditioner room, exhaust fan room, pump room, elevator machine room, MDF,		○
Common area	Changing room, WC, shower room, Corridor, stairs, hall		○

Note: ○ Operations to receive cooperation in this plan

(3) Examination of requests

The result of the detailed examination of requests is as follows.

1) Facilities plan

The summary of facilities to be constructed is as follows.

① Total number of stories was altered from 6 to 4 and standard module was changed from 7m to 6.5m in width to provide higher efficiency of space and floor area.
This alteration will not be an inconvenience to any activity of T.C Phase 2.

② Total floor area will not be changed because the surplus area will be used for switch gear room and other functions which were not originally included in the Preliminary Design.

③ Location of the Animal House

Animal houses are normally planned as a separate building because of smell from the house. Preliminary design was made with the location of the Animal House placed on the top level in consideration of the fact that the project site was smaller than required to provide a separate animal house.

However, it was concluded that the location will be changed from the top floor to GF in consideration that reduction of total floor area and also construction cost was possible by eliminating the need for one elevator dedicated to animal house use for

separation of clean and dirty circulation. Smell from the house shall be exhausted from penthouse Fan Room through vertical mechanical ventilation duct. The required spaces shall be coordinated with main machine room of the laboratory.

④ Road for activities of fire trucks

Kolkata City's Building Codes require a space of 3.5 m in working width to be laid out around a planned building. If the vacant space between the project site and connecting corridor of I.D. and a nurse dormitory could be incorporated into the required open space, it will maximize site layout and reduce building cost After discussion with CPWD and Fire Department of Kolkata, it was confirmed that the clear space outside the planned site was to be regarded as the required open space for activities of fire tucks.

⑤ GLP correspondence

As a result of confirmation of activities and research of T.C Phase 2 and detailed activities and environmental requirements with persons in charge of each division related to research and experiments, it was concluded that laboratory design will not be required to conform to GLP standards since the Project facility does not include any production facility for medical drugs.

⑥ Connection corridor between new NICED building and the Project Facility

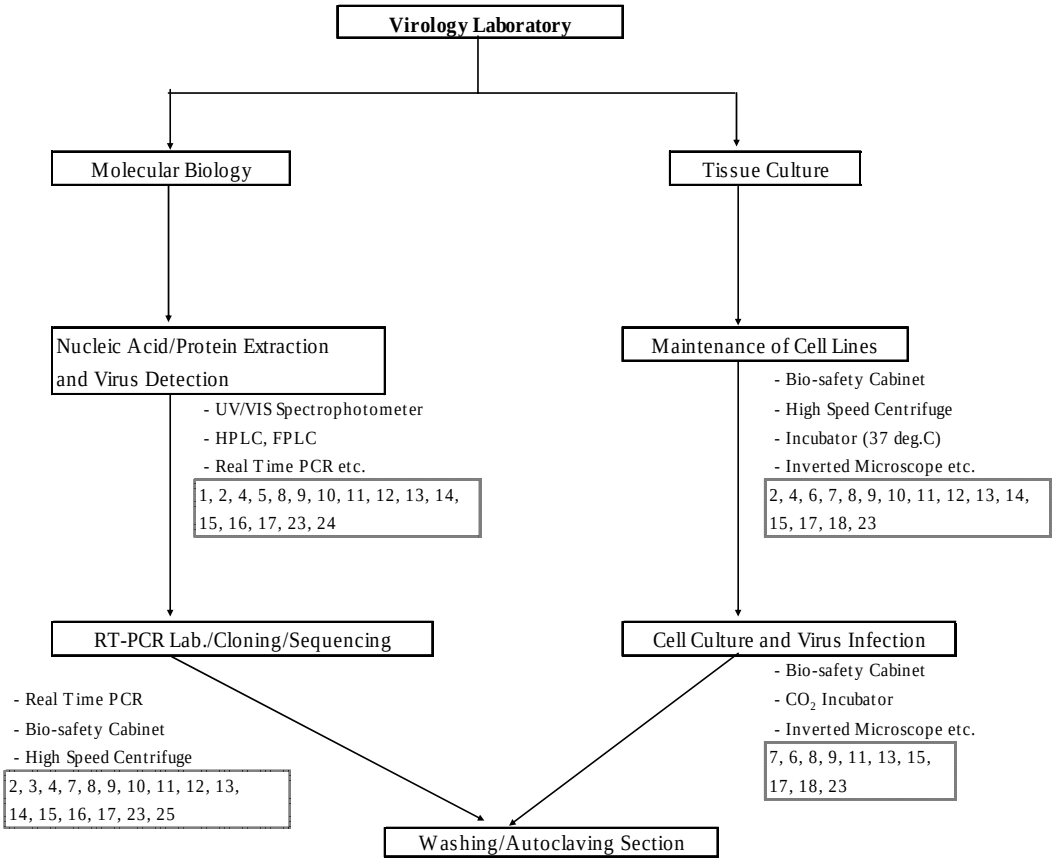
In the Preliminary Design, it was requested to provide a connecting corridor between the new building and the Project Facility either on the third or fourth floor. As a result of the field survey, it was determined that the NICED facilities in the building under construction were to function as the clinical analysis department of I.D. It was concluded that the activities did not have a direct relation with the activities proposed for the Project facilities. Therefore, the connecting corridor was deemed to be not necessary for the Project and was excluded from the project scope. An exterior passage way connecting the two buildings at ground level will be provided instead.

2) Equipment Procurement Plan

The purpose of research and the flow of planned research activities during T.C Phase 2 for each department are as shown below. Equipment closely related to activities in the process is described for each activity.

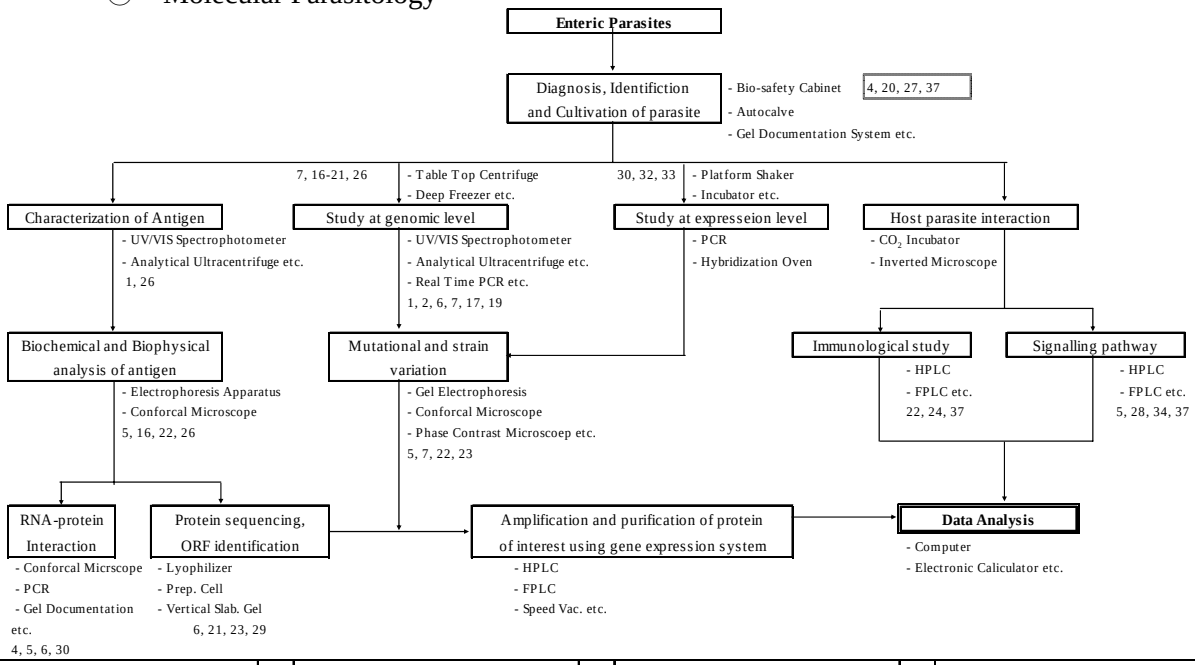
Flow chart of respective researches

① Molecular Virology



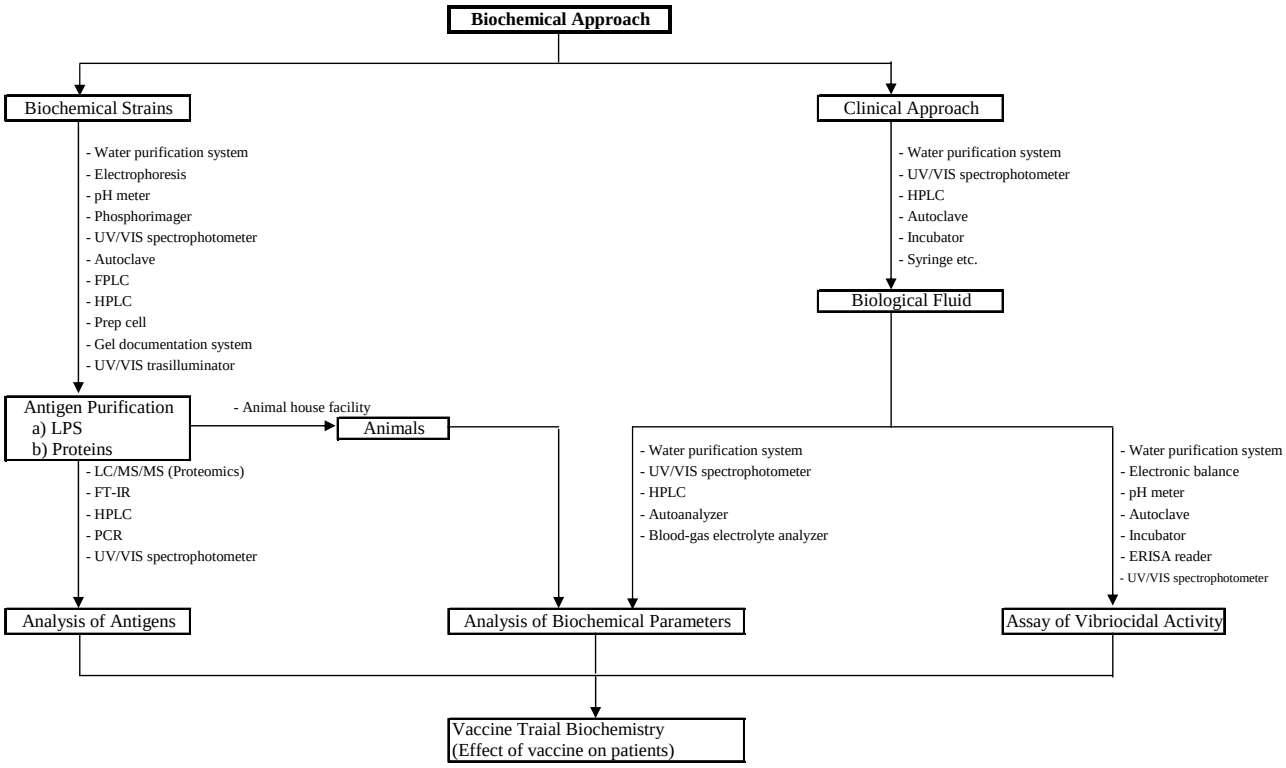
No.	Requested Equipment	No.	Requested Equipment
1	UV/VIS Spectrophotometer	21	Ultrasonic Cleaner
2	Bio-safety Cabinet	22	Pipette Washer
3	PCR	23	Vacuum Pump
4	High Speed Centrifuge	24	Protein Purification System
5	Ultrasonicator		a) HPLC with accessories
6	CO_2 Incubator		b) FPLC with accessories
7	Incubator (37℃)	25	Real Time PCR
8	Refrigerator (4℃)	26	Lyophilizer (Freeze Dryer)
9	Deep Freezer (-20℃)	27	Deep Freezer (-185℃)
10	Deep Freezer (-80℃)	28	Bright Field Phase Contrast Microscope
11	pH Meter		with digital camera
12	Electronic Balance		
13	Magnetic Stirrer		
14	Table Top Centrifuge (refrigerator with various rotors)		
15	Platform Shaker		
16	UV Transilluminator		
17	Water Purification System		
18	Inverted Microscope		
19	Autoclave		
20	UV Cross Linker		

② Molecular Parasitology



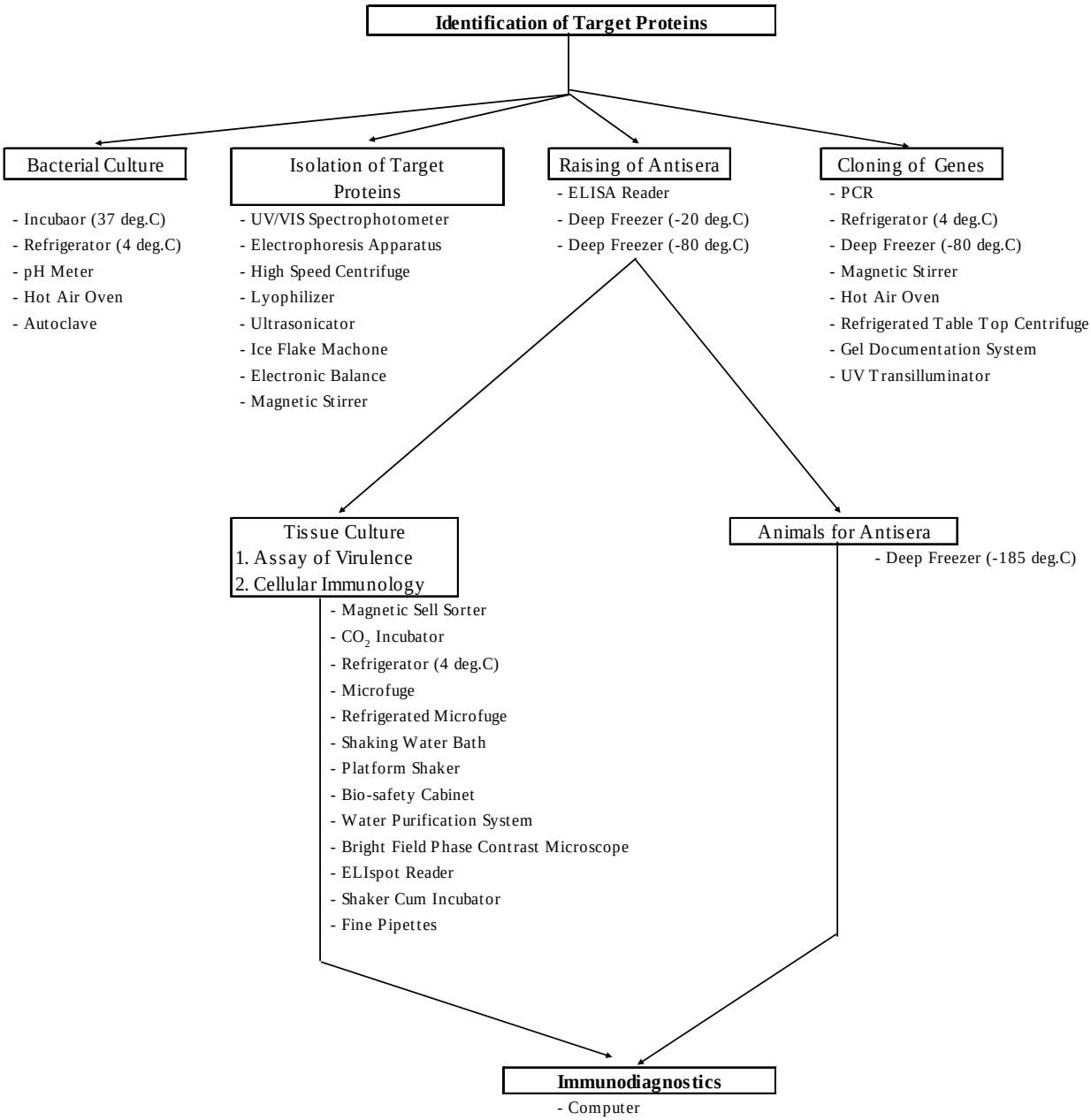
No.	Requested Equipment	No.	Requested Equipment	No.	Requested Equipment	No.	Requested Equipment
1	Analytical Ultracentrifuge	11	Deep Freezer (-20℃)	21	Vertical Slab Gel Electrophoresis with	31	Vortex Mixer
2	Real Time PCR	12	Deep Freezer (-80℃)		power pack 300V	32	Autoclave
3	Inverted Fluorescence - Phase Contrast	13	Deep Freezer (-185℃)	22	Isoelectric Focusing 2-D Electrophoresis	33	Speed Vac.
	Microscope with real time video	14	Electronic Balance		Apparatus	34	Hybridization Oven
4	Bio-safety Cabinet	15	Magnetic Stirrer	23	Gel Blot & Imaging System	35	Gel Dryer
5	LSM Laser for existing Conforcal Microscope	16	Hot Air Oven	24	Dry Bath	36	Vacuum Blot Instrument
6	PCR	17	Table Top Centrifuge (refrigerator with	25	Vacuum Pump	37	FACS-Multipurpose Flow Cytometer
7	Pulse Field Gel Electrophoresis Apparatus		various rotors)	26	Autopipette		
8	CO_2 Incubator	18	Water Purification System	27	Shaker		
9	Incubator (37℃)	19	UV Transilluminator	28	Microfuge (non refrigerated)		
10	Refrigerator (4℃)	20	Bright Field Phase Contrast Microscope	29	Microfuge (refrigerated)		
			with digital camera	30	Electrophoresis Apparatus (submarine) with		
					power pack 3000V		

③ Molecular Biochemistry

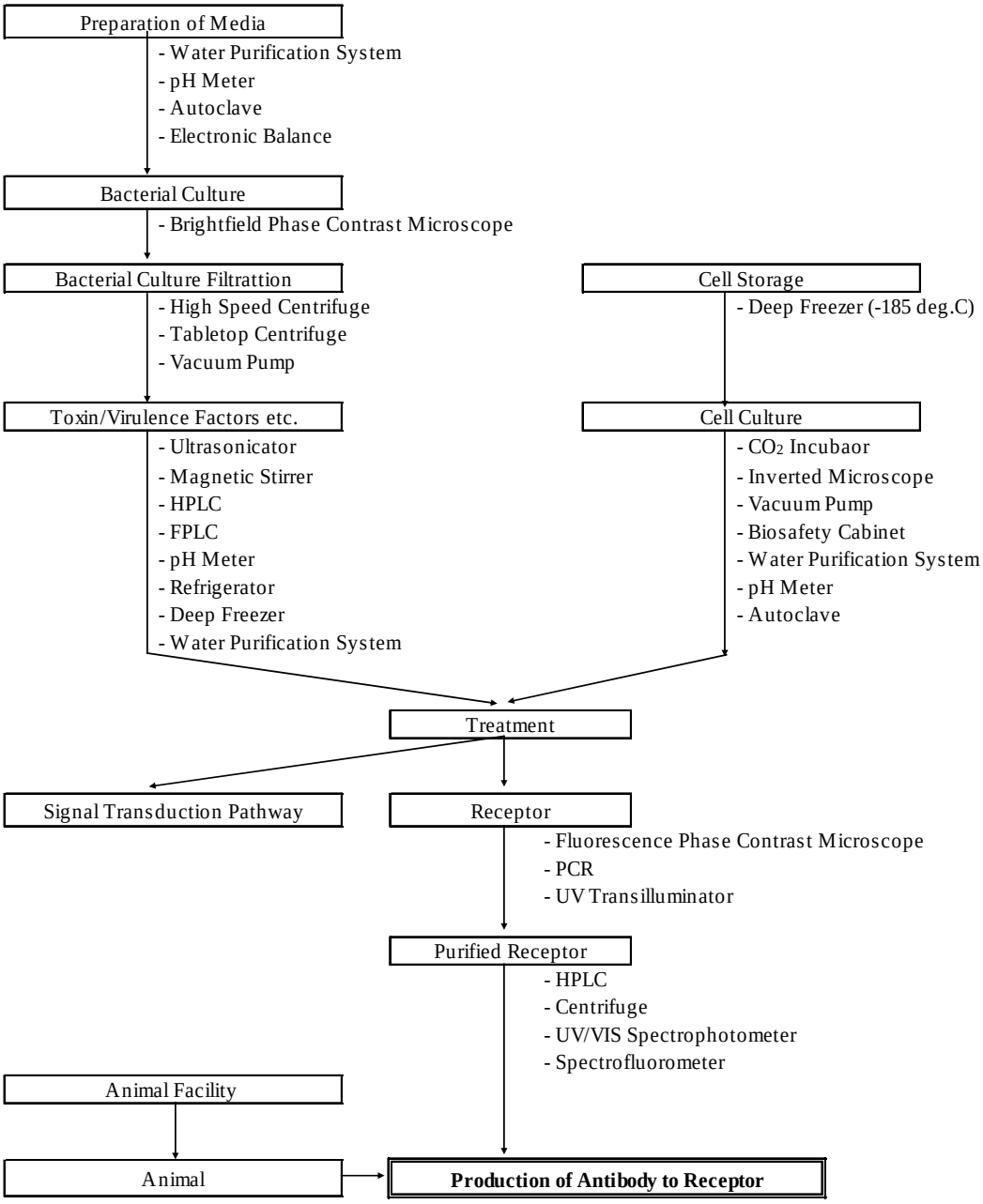


④ Molecular Immunology

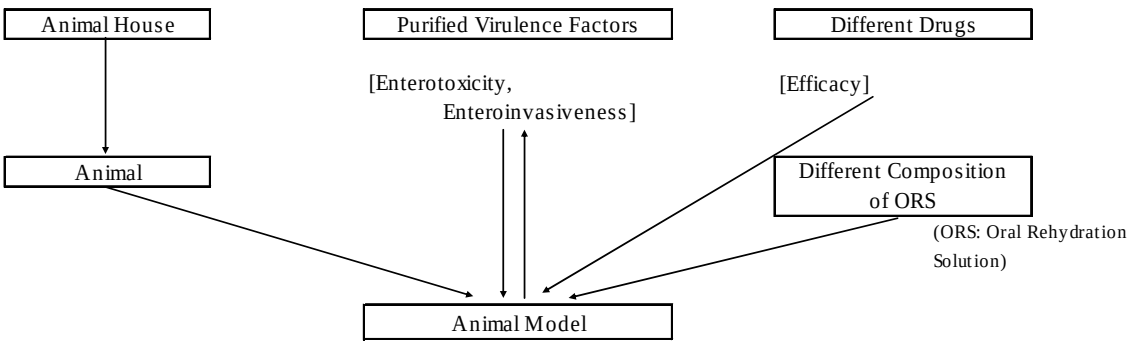
IMMUNODIAGNOSTICS OF ENTERIC PATHOGENS



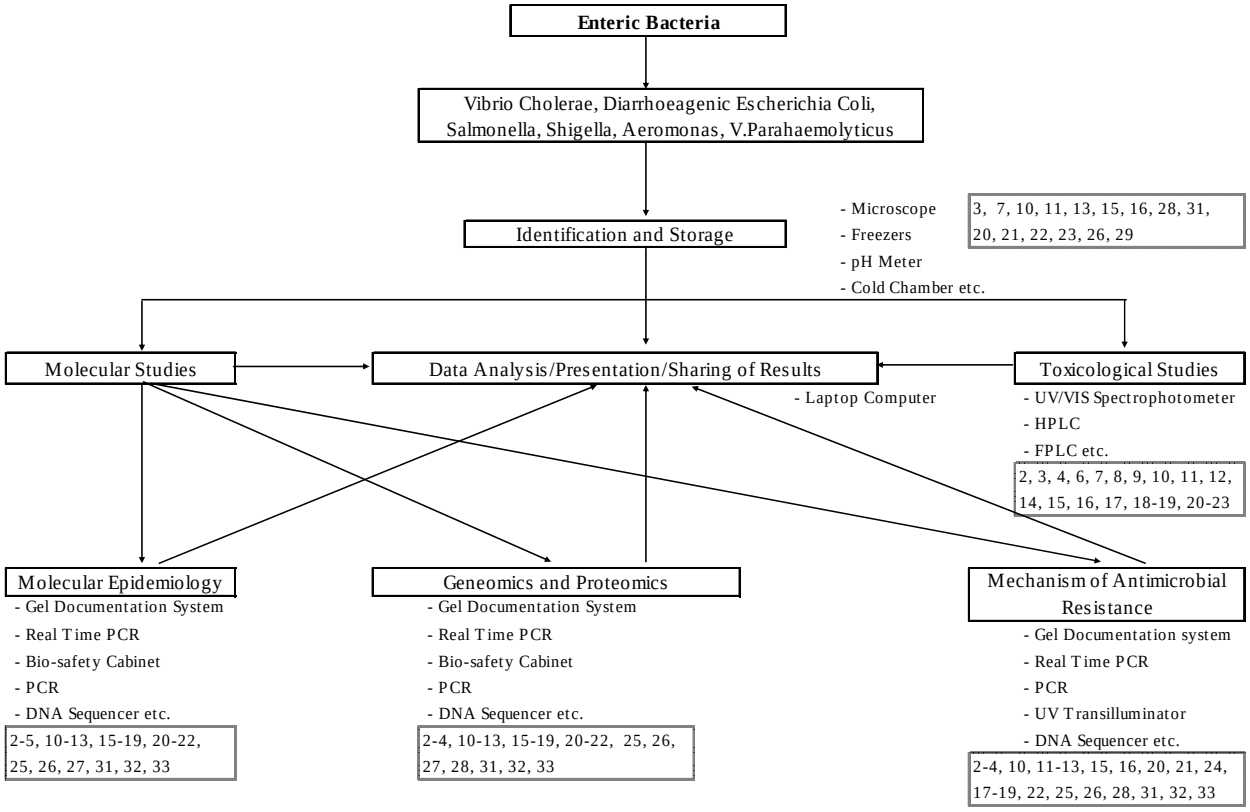
⑤ Molecular Pathophysiology



[Pathophysiology-Animal House]



⑥ Molecular Microbiology



No.	Requested Equipment	No.	Requested Equipment
1	UV/VIS Spectrophotometer	21	Platform Shaker
2	Gel Documentation System with CCD camera	22	Water Purification System
3	Bio-safety Cabinet	23	Bright Field Phase Contrast Microscope with accessories
4	PCR	24	UV Transilluminator
5	Pulse Field Gel Electrophoresis Apparatus	25	Electrophoresis apparatus (sub-marine gel) with power pack 300V
6	High Speed Centrifuge	26	Cold Chamber
7	Lyophilizer (Freeze dryer)	27	Speed Vac
8	Ultrasonicator	28	Autopipettes
9	CO_2 Incubator	29	Light Microscope
10	Incubator (37℃)	30	Vacuum Pump
11	Refrigerator (4℃)	31	Hybridization Oven
12	Deep Freezer (-20℃)	32	DNA Sequencer
13	Deep Freezer (-80℃)	33	DNA Array System
14	Deep Freezer (-185℃)		
15	Electronic Balance		
16	Magnetic Stirrer		
17	Table Top Centrifuge (refrigerator with various rotors)		
18	Microfuge (non-refrigerator)		
19	Microfuge (refrigerated)		
20	Shaking Water Bath (10℃-80℃)		

Policies regarding equipment procurement are as follows:

① Equipment shall be necessary for carrying out analysis, education and training, all of which accord with the purpose of activities in T.C Phase 2.

② Specifications, performance and quantity shall be verified to prevent duplication with equipment to be provided in T.C Phase 2.

③ Similar kinds of equipment to those already in use in departments of NICED shall be eliminated as much as possible to promote efficiency.

④ After confirming respective research purposes of NICED, if the purposes of activities will not be achieved only with the instrument in question to be used, addition of equipment shall be examined.

⑤ After confirming respective research purposes of NICED, equipment which are not indispensable for the relevant research purposes and those which are not immediately necessary shall be eliminated.

⑥ Spare parts shall be excluded. Consumables that will be included in the equipment plan shall be limited to those which are necessary for trial operation and for training of operation and maintenance of equipment for concerned Indian maintenance personnel.

The requested numbers of equipment is based on the activities shown in the previous flow charts for the each field of research. The requested numbers for basic and intermediate grade items were confirmed to be valid according to the stated research objectives and activities, as well as with the requirements of the T.C Phase 2 activities, proposed equipment to be procured under T.C Phase 2, the requested numbers for the Project, feasibility of common use and compatibility with existing equipment. Expensive and high grade equipment were found to be requested by almost all departments except for the Animal House, and some duplication was observed. Where it was deemed appropriate to have common use of these equipment in view of the research activities, a common laboratory and kitchen was planned to house the respective equipment, allowing for some reduction in the requested numbers. This reduction in numbers is also appropriate as it will reduce operation and maintenance costs in the future.

As a result of discussions with NICED researchers, rabbit cage for quarantine, mouse cage for quarantine, deep freezer (-20℃ to -30℃) for waste, cage system for infected rabbits, cage system for infected mice were changed to equipment indispensable to activities and, therefore, the minimum required numbers were added.

Each separate request was examined by establishing a basis of selection from viewpoints shown below. The results are as shown in the following table.

1: Validity that the equipment is indispensable

Equipment shall be indispensable for activities in T.C Phase 2 and achievement of the respective objectives.

◎ Equipment whose necessity is judged to be very high.

○ Equipment which is basic and judged to be necessary.

△ Equipment judged not to accord with the basic design policy of this plan.

× Equipment whose necessity is judged to be absent or quite low.

2: Technical level

◎ Equipment usable at the technical level of present researchers.

○ Equipment usable after giving operational instructions at set up.

△ Equipment requiring technical guidance for a certain period in advance of setting-up equipment.

3: Operation and maintenance

◎ Equipment which does not require special operation and maintenance.

○ Equipment which can be dealt with under the current operation and maintenance system and within the operation and maintenance budget.

△ Equipment which requires some kind of budgetary measure because of high operation and maintenance costs.

4: Validity of quantity

◎ Equipment for which the minimum number required is requested.

△ Equipment whose number can be reduced.

5: Judgement/evaluation

☆ Equipment whose procurement is judged to be validated the Project

× Equipment whose procurement is judged to be excluded from the Project.

(These equipment were deleted from final list of equipment)

Table 2-5 Study of Requested Equipment

Name of Equipment	Q'ty requested	Selection standard					Planned number
		1. Indispensable	2. Technology level	3. Maintenance	4. Validation of number	5. Judgment and evaluation	
[Division of Molecular Virology]							
UV/VIS Spectrophotometer	1	◎	◎	◎	◎	☆	1
Bio-safety Cabinet	3	◎	◎	◎	◎	☆	3
PCR	2	◎	◎	◎	◎	☆	2
High Speed Centrifuge	1	◎	◎	◎	◎	☆	1
Ultrasonicator	1	◎	◎	◎	◎	☆	1
CO2 Incubator	2	◎	◎	◎	◎	☆	2
Incubator (37℃)	2	○	◎	◎	◎	☆	2
Refrigerator (4℃)	4	○	◎	◎	◎	☆	4
Deep Freezer (-20℃)	2	○	◎	◎	◎	☆	2
Deep Freezer (-80℃)	1	◎	◎	◎	◎	☆	1
pH meter	4	○	◎	◎	◎	☆	4
Electronic Balance	2	○	◎	◎	◎	☆	2
Magnetic Stirrer	4	○	◎	◎	◎	☆	4
Table Top Centrifuge (refrigerator with various rotors)	2	◎	◎	◎	◎	☆	2
Platform Shaker	2	○	◎	◎	◎	☆	2
UV Transilluminator	1	◎	◎	◎	◎	☆	1
Water Purification System	1	◎	◎	◎	◎	☆	1
Inverted Microscope	1	◎	◎	◎	◎	☆	1
Autoclave	1	○	◎	◎	◎	☆	1
UV Crosslinker	1	◎	◎	◎	◎	☆	1
Ultrasonic Cleaner	1	○	◎	◎	◎	☆	1
Pipette Washer	1	○	◎	◎	◎	☆	1
Vacuum Pump	2	○	◎	◎	◎	☆	2
Protein Purification System a.HPLC with accessories	1	◎	◎	◎	◎	☆	1
Protein Purification System b.FPLC with accessories	1	◎	◎	◎	◎	☆	1
Real Time PCR	1	◎	◎	◎	◎	☆	1
Lyophilizer (Freeze dryer)	1	○	◎	◎	◎	☆	1
Deep Freezer (-185℃)	1	◎	◎	◎	◎	☆	1
Bright Field Phase Contrast Microscope with digital camera	1	◎	◎	◎	◎	☆	1

Name of Equipment	Q'ty requested	Selection standard					Planned number
		1. Indispensable	2. Technology level	3. Maintenance	4. Validation of number	5. Judgment and evaluation	
[Division of Molecular Epidemiology]							
Microscope with digital camera and accessories	1	◎	◎	◎	◎	☆	1
BP instrument (Sphygmomanometer)	4	◎	◎	◎	◎	☆	4
Stethoscope	5	◎	◎	◎	◎	☆	5
Electronic thermometer	5	◎	◎	◎	◎	☆	5
Infantometer (Baby height scale)	4	◎	◎	◎	◎	☆	4
Weighing machine with platform	2	◎	◎	◎	◎	☆	2
Baby weighing machine	4	◎	◎	◎	◎	☆	4
Refrigerator (4℃)	1	○	◎	◎	◎	☆	1
Deep Freezer (-20℃)	1	○	◎	◎	◎	☆	1
pH meter	3	○	◎	◎	◎	☆	3
Electronic Balance	2	○	◎	◎	◎	☆	2
Microwave Oven	1	○	◎	◎	◎	☆	1
Table Top Centrifuge (refrigerator with various rotors)	1	◎	◎	◎	◎	☆	1
[Division of Molecular Parasitology]							
Analytical Ultracentrifuge	1	◎	◎	◎	◎	☆	1
Real Time PCR	1	◎	◎	◎	◎	☆	1
Inverted Fluorescence - Phase Contrast Microscope with real time video	1	◎	◎	◎	◎	☆	1
Bio-safety Cabinet	1	◎	◎	◎	◎	☆	1
LSM Laser for existing Conforcal Microscope	1	△	○	○	△	☆	1
PCR	1	◎	◎	◎	◎	☆	1
Pulse Field Gel Electrophoresis Apparatus	1	◎	◎	◎	◎	☆	1
CO_2 Incubator	1	◎	◎	◎	◎	☆	1
Incubator (37℃)	1	○	◎	◎	◎	☆	1
Refrigerator (4℃)	1	○	◎	◎	◎	☆	1
Deep Freezer (-20℃)	1	○	◎	◎	◎	☆	1
Deep Freezer (-80℃)	1	◎	◎	◎	◎	☆	1
Deep Freezer (-185℃)	1	◎	◎	◎	◎	☆	1
Electronic Balance	1	○	◎	◎	◎	☆	1
Magnetic Stirrer	1	○	◎	◎	◎	☆	1
Hot Air Oven	1	○	◎	◎	◎	☆	1
Table Top Centrifuge (refrigerator with various rotors)	1	◎	◎	◎	◎	☆	1

Name of Equipment	Q'ty requested	Selection standard					Planned number
		1. Indispensable	2. Technology level	3. Maintenance	4. Validation of number	5. Judgment and evaluation	
Water Purification System	1	◎	◎	◎	◎	☆	1
UV Transilluminator	1	◎	◎	◎	◎	☆	1
Bright Field Phase Contrast Microscope with digital camera	2	◎	◎	◎	◎	☆	2
Vertical Slab Gel Electrophoresis with power pack 300V	3	◎	◎	◎	◎	☆	3
Isoelectric Focusing 2-D Electrophoresis Apparatus	2	◎	◎	◎	◎	☆	2
Gel Blot & Imaging System	1	◎	◎	◎	◎	☆	1
Dry Bath	1	◎	◎	◎	◎	☆	1
Vacuum Pump	2	○	◎	◎	◎	☆	2
Autopipette	3	○	◎	◎	◎	☆	3
Shaker	3	○	◎	◎	◎	☆	3
Microfuge (non refrigerated)	1	◎	◎	◎	◎	☆	1
Microfuge (refrigerated)	1	◎	◎	◎	◎	☆	1
Electrophoresis Apparatus (submarine) with power pack 3000V	2	◎	◎	◎	◎	☆	2
Voltex Mixer	2	○	◎	◎	◎	☆	2
Autoclave	1	○	◎	◎	◎	☆	1
Speed Vac	1	◎	◎	◎	◎	☆	1
Hybridization Oven	1	○	◎	◎	◎	☆	1
Gel Dryer	1	◎	◎	◎	◎	☆	1
Vacum Blot Instrument	1	◎	◎	◎	◎	☆	1
Multipurpose Flow Cytometer	1	◎	○	△	◎	☆	1
[Division of Molecular Biochemistry]							
Differential Scanning and Titration calorimeter	1	○	◎	◎	◎	☆	1
Protein Purification System a. HPLC with accessories	1	◎	◎	◎	◎	☆	1
Protein Purification System b. FPLC with accessories	1	◎	◎	◎	◎	☆	1
Protein Purification System c. Prep Cell	1	◎	◎	◎	◎	☆	1
Gel Documentation System with CCD camera	1	◎	◎	◎	◎	☆	1
FTIR Spectrophotometer	1	◎	◎	◎	◎	☆	1
Multi Angle Laser Light Scattering (MALLS)Photometer	1	○	◎	○	◎	☆	1
PCR	2	◎	◎	◎	◎	☆	2
High Speed Centrifuge	1	◎	◎	◎	◎	☆	1

Name of Equipment	Q'ty requested	Selection standard					Planned number
		1. Indispensable	2. Technology level	3. Maintenance	4. Validation of number	5. Judgment and evaluation	
Lyophilizer (Freeze dryer)	1	◎	◎	◎	◎	☆	1
Ultrasonicator	1	◎	◎	◎	◎	☆	1
Incubator (37℃)	1	○	◎	◎	◎	☆	1
Refrigerator (4℃)	2	○	◎	◎	◎	☆	2
Deep Freezer (-20℃)	1	○	◎	◎	◎	☆	1
Deep Freezer (-80℃)	1	◎	◎	◎	◎	☆	1
pH meter	2	○	◎	◎	◎	☆	2
Electronic Balance	2	○	◎	◎	◎	☆	2
Magnetic Stirrer	3	○	◎	◎	◎	☆	3
Microwave Oven	1	○	◎	◎	◎	☆	1
Hot Air Oven	1	○	◎	◎	◎	☆	1
Microfuge (non refrigerated)	2	◎	◎	◎	◎	☆	2
Microfuge (refrigerated)	1	◎	◎	◎	◎	☆	1
Shaking Water Bath (10℃-80℃)	1	○	◎	◎	◎	☆	1
Platform Shaker	2	○	◎	◎	◎	☆	2
Automated Proteomics workstation with LC-MS-MS	1	○	◎	△	◎	☆	1
Water Purification System	1	◎	◎	◎	◎	☆	1
Dry Bath	3	◎	◎	◎	◎	☆	3
Digital Autoclave	2	○	◎	◎	◎	☆	2
[Division of Molecular Immunology]							
MACS-Magnetic Sell Sorter	1	◎	◎	◎	◎	☆	1
ELISA Reader	1	◎	◎	◎	◎	☆	1
PCR	1	◎	◎	◎	◎	☆	1
Gel Electrophoresis Apparatus	1	◎	◎	◎	◎	☆	1
High Speed Centrifuge	1	◎	◎	◎	◎	☆	1
Ice Flake Machine	1	○	◎	◎	◎	☆	1
CO_2 Incubator	2	◎	◎	◎	◎	☆	2
Incubator (37℃)	1	◎	◎	◎	◎	☆	1
Refrigerator (4℃)	2	○	◎	◎	◎	☆	2
Deep Freezer (-20℃)	1	○	◎	◎	◎	☆	1
Deep Freezer (-80℃)	1	◎	◎	◎	◎	☆	1
Deep Freezer (-185℃)	1	◎	◎	◎	◎	☆	1
Electronic Balance	1	○	◎	◎	◎	☆	1

Name of Equipment	Q'ty requested	Selection standard					Planned number
		1. Indispensable	2. Technology level	3. Maintenance	4. Validation of number	5. Judgment and evaluation	
Magnetic Stirrer	2	○	◎	◎	◎	☆	2
Microwave Oven	1	○	◎	◎	◎	☆	1
Table Top Centrifuge (refrigerator with various rotors)	1	◎	◎	◎	◎	☆	1
Microfuge (non refrigerated)	2	◎	◎	◎	◎	☆	2
Microfuge (refrigerated)	2	◎	◎	◎	◎	☆	2
Shaking Water Bath (10℃-81℃)	2	○	◎	◎	◎	☆	2
Platform Shaker	2	○	◎	◎	◎	☆	2
Bio-safety Cabinet	2	◎	◎	◎	◎	☆	2
Water Purification System	1	◎	◎	◎	◎	☆	1
Inverted-Phase Contrast Microscope with digital camera	1	◎	◎	◎	◎	☆	1
UV Transilluminator	1	◎	◎	◎	◎	☆	1
ELIspot Reader	1	◎	◎	◎	◎	☆	1
Shaker Cum Incubator	1	○	◎	◎	◎	☆	1
Autoclave	2	○	◎	◎	◎	☆	2
Fine Pipettes	1	○	◎	◎	◎	☆	1
Mini-subcell GT with power pack 300 systeml	1	◎	◎	◎	◎	☆	1
Mini Trans-blot Transfer Cell with power pack 1,000	2	◎	◎	◎	◎	☆	2
High Pressure Washing Tool for Glassware	1	○	◎	◎	◎	☆	1
Negative Pressure Pump	1	○	◎	◎	◎	☆	1
UV/VIS Spectrophotometer	1	◎	◎	◎	◎	☆	1
Baby Compressor for filtration (1/2 hp)	1	○	◎	◎	◎	☆	1
Gel Documentation System with CCD camera	1	◎	◎	◎	◎	☆	1
[Division of Molecular Pathophisiology]							
Spectrofluorometer UV/VIS Spectrophotometer	1	◎	◎	◎	◎	☆	1
PCR	1	◎	◎	◎	◎	☆	1
High Speed Centrifuge	1	◎	◎	◎	◎	☆	1
Ultrasonicator	1	◎	◎	◎	◎	☆	1
CO_2 Incubator	1	◎	◎	◎	◎	☆	1
Refrigerator (4℃)	1	○	◎	◎	◎	☆	1
Deep Freezer (-20℃)	1	○	◎	◎	◎	☆	1
Deep Freezer (-80℃)	1	◎	◎	◎	◎	☆	1

Name of Equipment	Q'ty requested	Selection standard					Planned number
		1. Indispensable	2. Technology level	3. Maintenance	4. Validation of number	5. Judgment and evaluation	
pH meter	2	○	◎	◎	◎	☆	2
Protein Purification System a.HPLC with accessories	1	◎	◎	◎	◎	☆	1
Protein Purification System b.FPLC with accessories	1	◎	◎	◎	◎	☆	1
Water Purification System	1	◎	◎	◎	◎	☆	1
Bright Field Phase Contrast Microscope with digital camera	1	◎	◎	◎	◎	☆	1
UV Transilluminator	1	◎	◎	◎	◎	☆	1
Incubator (37℃)	2	○	◎	◎	◎	☆	2
Electronic Balance	2	○	◎	◎	◎	☆	2
Magnetic Stirrer	2	○	◎	◎	◎	☆	2
Hot Air Oven	1	○	◎	◎	◎	☆	1
Microfuge (refrigerated)	1	◎	◎	◎	◎	☆	1
Microfuge (non refrigerated)	1	◎	◎	◎	◎	☆	1
Shaking Water Bath (10℃-83℃)	2	○	◎	◎	◎	☆	2
Platform Shaker	1	○	◎	◎	◎	☆	1
ELISA Reader with microplate washer	1	◎	◎	◎	◎	☆	1
Autoclave	2	○	◎	◎	◎	☆	2
[Division of Molecular Microbiology]							
UV/VIS Spectrophotometer	1	◎	◎	◎	◎	☆	1
Gel Documentation System with CCD camera	1	◎	◎	◎	◎	☆	1
Bio-safety Cabinet	2	◎	◎	◎	◎	☆	2
PCR	2	◎	◎	◎	◎	☆	2
Pulse Field Gel Electrophoresis Apparatus	2	◎	◎	◎	◎	☆	2
High Speed Centrifuge	1	◎	◎	◎	◎	☆	1
Lyophilizer (Freeze dryer)	1	◎	◎	◎	◎	☆	1
Ultrasonicator	2	◎	◎	◎	◎	☆	2
CO_2 Incubator	2	◎	◎	◎	◎	☆	2
Incubator (37℃)	2	○	◎	◎	◎	☆	2
Refrigerator (4℃)	4	○	◎	◎	◎	☆	2
Deep Freezer (-20℃)	2	○	◎	◎	◎	☆	2
Deep Freezer (-80℃)	2	◎	◎	◎	◎	☆	2
Deep Freezer (-185℃)	1	◎	◎	◎	◎	☆	1
Electronic Balance	2	○	◎	◎	◎	☆	2

Name of Equipment	Q'ty requested	Selection standard					Planned number
		1. Indispensable	2. Technology level	3. Maintenance	4. Validation of number	5. Judgment and evaluation	
Magnetic Stirrer	3	○	◎	◎	◎	☆	3
Table Top Centrifuge (refrigerator with various rotors)	2	◎	◎	◎	◎	☆	2
Microfuge (non refrigerated)	2	◎	◎	◎	◎	☆	2
Microfuge (refrigerated)	2	◎	◎	◎	◎	☆	2
Shaking Water Bath (10℃-82℃)	3	○	◎	◎	◎	☆	3
Platform Shaker	2	○	◎	◎	◎	☆	2
Water Purification System	2	◎	◎	◎	◎	☆	2
Bright Field Phase Contrast Microscope with digital camera	1	◎	◎	◎	◎	☆	1
UV Transilluminator	2	◎	◎	◎	◎	☆	2
Electrophoresis Apparatus (submarine gel) with power pack 300V	4	◎	◎	◎	◎	☆	4
Cold Chamber	1	◎	◎	◎	△	☆	1
Speed Vac	1	◎	◎	◎	◎	☆	1
Autopipettes	2	○	◎	◎	◎	☆	2
Light microscope (Biological Microscope)	1	○	◎	◎	◎	☆	1
Vacuum Pump	2	○	◎	◎	◎	☆	2
Hybridization Oven	1	◎	◎	◎	◎	☆	1
DNA Sequencer	1	◎	◎	○	◎	☆	1
DNA Array System	1	○	○	△	◎	☆	1
[Division of Electron Microscopy]							
Atomic Force Microscope	1	○	○	△	◎	☆	1
Scanning Electron Microscope	1	◎	○	△	◎	☆	1
Bio-safety Cabinet	1	◎	◎	◎	◎	☆	1
[Serum Bank]							
[Sera Storage]							
Refrigerator	4	◎	◎	◎	◎	☆	4
Deep Freezer (-20℃)	2	◎	◎	◎	◎	☆	2
Deep Freezer (-80℃)	2	◎	◎	◎	◎	☆	2
Desk Top Computer with printer	1	◎	◎	◎	◎	☆	1
[Strain Storage]							
Refrigerator	4	◎	◎	◎	◎	☆	4
Deep Freezer (-20℃)	2	◎	◎	◎	◎	☆	2

Name of Equipment	Q'ty requested	Selection standard					Planned number
		1. Indispensable	2. Technology level	3. Maintenance	4. Validation of number	5. Judgment and evaluation	
Deep Freezer (-80℃)	2	◎	◎	◎	◎	☆	2
Desk Top Computer with printer	1	◎	◎	◎	◎	☆	1
[Seminar Room, Meeting Room, Administration]							
[Seminar Room]							
LCD Projector	1	◎	◎	◎	◎	☆	1
Desk Top Computer	1	◎	◎	◎	◎	☆	1
Overhead Projector	1	◎	◎	◎	◎	☆	1
[Meeting Room]							
LCD Projector	1	◎	◎	◎	◎	☆	1
Desk Top Computer	1	◎	◎	◎	◎	☆	1
Overhead Projector	1	◎	◎	◎	◎	☆	1
[Administration]							
Desk Top Computer	4	◎	◎	◎	◎	☆	4
Laser Printer	1	◎	◎	◎	◎	☆	1
Scanner	1	◎	◎	◎	◎	☆	1
[Animal House]							
Stainless steel rabbit holding cages with inbuilt racking device on wheel along with all accessories (complete set of 6 cages)	48	◎	◎	◎	◎	☆	48
Polycarbonate rodent cages with all relevant accessories	60	◎	◎	◎	◎	☆	60
Racks for above polycarbonate cages (trolley type)	5	◎	◎	◎	◎	☆	5
Acrylic Rabbit Restrainer	2	◎	◎	◎	◎	☆	2
Universal Rodent Restrainer	2	◎	◎	◎	◎	☆	2
Rabbit Ear Bleeder	2	◎	◎	◎	◎	☆	2
Rodent Injection Cone	2	◎	◎	◎	◎	☆	2
Animal Feeding Needles	12	◎	◎	◎	◎	☆	12
Weighing Balance for animals up to 4 kgs	2	◎	◎	◎	◎	☆	2
Vacuum Cleaner and Clipper	3	◎	◎	◎	◎	☆	3
Aquaguard	2	◎	◎	◎	◎	☆	2
Microprocessor Control Autoclave	1	◎	◎	◎	◎	☆	1
Bio-lux-CXT Microscope	1	○	◎	◎	◎	☆	1
Refrigerator	1	○	◎	◎	◎	☆	1
Deep Freezer (-70℃)	1	○	◎	◎	◎	☆	1
Digital Autoclave (pass through type)	1	◎	◎	◎	◎	☆	1

Name of Equipment	Q'ty requested	Selection standard					Planned number
		1. Indispensable	2. Technology level	3. Maintenance	4. Validation of number	5. Judgment and evaluation	
Operating Table	2	○	◎	◎	◎	☆	2
Head band magnifier with halogen light	2	○	◎	◎	◎	☆	2
Therapy chamber with accessories	2	○	◎	◎	◎	☆	2
Operation tool set including scissors, knives, forceps and instrument tray	2	○	◎	◎	◎	☆	2
Unity Electrocautery Products (cutting/coagulation-mode)	1	○	◎	◎	◎	☆	1
[Additional Equipment]							
Rabbit cage for quarantine	0	◎	◎	◎	◎	☆	1
Mouse Cage for quarantine	0	◎	◎	◎	◎	☆	1
Deep Freezer for Waste	0	◎	◎	◎	◎	☆	1
Cage System for Infected Rabbits	0	◎	◎	◎	◎	☆	2
Cage System for Infected Mice	0	◎	◎	◎	◎	☆	4

Table 2-6 Evaluation of Need and Validity

[Division of Molecular Virology]

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
UV/VIS Spectrophotometer	1	Used to measure absorption spectra in the ultraviolet/visible portion of substances and to analyze the structure, quality and quantity of compounds. There is a broad range of applications such as analyses of higher-order structure and denaturation and mutual action of biopolymers such as protein and nucleic acid, and quantitative analyses of matrix and metabolic product.	Indispensable to virological research of biopolymers, particularly of various kinds of protein and DNA.
Bio-safety Cabinet	3	A sanitary environment, free of contamination by germs and infectious material, is required for culturing and experimenting on fungal bodies, viruses and tissues of plants and animals. Safety cabinets keep experimental work sterile and undisturbed by people.	Indispensable to virological research of biopolymers, particularly of various kinds of protein and DNA.
PCR	2	Polymerase chain reaction device, also called a synthetic-enzyme chain reaction device, which makes many copies from an infinitesimal amount of DNA target specimen.	Indispensable to virological research of biopolymers, particularly of various kinds of protein and DNA.
High Speed Centrifuge	1	Equipped with a freezer and used for separation, purification and concentration of a specimen, mainly as pretreatment of the target specimens (micro-organisms and cells), in a low-temperature environment.	Indispensable to virological research of biopolymers, particularly of various kinds of protein and DNA.
Ultrasonicator	1	Used to crush cell walls and fungal bodies such as coliform bacillus by supersonic wave. Because specimens are not mechanically crushed, denaturation can be prevented.	Indispensable to virological research of biopolymers, particularly of various kinds of protein and DNA.
CO_2 Incubator	2	Used to cultivate cells, fungal bodies and viruses of plants and animals in a constant-temperature and CO2 environment.	Indispensable to virological research of biopolymers, particularly of various kinds of protein and DNA.
Incubator (37℃)	2	Used to cultivate cells, fungal bodies and viruses of plants and animals in a constant-temperature environment.	Necessary as a basic instrument.
Refrigerator (4℃)	4	Storing reagents, chemical agents, part of cellular structures and others at low temperature for experiments or other purposes.	Necessary as a basic equipment. There are many kinds and types of specimens and reagents in virological research requiring several cold-insulated rooms.

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
Deep Freezer (-20℃)	2	Storing fungi, viruses and cellular structures at ultracold temperature for experiments or other purposes. Storage temperature depends on the kind of specimen and purpose.	Necessary as a basic instrument.
Deep Freezer (-80℃)	1	Storing fungi, viruses and cellular structures at ultracold temperature for experiments or other purposes. Storage temperature depends on the kind of specimen and purpose.	Indispensable to virological research of biopolymers, particularly of various kinds of protein and DNA.
pH meter	4	Used to measure pH values of liquid specimens and adjust pH values for further experiments or measurements.	Necessary as a basic instrument.
Electronic Balance	2	Used to accurately measure quantity of a specimen for experiment/analysis/measurement.	Necessary as a basic instrument.
Magnetic Stirrer	4	Stirring or mixing specimens. It is possible to stir or mix while heating.	Necessary as a basic instrument.
Table Top Centrifuge (refrigerator with various rotors)	2	Equipped with a freezer and used for separation, purification and concentration of a specimen, mainly as pretreatment of the target specimens (micro-organisms and cells), in a low-temperature environment.	Indispensable to virological research of biopolymers, particularly of various kinds of protein and DNA.
Platform Shaker	2	Used to cultivate cells, fungal bodies and viruses of plants and animals while going, returning and gyrating in the air environment.	Necessary as a basic instrument.
UV Transilluminator	1	Used to detect DNA, RNA and fragments after electrophoresis and to obtain images by gel electrophoresis.	Indispensable to virological research of biopolymers, particularly of various kinds of protein and DNA.
Water Purification System	1	General tap water contains various impurities. If specimens treated with this water used are analyzed or measured as is, the result may not be accurate because it may have a component error. This device purifies water to satisfy a fixed water standard value.	Indispensable to virological research of biopolymers, particularly of various kinds of protein and DNA.
Inverted Microscope	1	Used for observation of fungi, viruses and cellular structures and especially indispensable to observation and photography of cells.	Indispensable to virological research of biopolymers, particularly of various kinds of protein and DNA.
Autoclave	1	Sterilizing, by high-pressure steam, specimen containers, appliances and others with which infectious fungi, viruses and cell specimens were treated.	Necessary as a basic instrument.
UV Crosslinker	1	Fixing DNA and RNA by irradiating specimens with ultraviolet rays, and confirming and photographing bands of migrating gel.	Indispensable to virological research of biopolymers, particularly of various kinds of protein and DNA.
Ultrasonic Cleaner	1	Displays its greatest utility in cleaning, uniformly by supersonic wave, containers and appliances with difficult to remove stains.	Necessary as a basic instrument.
Pipette Washer	1	Generally, washing pipettes is difficult because they are thin and long. This is a device to exclusively clean pipettes by ultrasonic wave.	Necessary as a basic instrument.
Vacuum Pump	2	A vacuum pump for various kinds of electrophoresing devices, which is used in combination with an analyzer or measuring device.	Necessary as a basic instrument.
Protein Purification System a. HPLC with accessories	1	Used for separation, purification, aliquot and qualitative and quantitative analyses of protein. It displays its greatest utility in quantitative analysis of thermally unstable compounds, labile natural products and biopolymers, and is used in a wide-range of fields.	Indispensable to virological research of biopolymers, particularly of various kinds of protein and DNA.
Protein Purification System b.FPLC with accessories	1	Also called a high-speed protein liquid chromatograph and mainly used for rapid separation and purification of protein. It is also used for determination of molecular weight, and analysis of distribution of water-soluble polymers caused by physiologically active protein, and analysis of the combined state of such dissolved molecules. Biological molecules have such properties as molecular weight, electrical charge and hydrophobicity. Purification of the target protein is carried out by a combination of the methods of filtration of gel, ion exchange, hydrophobic action, affinity action and so on.	Indispensable to virological research of biopolymers, particularly of various kinds of protein and DNA.
Real Time PCR	1	Has properties of a PCR-polymerase chain reaction device and makes many copies from an infinitesimal amount of DNA target specimen, and, furthermore, is capable of complicated operation and programming and of direct graphic display of results in service.	Indispensable to virological research of biopolymers, particularly of various kinds of protein and DNA.
Lyophilizer (Freeze dryer)	1	Freezes and dries specimens, and is used to treat and store specimens for analysis.	Necessary as a basic instrument.
Deep Freezer (-185℃)	1	Storing fungi, viruses and cellular structures at ultracold temperature for experiments or other purposes. Storage temperature depends on the kind of specimen and purpose.	Indispensable to virological research of biopolymers, particularly of various kinds of protein and DNA.
Bright Field Phase Contrast Microscope with digital camera	1	Used for observation of fungi, viruses and cellular structures and especially indispensable to observation and photography of cells.	Indispensable to virological research of biopolymers, particularly of various kinds of protein and DNA.

[Division of Clinical Epidemiology]

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
Microscope with digital camera and accessories	1	It is used for the observation of bacteria, viruses and cell tissues, and in particular essential for the observation of animal cells.	Indispensable for the study of clinical epidemiology.
BP instrument (Sphygmomanometer)	4	It measures human blood pressure.	Indispensable for the study of clinical epidemiology.
Stethoscope	5	It measures heart tones and pulsating flow, and checks for abnormality.	Indispensable for the study of clinical epidemiology.
Electronic thermometer	5	It is used to measure human temperature.	Indispensable for the study of clinical epidemiology.
Infantometer (Baby height scale)	4	It measures the height of a neonate while he (or she) is lying on his (or her) side.	Indispensable for the study of clinical epidemiology.
Weighing machine with platform	2	It is used to take human weight.	Indispensable for the study of clinical epidemiology.
Baby weighing machine	4	It is used to take the weight of a neonate.	Indispensable for the study of clinical epidemiology.
Refrigerator (4℃)	1	It is used to preserve reagents, chemicals and cell tissues at low temperatures for experimental and other purposes.	Indispensable as essential equipment.
Deep Freezer (-20℃)	1	It is used to preserve bacteria, viruses and cell tissues at extremely low temperatures for experimental and other purposes. The preservation temperatures depend on the type and purpose of specimens.	Indispensable as essential equipment.
pH meter	3	It is used to measure the pH value of liquid specimens and also to adjust the pH value for additional experiments and measurements.	Indispensable as essential equipment.
Electronic Balance	2	It is used to more accurately measure the quantity of experimental specimens and analysis-use or measurement-use specimens.	Indispensable as essential equipment.
Microwave Oven	1	It is intended to heat specimens, vessels and instruments with micro waves. Not only heating up the specimen surface, micro waves also make it possible to uniformly heat the interior of the specimens.	Indispensable as essential equipment.
Table Top Centrifuge (refrigerator with various rotors)	1	Equipped with a refrigerating unit, it is used to isolate, refine and concentrate specimens (microorganisms and cells) at low temperatures, mainly for the preliminary processing of analysis-use specimens.	Indispensable for the study of molecular biology in clinical epidemiology.

[Division of Molecular Parasitology]

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
Analytical Ultracentrifuge	1	This is used as preliminary treatment equipment for analysis specimens and isolates and separates the cells of plasmid DNA, RNA, viruses, bacteria, and intracellular micro-organs.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
Real Time PCR	1	This has the characteristics of PCR-Polymerase Chain Reaction Equipment, producing many copies from a trace of a target DNA specimen. In addition, it can execute complex operations and programs and graphically show the direct operating result on the display.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
Inverted Fluorescence - Phase Contrast Microscope with real time video	1	This is used to observe bacteria, viruses and cell tissues, and is essential for observing and photographing animal and plant cells in particular.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
Bio-safety Cabinet	1	In culturing or experimenting with animal or plant bacteria, viruses and tissues, an environment of aseptic cleanliness free from contamination or infection is required. The safety cabinet is intended to provide an unattended and contamination-free space for experimental work.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
LSM Laser for existing Conforcal Microscope	1	The confocal microscope is equipped with ultraviolet, visible-light, and infrared lasers and has analytical and image-processing functions added to the functions of a general-purpose microscope. Therefore, the confocal microscope can not only observe cells, bacteria and viruses but also analyze them qualitatively and quantitatively on the basis of spectrum.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
PCR	1	This is Polymerase Chain Reaction Equipment, also known as Synthetic Enzyme Chain Reaction Equipment, which produces many copies from a trace of a target DNA specimen.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
Pulse Field Gel Electrophoresis Apparatus	1	This isolates and analyzes biopolymers such as proteins and nucleic acids, and determines the DNA base sequence.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
CO_2 Incubator	1	This is used to culture animal and plant cells, bacteria and viruses in a certain temperature and CO_2 environment.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
Incubator (37℃)	1	This is used to culture animal and plant cells, bacteria and viruses in a certain temperature environment.	Whether it is indispensable as essential equipment.
Refrigerator (4℃)	1	This is used to preserve reagents, chemicals, and some cell tissues at low temperatures for experimental and other purposes.	Whether it is indispensable as essential equipment.
Deep Freezer (-20℃)	1	This is used to preserve bacteria, viruses and cell tissues at extremely low-temperatures for experimental and other purposes. The preservation temperatures depend on the type and purpose of specimens.	Indispensable as essential equipment.
Deep Freezer (-80℃)	1	This is used to preserve bacteria, viruses and cell tissues at extremely low-temperatures for experimental and other purposes. The preservation temperatures depend on the type and purpose of specimens.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
Deep Freezer (-185℃)	1	This is used to preserve bacteria, viruses and cell tissues at extremely low-temperatures for experimental and other purposes. The preservation temperatures depend on the type and purpose of specimens.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
Electronic Balance	1	This is used to accurately measure the quantity of experimental, analysis-use and measurement-use specimens.	Indispensable as essential equipment.
Magnetic Stirrer	1	This is used to stir and mix specimens. Stirring and mixing concurrent with heating are also possible.	Whether it is indispensable as essential equipment.
Hot Air Oven	1	This serves to heat and dry specimens, vessels and instruments.	Indispensable as essential equipment.
Table Top Centrifuge (refrigerator with various rotors)	1	Equipped with a refrigerator, this is used for isolating, refining and concentrating specimens (micro organisms and cells) at low temperatures, mainly for preliminary treatment of the specimens to be analyzed.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
Water Purification System	1	Common city water contains a variety of impurities. If a sample treated by such water is used "as is" for analysis and measurement, the result will be disastrous with component errors. This equipment is intended to provide water which will meet the requirement of a specific water quality standard.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
UV Transilluminator	1	This is used to detect DNA, RNA and fragments after electrophoretic migration and to obtain imagery by gel electrophoretic migration.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
Bright Field Phase Contrast Microscope with digital camera	2	This is used to observe bacteria, viruses and cell tissues, and is essential for observing and photographing animal and plant cells in particular.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
Vertical Slab Gel Electrophoresis with power pack 300V	3	This isolates and analyzes biopolymers such as proteins and nucleic acids, and determines the DNA base sequence.	Indispensable for the research of biopolymers, in particular for the study of proteins and DNA's in the field of parasite disease. In addition, whether it is useful for the training of students.
Isoelectric Focusing 2-D Electrophoresis Apparatus	2	This isolates and analyzes biopolymers such as proteins and nucleic acids, and determines the DNA base sequence.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
Gel Blot & Imaging System	1	This detects DNA, RNA or protein components from gel specimens by laser scanning and shows them on the image for qualitative analysis.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
Dry Bath	1	This is used to allow enzyme reaction process specimens, such as DNA shearing or annealing specimens or enzyme or complement inactivation specimens, to be treated at uniform temperatures.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
Vacuum Pump	2	This is used in combination with analytical and measurement equipment on a vacuum pump for electrophoretic migration equipment.	Indispensable as essential equipment.
Autopipette	3	This is used to dispense a specified volume of liquid specimen accurately into vessels used for analysis or experimentation.	Indispensable as essential equipment.
Shaker	3	This is used to culture animal or plant cells, bacteria, or viruses giving them reciprocating or circulatory vibration at certain temperatures in the air.	Indispensable as essential equipment.
Microfuge (non refrigerated)	1	This is effective for the isolation and separation of minute quantities of specimens and is used for isolating and separating cells of microorganisms, DNA and RNA. This is essential for use in the preliminary processing of analysis.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
Microfuge (refrigerated)	1	Equipped with a refrigerator, this isolates and separates specimens at low temperatures. It is used for specimens which are susceptible to thermal deterioration and will not stand heat well.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
Electrophoresis Apparatus (submarine) with power pack 3000V	2	This isolates and analyzes biopolymers such as proteins and nucleic acids, and determines the DNA base sequence.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
Voltex Mixer	2	This is a mixing apparatus mainly consisting of micro tubes and test tubes, designed to make specimens that do not easily mix together, blend uniformly by shaking them at high speed.	Indispensable as essential equipment.
Autoclave	1	This is used for steam-sterilization under high-pressure of specimen vessels and instruments which have handled infectious bacteria, viruses or cell specimens.	Indispensable as essential equipment.
Speed Vac	1	This serves to rapidly concentrate specimens, especially bio specimens, by centrifugal force at a constant temperature and under a vacuum condition, and is used for preliminary treatment of specimens.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
Hybridization Oven	1	There are several methods of cell, bacteria and virus culture. In a hybridization oven, culture is possible by shaking by bottle revolution, a seesaw motion or gyration at certain temperatures.	Indispensable as essential equipment.
Gel Dryer	1	There are two gel drying methods, air drying and vacuum drying. The dried gel is used for imaging, concentration analysis or long-term preservation.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
Vacum Blot Instrument	1	This is equipment for quick transcription of DNA and RNA from agarose gel.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.
Multipurpose Flow Cytometer	1	By applying laser light to bio cell specimens and analyzing the scattered light or fluorescent light reflected from the specimens, it is possible to determine and identify the type of the cells and quickly obtain highly precise information on the identified cells.	Indispensable for the research of biopolymers, in particular for the study of various proteins and DNA's in the field of parasite disease.

[Division of Molecular Biochemistry]

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
Differential Scanning and Titration calorimeter	1	It analyzes the thermal stability of biopolymer and intermolecular synergy in molecular structure and denaturation of protein. The titrator is used to analyze the equivalent point of the specimen to detect its density and electric conductivity.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biochemistry of various proteins and DNA's.
Protein Purification System a. HPLC with accessories	1	It is used to separate, refine, aliquot, and qualitatively and quantitatively analyze proteins. Highly effective for the quantitative analysis of thermally unstable compounds, labile natural products and biopolymers, it is used in a wide range of applications.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biochemistry of various proteins and DNA's.
Protein Purification System b. FPLC with accessories	1	Also known as High-speed Protein Liquid Chromatograph, it is used mainly for rapid separation and refining of proteins. It is used for the determination of molecular weight, and, by putting physiologically active protein into operation, for the analysis of distribution of water-soluble polymer and the bonding status between dissolved molecules. A biological molecule is characterized by molecular weight, electric charge and hydrophobic property, so that the refining of a target protein is achieved by combining various refining methods such as gel filtration, ion exchange, hydrophobic action and hydrophilic action.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biochemistry of various proteins and DNA's.
Protein Purification System c. Prep Cell	1	For the refining of proteins, it is necessary to preliminarily dissolve and dissociate protein-molecule-containing materials into a certain solution. The aliquot cell performs this task.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biochemistry of various proteins and DNA's.
Gel Documentation System with CCD camera	1	It is also possible to have the DNA, which is amplified by electrophoresis or a PCR device, shown on the image or to have the molecular weight measured by the use of special software.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biochemistry of various proteins and DNA's.
FTIR Spectrophotometer	1	Infrared spectrum measurement is possible for virtually all the materials, including the identification of isolated and refined components, the detection of minute materials as well as the detection of trace impurities. On the basis of this spectral data, the structural analysis and quantitative analysis of materials are made available.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biochemistry of various proteins and DNA's.
Multi Angle Laser Light Scattering (MALLS)Photometer	1	The laser light applied to a specimen will scatter all around. This apparatus detects the scattered light using detectors arranged at many angles and promptly determines the absolute molecular weight of the biopolymer.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biochemistry of various proteins and DNA's.
PCR	2	This is Polymerase Chain Reaction Equipment, also known as Synthetic Enzyme Chain Reaction Equipment, which produces many copies from a trace of target DNA specimen.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biochemistry of various proteins and DNA's.
High Speed Centrifuge	1	Equipped with a refrigerating unit, this is used to isolate, refine and concentrate specimens (microorganisms and cells) at low temperature, mainly for the preliminary processing of specimens in advance of analysis.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biochemistry of various proteins and DNA's.
Lyophilizer (Freeze dryer)	1	Having refrigerating and drying functions, this is used for the processing and preservation of specimens to be analyzed.	Indispensable for freeze-drying preservation of specimens.
Ultrasonicator	1	This is intended to break down cell membranes and bacteria such as Bacillus coli by means of a supersonic wave. Since the breakdown is not mechanical, denaturation of the specimen can be avoided.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biochemistry of various proteins and DNA's.
Incubator (37℃)	1	This is used to culture the cells, bacteria and viruses of animals and plants at certain temperatures.	Indispensable as essential equipment.
Refrigerator (4℃)	2	This is intended for the low-temperature preservation of reagents, chemicals and some cellular tissues for experimental or other uses.	Indispensable as essential equipment.
Deep Freezer (-20℃)	1	This is intended for the preservation at extremely low temperatures of bacteria, viruses and some cellular tissues for experimental or other uses. The preservation temperatures depend on the type and use of the specimens.	Indispensable as essential equipment.

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
Deep Freezer (-80℃)	1	This is intended for the preservation at extremely low temperatures of bacteria, viruses and some cellular tissues for experimental or other uses. The preservation temperatures depend on the type and use of the specimens.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biochemistry of various proteins and DNA's.
pH meter	2	This is used for the measurement of pH value of liquid specimens and for the adjustment of pH value for additional experiments and measurements.	Indispensable as essential equipment.
Electronic Balance	2	This is used to more accurately measure the quantity of experimental specimens and analysis-use or measurement-use specimens.	Indispensable as essential equipment.
Magnetic Stirrer	3	This is used to stir and mix specimens. It is also possible to stir and mix concurrently with the application of heat.	Indispensable as essential equipment.
Microwave Oven	1	Microwave heating of specimens, vessels and instruments is intended. Heating not only on the surface but uniformly into the specimen interior is also made available.	Indispensable as essential equipment.
Hot Air Oven	1	This heats and dries specimens, vessels and instruments.	Indispensable as essential equipment.
Microfuge (non refrigerated)	2	This is effective for the isolation and separation of minute quantities of specimens and is used for the isolation and separation of cells of microorganisms, DNA and RNA. This is essential in pre-processing in advance of analysis.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biochemistry of various proteins and DNA's.
Microfuge (refrigerated)	1	Equipped with a refrigerator, this is capable of conducting specimen isolation and separation at low temperatures and is used for specimens that are liable to thermal degeneration or that do not stand up well to heat.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biochemistry of various proteins and DNA's.
Shaking Water Bath (10℃-80℃)	1	This is used to culture animal or plant cells, bacteria, or viruses giving them reciprocating or circulatory vibration in water at certain temperatures.	Indispensable as essential equipment.
Platform Shaker	2	This is used to culture animal or plant cells, bacteria, or viruses giving them reciprocating or circulatory vibration at certain temperatures in the air.	Indispensable as essential equipment.
Automated Proteomics workstation with LC-MS-MS	1	This is shown either as LC/MS or LC/MS/MS. The latter, LC/MS/MS, is meant here. It has extended capabilities of LC/MS with the addition of a mass spectroscope to the function of liquid chromatography. The first MS of MS/MS is applied to obtain specimen identification information mainly for specimen isolation while the second MS is utilized for mass spectrometry of a target compound. Thus, the determination of amino acid sequence, structural analysis and molecular weight measurement of protein and peptide can be successfully conducted with extremely small quantities of specimens.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biochemistry of various proteins and DNA's.
Water Purification System	1	Common city water contains a variety of impurities. If a specimen treated by such water is used "as is" for analysis and measurement, the result will be disastrous with ingredient errors. This equipment is intended to provide water which will meet a specified water quality standard.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biochemistry of various proteins and DNA's.
Dry Bath	3	This is used to allow enzyme reaction process specimens, such as DNA shearing or annealing specimens or enzyme or complement inactivation specimens, to be treated at uniform temperatures.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biochemistry of various proteins and DNA's.
Digital Autoclave	2	This is used to sterilize specimen vessels and instruments, which handled infectious bacteria, viruses or cell specimens, with high-pressure steam.	Indispensable as essential equipment.

[Division of Molecular Immunology]

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
MACS-Magnetic Sell Sorter	1	It is used to separate and identify magnetically responsive human and other animal cells.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biological immunology of various proteins and DNA's.

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
ELISA Reader	1	Among biopolymers, there are some proteins and nucleic acids that are responsive to certain ultraviolet wavelengths and display a characteristic spectrum. Taking advantage of this behavior, it is possible to isolate, identify and quantitatively analyze specific proteins and nucleic acids. With this equipment, a variety of specimens in minute quantities can be analyzed promptly and concurrently.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biological immunology of various proteins and DNA's.
PCR	1	This is Polymerase Chain Reaction Equipment, also known as Synthetic Enzyme Chain Reaction Equipment, which produces many copies from a trace of target DNA specimens.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biological immunology of various proteins and DNA's.
Gel Electrophoresis Apparatus	1	This isolates and analyzes biopolymers such as proteins and nucleic acids, and determines the DNA base sequence.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biological immunology of various proteins and DNA's.
High Speed Centrifuge	1	Equipped with a refrigerating unit, this is used to isolate, refine and concentrate specimens (microorganisms and cells) at low temperatures, mainly for preliminary processing of specimens in advance of analysis.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biological immunology of various proteins and DNA's.
Ice Flake Machine	1	This is used to make ice to cool down the specimens, vessels, and analytic and measurement environments.	Indispensable as essential equipment.
CO_2 Incubator	2	This is used to culture animal and plant cells, bacteria and viruses in a certain temperature and CO2 environment.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biological immunology of various proteins and DNA's.
Incubator (37℃)	1	This is used to culture animal and plant cells, bacteria and viruses in a certain temperature environment.	Indispensable as essential equipment.
Refrigerator (4℃)	2	This is used to preserve reagents, chemicals, and some cell tissues at low temperatures for experimental and other purposes.	Indispensable as essential equipment.
Deep Freezer (-20℃)	1	This is used to preserve bacteria, viruses and cell tissues at extremely low-temperature for experimental and other purposes. The preservation temperatures depend on the type and purpose of specimens.	Indispensable as essential equipment.
Deep Freezer (-80℃)	1	This is used to preserve bacteria, viruses and cell tissues at extremely low-temperature for experimental and other purposes. The preservation temperatures depend on the type and purpose of specimens.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biological immunology of various proteins and DNA's.
Deep Freezer (-185℃)	1	This is used to preserve bacteria, viruses and cell tissues at extremely low-temperature for experimental and other purposes. The preservation temperatures depend on the type and purpose of specimens.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biological immunology of various proteins and DNA's.
Electronic Balance	1	This is used to more accurately measure the quantity of experimental specimens, analysis-use and measurement-use specimens.	Indispensable as essential equipment.
Magnetic Stirrer	2	This is used to stir and mix specimens. Stirring and mixing concurrent with heating are also possible.	Indispensable as essential equipment.
Microwave Oven	1	Microwave heating of specimens, vessels and instruments is intended. Heating not only on specimen surface but uniformly into the specimen interior is also made available.	Indispensable as essential equipment.
Table Top Centrifuge (refrigerator with various rotors)	1	Equipped with a refrigerating unit, this is used to isolate, refine and concentrate specimens (microorganisms and cells) at low temperatures, mainly for preliminary processing of specimens in advance of analysis.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biological immunology of various proteins and DNA's.
Microfuge (non refrigerated)	2	This is effective for the isolation and separation of minute quantities of specimens and is used for the isolation and separation of cells of microorganisms, DNA and RNA. This is essential for use in the preliminary processing of analysis.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biological immunology of various proteins and DNA's.
Microfuge (refrigerated)	2	Equipped with a refrigerator, this is capable of conducting specimen isolation and separation at low temperatures and is used for specimens that are liable to thermal degeneration or that do not stand up well to heat.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biological immunology of various proteins and DNA's.
Shaking Water Bath (10℃-81℃)	2	This is used to culture animal or plant cells, bacteria, or viruses giving them reciprocating or circulatory vibration in water at certain temperatures.	Indispensable as essential equipment.

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
Platform Shaker	2	This is used to culture animal or plant cells, bacteria, or viruses giving them reciprocating or circulatory vibration at certain temperatures in the air.	Indispensable as essential equipment.
Bio-safety Cabinet	2	In the culture or in experiments of animal or plant bacteria, viruses and tissues, an environment of aseptic cleanliness free from contamination or infection is required. The safety cabinet is intended to provide an unattended and contamination-free space for experimental work.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biological immunology of various proteins and DNA's.
Water Purification System	1	Common city water contains a variety of impurities. If a specimen treated by such water is used "as is" for analysis and measurement, the result will be disastrous with component errors. This equipment is intended to provide water which will meet the requirement of a specific water quality standard.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biological immunology of various proteins and DNA's.
Inverted-Phase Contrast Microscope with digital camera	1	This is used to observe bacteria, viruses and cell tissues, and is essential for the observation and photographing of animal and plant cells in particular.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biological immunology of various proteins and DNA's.
UV Transilluminator	1	This is used to detect DNA, RNA and fragment after electrophoretic migration and to obtain imagery by gel electrophoretic migration.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biological immunology of various proteins and DNA's.
ELIspot Reader	1	This is used to import the digital images of such biopolymers as proteins and nucleic acids in the specimens on the microplate, and conducts structural analysis of the molecules.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biological immunology of various proteins and DNA's.
Shaker Cum Incubator	1	This is used to culture animal or plant cells, bacteria, or viruses giving them reciprocating or circulatory vibration at certain temperatures in the air.	Indispensable as essential equipment.
Autoclave	2	This is used for high pressure steam-sterilization of specimen vessels and instruments which handled infectious bacteria, viruses or cell specimens.	Indispensable as essential equipment.
Fine Pipettes	1	This is used to dispense a specified volume of liquid specimen accurately into vessels utilized for analytical or experimental purposes.	Indispensable as essential equipment.
Mini-subcell GT with power pack 300 systeml	1	This isolates and analyzes biopolymers such as proteins and nucleic acids, and determines the DNA base sequence.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biological immunology of various proteins and DNA's.
Mini Trans-blot Transfer Cell with power pack 1,000	2	This isolates and analyzes biopolymers such as proteins and nucleic acids, and determines the DNA base sequence.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biological immunology of various proteins and DNA's.
High Pressure Washing Tool for Glassware	1	Using supersonic wave, this produces satisfactory results in washing off stain which is sticking to vessels or instruments and not easily cleaned.	Indispensable as essential equipment.
Negative Pressure Pump	1	This is used in combination with analytical and measurement equipment on a vacuum pump for electrophoretic migration equipment.	Indispensable as essential equipment.
UV/VIS Spectrophotometer	1	This measures the absorption spectrum of ultraviolet and visible portion of matter, and conducts structural analysis and qualitative and quantitative analysis of compounds. This has a broad area of applications, including the analysis of higher-order structure, denaturation, reciprocal action of biopolymers such as proteins and nucleic acids as well as the quantitative analysis of matrices and metabolic products.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biological immunology of various proteins and DNA's.
Baby Compressor for filtration (1/2 hp)	1	This is used as the source of air, pressure and power for various experiments.	Indispensable as essential equipment.
Gel Documentation System with CCD camera	1	It is possible to image DNA which is amplified by electrophoresis or by PCR equipment, and it is also possible to measure molecular weight using special software.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying molecular biological immunology of various proteins and DNA's.

[Division of Molecular Pathophysiology]

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
Spectrofluorometer UV/VIS Spectrophotometer	1	Displaying its greatest force in qualitative, quantitative, structural analyses and interaction analysis of biopolymers such as protein, nucleic acid, peptide, fat, sugars, vitamin, enzyme and antibiotic. It can be used for microanalysis and is vital for biological studies.	Indispensable to pathophpysiological research activities of biopolymers, particularly various kinds of protein and DNA.
PCR	1	Polymerase chain reaction device also called synthetic-enzyme chain reaction device, which makes many copies from an infinitesimal amount of DNA target specimen.	Indispensable to pathophpysiological research activities of biopolymers, particularly various kinds of protein and DNA.
High Speed Centrifuge	1	Equipped with a freezer and used for separation, purification and concentration of a specimen, mainly as pretreatment of the target specimen, (micro-organisms and cells) in a low-temperature environment.	Indispensable to pathophpysiological research activities of biopolymers, particularly various kinds of protein and DNA.
Ultrasonicator	1	Used to crush cell walls and fungal bodies such as coliform bacillus by supersonic wave. Because specimens are not mechanically crushed, denaturation can be prevented.	Indispensable to pathophpysiological research activities of biopolymers, particularly various kinds of protein and DNA.
CO_2 Incubator	1	Used to cultivate cells, fungal bodies and viruses of plants and animals in constant-temperature and CO2 environment.	Indispensable to pathophpysiological research activities of biopolymers, particularly various kinds of protein and DNA.
Refrigerator (4℃)	1	Storing reagents, chemical agents, part of cellular structures and others at low temperature for experiments or other purposes.	Necessary as a basic instrument.
Deep Freezer (-20℃)	1	Storing fungi, viruses and cellular structures at ultracold temperature for experiments or other purposes. Storage temperature depends on the kind of specimen and purpose.	Necessary as a basic instrument.
Deep Freezer (-80℃)	1	Storing fungi, viruses and cellular structures at ultracold temperature for experiments or other purposes. Storage temperature depends on the kind of specimen and purpose.	Indispensable to pathophpysiological research activities of biopolymers, particularly various kinds of protein and DNA.
pH meter	2	Used to measure pH values of liquid specimens and adjust pH values for further experiments or measurements.	Necessary as a basic instrument.
Protein Purification System	1	Used for separation, purification, aliquot and qualitative and quantitative analyses of protein. It displays its greatest utility in quantitative analysis of thermally unstable compounds, labile natural products and biopolymers, and is used in a wide range of fields.	Indispensable to pathophpysiological research activities of biopolymers, particularly various kinds of protein and DNA.
a.HPLC with accessories	1	Also called a high-speed protein liquid chromatograph and mainly used for rapid separation and purification of protein. It is also used for determination of molecular weight, and analysis of distribution of water-soluble polymers caused by physiologically active protein and analysis of the combined state of such dissolved molecules. Biological molecules have properties such as molecular weight, electrical charge and hydrophobicity. The target protein is purified by a combination of the methods of filtration of gel, ion exchange, hydrophobic action, affinity action and so on.	Indispensable to pathophpysiological research activities of biopolymers, particularly various kinds of protein and DNA.
b.FPLC with accessories	1	General tap water contains various impurities. If specimens treated with this water used are analyzed or measured as is, the result may not be accurate because it may have a component error. This device purifies water to satisfy a fixed water standard value.	Indispensable to pathophpysiological research activities of biopolymers, particularly various kinds of protein and DNA.
Water Purification System	1	Used for observation of fungi, viruses and cellular structures and especially indispensable to observation and photography of cells.	Indispensable to pathophpysiological research activities of biopolymers, particularly various kinds of protein and DNA.
Bright Field Phase Contrast Microscope with digital camera	1	Used to detect DNA, RNA and fragments after electrophoresis and to obtain images by gel electrophoresis.	Indispensable to pathophpysiological research activities of biopolymers, particularly various kinds of protein and DNA.
UV Transilluminator	2	Used to cultivate cells, fungal bodies and viruses of plants and animals in constant-temperature environment.	Necessary as a basic instrument.

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
Incubator (37℃)	2	Used to accurately measure quantity of a specimen for experiment/analysis/measurement.	Necessary as a basic instrument.
Electronic Balance	2	Stirring or mixing specimens. It is possible to stir or mix on heating.	Necessary as a basic instrument.
Magnetic Stirrer	1	Heating and drying various kinds of specimens, containers and appliances.	Necessary as a basic instrument.
Hot Air Oven	1	Equipped with a freezer, and used for separating/fractionalizing specimens in a low-temperature environment. It is used for specimens apt to suffer thermal denaturation and those which should be kept away from heat.	Indispensable to pathophpysiological research activities of biopolymers, particularly various kinds of protein and DNA.
Microfuge (refrigerated)	1	Effective for separating and fractionating micro specimens and used for separation and fractionation of micro-organisms and cells such as DNA and RNA. It is indispensable as an instrument for pretreatment for analysis.	Indispensable to pathophpysiological research activities of biopolymers, particularly various kinds of protein and DNA.
Microfuge (non refrigerated)	2	Used to cultivate cells, fungal bodies and viruses of plants and animals while going, returning and gyrating in a fixed-water-temperature environment.	Necessary as a basic instrument.
Shaking Water Bath (10℃-83℃)	1	Used to cultivate cells, fungal bodies and viruses of plants and animals while going and returning and gyrating in air environment.	Necessary as a basic instrument.
Platform Shaker	1	Some kinds of biopolymers such as protein and nucleic acid react to a specific ultraviolet wave length and represent a characteristic spectrum. Using this property, it is possible to separate, identify and analyze the quantity of a certain protein and nucleic acid. With this device, many micro specimens on a micro plate can be analyzed quickly at a time.	Indispensable to pathophpysiological research activities of biopolymers, particularly various kinds of protein and DNA.
ELISA Reader with microplate washer	2	Sterilizing, by high-pressure steam, specimen containers, appliances and others with which infectious fungi, viruses and cell specimens were treated.	Necessary as a basic instrument.
Autoclave			

[Division of Molecular Microbiology]

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
UV/VIS Spectrophotometer	1	This measures the absorption spectrum of ultraviolet and visible portion of a matter, and analyzes the structure quality and quantity of compounds. This has a broad applications, including analysis of higher-order structure, denaturation, and reciprocal action of biopolymers such as proteins and nucleic acids, as well as the quantitative analysis of matrices and metabolic products.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying microbiology of various proteins and DNA's.
Gel Documentation System with CCD camera	1	It is possible to image DNA which is amplified by electrophoresis or by PCR equipment, and it is also possible to measure molecular weight using special software.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying microbiology of various proteins and DNA's.
Bio-safety Cabinet	2	In culturing or experimenting on animal or plant bacteria, viruses and tissues, an environment of aseptic cleanliness free from contamination or infection is required. The safety cabinet is intended to provide an unattended and contamination-free space for experimental work.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying microbiology of various proteins and DNA's.
PCR	2	This is Polymerase Chain Reaction Equipment, also known as Synthetic Enzyme Chain Reaction Equipment, which produces many copies from a trace of a target DNA specimen.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying microbiology of various proteins and DNA's.
Pulse Field Gel Electrophoresis Apparatus	2	This isolates and analyzes biopolymers such as proteins and nucleic acids, and determines the DNA base sequence.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying microbiology of various proteins and DNA's.
High Speed Centrifuge	1	Equipped with a refrigerating unit, this is used to isolate, refine and concentrate specimens (microorganisms and cells) at low temperatures mainly for preliminary processing of specimens in advance of analysis.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying microbiology of various proteins and DNA's.
Lyophilizer (Freeze dryer)	1	This freezes and dries specimens, and is used to treat and preserve specimens to be analyzed.	Indispensable as essential equipment.

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
Ultrasonicator	2	This is intended to break down cell membranes and bacteria such as Bacillus coli by means of supersonic wave. Since the breakdown is not mechanical, denaturation of the specimen can be avoided.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying microbiology of various proteins and DNA's.
CO_2 Incubator	2	This is used to culture animal and plant cells, bacteria and viruses in a certain temperature and CO_2 environment.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying microbiology of various proteins and DNA's.
Incubator (37℃)	2	This is used to culture animal and plant cells, bacteria and viruses in a certain temperature environment.	Indispensable as essential equipment.
Refrigerator (4℃)	4	This is used to preserve reagents, chemicals, and some cell tissues at low temperatures for experimental and other purposes.	Indispensable as essential equipment. Since microbiology handles many kinds of specimens and reagents and their quantity is large, a great many cooler-boxes are demanded.
Deep Freezer (-20℃)	2	This is used to keep bacteria, viruses and some cell tissues in extremely low-temperature preservation for experimental and other purposes. The preservation temperatures depend on the type and purpose of specimens.	Indispensable as essential equipment.
Deep Freezer (-80℃)	2	This is used to keep bacteria, viruses and some cell tissues in extremely low-temperature preservation for experimental and other purposes. The preservation temperatures depend on the type and purpose of specimens.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying microbiology of various proteins and DNA's.
Deep Freezer (-185℃)	1	This is used to keep bacteria, viruses and some cell tissues in extremely low-temperature preservation for experimental and other purposes. The preservation temperatures depend on the type and purpose of specimens.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying microbiology of various proteins and DNA's.
Electronic Balance	2	This is used to accurately measure the quantity of experimental, analysis-use and measurement-use specimens.	Indispensable as essential equipment.
Magnetic Stirrer	3	This is used to stir and mix specimens. Stirring and mixing concurrent with heating are also possible.	Indispensable as essential equipment.
Table Top Centrifuge (refrigerator with various rotors)	2	Equipped with a refrigerating unit, this is used to isolate, refine and concentrate specimens (microorganisms and cells) at low temperatures mainly for preliminary processing of specimens in advance of analysis.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying microbiology of various proteins and DNA's.
Microfuge (non refrigerated)	2	This is effective for isolating and separating minute quantities of specimens and is used for isolating and separating cells of microorganisms, DNA and RNA. This is essential for use in the preliminary processing of analysis.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying microbiology of various proteins and DNA's.
Microfuge (refrigerated)	2	Equipped with a refrigerator, this is capable of isolating and separating specimens at low temperatures and is used for specimens that are susceptible to thermal degeneration or that do not stand up well to heat.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying microbiology of various proteins and DNA's.
Shaking Water Bath (10℃-82℃)	3	This is used to culture animal or plant cells, bacteria, or viruses giving them reciprocating or circulatory vibration in water at certain temperatures.	Indispensable as essential equipment.
Platform Shaker	2	This is used to culture animal or plant cells, bacteria, or viruses giving them reciprocating or circulatory vibration at certain temperatures in the air.	Indispensable as essential equipment.
Water Purification System	2	Common city water contains a variety of impurities. If a sample treated by such water is used "as is" for analysis and measurement, the result will be disastrous with component errors. This equipment is intended to provide water which will meet the requirement of a specific water quality standard.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying microbiology of various proteins and DNA's.
Bright Field Phase Contrast Microscope with digital camera	1	This is used to observe bacteria, viruses and cell tissues, and is essential for observing and photographing animal and plant cells in particular.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying microbiology of various proteins and DNA's.
UV Transilluminator	2	This is used to detect DNA, RNA and fragment after electrophoretic migration and to obtain imagery by gel electrophoretic migration.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying microbiology of various proteins and DNA's.

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
Electrophoresis Apparatus (submarine gel) with power pack 300V	4	This isolates and analyzes biopolymers such as proteins and nucleic acids, and determines the DNA base sequence.	Indispensable for the research of biopolymer, in particular from viewpoint of studying microbiology of various proteins and DNA's. Also, whether it is useful for the training of students.
Cold Chamber	1	- This is used to preserve reagents, chemicals, and some cell tissues at low temperatures for experimental and other purposes.	Indispensable as essential equipment.
Speed Vac	1	This serves to rapidly concentrate specimens, especially bio specimens, by centrifugal force at a constant temperature and under vacuum condition, and is used for the preliminary treatment of specimens.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying microbiology of various proteins and DNA's.
Autopipettes	2	This is used to dispense a specified volume of liquid specimen accurately into vessels used for analysis or experimentation.	Indispensable as essential equipment.
Light microscope (Biological Microscope)	1	This is used for the observation of bacteria, viruses and cell tissues and is essential for observing animal cells in particular.	Indispensable as essential equipment.
Vacuum Pump	2	This is used in combination with analytical and measurement equipment on a vacuum pump as electrophoretic migration equipment.	Indispensable as essential equipment.
Hybridization Oven	1	There are several methods of cell, bacteria and virus culture. In a hybridization oven, culture is possible by shaking by bottle revolution, a seesaw motion or gyration at certain temperatures.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying microbiology of various proteins and DNA's.
DNA Sequencer	1	This uses electrophoretic migration and automatically analyzes DNA base sequence.	Indispensable for the research of biopolymer, in particular from the viewpoint of studying microbiology of various proteins and DNA's.
DNA Array System	1	This analyzes the appearance pattern of pathogenic bacterium genes by highly sensitive DNA analysis, and is thus capable of detecting kinase and transcription factor from a trace of specimens, is capable of measuring even minute changes in common proteins and receptors, and is capable of counting specific disease cells (intestinal tract cells or cancer cells.)	Indispensable for the research of biopolymer, in particular from the viewpoint of studying microbiology of various proteins and DNA's.

[Division of Electron Microscopy]

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
Atomic Force Microscope	1	Also known as a scanning probe microscope and used to observe three-dimensional shape while scanning the specimen surface with a micro-probe. As this microscope excels in resolution in the direction of height of a specimen, it displays its greatest utility in analysis of external structure of specimens. Biological specimens can be observed under high magnification without complicated pretreatment, and conditions of fungus bodies and cells can be observed in detail.	Indispensable to molecular-biological research regarding biopolymers, especially various kinds of protein, DNA, intestinal pathogenic bacteria and viruses.
Scanning Electron Microscope	1	If a specimen is irradiated with an electronic beam, secondary electrons, reflected electrons, transmission electrons and other signals will be generated from the specimen. By imaging these, fine structure and form of specimens can be observed. As resolution and magnification are higher, it is possible to observe fine structure with higher image quality.	Indispensable to molecular-biological research regarding biopolymers, especially various kinds of protein, DNA, intestinal pathogenic bacteria and viruses.
Bio-safety Cabinet	1	A sanitary environment, free of contamination by germs and infectious material, is required for culturing and experimenting on fungal bodies, viruses and tissues of plants and animals. Safety cabinets keep experimental work sterile and undisturbed by people.	Indispensable to molecular-biological research regarding biopolymers, especially various kinds of protein, DNA, intestinal pathogenic bacteria and viruses.

[Serum Bank]

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
[Sera Storage]			
Refrigerator	2	Storing reagents, chemical agents and part of cellular structures at low temperature for experiments or other purpose. It is used for storage of serum here.	Indispensable to storage of serum and reagents.
Deep Freezer (-20℃)	2	Storing fungi, viruses and cellular structures at ultracold temperature for experiments or other purpose. Storage temperature depends on the kind of specimens and purpose. It is used for long-term storage of serum here.	Indispensable to storage of serum and reagents.
Deep Freezer (-80℃)	2	Storing fungi, viruses and cellular structures at ultracold temperature for experiments or other purpose. Storage temperature depends on the kind of specimen and purpose. It is used for long-term storage of serum here.	Indispensable to storage of serum and reagents.
Desk Top Computer with printer	1	Used to manage entry and removal of stored serum, and prepare and manage statistical data, etc.	Indispensable to storage of serum and reagents.
[Strain Storage]			
Refrigerator	2	Storing reagents, chemical agents and part of cellular structures at low temperature for experiments or other purpose. It is used for storage of strains here.	Indispensable to storage of strains and reagents.
Deep Freezer (-20℃)	2	Storing fungi, viruses and cellular structures at ultracold temperature for experiments or other purpose. Storage temperature depends on the kind of specimen and purpose. It is used for long-term storage of strains here.	Indispensable to storage of strains and reagents.
Deep Freezer (-80℃)	2	Storing fungi, viruses and cellular structures at ultracold temperature for experiments or other purpose. Storage temperature depends on the kind of specimen and purpose. It is used for long-term storage of strains here.	Indispensable to storage of strains and reagents.

[Seminar Room, Meeting Room, Administration]

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
[Seminar room]			
LCD Projector	1	Used to display data, etc. under magnification at seminar or meeting and to make explanations to participants.	Indispensable to seminars and academic meetings.
Overhead Projector	1	Used to display real objects of data and material under magnification at seminars or meetings and explain to participants.	Indispensable to seminars and academic meetings.
[Meeting room]			
LCD Projector	1	Used to display data, etc. under magnification at seminar or meeting and to make explanations to participants.	Indispensable to seminars and academic meetings.
Overhead Projector	1	Used to display real objects of data and material under magnification at seminars or meetings and explain to participants.	Indispensable to seminars and academic meetings.
Copy Machine	1	Used to prepare duplicates to distribute data, research papers and others to be presented at seminar or meeting.	Indispensable to seminars and academic meetings.
[Administration]			
Desk Top Computer	4	Used for clerical work/administration.	Indispensable to clerical work and administration.
Laser Printer	1	Used to output data of computers for clerical work/administration.	Indispensable to clerical work and administration.
Scanner	1	Used to output data of computers for clerical work/administration, particularly output related to drawings and images.	Indispensable to clerical work and administration.

[Animal House]

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
Stainless steel rabbit holding cages with inbuilt racking device on wheel along with all accessories (complete set of 6 cages)	48	Storage into which experimental-rabbit breeding cages and several other cages are put together under controlled conditions.	The apparatus is indispensable for breeding animals in the animal house.

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
Polycarbonate rodent cages with all relevant accessories	60	For breeding small experimental-animals, i.e. rats and mice, under controlled conditions.	The apparatus is indispensable for breeding animals in the animal house.
Racks for above polycarbonate cages (trolley type)	5	Storage into which several small experimental-animals, i.e. rats and mice, are put together.	The apparatus is indispensable for breeding animals in the animal house.
Acrylic Rabbit Restrainer	2	Cages for isolating and holding down small experimental-rabbits; used for their carriage, behavior control and special observation.	The apparatus is indispensable for breeding animals in the animal house.
Universal Rodent Restrainer	2	Cages for small experimental animals, i.e. rats and mice; used for their carriage, behavior control and special observation.	The apparatus is indispensable for breeding animals in the animal house.
Rabbit Ear Bleeder	2	Experimental rabbit ear-tag, used for its individual identification.	The apparatus is indispensable for breeding animals in the animal house.
Rodent Injection Cone	2	Injection fixater for administering a shot to small experimental animals; used for bacterium, virus or vaccine inoculation.	The apparatus is indispensable for breeding animals in the animal house.
Animal Feeding Needles	12	Equipment to provide small experimental animals (rats, mice, etc.) with special feed or nutrients.	The apparatus is indispensable for breeding animals in the animal house.
Weighing Balance for animals up to 4 kgs	2	Equipment to determine the weight of experimental animals.	The apparatus is indispensable for breeding animals in the animal house.
Vacuum Cleaner and Clipper	3	To cut the hair of experimental animals for experimental purposes, and to collect pollutants not smaller than 0.3 microns.	The apparatus is indispensable for experimenting on and breeding animals.
Aquaguard	2	Drinking water for experimental animals should be distilled water treated by ion-exchange and reverse osmosis filtration processes. It is required that the water should be prepared to meet a certain standard; for example, a standard that the total number of bacteria must be generally controlled not more than 100 cfu/mL, with the electric conductivity standing at 5.8μS/cm, etc.	The apparatus is indispensable for breeding animals in the animal house.
Microprocessor Control Autoclave	1	High pressure steam sterilization is needed, which should be applied, after various infection or non-infection animal experiments, to sterilize the clothes worn or instruments used in the experiments.	The apparatus is indispensable for experimenting on infected and non-infected animals.
Bio-lux-CXT Microscope	1	It is used for bacterial, virus and cellular tissue observation, and, in particular, essential for the observation of animal cell tissues.	The apparatus is essentially indispensable for experimenting on animals.
Refrigerator	1	It is used for low temperature preservation of reagents, chemicals and some cellular tissues for experimental and other purposes.	The apparatus is essentially indispensable for experimenting on animals.
Deep Freezer (-70℃)	1	It is used for extremely low temperature preservation of bacterial, virus and cellular tissues for experimental and other purposes. The preservation temperatures depend on the type and purpose of specimens.	The apparatus is essentially indispensable for experimenting on animals.
Digital Autoclave (pass through type)	1	Experimental animal breeding cages must be cleaned at regular or non-regular intervals to keep them free from contamination. The cages are washed with water, disinfected together with their accessories, and reused. These autoclaves are used for disinfecting cages and their accessories.	The apparatus is indispensable for experimenting on infected and non-infected animals.
Operating Table	2	A surgical operation bed for experimental animals. It is used for collecting cellular tissues in animal anatomy and for bacterial or virus inoculation.	The apparatus is essentially indispensable for experimenting on animals.
Head band magnifier with halogen light	2	Used for the enlargement or detail observation of cellular tissues in surgical operations or anatomy of experimental animals.	The apparatus is essentially indispensable for experimenting on animals.
Therapy chamber with accessories	2	For the experimental animals that underwent surgical operation or anatomy, it is used for their resuscitation or recovery as well as for the post-operative or post-anatomy observation.	The apparatus is essentially indispensable for experimenting on animals.
Operation tool set including scissors, knives, forceps and instrument tray	2	It is used as an operative or anatomy instrument for experimental animals.	The apparatus is essentially indispensable for experimenting on animals.
Unity Electrocautery Products (cutting/ coagulation-mode)	1	It is used as a cutting instrument and incision coagulant instrument in the operation or anatomy of experimental animals, which is particularly effective to prevent contamination during operation.	The apparatus is indispensable for experimenting on infected and non-infected animals.

[Additional Equipment]

Name of Equipment	Q'ty	Purpose of Use and Applications	Evaluation of Need and Validity
Rabbit cage for quarantine	1	Very useful as cages to keep experimental rabbits and as quarantine cages.	The apparatus is indispensable for experimenting on and breeding animals.
Mouse Cage for quarantine	1	Very useful as cages to keep small experimental animals (rats, mice, etc.) and as quarantine cages.	The apparatus is indispensable for experimenting on and breeding animals.
Deep Freezer for Waste	1	Temporary cold storage of infected and non-infected animals, or contaminated materials until their final disposal with a view to controlling the scattering of contamination.	The apparatus is indispensable for experimenting on infected and non-infected animals.
Cage System for Infected Rabbits	2	Facilities to breed, observe and experiment on infected animals (rabbits), managing the environmental conditions for temperature and humidity with anti-scattering control.	The apparatus is indispensable for experimenting on infected and non-infected animals.
Cage System for Infected Mice	4	Facilities to breed, observe and experiment on infected animals (rabbits), managing the environmental conditions for temperature and humidity with anti-scattering control.	The apparatus is indispensable for experimenting on infected and non-infected animals.

Validation of main equipment items

Results of validation of main equipment items are as follows:

・Multi Angle Laser Light Scattering (MALLS) Photometer

Requested by: Division of Molecular Biochemistry

A specimen is irradiated with laser light and then light is scattered from the specimen at multiple angles. By analyzing this scattered light, the size of molecular mass and structure of the specimen can be determined. Especially, it displays its greatest utility in determining the absolute molecular weight of biopolymers, obtaining information regarding the size of molecules and in characterizing molecules. Specifying molecules of biological specimens and gaining acquaintance with accurate molecule weight and structure form a part of research activities absolutely necessary for biochemistry.

・Liquid Chromatograph Mass Spectroscope (Automated protemics workstation with LC-MS-MS)

Requested by: Division of Molecular Biochemistry

This device allows the following works to be carried out with a high degree of accuracy and with ultramicro-specimens: sequence determination and structural analysis of proteins and amino acids such as peptide, and measurement of molecular weight. It is indispensable to a process to find out biochemically effective antibodies by purifying antigens and analyzing antibodies. As there are people who have experience with this device among incumbent researchers, there is no problem in the aspect of technique of use. A model whose operation and maintenance is easy shall be selected.

・DNA Sequencer

Requested by: Division of Molecular Microbiology

This is a device with experimental technique of cataphoresis applied and automated and is necessary to carry out separation/analysis of biopolymers such as protein and nucleic acid and to determine DNA base sequences. It is indispensable to clarification of genes of intestinal pathogenic bacteria, for example, vibrio cholerae, pathogenic colibacillus, shigella and salmonella, and analysis of protein. This device is already used frequently in the said research institute, and there is no problem with level of technique of use and with operation and maintenance.

・DNA Array System

Requested by: Division of Molecular Microbiology

There is a large variety of pathogenic bacteria and viruses and just carrying out identification requires much time and a complicated process. Although it has a purpose similar to a DNA sequencer in an aspect, this device quickly analyzes the manifestation pattern of a gene of pathogenic bacteria and viruses in a micro specimen by means of supersensitive DNA analysis. It displays its greatest utility in determining micro changes of proteins and receptors, and quantity of specific pathogenic bacterium cells. The device is indispensable to molecular-biological diagnoses and examinations. A model with an uncomplicated level of operation and maintenance shall be selected.

・Analytical Ultracentrifuge

Requested by: Division of Molecular Parasitology

This device is used as pretreating equipment for specimens to be analyzed and to separate/fractionate cells, viruses, fungal bodies and micro organs in cells such as plasmid DNA and RNA by means of ultra-high-speed revolution. Frequency of its use is very high.

・Multipurpose Flow Cytometer

Requested by: Division of Molecular Parasitology

With this device, it is possible to specify or identify the kind of target cell from analysis of spectra of scattered light and fluorescence generated by laser irradiation to cells, and to collect various kinds of information regarding the identified cells quickly with a high degree of accuracy. As abnormal cells can be detected, application to studies of antibody matter is made by observing an image of the detected cell and obtaining information. This device is already used frequently at the

said research institute and there will be no problems with technical capabilities level or in terms of operation and maintenance.

・Atomic Force Microscope

Requested by: Electron Microscope Room

With this microscope, it is possible to see fine structure of the specimen surface by scanning the specimen surface with a micro probe. Fine structure of a specimen can be observed as a three-dimensional shape irrespective of electrical conductivity or insulating property in various environments, for example, in the air or in solution. It is possible to observe biological specimens under high magnification without processing them, differently from the case of an electron microscope and, thereby, to get important information. A transmission electron microscope is already put to full and effective use and there is no problem with the technical level. A model that allows easy operation and maintenance shall be selected.

・Scanning Electron Microscope

Requested by: Electron Microscope Room

If a specimen is irradiated with an electronic beam, secondary electrons, reflected electrons, transmission electrons and other signals will be generated from the specimen. By amplifying and imaging these, fine structure and form of specimens can be observed under high magnification. This instrument is essential especially for clarification of bacteria and viruses.

2-2-2-2 Site and Facility Layout Plan

(1) Determination of Project Site Boundary

The proposed site for the Project was purchased from the State of West Bengal by NICED, the implementing organization for the Project, and is located approximately in the central part of the ID Hospital premises. The proposed site is reached by entering from the First Gate of the hospital facing the Sureth Chandra Banerjee Road on the southern side of the hospital and then going through a premise road. Access to the proposed site can be also had from the Second Gate on the north side of the premises. The existing NICED building is about 300 m from the Second Gate. However, although the street facing this Second Gate is connected to the Sureth Chandra Banergee Road mentioned above, the road is crooked and is not appropriate as an approach for heavy vehicles for construction works.

The study team confirmed that the proposed site for the Project facilities was 80 m x 33 m as shown in Figure. 2-3 and the premises boundary points were in place. However, due to the fact that the adjoining new building and the sub station are the possession of NICED, the local construction code for this project should be applied not as a single unit composed of only the Project facilities, but as the aggregate building complex of the three structures within the I. D Hospital premises. Design and supervision of the adjoining new building and its substation, are under the charge of Central Public Works Department (hereinafter "CPWD"). It was confirmed that CPWD shall be the counter-partner of the Japanese Consultant regarding checking of local laws, standards and submission for local government approval.

As a result of this field study, it has become clear that the following problems exist:

1) The construction area on the south side in the Project depends on the location for a substation for the new NICED building under construction. Discussions revealed that CPWD had not conducted re-design for the proposed plan based on JICA Preliminary Design, prepared in July 2003. This substation included electricity-receiving equipment the Project facilities and lack of information required for the Project facilities was preventing. CPWD re-design.
2) As the preliminary study plan did not include waste water treatment facilities and an incinerator necessary for the Project, substantial changes such as increase in the number of building stories and construction of a basement will be indispensable in order to accommodate such facilities within the proposed site.
3) Existing trees in the vicinity of the boundary of the proposed site will become an obstruction when the boundary wall is installed. The felling the trees are restricted by

Kolkata Building Code. Therefore, thoughtful consideration is necessary for the layout plan of the Project.

Concerning the above-mentioned ①, Proposed building will include switch gear room to receive electric supply directly from CSC. Concerning ②, NICED purchased the necessary site with the area of 800sqm in opposite side of Project site, from the State of West Bengal, in accordance with recommendations made by the Study team. Registrations of the land from State of West Bengal to NICED will be finalised before the commencement of the implementation of the Project.

Concerning ③, the Indian side will execute construction of permanent fence on the property boundary line including relocation or cutting of tall trees near to the fence line.

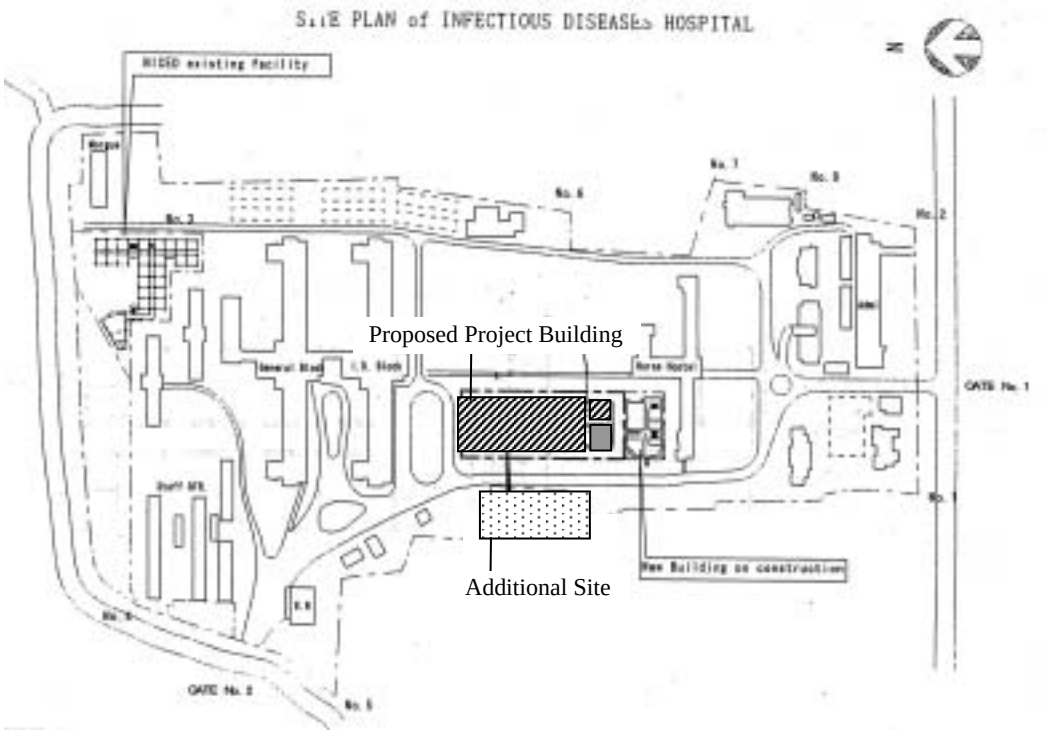


Figure 2-3 Planned Construction Site

2-2-2-3 Architectural Plan

(1) Prerequisites of Design Conditions

1) Design standards

It was confirmed that there were no medical drug production facilities in the Project and from further confirmation of individual research activities and required environmental conditions for each research department, it was confirmed that there was no need for designing the facilities in conformity to GLP.

The design standards of this research facilities plan are as follows:

① The design shall conform to the National Building Code of India, 1983 (hereinafter "NBC").

② The design shall conform to provincial standard laws including West Bengal Province building standards (the Kolkata Municipal Corporation Building Rules, 1990.)

③ A design for each Department of laboratories shall be prepared so as to realize floor area necessary for both equipment and instruments and activities in T.C Phase 2. Minimum space required should take into account equipment and materials included in the Project, those which have been already provided in the T.C Phase 2, those to be relocated from existing NICED laboratories to facilities in the Project, and those likely to be procured in the future through technical cooperation.

④ The design for air-conditioning environment shall conform to the degree of cleanliness corresponding to cell research and analysis at the molecular level of each Department.

⑤ Since NICED is designated as a cooperative organization of WHO, minimum efficiency and standards required as infectious disease research facilities shall be satisfied.

⑥ Space necessary for data processing and research activities of researchers and activities of trainees and outside researchers shall be set, with consideration given to NICED organizational planning.

⑦ For other departments, size shall be determined using standard dimensions such as an Architectural Design Reference Collection (Kenchiku Shiryou Shuusei, Japanese) as reference data.

2) Floor Layout

① Configuration of facilities

Facilities in the Project consist of four buildings: a laboratory building, a generator room, an incinerator and a pump room for sewage treatment plant. The number of stories of the laboratory building was studied and finally altered from 6 to 4 in consideration of efficiency of floor area for each department, construction cost, and appropriate volume of the building within the Project site area of 2,680 sqm. In addition, the generator room shall be a separate building, in accordance with the Kolkata Municipal Corporation Building Rules 1990. The incinerator and Pump Room for sewage treatment shall be constructed on the extended project site.

Vehicle traffic shall be one-way, gates shall be put up at three points, and a guardhouse shall be annexed, so that the flow of people and materials to the laboratories will not commingle with the flow of people and materials to the Animal House. It is planned for drive ways to be laid out on the Project site to lead to two separate entrances of the Project facilities. A parking lot necessary for the Project will be prepared by the Indian side in a place near the Project site.

② Plan Configuration

The main use of the ground floor of the laboratory building will be an Animal House, along with machinery spaces and the main entrance lobby. Above ground floors, including first, second and third floors have laboratory zones on both east and west sides divided by the central core and corridor zone. Each floor shall be divided into three fire control zones with an area of 1500 sqm or smaller according to NBC regulations. The laboratories and corridors shall be separate fire control zones with walls and doors with two hour fire resistance ratings in conformance with NBC regulations. Other structures are small scale single story buildings.

Configuration of each floor of the Project facility is as follows:

The ground floor (first floor) functionally consists of three parts; ① an entrance lobby and a space with exhibition functions, ② the Animal House and ③ power and machine rooms for the whole building. The main entrance of the building will be placed in the southern part of the west side of the laboratory, and the entrance to the Animal House will be placed on the north side of the building.

On the 1st floor, there will be the electron microscope and atomic-force microscope rooms, a surveillance network room and rooms related to administration such as the

Director's office, as well as a seminar room and a conference room. In order to secure precision of the devices, electron microscopes have been designed to be placed in the northeastern end of the building where physical and noise vibrations are minimal. In the central core zone of each floor excluding the ground floor, shared-equipment rooms such as refrigerator rooms, incubator rooms, the bacterial strain depositories and blood serum depositories for the Serum Bank are placed.

On the 2nd floor, there are research laboratories for pathophysiology, immunology, virology and epidemiology, and cell culture rooms will be also provided for two departments: immunology and virology. On the third floor, there are research laboratories for microbiology, parasitology and biochemistry, and cell culture rooms will be also provided for microbiology and parasitology departments.

On each floor excluding the ground floor, corridors will be planned on both sides of the core, and the ends of the corridors are glass-block windows to provide light, reducing the closed-in atmosphere.

An elevator machine room and an elevated tank space will be provided in the penthouse, in addition to an exhaust fan room.

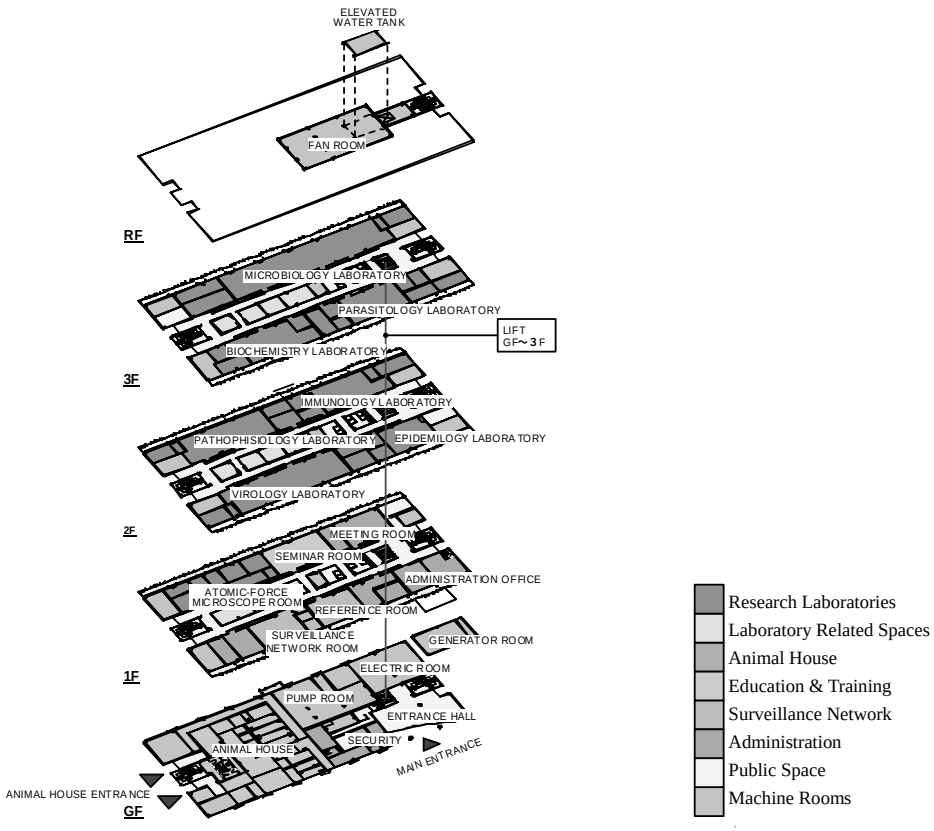


Figure 2-4 Configuration of the Use of Each Floor

3) Plan of Each Department

① Animal House

The Animal House is on the ground floor, on the north side half of the building. Two entrances/exits are provided, one for the clean circulation and the other for removal of dirty (contaminated) waste. The final requests regarding the Animal House include four general breeding rooms (one room each for mice, hamsters, rats and rabbits), two infected animal breeding rooms, a clean preparation room, a cage-washing room, an operation room (dissection room), an examination room and a general experiment room, as well as changing rooms for the staff and researchers, the Animal House administration office, feed storage, a quarantine space, contaminated waste matter storage (for storage of corpses of experimental animals), and a receiving room. In designing the layout of the rooms, it is absolutely necessary to strictly carry out entrance–exit control between clean areas and dirty areas to prevent cross-contamination. Particular thought was given to circulation planning within the area where infected animals would be bred. The size of each space was determined from minimum space and equipment size requirements for their respective activities.

② Research Laboratories

Consideration was given to securing flexibility for future changes and additional equipment by setting a standard module which would be the base for designing each room. Frontage of 6.5 m which is common among research laboratories was adopted. Depth of the standard room was determined to be 7.8 m with consideration given to laboratory tables on the window side, central-island laboratory tables (standard length 3 m + sink 0.6m), passage, cabinets on the corridor side and the vertical mechanical shaft. With this standard experimental laboratory of 6.5 x 7.8 m + 1.75 x 0.7 m (the doorway part) as a basic unit, required space for requested equipment and equipment to be relocated from the existing facilities for each research department was provided.

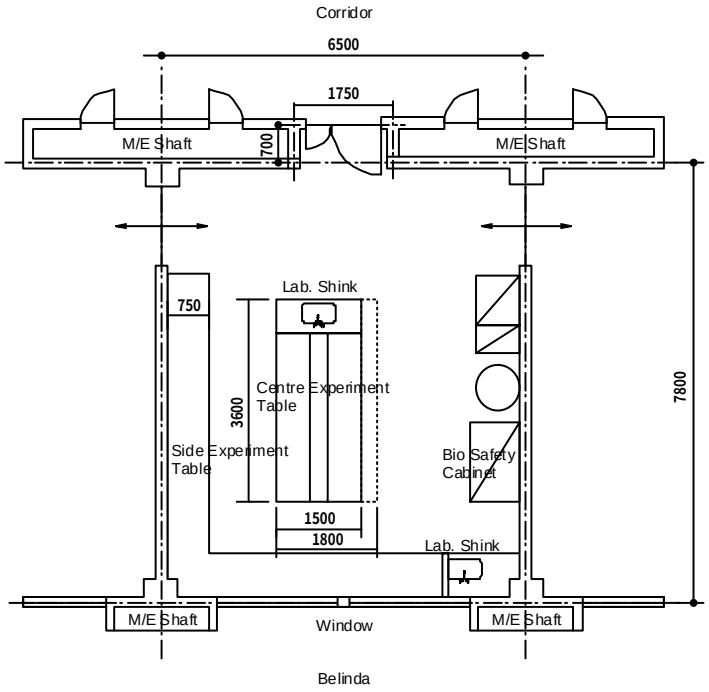


Figure 2-5 Drawing of the Standard Research Room

The size of each research department was determined by providing the minimum area required for research activities to be carried out including space for use of equipment.

Equipment which can be used commonly for research activities of various research departments were put together in rooms in the core zone, such as a shared kitchen, a shared experimental laboratory, a shared freezer and a shared incubator. As a result, people in various departments can use such equipment efficiently and economically and the size of each laboratory becomes compact as a whole. For the departments of immunology, virology, microbiology and parasitology, there is one cell-culture room each which are indispensable to their activities. As these rooms require 24-hour air conditioning control, the layout has been planned to allow a separate single air-conditioning zone for each of these rooms.

The number of researchers including those who work in each research room and area in square meters for each Department are as shown in the following table. The total number of researchers working in each research room (assistant directors, research staff and technical staff) is 86 in total; one person has about 20 sqm of laboratory space, which is similar to Japanese research institutes. In these laboratories, approximately 70 additional researchers and students are training on a steady basis.

Table 2-7 Floor Area of Facilities

		Planned area (sqm)	Number of researchers	Remarks
Laboratories	Molecular microbiology laboratory	390.1	12	
	Molecular biochemistry laboratory	202.5	10	
	Molecular parasitology laboratory	203.5	11	
	Molecular virology laboratory	281.0	14	
	Molecular immunology laboratory	189.6	10	
	Epidemiology laboratory	111.1	16	
	Molecular Pathophysiology laboratory	226.1	7	
	Atomic-force microscope room	172.3	6	
	Sub-total of laboratories	1,776.2	86	Excluding about 70 trainees
Common laboratories	Rooms for equipment and materials in common use, freezer/cold storage etc., incubators, meeting room JICA's expert office	300.2		
Animal House	Breeding department (2 infected-animal breeding rooms and 4 general breeding rooms) Preparation room, sterilizing room, dissection room, Animal House laboratory	565.2	5	
Education and training	Seminar room	103.9	7	
Surveillance network	Surveillance network centre, etc.	183.9	8	
	Total	2,929.4	106	

③ Serum Bank and Strain Storage

A Serum Bank room and the administrative office for the bank will be provided on the first floor. Freezers and refrigerators for storage of blood serum and strains will be provided based on the final requests.

④ Electron microscope room

The requested equipment includes an atomic-force microscope and a scanning electron microscope for procurement. It is also planned that the Indian side will relocate the existing transmission electron microscopes, cryostats and others, purchased and used in the existing building by the Indian side, for use in the Project facilities. Accordingly, the Project shall include three separate electron microscope rooms as well as rooms for auxiliary equipment room, a preparation room and a researcher room. Electron microscopes have extremely strict installation conditions

regarding vibration and sound and change in humidity. For the placement of the rooms, the opposite side of the hospital premises road has been selected, where there is least vibration or noise from machine rooms or other facilities. Each microscope room shall be surrounded by RC walls. In all rooms, glass-wool acoustic insulation material shall be glued on walls and ceilings, and tile carpet which has high sound-absorption property shall be placed on the floor. Lighting and air conditioning equipment will be specified to provide maximum reduction of sound vibration. In particular, air-conditioning equipment shall be designed with appropriate measures taken such as inclusion of a sound-absorbing chamber. Microscope equipment and materials must be selected from those which are equipped with a device for vibration attenuation.

⑤ Seminar and Training Rooms

NICED makes its facilities available for the Third Country Training Program of Molecular Epidemiology of Diarrheal Diseases, hosted jointly with JICA (10 participants from nine countries), the Domestic Training Program on Molecular Epidemiology of Diarrheal Diseases, focusing on molecular epidemiology diarrheal diseases (participated by 11 domestic organizations), the Training Program of Immunization Strengthening Project, targeting mid-level health care workers (held 15 times a year, 259 participants in total), various kinds of academic conferences, lecture classes and practical training of students. The proposed building design will include a minimum necessary area of seminar space to accommodate 40 participants for study, training and seminars related to T. C. Phase 2 activities. It also provides one meeting room for 24 participants for regular weekly meetings of heads of department, staff-chief meetings etc. However, a conference room which was originally requested from NICED for this facility will not be provided in the Project facilities since the existing NICED assembly hall is adequate for the purpose, based on review of current usage.

⑥ Surveillance Network

Besides a server room, a room where up to 20 people such as staff for data input and analysis and documentation/management can work will be provided, and necessary LAN wiring will be installed. In addition, a reference room will be set up in an adjacent space, where researchers will read mainly periodical professional journals which is required reference material for any researcher.

⑦ Administration Department

Administration office for NICED as a whole will be done in the existing building. In the Project facilities, a Director Room and a small administration office for three clerical employees, a secretary and two persons in charge of education and training will be provided and space for computers, printers and copying machines for administrative purposes will also be provided.

⑧ Entrance Area

The Entrance Lobby of the building will be provided with spaces to present achievements and public education/ announcements concerning NICED activities, in addition to the entrance control function.

⑨ Safety Facilities

Emergency shower facilities will be installed at both ends of a corridor, for emergency use in case of accidental exposure to chemicals and infectious agents in the laboratories.

4) Elevation Planning (shape and finishing material)

The Project facilities consist of a separate electric generator building, a pump house ancillary to a waste water treatment facilities and an incinerator building, besides the main research laboratory building. Outer walls of the building shall generally be rigid-frame reinforced-concrete structure with reinforced-concrete-block wall construction and the standard finish will be sprayed-paint finish over mortar screed. The wall openings will be aluminium sash windows with wind resistance of 160 kg/m^3 and water tightness capable of withstanding cyclones. The roof shall be of concrete-covered built-up asphalt waterproofing and shall be designed with sufficient slab gradient to prevent puddles from unevenness.

Kolkata city is located at latitude 23°N and the sun altitude is relatively high. Therefore, there is little concern about sunlight from the southern side. On the other hand, the east and west outside walls will have heavy air conditioning loads because the building is long from north to south. Reduction of the air conditioning load shall be facilitated by blocking the amount of early-morning east and early-evening west sunlight by installing exterior louvers on the balconies.

5) Sectional Planning

Air conditioners are necessary for the laboratory facilities on each floor because of the intended activities for the Project. The height of the standard floor shall be 4 m and the standard ceiling height shall be 2.7 m. In particular, special exhaust from the Animal House on the ground floor and laboratories on the first to third floors will be discharged to the exhaust fan room in the penthouse through vertical duct space in the core zone or exterior balconies. The water-supply system shall be distributed to each room through the core zone, and waste water will be directed out of the building through a pipe space in the exterior balconies. The ground floor is constructed at a height of 0.6 m above ground level according to Kolkata City building codes.

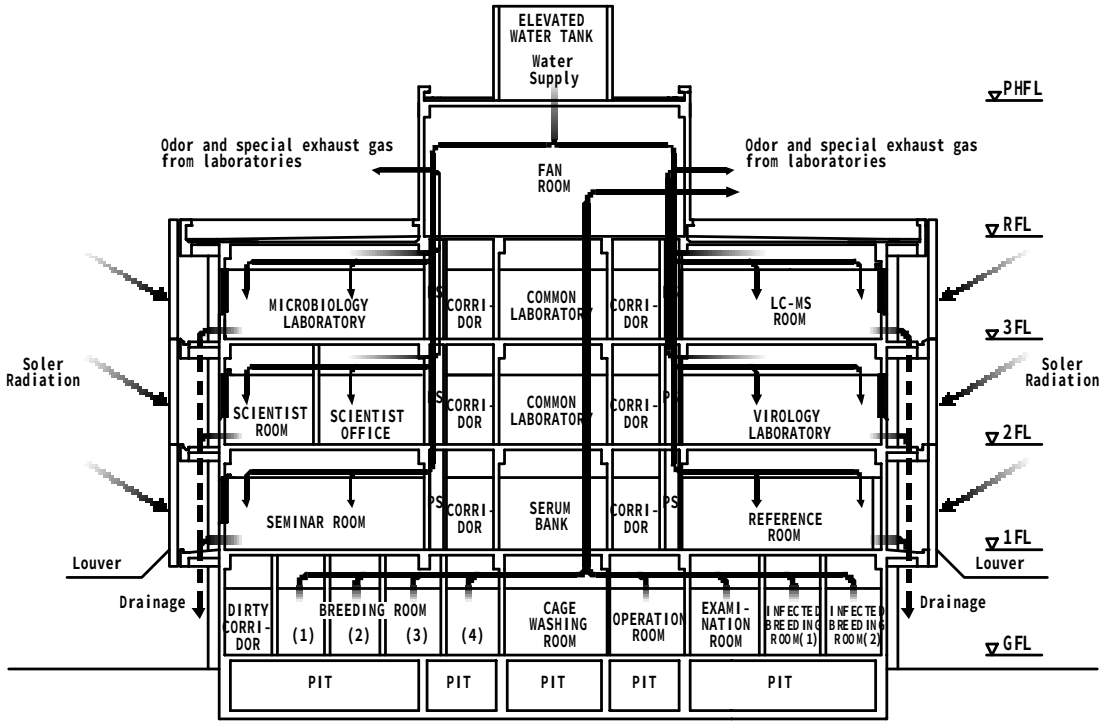


Figure 2-6 Cross Sectional View

(2) Required Floor Area of Each Department

Table 2-8 Rooms in the Facilities and Floor Areas (sqm)

Name of Room	GF	1F	2F	3F	RF
Molecular microbiology laboratory				390.1	
Molecular biochemistry laboratory				202.5	
Molecular parasaitology laboratory				203.5	
Molecular virology laboratory			281.0		
Molecular immunology laboratory			189.6		
Epidemiology laboratory			111.1		
Molecular pathophysiology laboratory			226.1		
Atomic-force microscope room		172.3			
Rooms for equipment and materials in common use Incubators Freezer/cold storage Common kitchen Meeting room JICA's expert office		129.0	85.6	85.6	
The breeding department（2 infected-breeding rooms・4 normal breeding rooms） Preparation room Examination room Operation room Animal house laboratory Storage room Changing room	565.2				
Seminar room		103.9			
Network center Server machine room Reference room		183.1			
Security Driver's room Administration room Director's room	109.2	346.0			
Changing room W,C Shower room Corridor Staircases Hall	295.1	384.3	405.0	409.5	26.2
Air-conditioner room Fan room Pump room Elevator machine room MDF Switch gear room Electric room LPG room Laboratory gas room	473.3	147.3	167.5	174.7	235.0
Total	1,442.8	1,465.9	1,465.9	1,465.9	261.2
Balcony	550.0				
Total floor area	6,651.7				
Generator room					61
Incinerator					70
Sewage treatment plant pump house					23
Project area	6,805.7				

2-2-2-4 Structural Plan

(1) Ground condition of the planned construction site

Boring, soil testing and site levelling were carried out at three points on the planned construction site for the Project facilities. The summary of the ground condition obtained from the survey is as follows:

- The ground level of the site is about 0.3 meter higher than the premises road.
- The ground-water level was found to at a high level, about 1.0 m under the present ground surface. As it is anticipated that the water level will be higher in the rainy season, it is presumed that the ground-water level is near the ground surface.
- An appropriate supporting layer where N Values are continuously 50 or higher for more than 5 m thickness was not found to the depth of 40m.

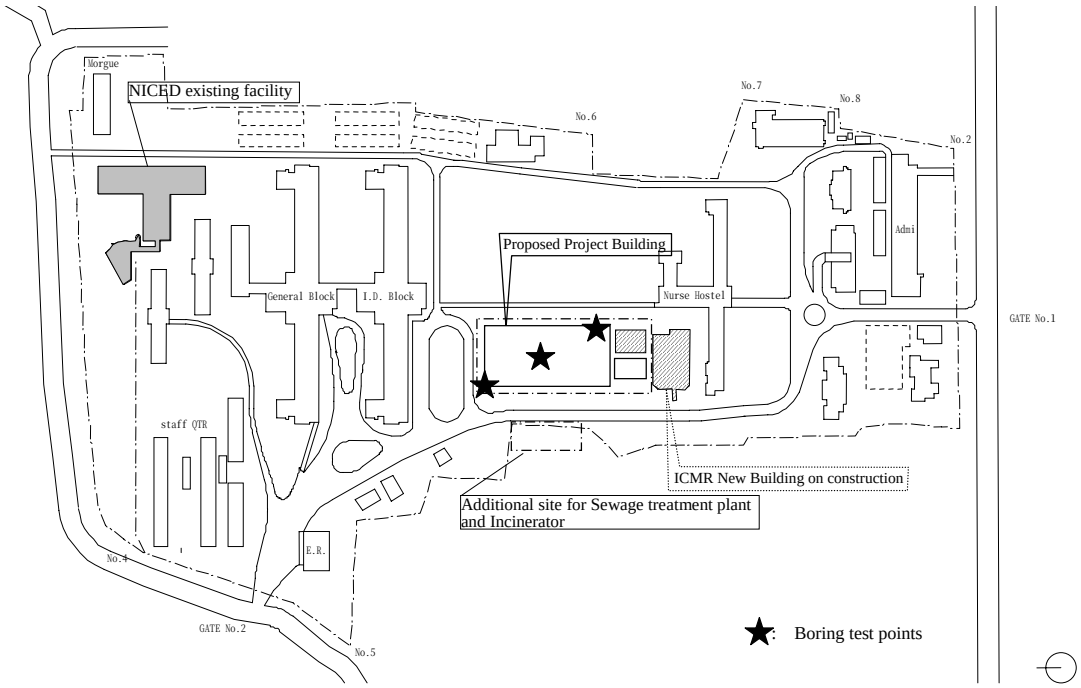


Figure 2-7 Boring Points on the Planned Construction Site

(2) Foundation Plan

The new building under construction adjacent to the Project site has six stories above ground. The foundations are cast-in-place reinforced-concrete piles. The Project Facilities are proposed to have four stories above ground and a foundation almost identical to the building under construction.

For the chimney, a height of 30 m above ground is required by local law. Therefore, it is necessary to adopt a pile foundation in order to restrain differential settlement due to dead weight and ensure the stability against overturning moment caused by earthquakes or wind pressure. PC piles are not common construction in the normal local buildings and it is necessary to consider reduction of hazardous vibrations to the nearby hospital during execution of work. Therefore, cast-in-place piles shall be employed. For Kolkata, it has been confirmed that liquefaction of ground need not be considered in structural design, because the ratio of local content of fine-grained soil is high and it has been determined that seismic force is not at the level which would cause liquefaction.

The diagram for a borehole is shown below in Figure 2-8.

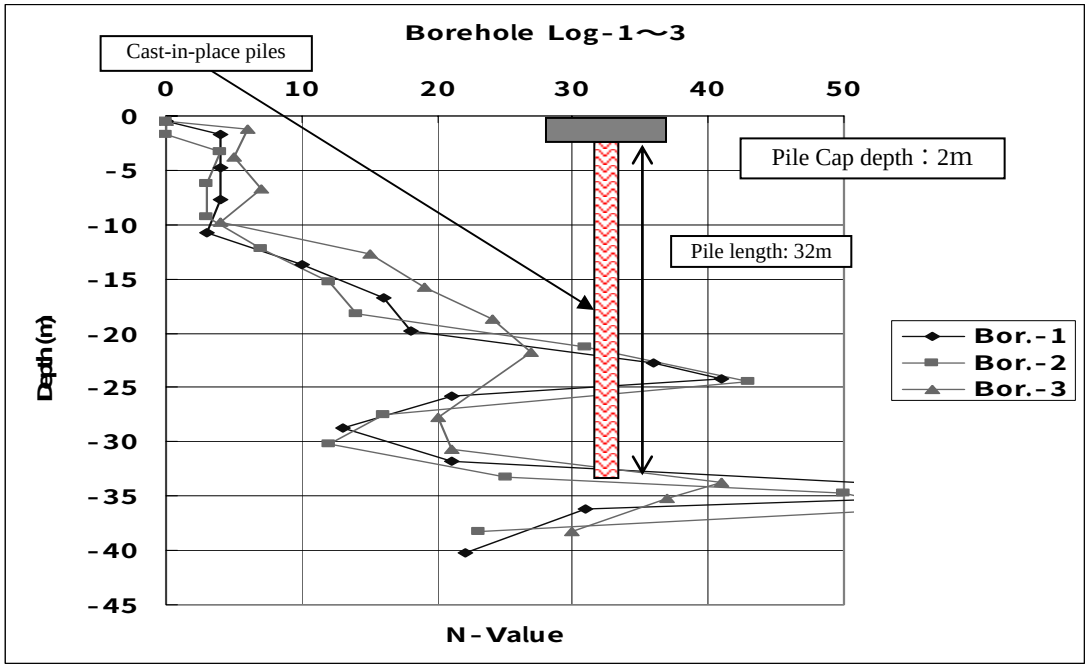


Figure 2-8 Borehole Log Diagram

(3) Structural Design

The structural form of the new building shall be a rigid moment frame reinforced concrete structure, which is commonly used in India, for the main structure. Only the minimum parts structurally required for columns, beams and floors shall have reinforced concrete structure, and outside and partition walls shall be of block or brick construction.

For the new Project laboratory facilities, shear walls shall also be employed, as stress due to seismic force will be excessive if only a pure rigid moment frame reinforced concrete structure is employed.

(4) Design Loads

Design loads to be adopted in the Project shall be calculated in conformity to the following standards and criteria.

Indian Standard, hereinafter referred to as IS.

IS 1893(Part 1): 2002 “Criteria for Earthquake Resistant Design of Structures”

National Building Code: 1983 Part VI Structural Design Section “1.Loads”

1) Dead Load

Dead load shall be calculated mainly based on finishing material and weight of structural material.

2) Live Loads

Design live load of the building shall be set as shown in Table 2-9 according to the purpose of use of a room besides the above-mentioned standards and criteria. It is described in IS 1893 (Clause 7.3.1, Part l) that live load in the calculation of seismic force shall be 25% in the case of 3,000 N/sqm or less and 50% in the case of values over 3,000 N/sqm.

Table 2-9 Principal Live Loads

Area	Imposed Load (For Frame)	Imposed Load (For seismic force)
Laboratory	3,000 N/sqm	1,500 N/sqm
Conference Room, Office	1,800 N/sqm	450 N/sqm
Storage Room	7,000 N/sqm	3,500 N/sqm
Corridor	1,800 N/sqm	450 N/sqm

3) Wind Load

Wind load shall be found from descriptions in "4. Wind Load," Section 1, Part VI, NBC Standards. Namely, wind pressure for design (N/sqm), P_z, can be obtained from the following expression:

$$P_Z = 0.6 \cdot V_Z^2$$

Where $V_z = V_b \cdot k_1 \cdot k_2 \cdot k_3$, V_z is design wind velocity at height Z, k_1 is a risk coefficient to the design service life (1.0 is adopted for 50 years (the standard value), k_2 is a coefficient to geological division and building height and width, and k_3 is a coefficient when there is a vertical interval.

V_b represents the basic wind speed and is proscribed by law. The zone map is shown in Figure 2-9 and Kolkata belongs to the area with standard wind velocity V_b of 50 m/s.

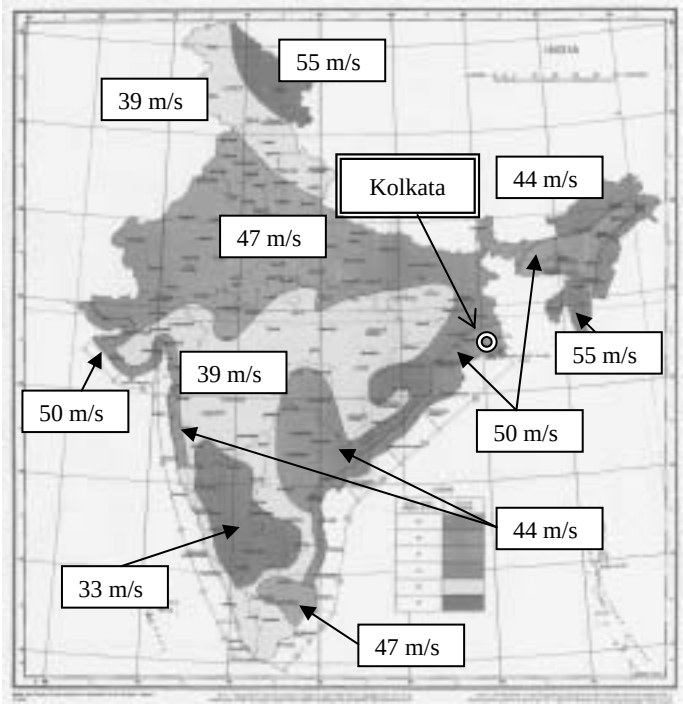


Figure 2-9 Basic Wind Speed for Design
(Based on 50-year Return Period)

Calculation of actual wind pressure F (N/sqm) acting on the building is as follows:

$$F = C_f \cdot A \cdot p_d$$

Where C_f is a wind pressure coefficient, A is area receiving wind (sqm) and p_d is wind pressure (N).

4) Seismic Load

India has several geologically unstable areas mainly on the bordering areas to the Asian continent, including the Himalayan district. In the Indian sub-continent, although relatively large earthquakes have occurred historically, frequency of occurrence is relatively low and magnitude of earthquakes is relatively low. Based on these circumstances, the first edition of Guidance for Earthquake Resistant Design IS 1893 was published in 1962 and revisions were made five times up to 2002. Figure 2-10 shows the centre and magnitude of earthquakes which occurred before 1993.

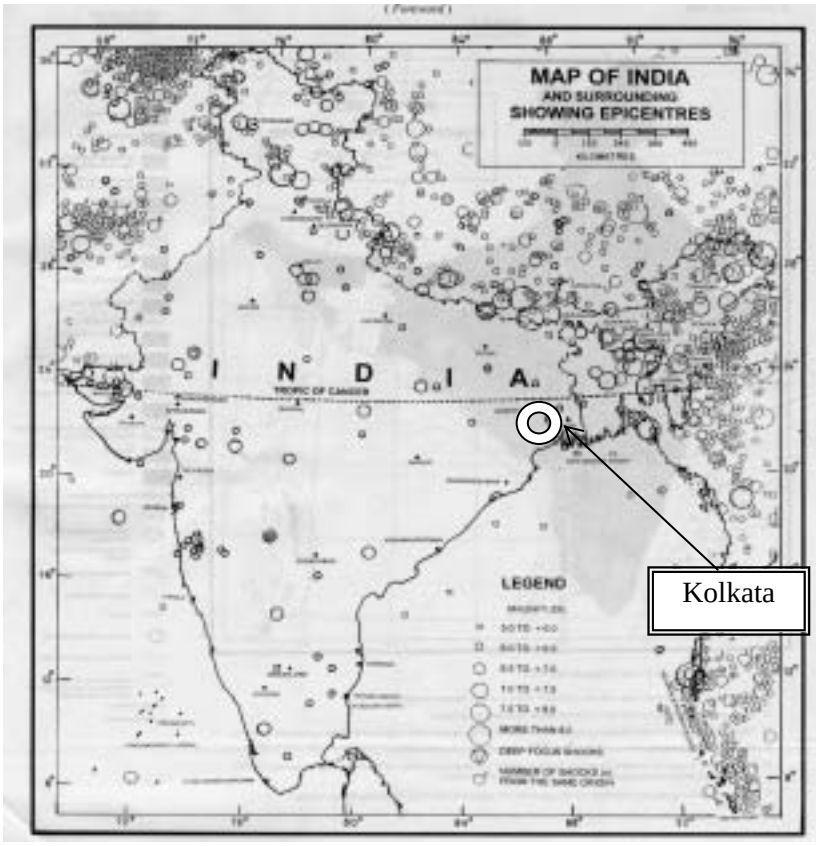


Figure 2-10 Historical Occurrences of Earthquakes in India

Based on historical occurrences of earthquakes as shown in Figure 2-10 and forecasts of future occurrence, a map of seismic region coefficients for design is shown in IS 1893 as shown in Figure 2-11. Accompanying the fifth revision of IS 1893 (in 2002), Zone I in the previous versions was incorporated in Zone II. Regional coefficients are now set at four levels; Zones II to V. Kolkata belongs to Zone III (Annex E, IS 1893 (Part 1), 2002). Seismic regional coefficients for design organized by zones are shown in Table 2-10.

Table 2-10 Seismic Regional Coefficients for Design (Part 1, Clause 6.4.2, IS 1893)

Seismic zone	II	III	IV	V
Seismic Intensity	Low	Moderate	Severe	Very Severe
Z	0.10	0.16	0.24	0.36

Importance factors are described as shown in Table 2-11. Because of the purpose of use, "I=1.0" is adopted.

Table 2-11 Importance Factor (Part 1, Clause 6.4.2, IS 1893)

Structure	Importance Factor
Important service and community buildings, such as hospitals; schools; monumental structures; emergency buildings like telephone exchange, television stations, radio stations, railway stations, fire station buildings; large community halls like cinemas, assembly halls and subway stations, power stations	1.5
All other buildings	1.0

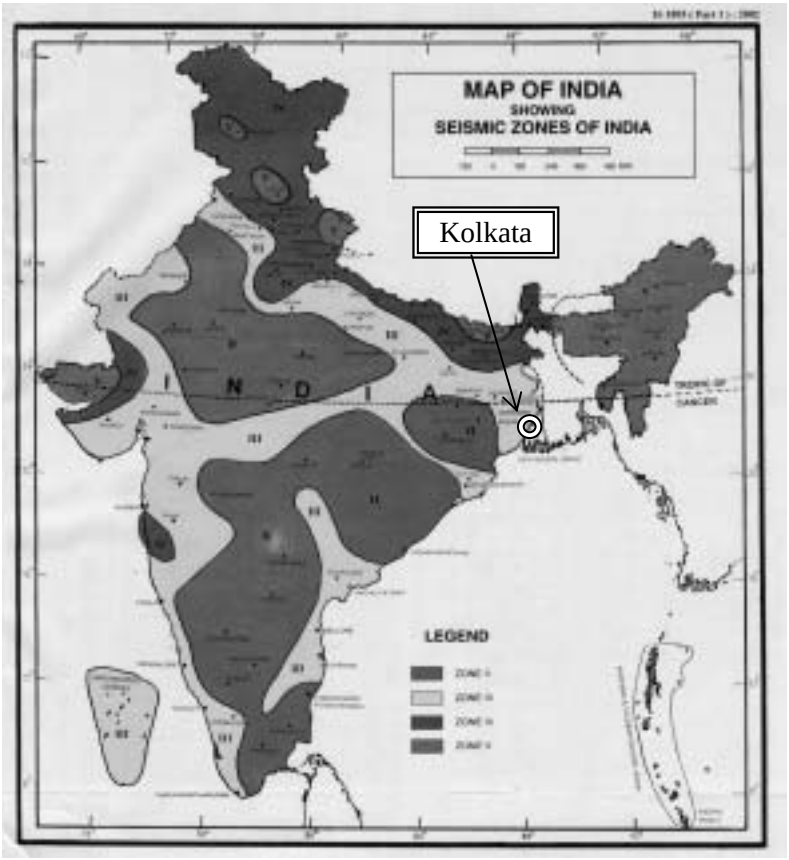


Figure 2-11 Seismic Regional Coefficients for Design

Horizontal shearing force are calculated based on the equations mentioned above, (Clause 6.4.2, IS1893, 2002).

Comparison between design wind pressure and design seismic force is shown in Figure 2-12. From the figure it can be seen that design horizontal force is determined from seismic force for all storeys.

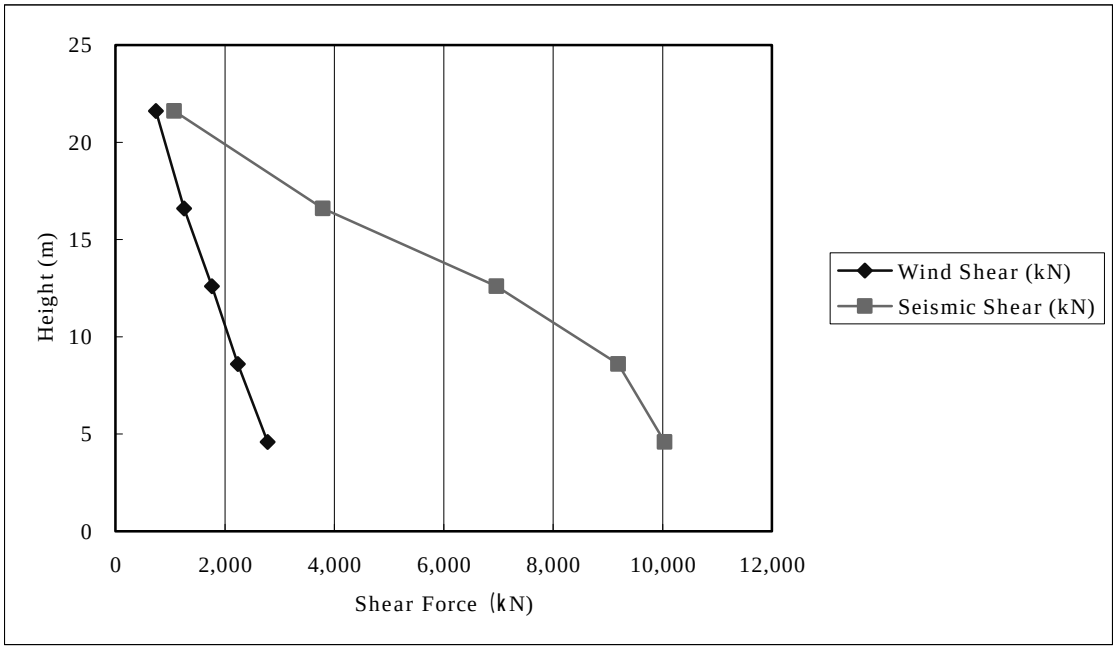


Figure 2-12 Comparison of Design Shear Force

5) Structural Design Criteria

The National Building Code of India, Indian Standards and Kolkata Municipal Corporation Building Rules, 1990 shall be followed in principle.

Reinforced-concrete structural members shall be designed with combination of loads set down in IS 1893-2002 (Clause 6.3.1.2, Part 1) and IS 456-2000 (Clause 36.4.1) (limit state method).

That is to say,

① 1.5(DL+IL)

② 1.2(DL+IL±EL) or 1.2(DL+IL±WL)

③ 1.5(DL±EL) or 1.5(DL±WL)

④ 0.9DL±1.5EL or 0.9DL±1.5WL (This load combination is to be considered when stability against overturning or stress reversal is critical).

Where DL is dead load, IL is live load, EL is earthquake force and WL is wind load.

6) Material to be used and material strength

Concrete: In conformity to IS 456, ordinary concrete shall be used.

Concrete provided in IS 456 is shown in Table 2-12.

Table 2-12 Strength of Concrete (Clause 6.1, IS 456)

Group	Grade Designation	Specified Characteristic Compressive strength of 150mm Cube at 28 Days in N/msqm
Ordinary Concrete	M10	10
	M15	15
	M20	20
Standard Concrete	M25	25
	M30	30
	M35	35
	M40	40
	M45	45
	M50	50
	M55	55
High Strength Concrete	M60	60
	M65	65
	M70	70
	M75	75
	M80	80

Strength of concrete to be used for the main structure shall be M25 - M30, and that for earth floor slab shall be M15-M20.

Reinforcing bars to be used shall be deformed bars in conformity to IS 1786 (stress intensity at the yielding point, f_y=415 N/msqm) or deformed bars in conformity to stress intensity at the yielding point SD390 of JIS G3112 (f_y=390/Nmsqm). Cross sections provided in IS 1786-1985 shall follow Table 2-13.

Table 2-13 Cross Section Area and Unit Length Weight of Reinforcing Bars

	Cross sectional Area (sqcm)	Unit Weight (N/m)	Remarks
D10	0.786	6.047	
D12	1.131	7.918	
D16	2.012	15.48	
D18	2.546	19.60	
D20	3.143	24.21	
D22	3.803	29.20	
D25	4.911	37.73	
D28	6.160	47.33	
D32	8.046	61.84	

In IS 1786, there are two types of deformed bars, T.M.T. (Thermo Mechanically Treated) and T. S. (Twisted Square). The former is a bar made by forming a rib of a deformed bar under heat process and the latter is formed by twisting a square steel bar or two round bars under cold process. All of reinforcing bars used in Japan are of the former type. The

latter reinforcing bars are relatively inexpensive, but as their elongation after yielding is small, there is a concern that those bars will cause brittle failure can occur under earthquake conditions. It is necessary that T. M. T. bars be used for this project based on seismic design for the structure.

2-2-2-5 Mechanical and Electrical Plan

(1) Electricity Plan

1) Electricity Receiving and Transformer Equipment

Electric power supply to the planned facilities will be received through two low-voltage transfers of 750 kVA to be newly installed and connected to the power grid by one high-voltage line to be provided by Calcutta Electric Service Company (CESC). Although power can be received by single piece of equipment with capacity of 1500 kVA, two transformers shall be installed with consideration given to reduction of secondary low-voltage capacity and operation during maintenance. It is ideal from the viewpoint of stability of power supply that transmitted electricity is received by two lines but it has been found that CESC has only one line. In the planned facilities, a room of 4.9 x 4.9 m will be provided as space for a high-voltage branch connection for CESC.

Electric power from CESC high-voltage branch board (6 kV) will be brought in and distributed to two NICED high-voltage incoming panels of 750 kVA. From the fact that the actual demand factor of the existing facilities is 33% at maximum, the maximum energy demand for the Project facilities is estimated to be 500 kW. Therefore, the number of transformers shall be one. The transformer shall have a voltage switching function (with tap adjusting), distribution voltage shall be changed from 3φ4W415/240V to 3φ 4W 400/230V, and power shall be supplied at 3φ3W 400V for power supply and at 3φ 2W 230V for electric lighting and outlets.

The proposed electric power inlet route is shown in Figure 2-13 "Main Piping and Power Cable Infrastructure" The single line diagram for receiving equipment and power distribution is shown in Figure 2-14.

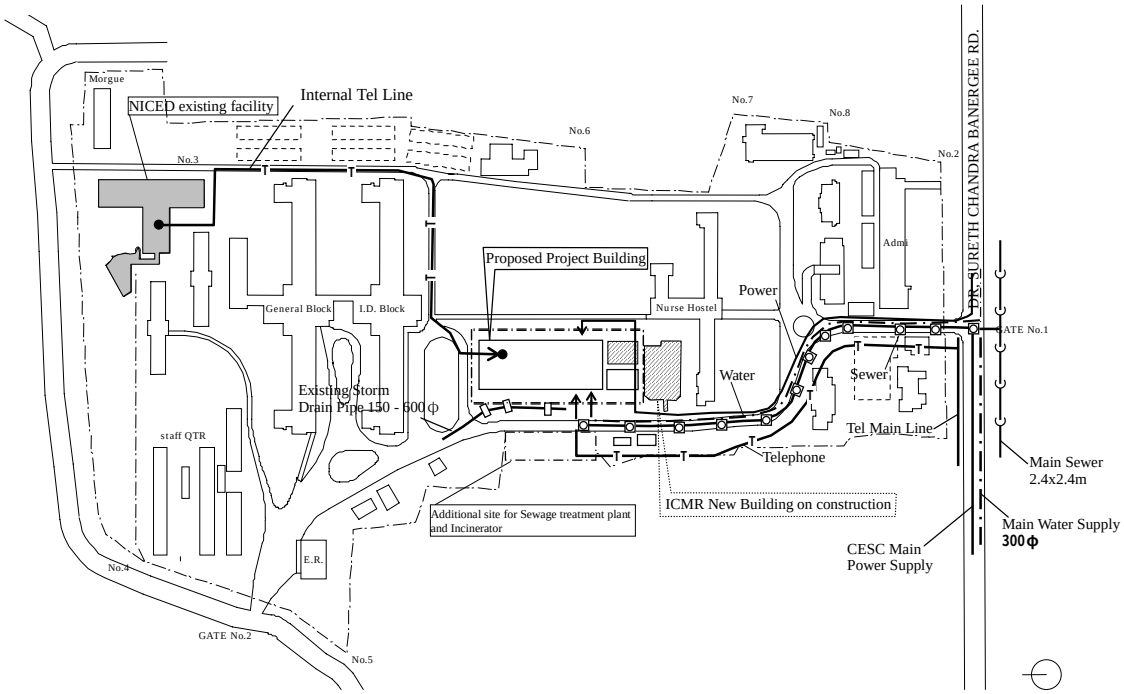


Figure 2-13 Main Piping and Power Cable Infrastructure

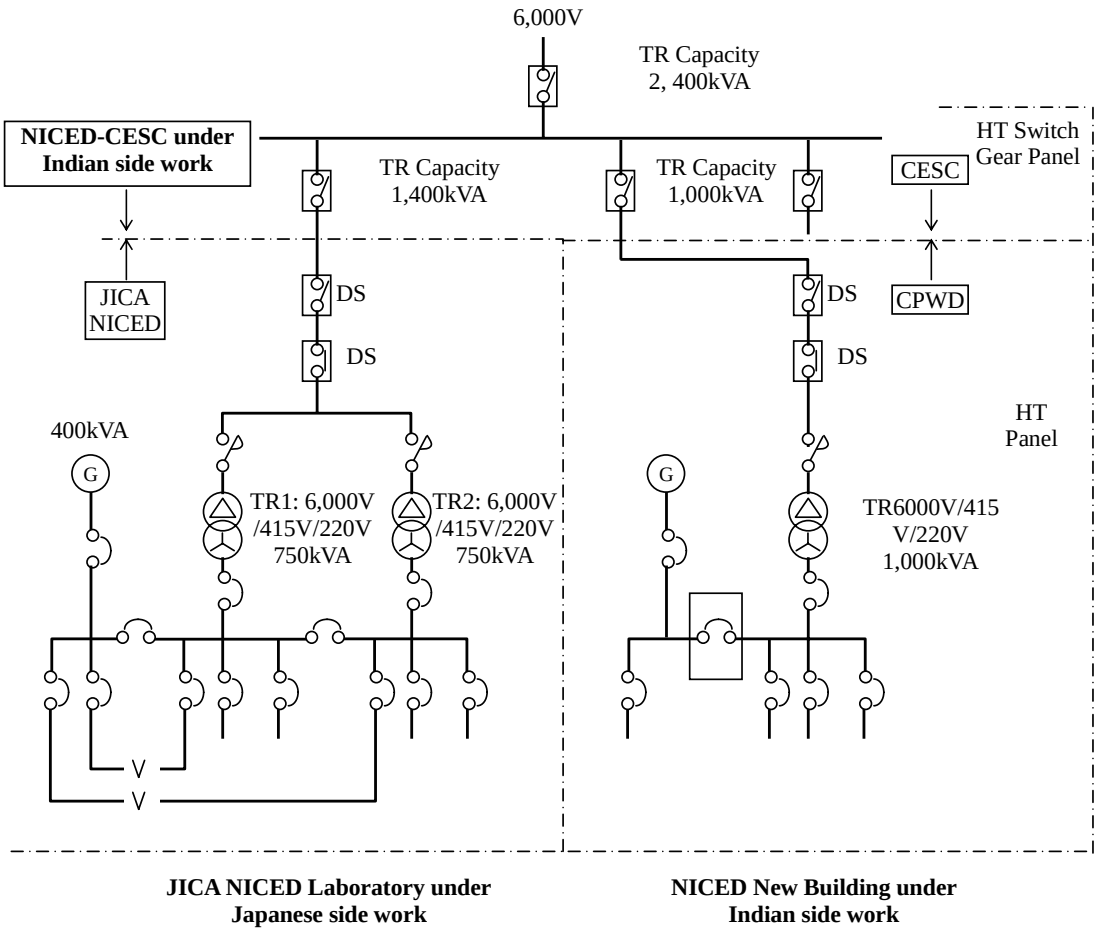


Figure 2-14 Single Line Diagram of Sub Station

2) Emergency Generator System

As a result of the field study, it was found that frequency of electricity failure was high in the site area and the voltage fluctuation band was broad. In the Project laboratory facility, experimental data will be disrupted due to any electricity failure during research experiments and there are both equipment and rooms that absolutely require load to be supplied continuously on a 24 hours basis. Anticipated electricity failure will cause enormous damage. Therefore, an emergency diesel generator with capacity of around 400 kVA shall be installed as the minimum backup power source, required for enabling stable power supply in an emergency, for experimental equipment and instruments, air-conditioning facilities and emergency and disaster-related equipment systems.

As a result of measuring voltage fluctuation of NICED's existing facilities in this study, it has become clear that the fluctuation is between + 10% and 20% or wider, which is a very poor situation. Electric power shall be supplied from the centrally installed AVR power source to instruments which are found to require stable power for reliable performance.

3) Trunk Power Line

The trunk power line shall be planned for two systems, commercial and commercial/generator, according to places to which power is supplied. Power will be supplied to general destinations under the commercial system and to important demand points for research and supply to disaster prevention under the commercial/generator system.

4) Lighting and Outlet Equipment

Lighting equipment shall be planned with priority given to fluorescent lamps which can be easily procured locally and have relatively low maintenance cost. Illumination intensity shall be planned at around 50% of the Japanese standard taking into consideration the existing local conditions and reduction of maintenance costs. For outdoor lighting, mercury lamps commonly used locally shall be adopted. For research facilities and experimental laboratories, plug-socket wiring shall be provided from walls or ceiling as required by equipment configuration.

Plug Sockets will be divided into two kinds, general and emergency, and only emergency outlets (including those for experiment equipment) will be connected to the generator circuit (AVR power source). For laboratory rooms, outlets of the unit type which are commonly used locally will be adopted and installed on the wall at fixed intervals.

5) Lightening Protection System

A lightning conductor will be installed on the roof and a lightning conductor system will be installed on the elevated tank.

6) Telephone Equipment System

Based on the size of the project facilities, the telephone equipment system shall be planned with a PBX which can accommodate 10 PBX lines with maximum extension capacity of 200 internal lines, while about 20 dedicated external lines shall be led in. It will be planned with coordination with the existing facilities taken into consideration. The MDF will be provided on the ground floor.

For extension connection to the existing facilities and others, only cable racks and pipes will be provided that will enable roaming with the exchange to be installed.

7) Public Announcement System

The main device of the public announcement system will be located in the administration office on the 1st floor because it will be operated by the staff of the Maintenance Department. Speakers will be provided in appropriate places in the Project facilities to establish a system which enables paging of the office staff and broadcast emergency announcements throughout the whole building.

In the Project facilities, broadcasting of emergency announcements will be made by staff and no automatic emergency announcement facilities will be provided.

8) Central Supervision Equipment

Central supervision panel monitoring building machinery, room temperature conditions, operational conditions including warning signal from equipment and electric supervision panel monitoring electric supply conditions will be provided at Security Office located on GF.

9) Automatic Fire Alarm Equipment

Fire alarm equipment shall be planned according to local laws or BS criteria. Each room will be equipped with a detector, and the main receiver of automatic fire alarms will be provided in the Security Office on the ground floor. Based on the central gas piping equipment for facilities, a gas leak alarm shall be placed in various places so that central supervision can be provided.

10) LAN System

The scope of LAN system to be borne by Japanese side will include connection works between existing building and new laboratory, cable with cable ladder for vertical electrical shaft, conduit and cable, connection conduit and cable between satellite antenna base and server room of Surveillance Network.

11) Security System

Electrical locks or an ID card operated security system shall be installed in the server room, the cell culture rooms and the infected-animal breeding rooms in the Animal House.

12) Television Cabling System

Conduit piping for satellite communication necessary for the extension of surveillance network and conduit piping and television outlets for television connections will be provided. Wiring and connection shall be borne by NICED.

(2) Building Systems Equipment

1) Water Supply System

City water shall be directly supplied to the Project facilities from main pipe size of 300φ located under Sureth Chandra Banaergee Road on the south side of the site. Lead in works of the water supply shall be borne by NICED in between main pipe and connection to the Project facilities.

Well water supply system including well borehole shall be included in the scope of Japanese side in consideration of utility situation of Kolkata, where most public facilities have well water supply system.

Water supply for the laboratories shall be divided into water for miscellaneous use and purified water, for which a water purifying plant will be installed. The plant specifications will provide for water satisfying WHO standards on hardness and chlorine ion content.

It is estimated from the size of proposed facilities that consumption of water for miscellaneous use per day will be about 15 m^3 and that of purified water per day will be 35 m^3, therefore total water consumption is estimated to be 50 m^3 per day. Capacity of the raw-water intake reservoir shall be equivalent to water consumption per day and the reservoir shall be located in an underground tank. Water for miscellaneous use shall be pumped directly to an elevated water tank for miscellaneous use on the roof by a storage pump and then distributed to lavatories by gravity. Capacity of the purified-water tank shall also be equivalent to daily consumption and an elevated FRP tank will be installed

on the roof of machine room. Water shall be pumped to the elevated water tank by the storage pump and then distributed to the training facilities by gravity.

Special water supply required for equipments such as demineralised water and sterilized water will be provided locally from purified water system equipment to be procured under the Project.

The standard flow of the water supply and drainage system is shown in Figure 2-15.

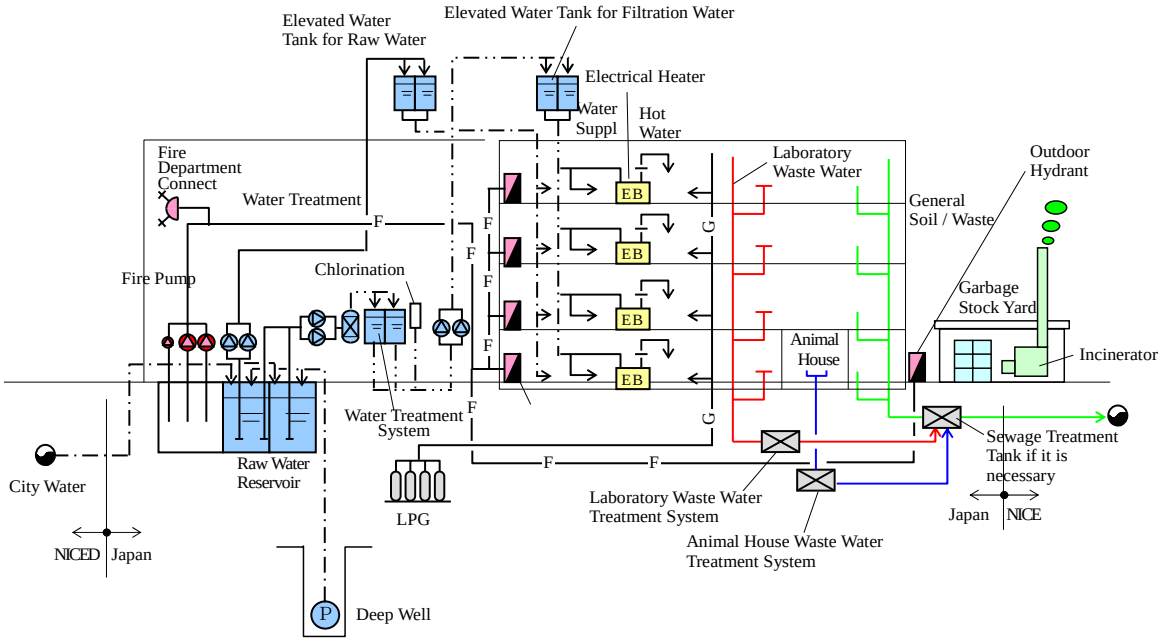


Figure 2-15 Water Supply and Drainage System Flow

2) Drainage Facilities

General sewage water and miscellaneous waste water will have separate internal piping systems, joined into a single system outdoors, and then be connected to general waste water treatment facilities. Treated waste water shall be discharged at the location of Gate 1 of I.D. through a 2.4 m x 2.4 m culvert of the main drainage under Sureth Chandra Banaergee Road on the south side of the premises. Works for general waste water treatment facilities and the main drainage shall be carried out by the NICED side.

For drainage from research facilities, waste water treatment equipment suitable for the purpose shall be provided as water quality will depend on research activities. Basically, acid/alkali treatment and sterilization shall be carried out. The separately treated waste water will then be discharged to the general waste water treatment facilities. Each research laboratory shall be equipped with drain pipes of about 80ϕ at every span with change in the layout taken into consideration.

Equipment for waste water purification including sterilization shall be installed separately for drainage from the Animal House. After treatment, the waste water will be discharged to the general waste water treatment facilities. It is acceptable for water to be connected directly to the main drainage according to the degree of sterilization. For drainage from the breeding rooms, a large stainless steel trap will be provided to prevent clogging and effluvium of waste water and to facilitate operation and maintenance. Drainage pipes shall be installed in an underground pit to allow easy inspections.

3) Hot-water Supply Equipment

Either individual hot water storage system or electric flash hot water heater was selected as the hot water supply equipment for the planned facilities. Calculation of required hot water volume showed the chosen system was reasonable in terms of cost and maintenance due to low volume required. The demand points where hot water supply equipment is installed are the Cleaning rooms, quality control room, blood-sampling room, sinks in the research laboratories, shower rooms

4) Sanitary Fittings

Toilet bowls in each lavatory will be one unit in Western style and the remaining will be of the Indian style. Basically, those of a low tank system which is easy to be maintained will be employed. Urinals will be either floor-standing or wall-mounted type.

Wash basins will be placed in appropriate locations in each lab. A branch for a future water purifier shall be provided. Three branch faucets for experiments shall be put on each laboratory table. Sinks in research laboratories shall be equipped with water-washing equipment with a hand lever. Water and hot water shall be supplied to necessary places and traps shall be fit to necessary places for drainage from experimental tables and the Animal House.

Emergency shower rooms shall be provided as necessary for each floor.

5) Supply of LPG gas

LPG gas shall be supplied by the central system to safety cabinets in the research laboratories. Piping shall be basically open and a gas-leak alarm system shall be provided internally and on the piping routes.

6) Waste material

General waste material shall be collected by the city, as in existing facilities, but experimental waste shall be disposed of by an oil fired incinerator, to be provided under the Project. Waste material such as animal corpses from the Animal House will be treated in the same way. Special hazardous material will be stored in the existing hazardous material storage in the existing building and then treated.

A garbage dump will be provided in the incinerator facility. The incinerator will be installed in the space adjacent to this dump. Combustion temperature of the incinerator shall be 800 - 1000°C or higher so as not to generate dioxin and its specifications will meet requirements for hospital waste. The specifications of the incinerator will also conform to Indian environmental standards, and smoke-and-soot treating equipment in particular shall satisfy the standards. The chimney shall have a height of 30 m or higher set by taking environmental standards and adjacent buildings into consideration.

7) Fire Fighting Equipment

Fire fighting equipment shall be planned according to the Indian National Building Code and criteria of fire fighting. In specifications and equipment where local laws are not yet established, the plan will be made based on British Standards or Japanese criteria.

It has been decided from the size of the planned facilities that the following equipment shall be provided: dedicated automatic fire alarms, internal fire hydrants, external fire hydrants, fire pipes for dedicated use by the fire crew, connecting valves for the fire crew (Siamese connections) and extinguishers. As a result of confirmation with West Bengal Province Fire Department, a sprinkler system will not be installed. Local laws require provision of two pumps of which one shall take power from the emergency power generator.

8) Air-conditioning and Ventilation Equipment

Cleanliness levels corresponding to P2 specifications are required in some spaces in the Project facilities. Cooling installations shall be provided throughout the building excluding rooms which do not need air-conditioning equipment such as storage rooms and lavatories.

Cell culture rooms and common laboratories will be made semi-air-tight and be serviced by individual 24-hour air conditioning provided with mid-performance filters. The electron microscope laboratory will have 24 hour air conditioning with temperature and

humidity (dehumidifying only) control. Incubator rooms will have 24 hour air conditioning with room air temperature kept at 37°C.
Discharge from the safety cabinets and the draft chambers will be sent up through a duct to the rooftop. For acid/alkali discharge air, an absorption filter will be installed.

The air conditioning in the Animal House will be of the semi-central cooling and heating type with a medium-performance filter similar to that in the research laboratories. However, as two rooms in the Animal House will be for infected animal breeding, the inside of those rooms need to be kept at negative pressure by installing a high-performance filter, and the air-conditioning systems for those rooms must also be kept separate from other systems. Similarly, the air conditioning in the operating room will correspond to the infected zone. Air conditioning of the Animal House, the whole external air system will be adopted smell control and heating will be planned to account for low temperature in the winter season. A deodorizing device shall be provided in discharge air system. The allocation of air conditioner system for each room will be determined according to its functions.

A prefabricated cold room will be provided on each floor and the room temperature shall be kept at 4℃.

Air-conditioning shall adopt the locally common air-cooled air conditioning systems, and an individual or semi-central system shall be employed.

Air-conditioning methods for each room and area are shown in Table 2-16. The conceptual diagram of each air conditioner is shown in Figure 2-16 to 2-19.

Table 2-14 Air-conditioning Methods and Areas

	Room Name	Semi-Central Cooling AC	Individual Cooling AC	24H AC	Room Pressure	Medium Filter	High Efficiency Filter
1F	Director Room		○				
	Administration Office		○				
	Meeting Room		○				
	Seminar Room		○				
	Surveillance Room		○				
	Server Room		○	○			
	Serum Bank, Strain, Sera	○		○		○	
	Maintenance Workshop		○				
	Electronics Microscope	○				○	
	Expert Room		○				
	Reference Room		○				
	Scientist Room		○				
2F	Tissue Culture	○		○		○	
	Scientist Office		○				
	Pathophisiology Lab.						
	Virology Lab.						
	Immunology Lab.						
	Common Lab.	○		○			
	C,B Room	○		○		○	
	Incubator Room		□	○			
	Epidemiology Lab.		○				
3F	Tissue Culture	○		○		○	
	Incubator Room		□	○			
	Biochemistry Lab.		○				
	LC/MS Room	○		○		○	
	Scientist Office		○				
	Parasitology Lab.		○				
	Confocal Microscope	○		○		○	
	Amoeba Tissue	○		○		○	
	Common Lab.		○	○			
GF	(Animal House)						
	Breeding Room	●		○		○	
	Infected Breeding Room	●		○	▲	○	○
	Clean Preparation	◎				○	
	Dirty Corridor	◎				○	
	Washing Room	◎				○	
	Receiving Room	◎				○	
	Quarantine Room	◎				○	
	Feed Room		○	○			
	Exam. Room	◎			▲	○	○
	Operation Room	◎			▲	○	○
	Sterilizing	◎			▲	○	○
	Changing Room	◎				○	
	Office		○				
	Animal House Lab.	◎				○	

○：To adapt

◎：Cooling All Fresh Air　●：Cooling/Heating & All Fresh Air

□：Heating　▲：Negative

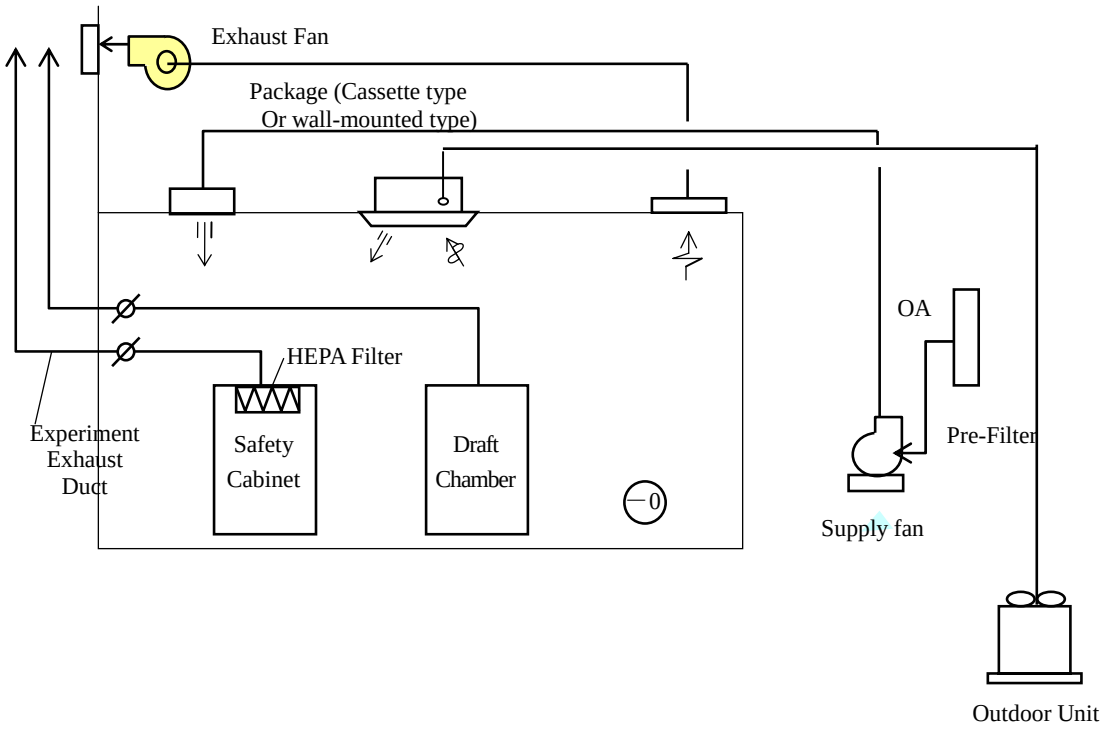


Figure 2-16 Standard Laboratory 1

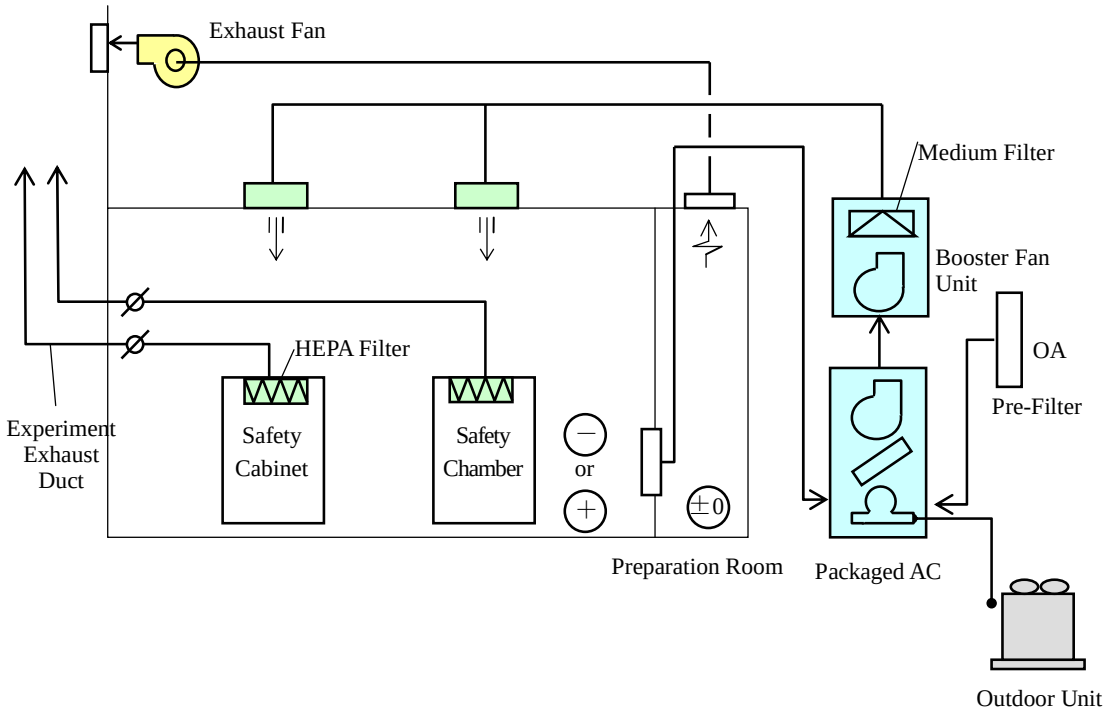


Figure 2-17 Standard Laboratory 2

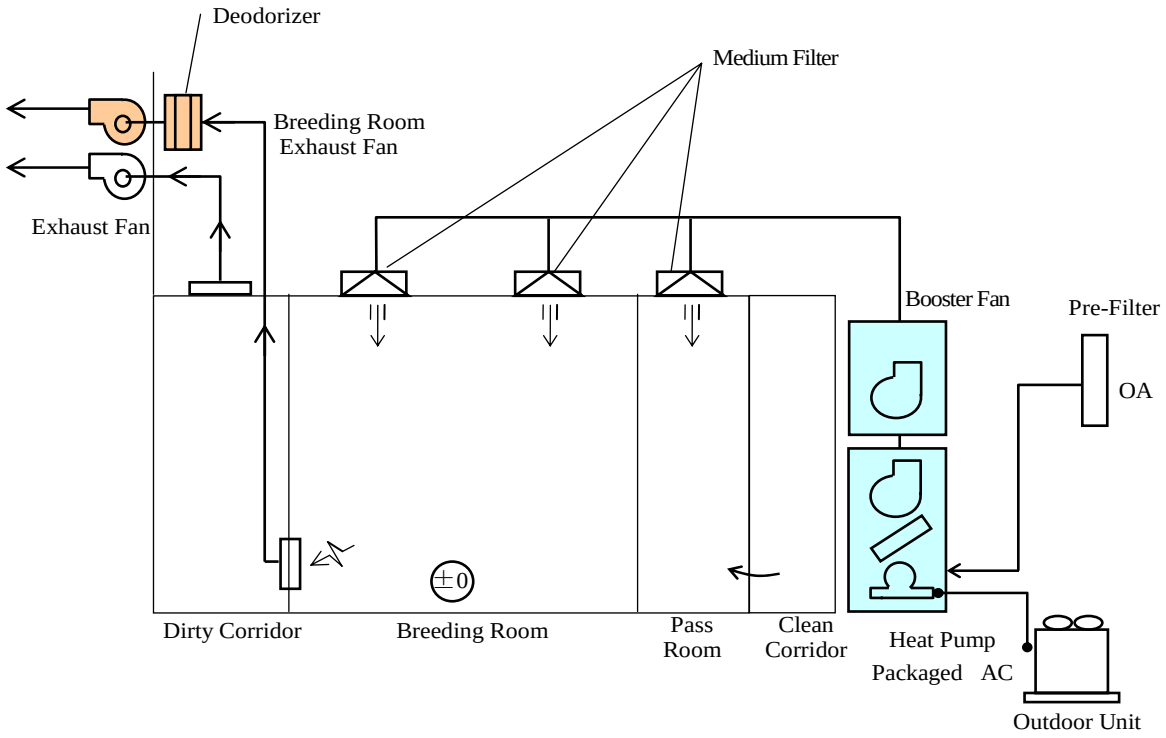


Figure 2-18 Standard Animal House 1 (P2)

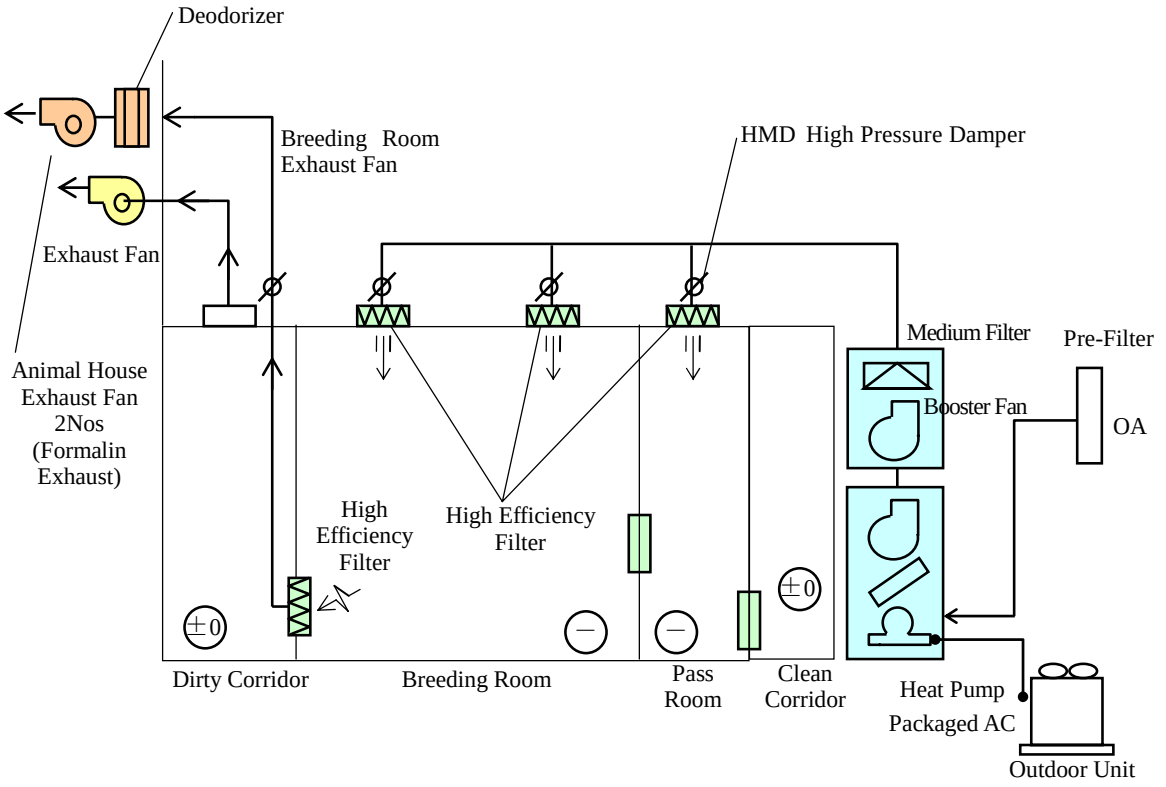


Figure 2-19 Standard Animal House 2 (P2+HEF)

(3) Infrastructure Equipment Plan

1) Power Lead-In: Dedicated power source lead-in will be provided under NICED works from Sureth Chandra Banaergee Road on the south side of the premises to the Project facilities. A branch receiving room of Calcutta Electric Power Service Company (CESC) shall be constructed in the Project facilities by the Japanese side.

2) Water Supply Lead-In: Dedicated city water lead-in will be provided under works of NICED from Sureth Chandra Banergee Road on the south side of the premises to the Project facilities. Since water supply is subject to hour rationing, Japanese side will install a well for exclusive use. As it is necessary to greatly improve the water quality for research water, water purification system will be installed in the water supply system.

3) Drain Pipe Connections: Dedicated pipes shall be laid under NICED works from waste water treatment equipment in the facilities to sewage mains under Sureth Chandra Banergee Road on the south side of the premises.

4) Telephone Line Connections: Telephone lines shall be laid under works from Sureth Chandra Banergee Road on the south side of the premises to the Project facilities. Extension lines will be laid between the existing NICED facilities and the Project facilities by NICED.

2-2-2-6 Construction Material Procurement Plan

Construction materials will be selected with consideration for ease of operation and maintenance to be carried out by the Indian side after completion and for keeping maintenance costs low and for materials that can be easily procured in India and which use construction methods familiar and well established among local contractors.

Basic points to be kept in mind regarding the selection of materials are as follows:

(1) External finishing material

1) Roof

In order to secure long lasting waterproof performance, the roof for reinforced concrete structure will have asphalt built-up waterproofing on the concrete slab covered with protective concrete. Thermal insulation with insulating material of 50 mm will be provided to counter effects of Indian climate.

2) External wall

Partition walls of the building except for the building frame shall be concrete-block masonry or brick work because these materials can be locally obtained at a low price. As local bricks vary in quality, however, those of good quality shall be selected. The base of finish will be towelled mortar screed, and finish shall be done by durable multi-layer spray painting, with joints to be provided to reduce shrinkage.

(2) Internal finishing material

1) Floor

Porcelain floor tiles of 300 x 300 mm shall be used for rooms, including laboratory rooms, corridors and the entrance hall, and those of 200 x 200 m shall be used for places exposed to water such as lavatories. Materials that allow easy cleaning will be employed as much as possible. The electron microscope room and the surveillance network room shall be finished with carpet tile. Stock rooms and machine rooms shall be finished with dust-proof painting on towelled mortar screed.

2) Internal wall

The base of partition walls inside the building shall be concrete-block masonry and general parts shall be finished by painting on a mortar base. Paint materials will be selected for materials which will not gather mold due to dirt stain or moisture shall be selected. Rooms such as research rooms shall be finished in part and lavatory and hot-water service rooms shall be fully finished with porcelain wall tiles.

3) Ceiling

For common rooms, the T-bar grid system with rock-wool sound-absorbing boards, which are commonly used, shall be adopted. For research and experimental facilities, dressed calcium silicate boards shall be used to ensure cleanliness.

4) Fittings and others

External fittings (such as window-related fittings and doors), and aluminium sashes shall be used for water-tightness, air-tightness and weathering resistance. Inside fittings for doors in the clean zone such as laboratory facilities and common laboratories shall be semi-airtight for maintaining air-tightness and shall be made of steel with two-hour fire-resisting performance as required by law. Other fittings will generally be made of wood.

Finishing materials and related construction methods are summarized below.

Table 2-15 Finishing Materials and Construction Methods

Part of the building	Local construction method (including that of the existing buildings)	Construction method to be adopted	Reason for adoption
Roof	Flat roof (with asphalt waterproof thermal insulation)	Flat roof (with asphalt waterproof thermal insulation)	Excels in water proofing property and is generally used in the local area. Maintenance is relatively easy.
External wall	Masonry (block/brick) Mortar painting finish	Masonry (block/brick) Mortar painting finish	Commonly used in the local area and workers have experience with its construction.
Floor	Tile Terrazzo block	Tile	Commonly used in the local area and maintenance is relatively easy and cleaning is also easy.
Inside wall	Tile Painting	Tile Painting	Commonly used in the local area and maintenance is easy.
Ceiling	Grid system ceiling (rock-wool sound absorbing board) Conventional construction method (with a rock-wool sound absorbing board on a plaster board)	Grid system ceiling (rock-wool sound absorbing board) Conventional construction method (with a rock-wool sound absorbing board on a plaster board)	Commonly used in the local area and maintenance is relatively easy. Ceilings shall be sealed to improve airtight efficiency, to cover pipes and to prevent ceilings from becoming dirty.
Fittings	Wood Aluminum Steel	Wood Aluminum Steel	Commonly used in the local area. For doors for which air-tightness is required, fittings shall be made of steel and shall be airtight.

2-2-2-7 Equipment Plan

Equipment list to be provided in the Project is as follows.

Table 2-16 Equipment List

No.	Name of Equipment	Animal House	Molecular Biochemistry	Clinical Epidemiology	Molecular Immunology	Molecular Microbiology	Molecular Parasitology	Molecular Virology	Molecular f Pathophisiology	Electron Microscopy Room	Serum Bank	Strain Storage	Seminar Room	Meeting Room / Administration	Total
1	Atomic Force Microscope									1					1
2	Light microscope (Biological Microscope)	1		1		1									3
3	Bright Field Phase Contrast Microscope with digital camera					1	2	1	1						5
4-1	Inverted Fluorescence - Phase Contrast Microscope with real time video						1								1
4-2	Inverted-Phase Contrast Microscope with digital camera				1			1							2
5	LSM Laser for existing Conforcal Microscope						1								1
6	Scanning Electron Microscope									1					1
7	Multi Angle Laser Light Scattering (MALLS)Photometer		1												1
8	High Performance Liquid Chromatograph		1												1
9	Spectrofluorometer UV/VIS Spectrophotometer								1						1
10	FTIR Spectrophotometer		1												1
11	UV/VIS Spectrophotometer				1	1		1							3
12	UV Transilluminator				1	2	1	1	1						6
13	UV Crosslinker							1							1
14	Differential Scanning and Titration calorimeter		1												1
15-1	Protein Purification System a. HPLC with accessories		1					1	1						3
15-2	Protein Purification System b. FPLC with accessories		1					1	1						3
15-3	Protein Purification System c. Prep Cell		1												1
16	PCR		2		1	2	1	2	1						9
17	Real Time PCR						1	1							2
18	Gel Documentation System with CCD camera		1		1	1									3
19	Gel Blot & Imaging System						1								1
20	Gel Dryer						1								1
21	DNA Array System					1									1
22	DNA Sequencer					1									1
23	ELISA Reader				1				1						2
24	ELIspot Reader				1										1
25	MACS-Magnetic Sell Sorter				1										1
26	Multipurpose Flow Cytometer						1								1
27-1	Electrophoresis Apparatus (submarine gel) with power pack 300V					4									4

No.	Name of Equipment	Animal House	Molecular Biochemistry	Clinical Epidemiology	Molecular Immunology	Molecular Microbiology	Molecular Parasitology	Molecular Virology	Molecular f Pathophisiology	Electron Microscopy Room	Serum Bank	Strain Storage	Seminar Room	Meeting Room / Administration	Total
27-2	Electrophoresis Apparatus (submarine gel) with power pack 3000V						2								2
28	Gel Electrophoresis Apparatus				1										1
29	Isoelectric Focusing 2-D Electrophoresis Apparatus						2								2
30	Mini Trans-blot Transfer Cell with power pack 1,000				2										2
31	Mini-subcell GT with power pack 300 systeml				1										1
32	Pulse Field Gel Electrophoresis Apparatus					2	1								3
33	Vertical Slab Gel Electrophoresis with power pack 300V						3								3
34	Ultrasonicator		1			2		1	1						5
35	CO2 Incubator				2	2	1	2	1						8
36	Incubator (37℃)		1		1	2	1	2	2						9
37	Refrigerator	1	2	1	2	5	1	4	1		4	4			25
38-1	Deep Freezer (-20℃) (400-500L)		1	1	1	2	1	2	1		2	2			13
38-2	Deep Freezer (-20℃) (400-500L)	1													1
39	Deep Freezer (-70℃～-80℃)	1	1		1	2	1	1	1		2	2			12
40	Deep Freezer (-185℃)				1	1	1	1							4
41	Ice Flake Machine				1										1
42	Analytical Ultracentrifuge						1								1
43	High Speed Centrifuge		1		1	1		1	1						5
44	Table Top Centrifuge (refrigerator with various rotors)			1	1	2	1	2							7
45	Microfuge (non refrigerated)		2		2	2	1		1						8
46	Microfuge (refrigerated)		1		2	2	1		1						7
47	Hot Air Oven		1				1		1						3
48	Hybridization Oven					1	1								2
49	Lyophilizer (Freeze dryer)		1			1		1							3
50	Speed Vac					1	1								2
51	Negative Pressure Pump				1	2	2	2							7
52	Baby Compressor for filtration (1/2 hp)				1										1
53	Vacuum Blot Instrument						1								1
54	Bio-safety Cabinet				2	2	1	3		1					9
55	Electronic Balance		2	2	1	2	1	2	2						12
56	Weighing machine with platform			2											2
57	Baby weighing machine			4											4
58	Microwave Oven		1	1	1										3
59	pH meter		2	3				4	2						11
60	Shaker		2		2	2	3	2	1						12
61	Shaker Cum Incubator				1										1
62	Magnetic Stirrer		3		2	3	1	4	2						15
63	Vortex Mixer						2								2
64	Shaking Water Bath (10℃-80℃)		1		2	3			2						8
65	Dry Bath		3				1								4
66	Water Purification System		1		1	2	1	1	1						7
67-1	Autoclave (50L)	1	2		2		1	1	2						9
67-2	Autoclave (Pass through type)	1													1
68	Autopipette				1	2	3								6

No.	Name of Equipment	Animal House	Molecular Biochemistry	Clinical Epidemiology	Molecular Immunology	Molecular Microbiology	Molecular Parasitology	Molecular Virology	Molecular f Pathophisiology	Electron Microscopy Room	Serum Bank	Strain Storage	Seminar Room	Meeting Room / Administration	Total
69	Pipette Washer							1							1
70	BP instrument (Sphygmomanometer)			4											4
71	Stethoscope			5											5
72	Electronic thermometer			5											5
73	Infantometer (Baby height scale)			4											4
74	Ultrasonic Cleaner				1			1							2
75-1	Desk Top Computer with printer										1				1
75-2	Desk Top Computer												1	4	5
76-1	Stainless Steel Rabbit Holding Cages with inbuilt racking device	48													48
76-2	Rabbit Holding Cages	12													12
77	Polycarbonate rodent cages with all relevant accessories	60													60
78	Racks for Item AH2 Rodent Cages	5													5
79	Acrylic Rabbit Restrainer	2													2
80	Universal Rodent Restrainer	2													2
81	Rabbit Ear Bleeder	2													2
82	Rodent Injection Cone	2													2
83	Animal Feeding Needles	12													12
84	Weighing Balance for animals up to 4 kgs	2													2
85	Vacuum Cleaner and Clipper	3													3
86	Aquaguard	2													2
87	Operating Table	2													2
88	Head Band Magnifier with halogen light	2													2
89	Therapy Chamber with accessories	2													2
90	Operation tool set including scissors, knives, forceps and instrument tray	2													2
91	Utility Electrocautery Products	1													1
92	Cage System for infected rabbits	2													2
93	Cage System for infected mice	4													4
94	Rabbit Cage for quarantine	1													1
95	Mouse Cage for quarantine	1													1
96	LCD Projector												1	1	2
97	Overhead Projector												1	1	2
98	Copy Machine													1	1
99	Laser Printer													1	1
100	Scanner													1	1

Specification, component and purpose of use of equipments are as follows.

Table 2-17 Specification of Equipment

No.	Name of Equipment	Q'ty	Main Specification
1	Atomic Force Microscope	1	Light source: Laser diode Detection devices: Photo detector Maximum scanning range : 30μm x 30μm Maximum measuring range: 5μm Maximum sample loading size: 24mm diameter x 8mm Drive range: 6mm x 6mm Scan controller 1) X/Y axis output: ±210V, full-time 16-bit accuracy 2) Z axis output: ±210V, maximum 22-bit accuracy Feedback controller: Digital DSP control system Communication interface protocol: TCP/IP
2	Light microscope (Biological Microscope)	3	Eyepieces: 10X magnification, field of view 18mm Objective lenses: 5X/0.12, 10X/0.25, 40X/0.65 and 100X/1.25 oil Phototube: Binocular Illumination: Kohler illumination, integrated 20W tungsten halogen lamp
3	Bright Field Phase Contrast Microscope with digital camera	5	Eyepieces: 10X magnification, field of view 18mm Objective lenses: 5X/0.12, 10X/0.25, 40X/0.65 and 100X/1.25 oil Binocular Stage: X-Y stage, scanning range 75 x 30mm by control knobs Bright field contrasting Illumination: Kohler illumination, integrated 20W tungsten halogen lamp
4-1	Inverted Fluorescence - Phase Contrast Microscope with real time video	1	Eyepieces: Paired, 10X magnification bright field focusing, field of view 18mm Objective lenses: 5X/0.12, 10X/0.25, 20X/0.30 and 40X/0.50l Phototube: Binocular Specimen Stage: 210 x 290mm Contrast setting: by Differential Interference Contrasting Illumination: Transmitted-light illumination, integrated 12V 35W halogen lamp
4-2	Inverted - Phase Contrast Microscope with digital camera	2	Eyepieces: Paired, 10X magnification bright field focusing, field of view 18mm Objective lenses: 5X/0.12, 10X/0.25, 20X/0.30 and 40X/0.50l Phototube: Binocular Specimen Stage: 210 x 29 Contrasting techniques: Bright field and phase contrast Illumination: Transmitted-light illumination Integrated halogen lamp
5	LSM Laser for existing Conforcal Microscope	1	VIS laser module:Diode laser, Ar, ArKr, HeNe laser UV laser module:Ar, Kr laser
6	Scanning Electron Microscope	1	Resolution: 1) High vacuum mode: 3.0nm at 30kV, 2) Low vacuum mode: 4.0nm at 30kV Magnification: X8 to X300,000, X5 to X7 Accelerating voltage: 0.5 to 30kV Condenser lens: Zoom condenser lens Objective lens: Conical objective lens Specimen stage: Eucentric type, X80 x Y40 x Z5mm to 48mm Specimen size: Maximum 150mm diameter Data processing hardware and software
7	Multi Angle Laser Light Scattering (MALLS) Photometer	1	Laser wavelength: 690 nm Light source: 30mW GaAs linearly polarized laser Detectors: 18 angles Detector resolution: 16-bit Scattering volume: 0.07μL Molecular weight range: Approx. 103 to 109 g/mole (Daltons) Molecular size range: Approx. 10 to 500 nm, typical Data processing hardware and software

No.	Name of Equipment	Q'ty	Main Specification
8	High Performance Liquid Chromatograph	1	System Controller: Display, Floppy disk drive, Input/output terminals- External start input: 1, Output: 4, External power switch control: 1, Optical link: 1, Remote signal: 8, RS-232C, Analysis files: 20 files (parameters, time programs: total 400 steps, 0.01 to 9999.9min.), Fraction collector files: 10 files (parameters, time programs: total 100 steps, 0.33 to 9999.9min.), Auto-injector sequence files or analysis sequence files: 102 steps, Auto-injector sample pretreatment files: 20 files, 250byte/file, Control: Solvent delivery control, auto-injector control, column oven control, detector control, fraction collector control, self-diagnosis, safety functions, etc. Solvent Delivery Unit (Pump Unit) Column Oven, Auto Injector Degasser Photodiode Array Detector
9	Spectrofluorometer UV/VIS Spectrophotometer	1	Light source: Xenon lamp Excitation and emission monochromators: Concave, blazed holographic grating Wavelength scale: 220 to 900nm Wavelength accuracy: ±1.5nm Wavelength slewing speed: Approximately 20,000nm/min Data processing hardware and software
10	FTIR Spectrophotometer	1	Wavenumber range: 7,800 to 350 cm-1, 12,500 to 240 cm-1 Resolution: 0.5～16cm-1 for middle/far IR and 2～16cm-1 for near IR Detector:1) DLATGS for middle/far IR, 2) InGaAs detector for near IR Optical system: Single beam optics Interferometer: Michelson interferometer Data processing hardware and software
11	UV/VIS Spectrophotometer	3	Wavelength range: 190 to 1100nm Wavelength display: 0.1nm incre Wavelength scanning speed: Approx. 3,200nm/min to 160nm/min Noise level: 0.002Abs Detector: Silicon photodiode Light source: 20W halogen lamp Data processing hardware and software
12	UV Transilluminator	6	UV wavelength: 302nm Available gel size: 21 x 25cm Surface intensity: Average: 9,000μW/cm2
13	UV Crosslinker	1	UV output: 15W x 6 pcs. (312nm tube) Exposure setting: Digital Exposure control: 1) Illuminator: Continuous exposing, 2) Cross linker: Automatic control Exposing size: Within 200 x 200mm
14	Differential Scanning and Titration calorimeter	1	A. Differential Scanning Calorimeter Temperature range: -10 to +160°C Cell design: Choice of 0.33mL capillary or cylindrical cells Baseline repeatability: RMS±25 nWatts (±0.4μcal/C) at 1°C/min B. Titration Calorimeter Sensitivity: Detectable heat effect 0.1μJ Baseline stability: Better than ±0.02 μWatt/hr. Temperature range: 0 to 80°C
15-1	Protein Purification System a. HPLC with accessories	3	System Controller Solvent Delivery Unit (Pump Unit) Column Oven:2) Temperature setting range: 4 to 80°C Auto Injector Degasser: Vacuum membrane degassers operate via special semi-permeable tubing Spectrofluorometric Detector:2) Wavelength range: 200 to 650nm Photodiode Array Detector: Wavelength range: 190 to 800nm Workstation
15-2	Protein Purification System b. FPLC with accessories	3	System configuration - System base unit - Workstation (pump unit): Flow rate: 0.01 to 10mL/min - Sample injector valve - UV/VIS detector: Wavelength range: 190 to 370nm with deuterium lamp and 370 to 740nm - Fraction collector - pH Monitor - Sample injector valve Workstation

No.	Name of Equipment	Q'ty	Main Specification
15-3	Protein Purification System c. Prep Cell	1	Sample capacity (mass/volume): 1 to 500mg/0.5 to 15mL Gel tube dimensions: 28 and 37mm ID, 14cm length Elution buffer tank capacity: 900mL Under buffer tank capacity: 2 to 3L
16	PCR	9	Sample capacity: 25 x 0.2mL tubes Temperature control range: 4 to 99°C Temperature distribution: ±0.6°C and ±1.0°C Max. number of cycles: 99
17	Real Time PCR	2	Sample capacity: 96 wells Sample volume range: 10 to 100µL Excitation range: 470 to 505nm Detection: Two photomultipliers Signal to noise ratio: <5nm fluorescence Temperature range: 0 to 105°C Temperature uniformity: ±0.4°C System control and data processing hardware and data processing software
18	Gel Documentation System with CCD camera	3	Camera resolution: 768 x 494 pixels Sensitivity: 0.1ng of ethidium bromide-stained DNA Sample size: 25 x 26cm System control and data processing system and data processing software
19	Gel Blot & Imaging System	1	Scan area: 35 x 43cm Pixel size: 200, 100 and 50µm, selectable Pixel accuracy: ±0.15% or better Light source: red laser diode (635nm) and blue LED (450nm) Data format: 16-bit, TIFF. System control and data processing system and data processing software
20	Gel Dryer	1	Type: Vacuum drying Drying surface: 35 x 45cm Gel capacity: 2 large format gels, sixteen 7x8cm gels Operating temperature: 50 to 90°C Vacuum pump
21	DNA Array System	1	A. Imaging system Storage capacity: 300 DNA microarrays per stacker Throughput: 30 arrays in 45 min. Excitation laser: 635nm (red)/7mW output, 532nm (green)/10mW output Imaging area: 5 x 7mm in object focal plane B. Detection system High-performance CCD camera, with 16-bit dynamic range Signal to noise ratio: 75dB at 90% saturation Image resolution: 13µm Computer: System control and data processing computer
22	DNA Sequencer	1	Sample requirement: Samples are automatically injected directly from a single 96- or 384-well micro plate Laser: Argon-ion multiline, single mode, 488nm and 514.5nm Electrophoresis: Capillary electrophoresis, samples are simultaneously injected into the parallel four-capillary array Spectral array detection Read length of sequencing analysis data: Greater than 1200 base or 600 base pairs Data processing hardware and software
23	ELISA Reader	2	Wavelength range: 400 to 750nm OD range: 0 to 3.5 OD Resolution: 0.001 OD] Number of filters: Up to 8 filters Photo detector: 9 silicone photo diodes Light source: 20W tungsten-halogen lamp Display: LCD Micro Plate Washer
24	ELIspot Reader	1	Digital color camera: 512 x 512 pixels 2-axis durable ball bearing stage with high precision servo motors Scan speed: Entire 96-well plate in/within 1 min Workstation
25	MACS-Magnetic Sell Sorter	1	Isolation capability: 10^7 cells/sec Column capacity: 4 x 10^9 Input volume: 0.5 to 50mL

No.	Name of Equipment	Q'ty	Main Specification
26	Multipurpose Flow Cytometer	1	Lasers and laser power out of the fiber: - 488nm Coherent sapphire solid state, 13mW-20mW - 633nm Uniphase HeNe air-cooled, 10mW-20mW - 407nm Point Source Violet solid state, 10mW-17mW Sample acquisition rate: Maximum acquisition rate 70,000 events per second with 8 parameters Optical coupling: Quartz cuvette flow cell Forward scatter detector and filters: Photodiode detector Side scatter detector: Photomultiplier Fluorescence detectors and filters: Three fixed fiber apertures Sample tube collection devices --- microtubes, 12 x 75mm, and 15mL Data processing hardware and software
27-1	Electrophoresis Apparatus (submarine gel) with power pack 300V	2	System configuration - Sub-cell unit - UV-transparent tray 15 x 10cm and 15 x 20cm - Two casting gates - Gel caster - Leveling bubble - Two 1.5mm thick comb (15- and 20-well) - Power supply unit, 300V Gel size: 15x10, 15x15, 15x20cm or 15x25cm
27-2	Electrophoresis Apparatus (submarine gel) with power pack 3000V	2	System configuration - Sub-cell unit - UV-transparent tray 15 x 10cm and 15 x 20cm - Two casting gates - Gel caster - Leveling bubble - Two 1.5mm thick comb (15- and 20-well) - Power supply unit, 300V Gel size: 15x10, 15x15, 15x20cm or 15x25cm
28	Gel Electrophoresis Apparatus	1	System configuration 1) Under buffer tank: 1 set 2) Lid with cable: 1 set 3) Electrode assembly: 1 set 4) Cramping frame: 1 set 5) Buffer dam: 1 set 6) Glass plate set with 0.75mm spacer: 5 sets 7) Casting frame: 2 pcs. 8) Comb, 0.75mm thick, 10-well: 2 pcs. 9) Casting stand: 1 set 10) Sample loading guide for 10-well comb 11) Power supply unit: 1 set
29	Isoelectric Focusing 2-D Electrophoresis Apparatus	1	Isoelectric focusing cell consists of 1) Basic unit 2) 7, 11 and 17cm focusing trays with lids 3) One pack each of 7, 11 and 17cm re-hydration/equilibration trays with lids 4) 2 pairs of forceps Temperature control and operating range: 10 to 25°C within ±0.5°C Power output: 50 to 10,000V
30	Mini Trans-blot Transfer Cell with power pack 1,000	1	Configuration - 2 gel holder cassettes - 4 fiber pads - 1 package (7.5 x 10cm, 50 sheets/package) of precut blot absorbent filter paper - Modular electrode assembly - Bio-ice cooling unit - Lower buffer chamber - Lid with power cables - Power supply unit, 1000V
31	Mini-subcell GT with power pack 300 system	1	System configuration - Sub-cell unit - UV-transparent tray - Casting gates - Two 1.5mm fixed-height comb (8- and 9-well) - Power supply unit, 300V

No.	Name of Equipment	Q'ty	Main Specification
32	Pulse Field Gel Electrophoresis Apparatus	2	System configuration - Gene control unit - Gene electrophoresis unit - Electrode kits - Gel casting accessories - Cooling unit
33	Vertical Slab Gel Electrophoresis with power pack 300V	2	System configuration - Glass plates - 16cm clamp assemblies - Cams - Dual gel casting stand with leveling base and level - Buffer dam - Spacer-mate alignment template - Wonder wedge plate separation tool - Power supply unit Gel size: Maximum 18 x 16cm
34	Ultrasonicator	4	Output: Not less than 550 watts Horn for oscillation: 1/2" titanium disruptor horn, or equivalent Amplification: Variable amplitude control
35	CO2 Incubator	8	Capacity: 150 liters Temperature range: Room temp. +3°C to 55°C Constant humidity: 95%rH or higher CO_2 measuring and control range: 0 to 20%, control accuracy: ±0.1% O_2 measuring and control range: 1 to 20 or 5 to 90%, control accuracy: ±0.1%
36	Incubator (37℃)	9	Temperature range: Ambient +5°C to 80°C Temperature uniformity: 3°C at 37°C Inner door: Tempered glass door Capacity: 300L Number of shelves: 5 pcs
37	Refrigerator	16	Effective capacity: More than 500 liters Temperature range: 2 to 14°C Door: Two sliding glass doors
38	Deep Freezer (-20℃)	14	Effective capacity: more than 500 liters Temperature control range: -20 to -30°C Temperature display: Digital
39	Deep Freezer (-70℃～ -80℃)	12	Effective capacity: more than 500L Temperature range: -20 to -86°C Temperature display: Digital LED
40	Deep Freezer (-185℃)	4	Effective Capacity: 128 liters Temperature range: -100 to -159°C Temperature control: Microprocessor control Temperature display: LED digital display Internal dimensions: 500 x 450 x 572Hmm
41	Ice Flake Machine	1	Ice making capacity: 90L/day]Storage capacity: 28 L Shape of ice: Flake
42	Analytical Ultracentrifuge	1	Maximum speed: 80,000rpm Maximum RCF: more than 600,000xg Temperature setting range: 0 to +40°C Temperature control accuracy: ±1°C Speed control accuracy: ±100rpm
43	High Speed Centrifuge	5	Maximum speed: 22,000 rpm Maximum RCF: 51,200xg Maximum capacity: 4mL tube x 1,000 Temperature range adjustment: -20 to +40°C
44	Table Top Centrifuge (refrigerator with various rotors)	5	Maximum speed: 23,000rpm Maximum RCF: 50,000xg Temperature range: -19°C to +40°C Timer: 9 hrs and 59 min.
45	Microfuge (non refrigerated)	8	Maximum rotational speed: 16,400rpm Maximum RCF: 25,000xg Display: Digital Timer: Up to 99 min. or continuous run Safety functions

No.	Name of Equipment	Q'ty	Main Specification
46	Microfuge (refrigerated)	7	Maximum rotational speed: 13,200rpm Maximum RCF: 16,200xg Temperature setting: -9 to 40°C in 1°C increment Display: Digital Timer: Up to 99 min.
47	Hot Air Oven	3	Temperature range: 40 to 260°C Temperature control: Microprocessor Capacity: 70 liters Inner dimensions: 450 x 400 x 400mm Display: Digital Timer
48	Hybridization Oven	2	Temperature range: Room temp. +5°C to +80°C Temperature control accuracy: ±0.1 to 0.2°C Shaking speed: 5 to 60rpm Shaking plate size: 260 x 230mm
49	Lyophilizer (Freeze dryer)	3	Cooling temperature: -45°C Dehumidifying capacity: 4L/time Internal volume: Approximately 200mm diameter x 395mm Refrigerator: Air-cooling closed type, 400W HFC
50	Speed Vac	2	Rotation speed: 1,400rpm, fixed Vacuum: 20hPa Temperature pre-selection: Room temperature, 30°C, 45°C and 60°C Diaphragm pump
51	Vacum Pump	7	Flow rate: Up to 31L/min Diaphragm type Vacuum gauge Pressure gauge
52	Baby Compressor for filtration (1/2 hp)	1	Output: 0.4kW Maximum pressure: 0.69MPa Speed: 1200 rpm Displacement air volume: 48L/min.
53	Vacuum Blot Instrument	1	System configuration - Vacuum pump - Vacuum regulator - Base with vacuum stage - Porous vacuum plate - Reservoir seal O-ring - Sealing frame - Assorted window gaskets - Lid
54	Bio-safety Cabinet	9	External dimensions: 1,300W x 900D x 1,860Hmm Clean level: Class 100 Dust collection: More than 99.99% at 0.3μm particle pass Wind velocity: 0.5m/sec. Wind volume: 22 m^3/min. Air flow: Air circulation current Sterilization lamp
55	Electronic Balance	12	Weighing capacity: 220g/82g Minimum display: 0.1mg Display: Digital Pan diameter: Approx. 80mm diameter
56	Weighing machine with platform	2	Weighing capacity: 150kg Readability: 50g Platform size: Approximately 310 x 320mm Display: Digital
57	Baby weighing machine	4	Baby: 14kg readability 20g Baby tray dimensions: 10-7/8" x 22-1/4" Display: Digital
58	Microwave Oven	3	Power: 900W or more Capacity: At least 30 liters Timer
59	pH meter	8	pH range: -2.00 to 19.999 pH resolution: Variable 0.001/0.01/0.1 Conductivity resolution: 0.01μS/cm to 1,000mS/cm, autoscaling mV range: -1999 to +1999 mV resolution: 0.1 Temperature range: -30 to 130°C

No.	Name of Equipment	Q'ty	Main Specification
60	Shaker	11	Shaking speed: 25 to 250rpm Shaking width: 25mm Loading capacity: 1) Test tubes, 16mm OD: 120 pcs. 2) Erlenmeyer flasks, 100mL: 10 pcs Display: Digital Timer
61	Shaker Cum Incubator	1	Temperature range: +4°C to +70°C Temperature control precision: ±0.3 to 1.0°C Temperature control: PID control Temperature display: Digital Cooling method: Compressor, air cooling closed type Shaking mode: Reciprocating and orbital shaking, changeover Shaking width: 10 to 40mm, variable Shaking speed: 20 to 200rpm Shaking table size: Approx. 400 x 300mm, table with spring net Timer
62	Magnetic Stirrer	15	Stirring capacity: 5000mL in beaker Speed range: 150 to 1,500rpm Hot plate temperature: Maximum 350°C Plate size: 185 x 190mm
63	Vortex Mixer	2	Stirring style: Horizontal eccentric stirring Stirring speed: 1 to 2500rpm Available tubes: Microtube, test tube, 200mL measuring cylinder etc.
64	Shaking Water Bath (10℃ -80℃)	8	Operating temperature range: Room temp. +5 to 80°C Temperature controller accuracy: ±0.03°C Number of strokes: 20 to 140rpm Shaking width: 40mm Capacity: 100mL flask x 20 pcs. and 16-18mm OD test tube x 225pcs.
65	Dry Bath	2	Temperature range: Room temp. +5°C to 200°C Temperature control accuracy: ±0.1 to 0.4°C Number of aluminum blocks: 2
66	Water Purification System	7	System Configuration - Pretreatment system - Main treatment system - Storage reservoir Pretreatment system:Resistivity and conductivity of product water, TOC, Bacteria count Main treatment system:Resistivity, TOC, Bacteria, Pyrogens Storage reservoir capacity: 30 liters
67-1	Autoclave	9	Chamber capacity: 53 liters Temperature setting range: 105°C to 132°C Temperature control: Microprocessor control Maximum operating pressure: 216kPa
67-2	Autoclave	1	Capacity: more than 420 liters Chamber size: 650x650x1000mm or more Temperature range: 105 to 132°C Temperature display: Digital Pressure range: 0 to 2 bar Pass through doors
68	Autopipette	5	2μL, 10μL, 100μL, 1000μL, 5000μL, 10mL, incl. 8Channel 100μL, 8Channel 300μL
69	Pipette Washer	1	Basket dimensions: 136mm diameter x 500mm Output power: 250W Oscillating frequency: 28 kHz Required water volume: 2 to 5L/min.
70	BP instrument (Sphygmomanometer)	4	Type: Aneroid type with gauge holder Pressure range: 0 to 300mmHg Air inflation: Latex inflation
71	Stethoscope	5	Chestpiece: Zinc chrome plated Binaural: Contour type brass chrome plated Eartips: Black plastic Rubber tubing: 22” length
72	Electronic thermometer	5	Size: 128 x 8 x 17mm Display: Digital Power source: Battery DC1.5V Alarm: Buzzer alarm

No.	Name of Equipment	Q'ty	Main Specification
73	Infantometer (Baby height scale)	4	Type: Expansion and contraction type Application: for new born and babies
74	Ultrasonic Cleaner	2	Cleaning capacity: 16 liters Bath material: Stainless steel Oscillating frequency: 28 kHz Output power: 200W Temperature setting range: Room temp. +5°C to 60°C
75-1	Desk Top Computer with printer	1	Processor: Pentium IV 933MHz or faster RAM: 512MB or higher Hard disk: At least 40GB Disk drive: 3.5 inch floppy disk, CD-RW drive Keyboard: Standard keyboard with mouse, or equivalent Display: At least 17 inch, color, VGA or SVGA Printer: A4 size ink jet color printer
75-2	Desk Top Computer	5	Processor: Pentium IV 933MHz or faster RAM: 512MB or higher Hard disk: At least 40GB Disk drive: 3.5 inch floppy disk, CD-RW drive Keyboard: Standard keyboard with mouse, or equivalent Display: At least 17 inch, color, VGA or SVGA
76	Stainless Steel Rabbit Holding Cages with inbuilt racking device	48	Cage size: 18 ” (W) x 24 ” (D) x 18 ” (H), or 350-450(W) x 480-500(D) x 350-420(H)mm Material: Stainless steel Accessories for the cage1) Removable bottom tray for refuse disposal2) Spot welded wire grid floor3) Food hopper4) Grass stand5) Bottle holder with 650mL capacity bottle and siphon tube6) Data label holder Rack for cages to hold 6 cages1) Fabricated from 1 inch square hollow pipe and angle2) Material: Stainless steel, mirror finish3) Casters for rack: Heavy duty 4 ” diameter casters
77	Polycarbonate Rodent Cages	60	Type: Polycarbonate made, autoclavable, see-through, with stainless steel wire lid along with extra stainless steel cover on the built-in feed compartment to protect the feed from outside pest Cage 1) Size: 11 ” x 9 ” x 5.5 ” /290 x 220 x 140mm2) With graduated marks, along with Stainless steel screw cap and silicon washer 300mL capacity with 2 ” long straight nozzle3) With Stainless wire grill to fit the cage bottom, rests 30mm above the cage floor, and with handle for inserting and removing
78	Racks for Item AH2 Rodent Cages	5	Cage holding capacity: 16 cages of item AH2Fabricated from 1 ” square hollow pipe and angle Material: Stainless steel, mirror finish Casters for rack: Heavy duty 4 ” diameter casters Rack size: Approximate 39 ” x 21 ” x 60 ”
79	Acrylic Rabbit Restrainer	2	Size: 14 ” -19 ” x 6 ” x 7 ” or 360-480 x 150 x 190mm Restraining weight range: 4 to 7kg Neck opening: Adjustable 4.4 to 6.4cm diameter Sliding back plate: 4.1cm access hole Adjustable vertical head restraint bars prevent rabbit from side-to-side during ophthalmological studies Floor: Non-slip floor
80	Universal Rodent Restrainer	2	A. for 10-15g to 30-40g animals: 1 set B. for 110-150 to 300g animals: 1 set Material: Clear acrylic plastic, see-through Restraining area: Adjustable Removable raised inner floor, tailgate Headgate fits into any of four positions for various sizes of rodents
81	Rabbit Ear Bleeder	2	Ear punch, with spring return handle: 1 Gauge: 1 Aluminum tags numbered consecutively from 1 to 500, 6 x 10mm: 500 Aluminum washers, 95mm diameter: 500 Plastic washers in 5 colors (red, blue, green, orange, white), 9.5mm: 100 each
82	Rodent Injection Cone	2	Type: Transparent Cone opening: 102mm (4 ”) diameter Cone length: 146mm (5.75 ”) Applicable animals: 15 to 600g
83	Animal Feeding Needles	12	Length: 50.8mm (2 ”) Material: Stainless steel
84	Weighing Balance for animals up to 4 kgs	2	Weighing capacity: 6200g Minimum display: 0.01g Animal holding bucket

No.	Name of Equipment	Q'ty	Main Specification
85	Vacuum Cleaner and Clipper	3	1) Clipper shield 2) Vacuum cleaner with cart 3) Small animal clipper Vacuum cleaner:HEPA filter
86	Aquaguard	2	Purification process: 1) Intake from tap water2) Active carbon purification (for 8000 liters per cartridge)3) Ion exchange resin purification (for 200 liters per cartridge)4) Hollow fiber filter (0.1μm) purification (for 2000 liters per cartridge) Purified water volume: 0.5L/min.
87	Operating Table	2	Type: Medium animal hydraulic base operating table Dimensions: Table top: 470 x 1070mm Heating element capacity: 250W
88	Head Band Magnifier with halogen light	2	Headband magnifier: 4X Light: Halogen 6V, 10WACCESSORIES with AC adapter
89	Therapy Chamber with accessories	2	Chamber size: 580 x 360 x 310mm Chamber door: Transparent Supply of moist and/or oxygen enriched air to a single animal.
90	Operation tool set including scissors, knives, forceps and instrument tray	2	Operation tool: Scissors, Forceps, Round knurled chuck handles, Bowman knife, Micro dissecting knife, Micro dissecting knife
91	Utility Electrocautery Products	1	Input power: 75W Selected function and LED indication
92	Cage System for infected rabbits	2	
93	Cage System for infected mice	4	
94	Rabbit Cage for quarantine	1	
95	Mouse Cage for quarantine	1	
96	LCD Projector	2	SVGA: 800 x 600 Screen size: 30” to 300” Zoom lens: Yes
97	Overhead Projector	2	Pick-up device: 1/3 ” progress scan CCD Effective pixels: 1024 (H) x 768 (V) Shooting area: 380 x 285mm maximum, 38 x 28.5mm minimum Zooming: 10X
98	Copy Machine	1	Speed: 55 pages per minute Resolution: 600 x 600 x 8-bit Memory (pre-collation): 128MB Reduction/enlargement: 25% to 400% Paper size1) A4/Letter (210 x 297mm) 2) Legal (8.5 x 14”)
99	Laser Printer	1	Speed: 45 pages per minute Processor speed: 333MHz System disk (HDD): 9.1GB Memory (pre-collation): 320MB to 512MB Reduction/Enlargement: 25% to 400%
100	Scanner	1	Input scan speed: 28ppm Send doc. Size: A3, B4, A4, B5, A5 Resolution: 200x200dpi, 400x400dpi, and 600x600dpi

2-2-3 Basic Design Drawings

Basic design drawings are attached in the following pages.

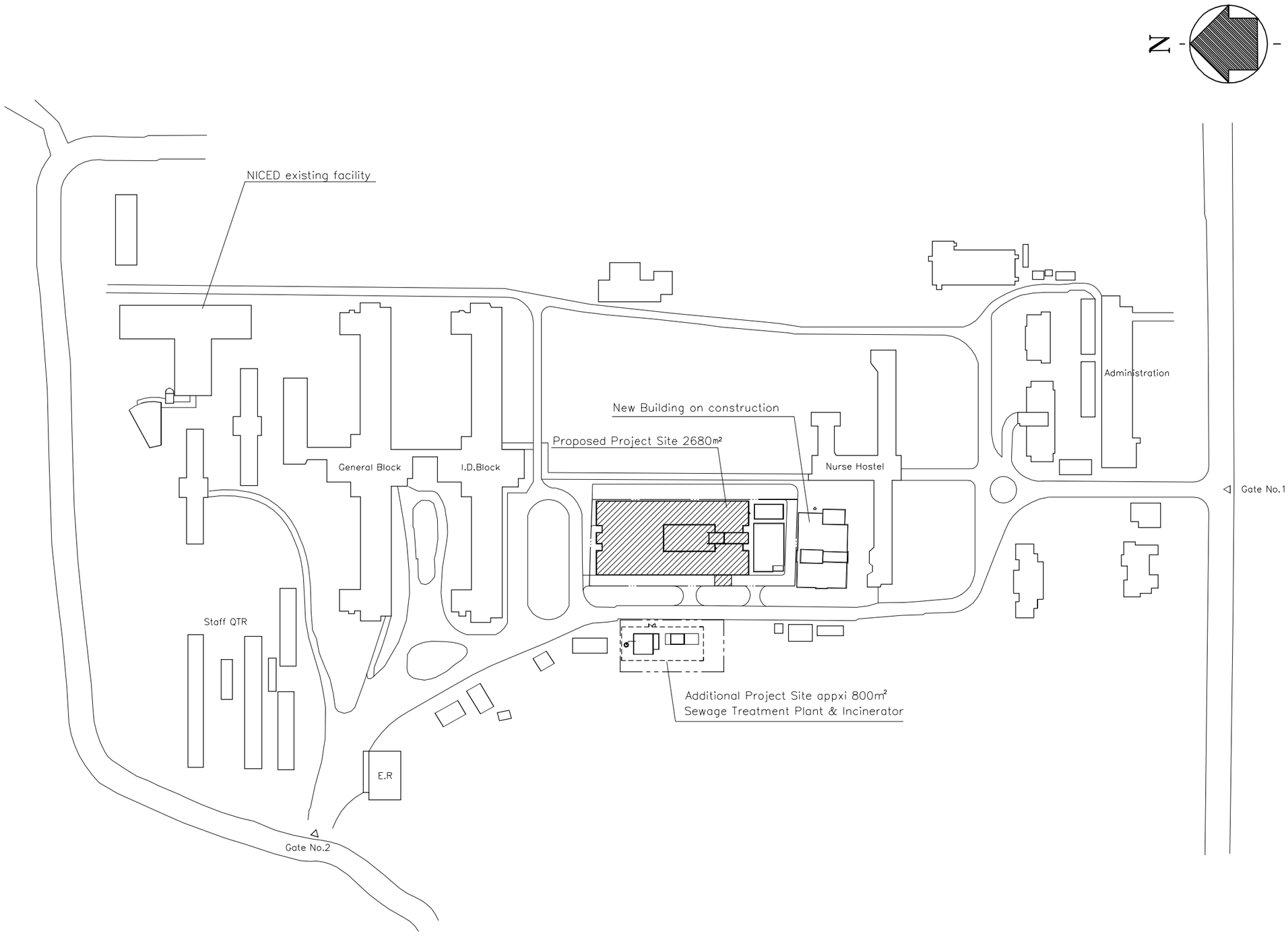
Table 2-18 List of Drawings

Number	Name of Drawings	Scale
1	General Site Plan	1/1600
2	Site Plan	1/400
3	Ground Floor Plan	1/200
4	1st Floor Plan	1/200
5	2nd Floor Plan	1/200
6	3rd Floor Plan	1/200
7	Roof Floor Plan	1/200
8	Elevation	1/400
9	Section	1/400

The total floor area of the planned facilities is as follows.

Table 2-19 Floor Area of Project Facilities

	Area to be built（m^2）
Roof Floor	261
3rd Floor	1,466
2nd Floor	1,466
1st Floor	1,466
Ground Floor	1,443
Balcony	550
Generator Room	61
Plant Building	23
Incinerator	70
Total	6,806



The Basic Design Study On The Project for Founding A Collaborative Diarrheal Disease Research And Control Center In India	TITLE GENERAL SITE PLAN SCALE 1/1600	NO. 1

I.D.Block

CONNECTING CORRIDOR

Nurse Hostel

ROTARY

WASTE DISPOSTAL FROM ANIMAL HOUSE

ENTRANCE TO ANIMAL HOUSE

PROPOSED NICED FACILITY

PROPOSED GENERATOR BUILDING

ECHIMMNY

CPWD Sub Station

NEW WELL

CPWD (On Construction)

REFERENCE

EXIT GATE

GUARD HOUSE

MAIN ENTRY

EXIT GATE

GUARD HOUSE

ENTRY GATE

MAIN ENTRAT

EXISTING ACCESS ROAD

STACK SMOKE

INCINERATOR PROPOSED

PROPOSED SEWAGE TREATMENT PLANT

FENCE (MESH FENCE H=1500)

PARKING (OUT OF SCOPE)

EXISTING PUMP OFFICE

EXISTING PUMP HOUSE

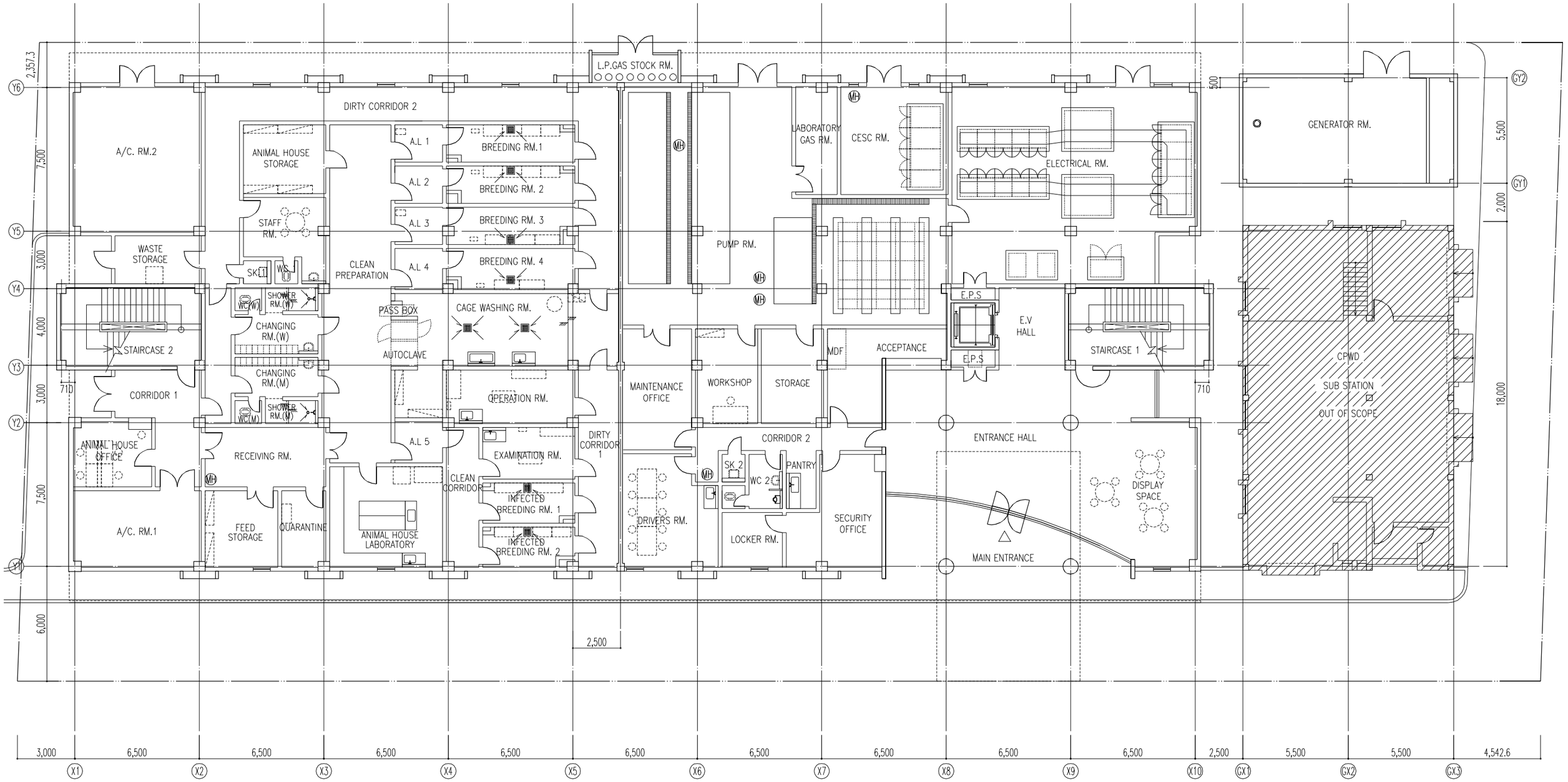
SMOKE STACK

EXISTING I.D.HOSPITAL INCINERATOR

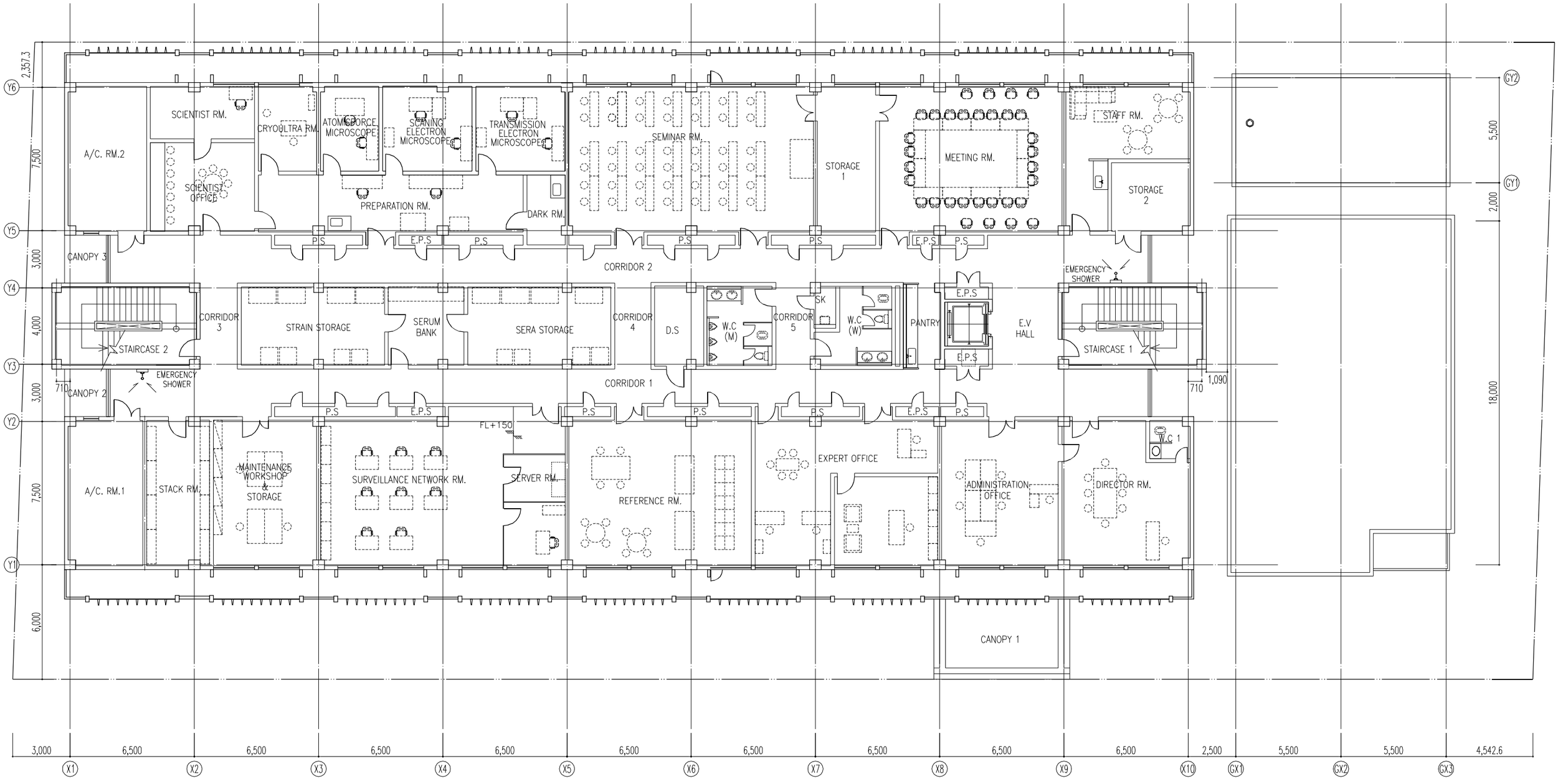
N

REGEND	
SITE BOUNDRY	
FENCE	
GATE	

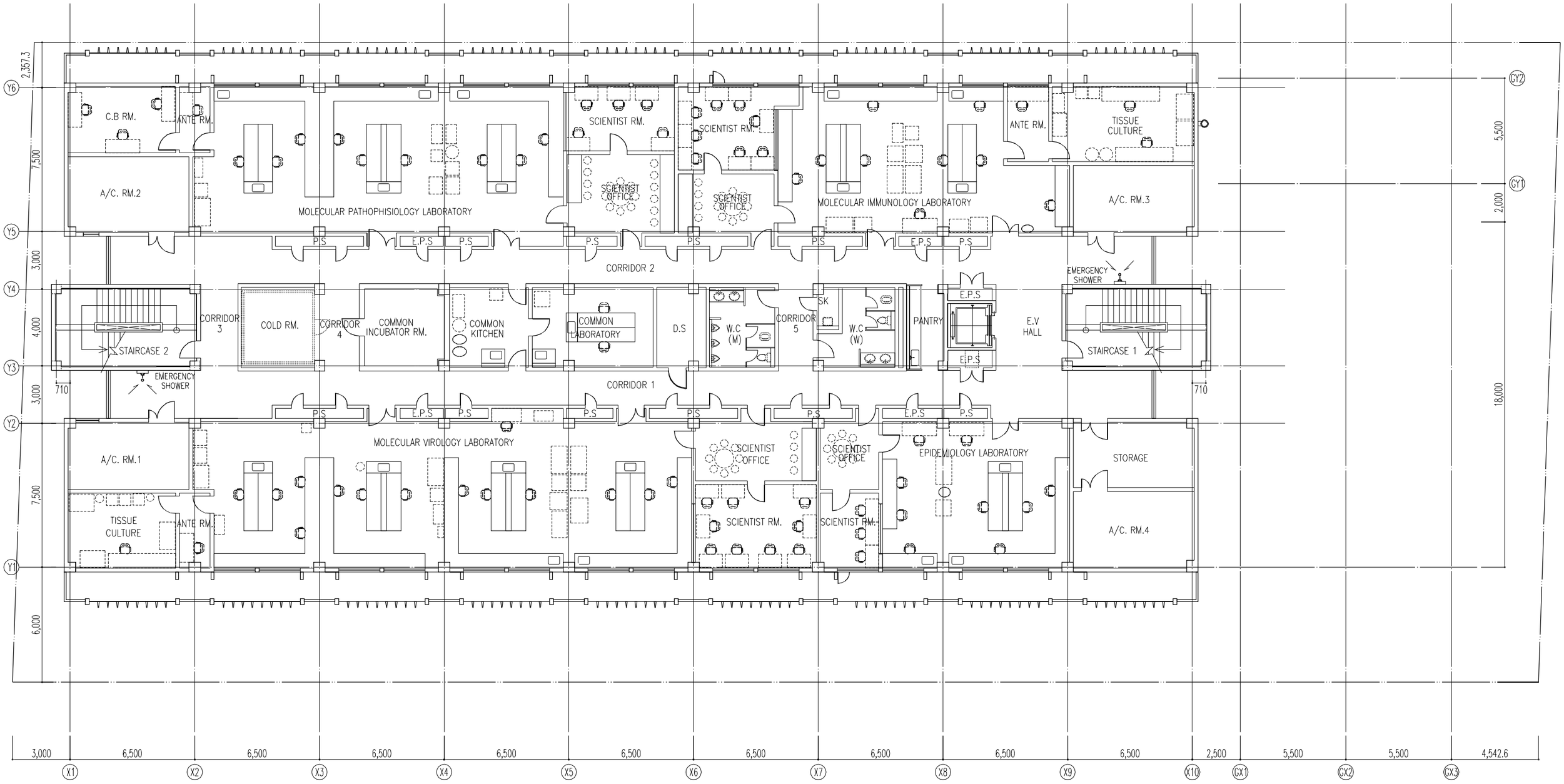
The Basic Design Study On The Project for Founding A Collaborative Diarrheal Disease Research And Control Center In India	TITLE: SITE PLAN SCALE: 1/400	NO. 2



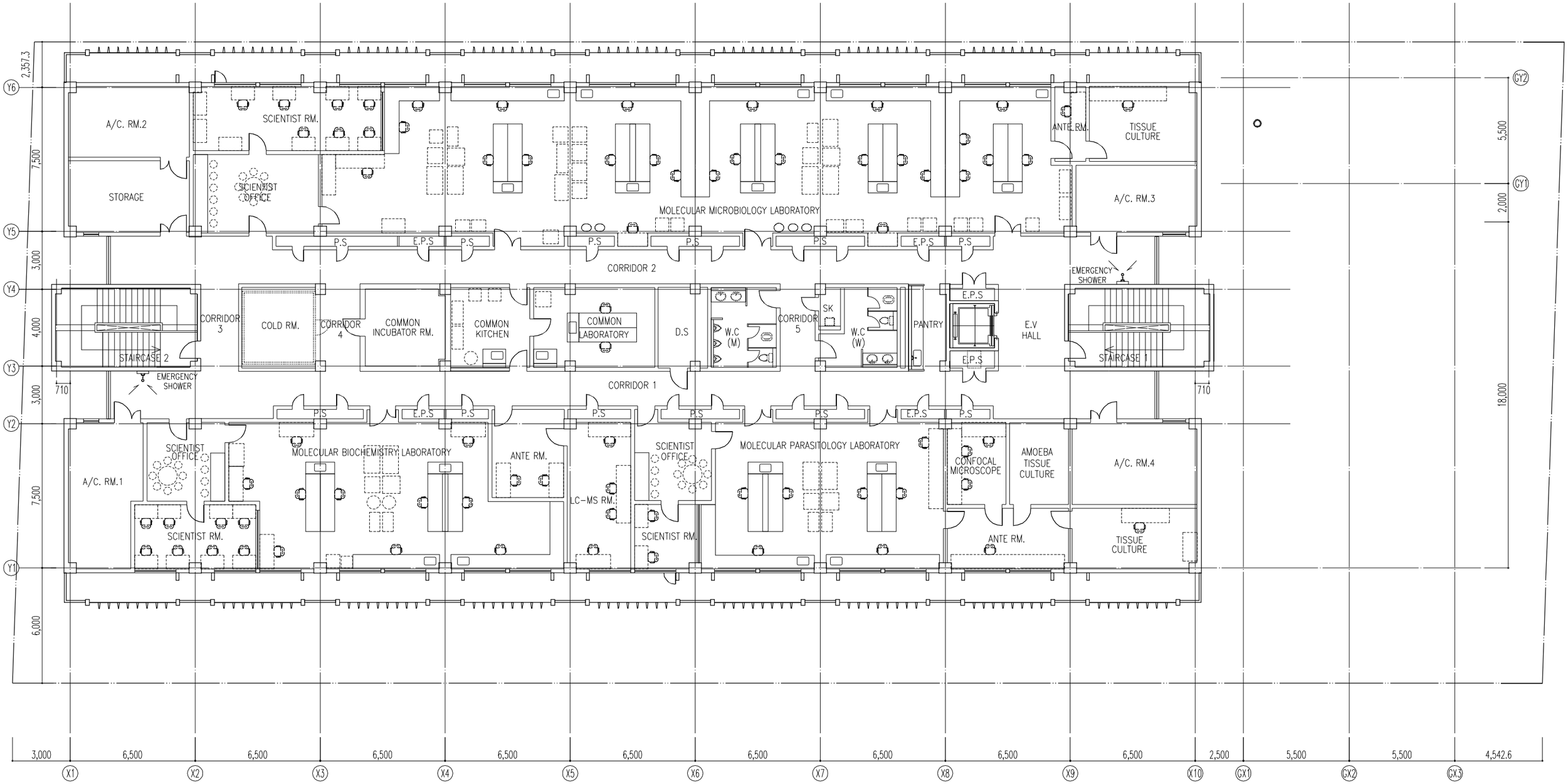
The Basic Design Study On The Project for Founding A Collaborative Diarrheal Disease Research And Control Center In India	TITLE GROUND FLOOR PLAN SCALE 1/200	NO. 3



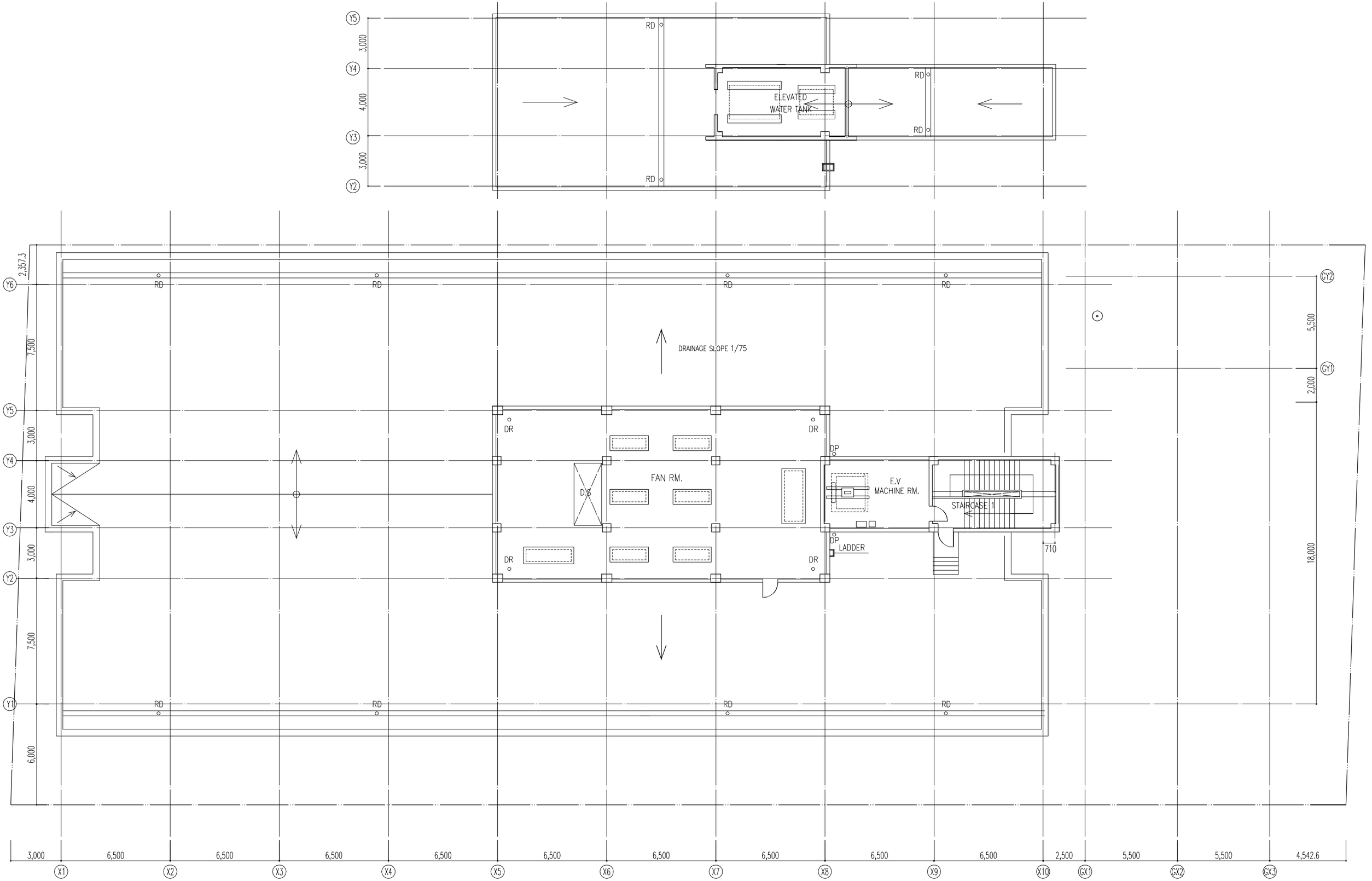
The Basic Design Study On The Project for Founding A Collaborative Diarrheal Disease Research And Control Center In India	TITLE: 1ST FLOOR PLAN SCALE: 1/200	NO. 4



The Basic Design Study On The Project for Founding A Collaborative Diarrheal Disease Research And Control Center In India	TITLE 2ND FLOOR PLAN SCALE 1/200	NO. 5

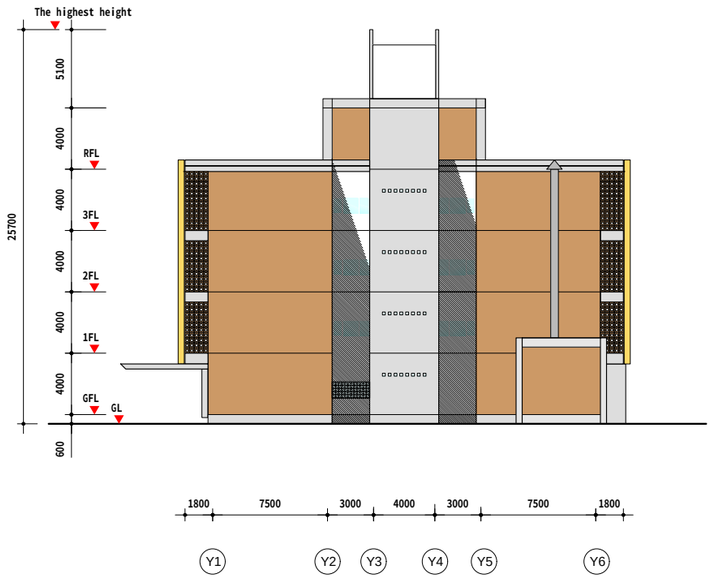


The Basic Design Study On The Project for Founding A Collaborative Diarrheal Disease Research And Control Center In India	TITLE 3RD FLOOR PLAN SCALE 1/200	NO. 6



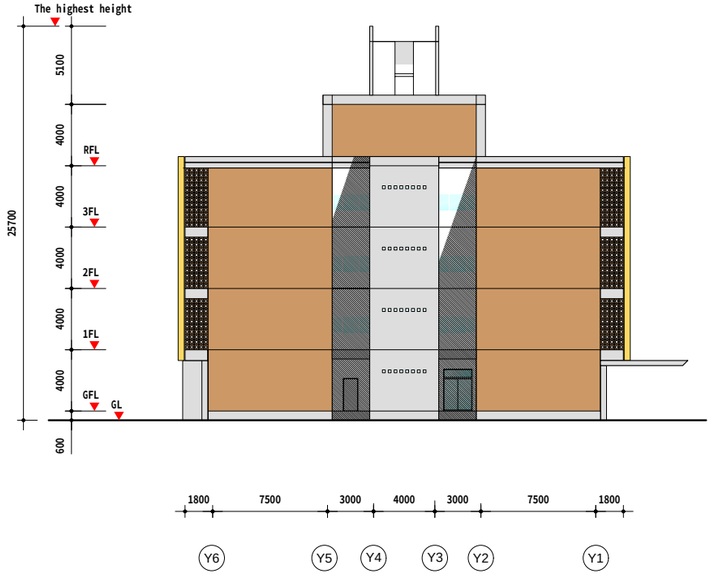
The Basic Design Study On The Project for Founding A Collaborative Diarrheal Disease Research And Control Center In India	TITLE ROOF FLOOR PLAN SCALE 1/200	NO. 7

WEST ELEVATION



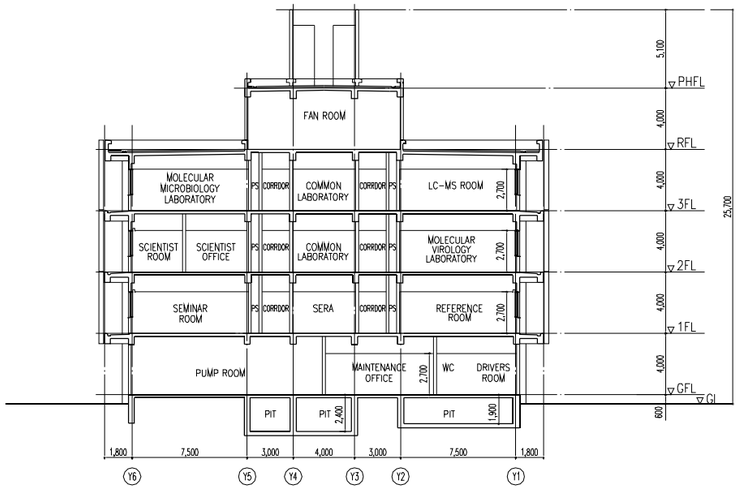
SOUTH ELEVATION

EAST **ELEVATION**

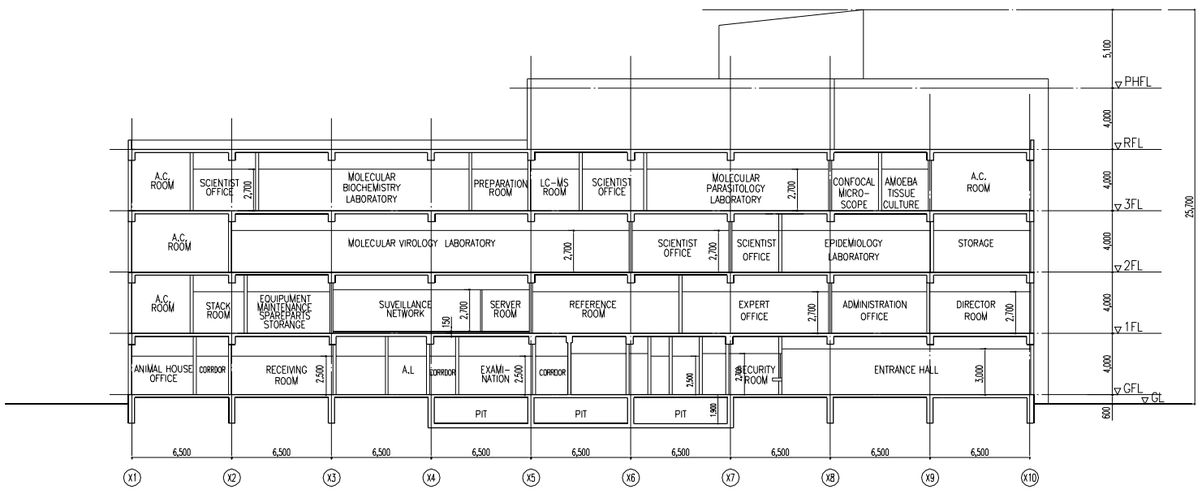


NORTH **ELEVATION**

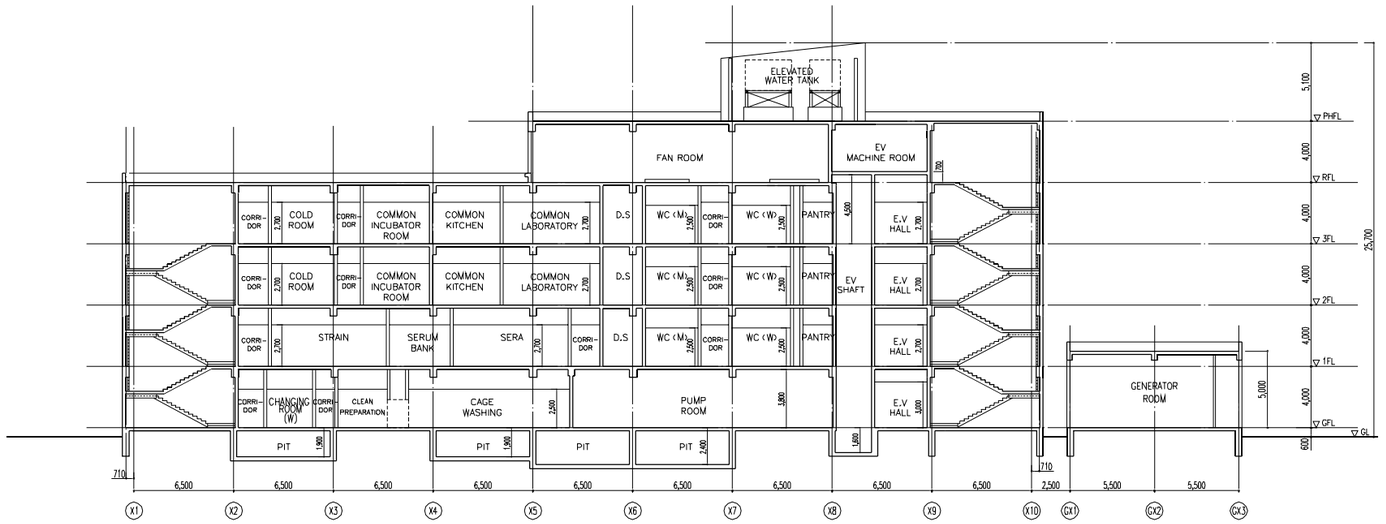
The Basic Design Study On The Project for Founding A Collaborative Diarrheal Disease Research And Control Center In India	TITLE: ELEVATION SCALE: 1/400	NO.: 8



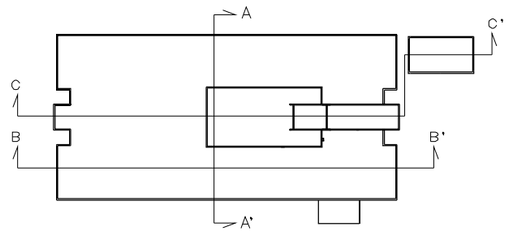
A—A' SECTION



B—B' SECTION



C—C' SECTION



KEY PLAN

The Basic Design Study On The Project for Founding A Collaborative Diarrheal Disease Research And Control Center In India	TITLE SECTION SCALE 1/400	NO. 9

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

(1) Implementation System

The Project will be implemented under Japanese Grant Aid Scheme, after the Exchange of Notes (E/N) is signed on the Project, by and between the Governments of Japan and the Government of India after the decision by the Cabinet of the Government of Japan.

The responsible organization is MOH, which will prepare the necessary budgetary measures for the implementation of Indian obligations under the Project. The implementing organizations are ICMR and NICED. They will enter into agreements/contracts with a Japanese consultant, a Japanese construction company and a Japanese company for equipment procurement for the works for implementation of the Project, will execute the budget of the Indian side, and will take all other actions that may be required.

The relation among the responsible organization, the Implementing organization and the contractors is as follows:

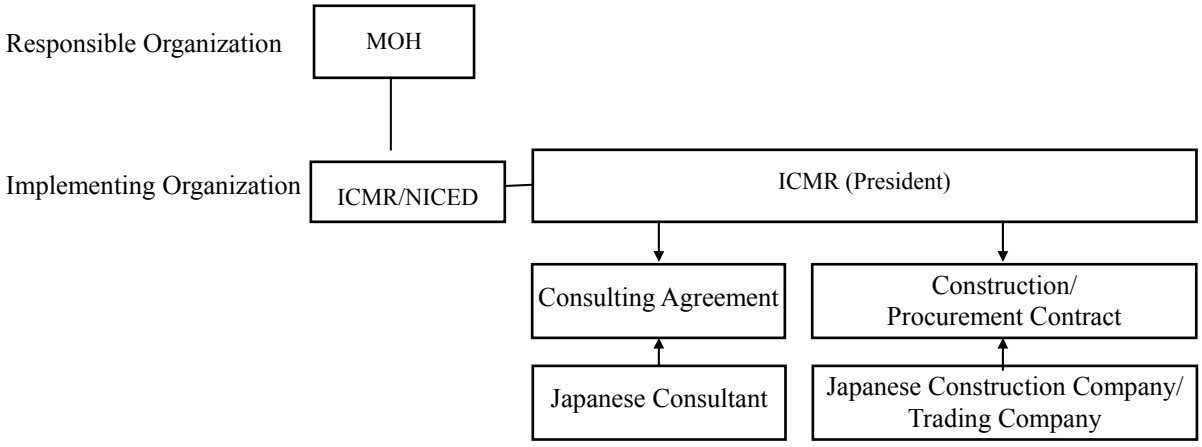


Figure 2-20 Organisation for Implementation of the Project

In order to promote the smooth implementation of the Project on the Indian side, the following matters shall be carried out by ICMR and NICED:

① Arrange Banking Agreements (B/A) and Authorization to Pay (A/P) procedures for execution of payments through new accounts to be opened for the implementation of the Project by Ministry of Finance of the Government of India (hereinafter "MOF") after signing of E/N.

② Enter Consultancy Agreement with a Japanese consultant and issue A/P under the terms of the Agreement.

③ Enter Construction Contracts/Equipment Procurement Contracts with construction and equipment procurement companies and issue A/P under the terms of the Contracts.

④ Issue work permits to the personnel of the Japanese consultant and the construction and equipment procurement companies for work in India under the Project.

⑤ Obtain tax exemption for equipment and materials to be imported from Japan or third countries

⑥ To take all necessary procedures to obtain approval at the provincial level (SFC) for the implementation of the Project and secure counterpart funds that may be necessary on the Indian side

⑦ Undertake all necessary procedures for application and obtain authorization of building construction and acquisition of all necessary licenses, permission and authorizations related to construction.

⑧ Securing and appointing personnel needed to implement the Project

⑨ Securing and implementing the budget on the Indian side needed to implement the project

⑩ Procuring all materials and equipment required for operation, maintenance and administration of the Project facilities and equipment.

⑪ Securing the budget for maintenance, management and operation of the facilities including the maintenance of the equipment mentioned in ⑩ above and execution thereof.

(2) Project Implementation Process

The Project shall be promoted by NICED who will serve as implementing organization on behalf of ICMR regarding examination and approval of the detailed design and of contents of tender documents (detailed design drawings, specifications, etc.), inspection of construction works and other matters.

The flow of procedures for implementation of the project is shown in the following figure.

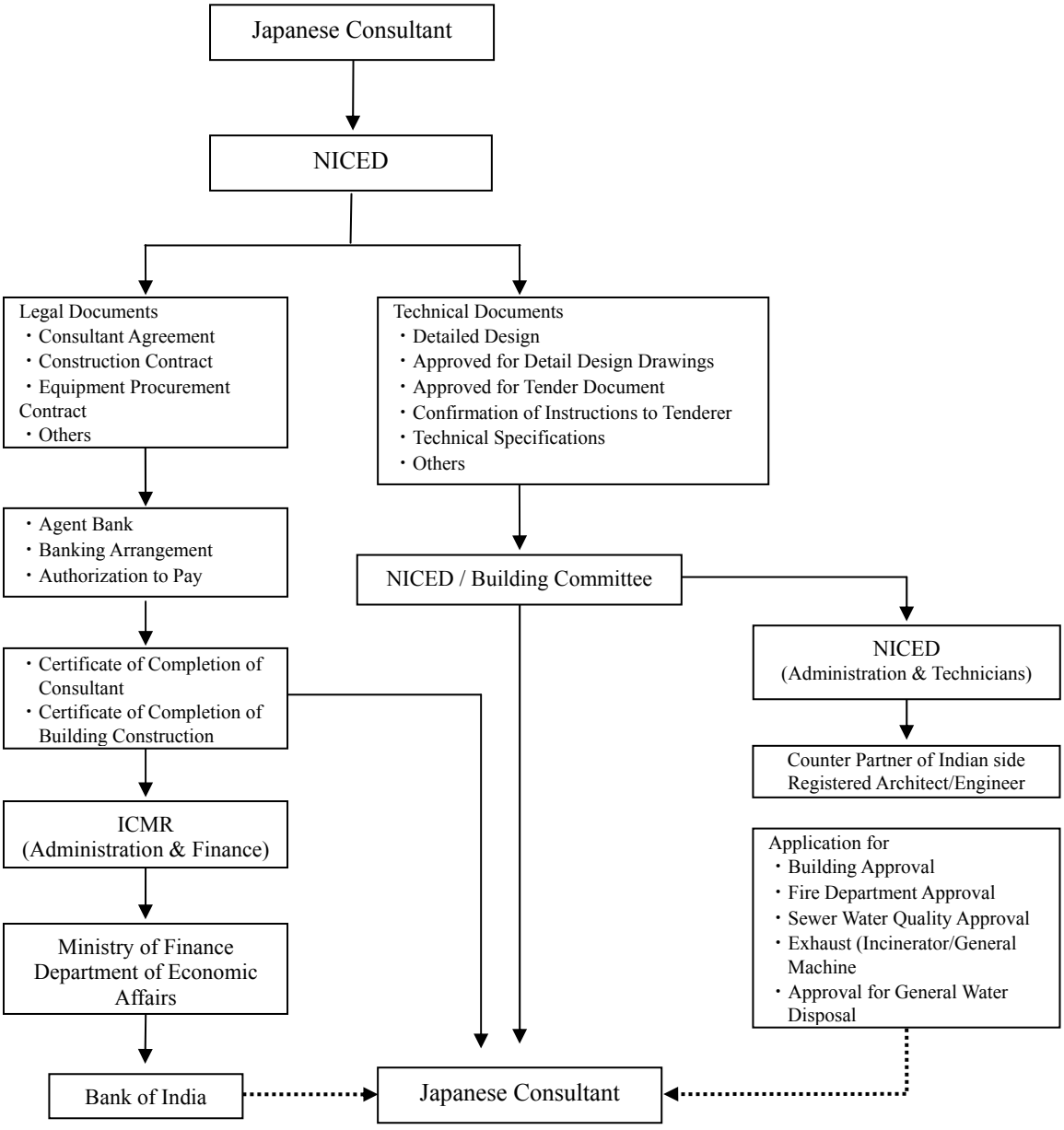


Figure 2-21 Procedures for Implementation of the Project

Although NICED is a central government institution, the new laboratory building plan must be approved subject to laws including NBC codes and West Bengal State building codes (Kolkata Municipal Corporation Building Rules 1990). The Basic Design Study team found that it takes about 6 months for all approvals to be obtained from Indian side for this Project.

Therefore, the complete schedule of the Project must include consideration for procedural requirements for both Japanese and Indian sides in order to secure smooth implementation of the Project.

It was confirmed between Indian side and Basic Design Study team that Indian side will include appointment of registered Architect or chartered Engineer who will have responsibility for submission for construction approval.

(3) Consultant

After the E/N is concluded, ICMR will conclude a consultant agreement with a Japanese consultant, regarding detailed design and construction supervision and will receive verification of the Government of Japan on the agreement. For the smooth implementation of the Project, it is important to conclude a consultant agreement as early as possible after the conclusion of the E/N. After concluding the agreement, the consultant will prepare the detailed design drawings (Tender Documents) on the basis of the Basic Design Study Report with the approval of NICED. Then ICMR will approve the tender documents, in accordance with the procedures mentioned above. The consultant will carry out the assistance services for tender and the construction supervision services based on the agreement.

(4) Contractor

The Works relevant to the Project include construction work for building of facilities and equipment works for procurement and installation of equipment. The contractors will be appointed from among qualified Japanese legal entities through an open competitive tender with restrictions on qualifications of tenderer.

ICMR and NICED will conclude contracts on construction and equipment works with the successful tenderers, and receive the verification on the contracts from the Government of Japan.

(5) Utilization of Local Engineers

Construction supervision, in particular the quality control of concrete in pile works and structural works is important. In order to conduct frequent quality control including that of the concrete plant, two local construction engineers shall be employed in addition to a Japanese resident engineer. The Project facility is a research facility which requires cleanliness suitable

for cell study at the molecular level. The execution of works for mechanical and electrical building systems will require higher precision than that for general buildings. Local mechanical/ electrical engineers with high technical capabilities will be employed.

The following people will be also utilized: accounting staff, draftsmen for preparation of working drawings, security guards, storeroom clerks, administrative staff, and drivers and so on.

(6) Utilization of building constructors and dispatching of engineers

Construction of the Project shall be done by Japanese construction firm as the main contractor of construction works under contract with ICMR. It is expected that the firm will have contract with Indian construction firm as the sub contractor to execute construction works.

Sizes of top three Indian construction firms are approximately 8,000 to 3,500 employees and of 60 to 10 billion yen for annual contracted orders. It is a characteristic of Indian company that the number of employees is larger for order volume compared with Japanese companies.

The capability of building constructors is rated by CPWD, which belongs to the Ministry of Urban Development, into Classes 1 to 5 according to their business size and the results published.

It is recommended that the Japanese firm will appoint their sub contractor from Class 1 in consideration of the high level of precision required for the facilities for conducting molecular level research and maintaining of cleanliness.

Additionally, technical guidance and project management by experienced Japanese engineers are absolutely necessary for the construction of the laboratory.

Meticulous supervision and guidance of construction methods, quality control and safety management by employing local engineers under experienced Japanese engineer must be carried out.

2-2-4-2 Implementation Conditions

(1) Temporary Work Plan

As the construction site for the Project is small with only 3,480 m^2 in total, little space can be set aside for temporary construction works necessary for construction. Therefore, space for temporary construction will have to be borrowed from the government of the State of West Bengal, the owner of land adjoining the Project site, during the period of the work. In addition, since the west side of the Project site is the main premises road for patients of the hospital and their visitors, a temporary enclosure will be made or measures against falling objects will be taken to prevent accidents such as injury to a third party. The road on the east side of the hospital which runs from Gate 1 will be used as a temporary access road for the I. D. Hospital with its thoroughfare widened. A plan for temporary construction was studied in order to minimize effects on normal activities of the hospital. The work site will be temporarily fenced around so as to restrain scattering of dust accompanying works as much as possible. An access gate will be built at two points on north and south boundaries. It is anticipated that the gateway on the south side will be mainly used to carry in equipment and materials and that on the north side will be used by people concerned with works, and light-weight vehicles. Guards will be stationed at both gates full-time. Construction cost of work to widen the road on the east side, which will be used temporarily in the period of works, and temporary construction of fences and others shall be included in the construction cost of the facilities in the Project.

If construction vehicles use the main road, they will be mixed with general vehicles and foot passengers and will have to share the premise road. Therefore, a safe access road shall be acquired, security guards shall be positioned and the premise road will be kept clean and clear of obstacles. The selection of the construction material stockyard, temporary construction offices and a batching plant will be undertaken after sufficient consultation with NICED, in order to minimize impact on activities of the hospital.

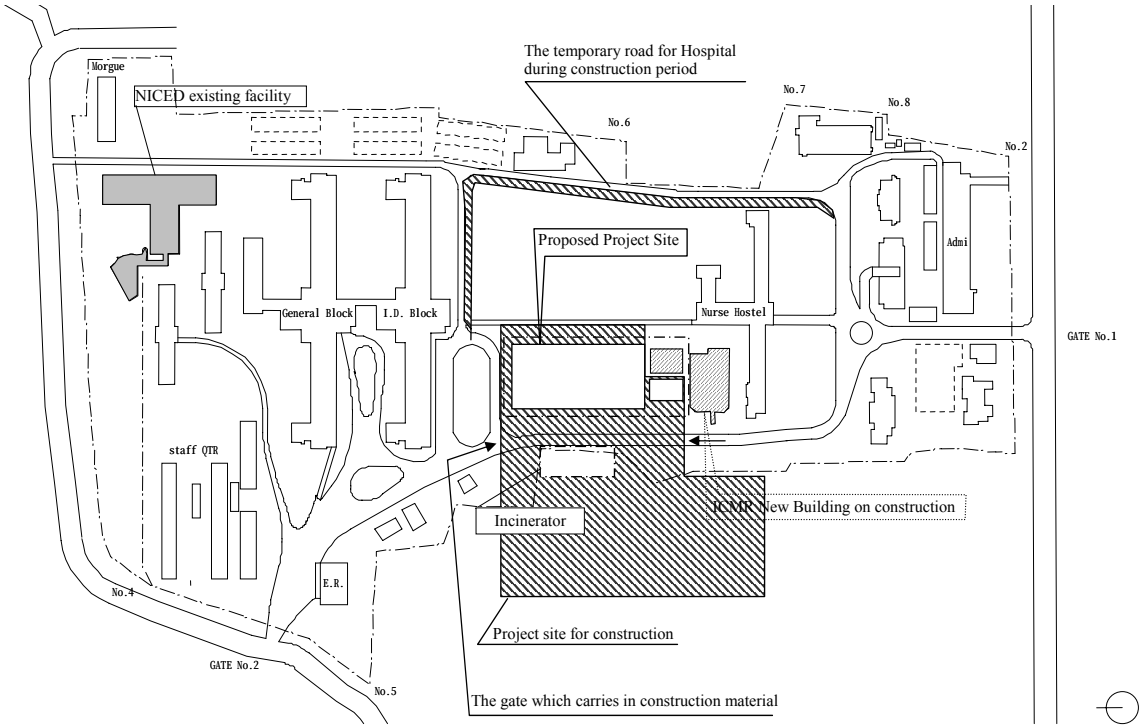


Figure 2-22 Project Site and Surrounding Area

(2) Procurement of Materials

In order to facilitate repair, maintenance and management after handing over the Project facilities, the basic principle will be to procure locally available materials and equipment. Although there is a wide variety of materials and equipment of variable quality and specifications which are imported from countries in Southeast Asia in addition to those produced in India, it is necessary to devise a plan to procure materials and equipment with an allowance of time so as not to delay the works, because there is a limit to quantity of imported articles and it is also necessary to be careful about variations in quality. Aluminium window sashes and semi-air lock type doors, for which the minimum performance required as facilities of biological research laboratories must be ensured, will be procured from third countries.

(3) Special Construction Methods

This project facility is a 4 storey reinforced concrete structure and no special construction method shall be adapted.

According to the survey conducted by Basic Design Study, it is recommended to include quality control for concrete works because there are only two numbers of plants for ready mixed concrete in Kolkata City, located 30 to 60 minutes distance by car from the Project site, which have no strict quality control measurement for the production at the plants. The plants also have only limited capacity of supply.

2-2-4-3 Scope of Work

The following table clarifies the division between the Japanese obligations and the Indian obligations for the smooth implementation of the Project.

Table 2-20 Japanese Obligation and Indian Obligation

Works to be borne by Japanese side	Works to be borne by India side
1. Building construction work (Including standard movable & fixed furniture and fixtures).	1. Preparation of construction site ・Preparation of construction site and site clearance ・Relocation, demolition and diversion of existing structures including any underground object, ID Hospital incinerator, sewer piping, water supply piping and electrical cabling.
2. Electrical Work Portion of Sub-station electrical system for the Project building, power and main wiring system, lighting and socket outlet system, telephone system, LAN piping system, Automatic fire alarm system, Public address system, cable TV cabling and lightning protection system	2. Infrastructure connection work ・ New incoming power line to the Project facility and connection cost to CESC system. ・ New incoming telephone line to new MDF and internal telephone cabling between existing MDF room & the proposed Project MDF. ・ New water supply main line to proposed water reservoir of the Project. New sewer main line to the proposed sewage treatment plant of the Project from city main sewer line.
3. Mechanical work Water supply system, Drainage system, Hot water supply system, LPG gas supply system, Sanitary fixtures, Fire protection system, Air conditioning and Ventilation system, Equipment monitoring system	3. Landscape work ・Road outside the Project Site, incl. diversion road for patient access to ID Hospital from S.C Banerjee Road. ・Gardening and planting ・Security fence installation work around site boundary ・Parking space ・Sewage treatment plant space
4. Special work Generator system and AVR power supply system, Laboratory waste water treatment system, Animal house waste water treatment, Total sewage treatment system Water treatment system and deep well Lab. Gas supply system Incinerator for Lab/animal solid waste	4. Furniture and equipment ・Curtain for windows (rail work will be done by Japanese side), ・Blinds, ・Ordinary office furniture.
5. Landscape work Maintenance road, Exterior lighting fixtures. Security fence for Sewage treatment plant and Incinerator	5 Application for related Authority approval and submission of design drawings
6. Equipment work Procurement and installation of equipment	6 Equipment work Relocation of existing laboratory equipment

2-2-4-4 Consultant Supervision

A Japanese consultant firm will conclude the Agreement for Consultants Services with ICMR and the said consultant will prepare the tender documents for construction and equipment procurement. After assisting in tendering of the Project, upon the award of construction and equipment procurement contract(s), the consultant will commence the construction supervision services. The purpose of supervision services executed by the consultant is to oversee the construction and the procurement and installation of equipment and to ensure quality and construction progress is consistent with the contents of contract documents. To secure this, the consultant as a supervisor will issue guidance, advice and coordination to the contractor(s) regarding quality of works and progress of construction schedule. The consultant services include the following items:

(1) Assistance in tendering of construction and equipment procurement contract(s)
This item includes the preparation of tender documents necessary to select the contractor(s) for construction and equipment procurement and also the issuance of Tender Notice, acceptance of tender applications, pre-qualification of applicants, holding of explanatory meeting for tendering, distribution of tender documents and accepting and evaluation of tenders. Furthermore, the consultant will lend guidance and assistance for the contract signing procedure between the successful tenderer and ICMR.

(2) Issuing guidance, advice and coordination to contractor(s)
The consultant will examine the construction schedule, construction plans, procurement plan of construction materials and procurement & installation plans for equipment submitted by the contractor(s) and issue guidance, advice and provide coordination.

(3) Inspection and approval of working drawings and shopdrawings prepared by contractor(s), subcontractors and suppliers.
The consultant will inspect the work drawings, shop drawings and other construction documents and provide approval along with any necessary guidance.

(4) Confirmation and approval for construction materials and production equipment
The consultant will inspect the proposed construction materials and equipment for conformity with the contract documents and issue approval of their use and procurement.

(5) Inspections of works

The consultant will conduct factory inspections of construction materials and procured equipment; attend construction tests and conduct tests to measure quality and performance compliance as necessary.

(6) Progress report of construction and installation.

The consultant will ascertain the status of construction schedule and site conditions and report on the construction progress to concerned agencies of both countries.

(7) Confirmation and verification of trial run results and final inspection upon completion.

The consultant will conduct completion inspections for buildings, ancillary systems and equipment procurement and conduct trial runs of the equipment to confirm that the completed facilities meet the performances stipulated in the contract documents and submit a completion inspection report to ICMR and NICED.

(8) Construction Supervision Organization

The consultant will assign one resident engineer to perform the activities described above. In addition, the consultant will send experts in relevant fields to the site, as necessary, following the progress of the construction works. The experts will conduct discussions, inspections, guidance and coordination necessary for project implementation. Furthermore, the consultant will assign experts in Japan to establish a back up system. Finally the consultant will report to the concerned agencies of the Government of Japan concerning relevant matters on the progress of the Project, payment procedures, completion and handing over and other matters.

A draft Supervision Organization is shown in the following figure.

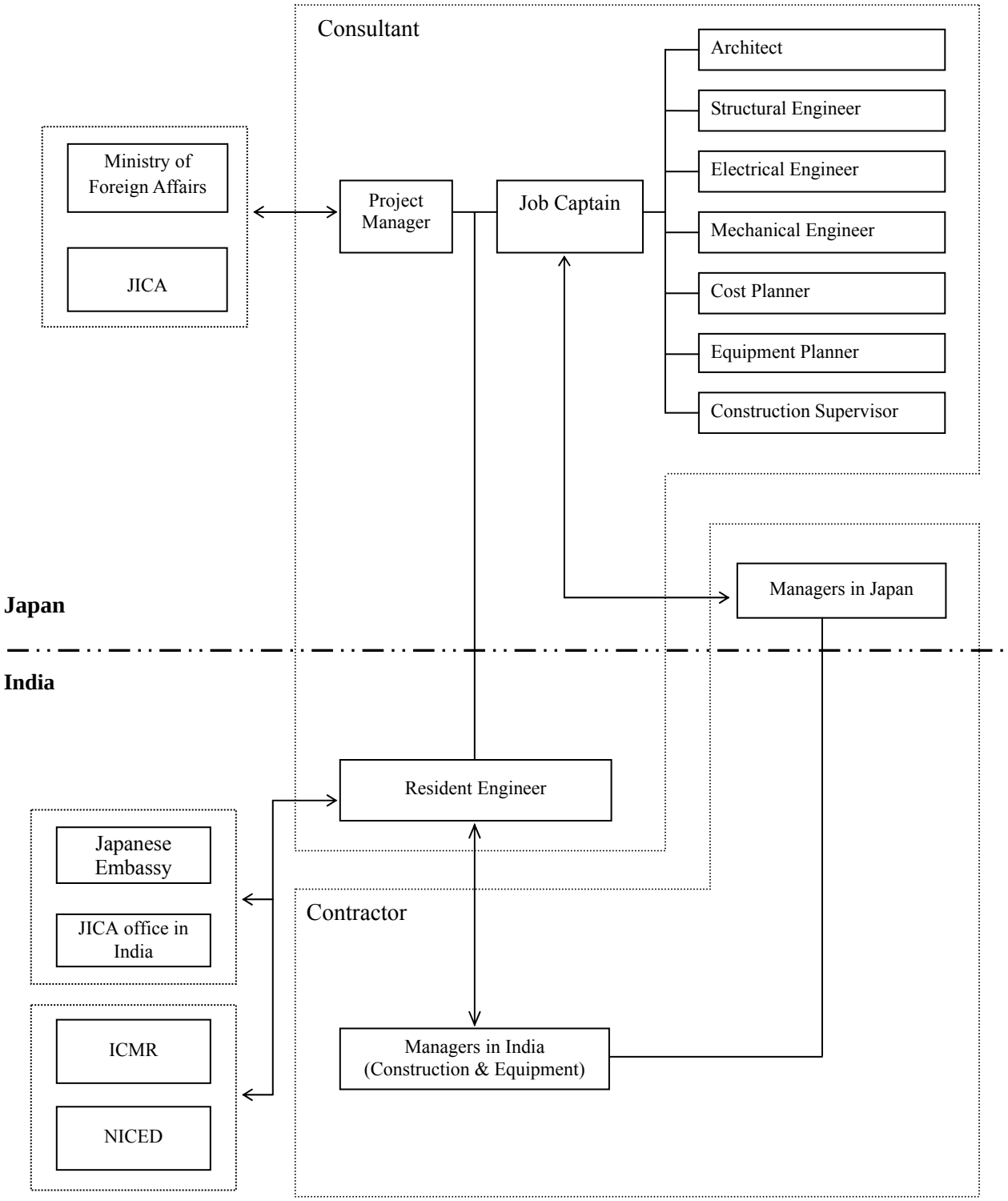


Figure 2-23 Supervision System

2-2-4-5 Quality Control Plan

The quality control of concrete shall be performed according to Indian Standard as a general rule.

(1) Materials

・ Cement

The following Ordinary Portland Cement shall be used conforming to IS.

33 Grade Ordinary Portland Cement conforming to IS 269

43 Grade Ordinary Portland Cement conforming to IS 8112

53 Grade Ordinary Portland Cement conforming to IS 12269

・ Aggregate

The aggregates shall conform to IS 383.

1) Fine Aggregate

Crushed stone or sand should be used as fine aggregate. Although river sand is usually used in Kolkata, the chloride content will be restricted by Table 2-23 and tested for compliance.

2) Coarse Aggregate

River gravel or crushed stone will be used as coarse aggregate. The maximum size of coarse aggregate should be 20 mm.

・ Admixture

The water-reducing agent conforming to IS 9105 will be used.

・ Water

Mains water or equivalent will be used in principle. Recycled water shall not be used as a rule.

Also, the pH value of water will be not less than 6. (IS 456-2000 Clause 5.4.2)

(2) Mix Proportion

・ To achieve the required quality, the ratio of components will be determined by trial mixings. The required quality is for the strength of the structural concrete for 28 days to be equal to or above design standard strength, with reference to the following.

1) Water Content

Water reducing agent will be used appropriately to ensure a good workability with water content of 185 kg/m^3 (Defined by JASS 5) or less.

2) Cement Content

The cement content should conform to Table 2-22. The water/cement ratio should be as small as possible.

Table 2-21 Environmental Exposure Conditions

(IS 456-2000 Clause 8.2.21 and 35.3.2)

No.	Environment	Exposure Conditions
i)	Mild	Concrete surface protected against weather or aggressive conditions, except those situated in coastal area.
ii)	Moderate	Concrete surfaces sheltered from severe rain or freezing whilst wet Concrete exposed to condensation and rain Concrete continuously under water Concrete in contact or buried under non-aggressive soil/ ground water Concrete surfaces sheltered from saturated salt air in coastal area
iii)	Severe	Concrete surfaces exposed to severe rain, alternate wetting and drying or occasional freezing whilst wet or severe condensation. Concrete completely immersed in sea water Concrete exposed to coastal environment
iv)	Very Severe	Concrete surfaces exposed to sea water spray, corrosive fumes or severe freezing conditions whilst wet Concrete in contact with or buried under aggressive sub-soil/ ground water
v)	Extreme	Surface of members in tidal zone Members in direct contact with liquid/ solid aggressive chemicals

Table 2-22 Minimum Cement Content, Maximum Water-Cement Ratio and Minimum Grade of Concrete for Different Exposures with Normal Weight Aggregates of 20 mm Nominal Maximum Size

(IS 456-2000 Clause 6.1.2)

No.	Exposure	Plain Concrete			Reinforced Concrete		
		Minimum Cement Content (kg/m^3)	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete	Minimum Cement Content (kg/m^3)	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete
i)	Mild	220	0.60	-	300	0.55	M20
ii)	Moderate	240	0.60	M15	300	0.50	M25
iii)	Severe	250	0.50	M20	320	0.45	M30
iv)	Very Severe	260	0.45	M20	340	0.45	M35
v)	Extreme	280	0.40	M25	360	0.40	M40

3) Air Content

2.0% is taken as the standard.

4) Chloride Content

The chloride content shall be restricted by Table 2-23, taking into account the volume of chemical admixture.

Table 2-23 Limits of Chloride Content of Concrete

(IS 456-2000 Clause 8.2.5.2)

No.	Type or Use of Concrete	Maximum Total Acid Soluble Chloride Content Expressed as kg/m^3 of Concrete
i)	Concrete containing metal and steam cured at elevated temperature and pre-stressed concrete	0.4
ii)	Reinforced concrete or plain concrete containing embedded metal	0.6
iii)	Concrete not containing embedded metal or any material requiring protection from chloride	3.0

5) Workability

Table 2-24 Workability of Concrete

(IS 456-2000 Clause 7.1)

Placing Conditions	Degree of Workability	Slump (mm)
Blinding concrete; Shallow sections; Pavements using pavers	Very low	*1
Mass concrete; Lightly reinforced sections in slabs, beams, walls, columns; Floors; Hand placed pavements; Canal lining; Strip footings	Low	25-75
Heavily reinforced sections in slabs, beams, walls, columns;	Medium	50-100
Slipform work; Pumped concrete	Medium	75-100
Trench fill; In-situ piling	High	100-150
Tremie concrete	Very high	*2

*1: In the "very low" category of workability where strict control is necessary, for example pavement quality control, measurement of workability by determination of compacting factor will be more appropriate than slump and a value of compacting factor of 0.75 to 0.80 is suggested.

*2: In the "very high" category of workability, measurement of workability by determination of floe will be appropriate.

・ Establishment of Mix Proportion Strength (IS 456-2000 Clause 9.2)

In principle, the mix proportion strength will be set in line with IS 456-2000. The mix proportion strength is expressed as a compressive strength of normally cured test pieces (150 mm Cube) for 28 days. Temperature adjustment is not described in IS. Even in winter season, the ambient temperature is relatively high in Kolkata, so it is not necessary to take cold weather measures. On the other hand, the temperature can rise up to approximately 40°C in

the summer season. Special attention must be paid to high ambient temperatures during casting of concrete, while the cement content shall be carefully controlled to reduce reaction heat as much as possible.

$$F = Fc + 1.65\sigma$$

where;

F ：Target mean strength of concrete（N/mm^2）

Fc ：Characteristic strength（N/mm^2）

σ ：Standard Deviation（N/mm^2）

・Nominal Mix

Nominal mix concrete may be used for concrete of M20 or lower. The proportions of materials for nominal mix concrete shall be in accordance with Table 2-25.

Table 2-25 Proportions for Nominal Mix Concrete

(IS 456-2000 Clause 9.3 and 9.3.1)

Grade of Concrete	Total Quantity of Dry Aggregates by Mass per 50 kg of Cement, to be Taken as the Sum of the Individual Masses of Fine and Coarse Aggregates, kg, Max	Proportion of Fine Aggregate to Coarse Aggregate (by Mass)	Quantity of Water per 50 kg of Cement, Max
M15	330	Generally 1:2 but subject to an upper limit of $1:1^1/_2$ and a lower limit of $1:2^1/_2$	32
M20	250		30

・Under-Water Concreting (IS 456-2000 Clause 14.2)

Apply for the cast in-situ concrete bored piles.

The water-cement ratio shall not exceed 0.6.

Concrete cast under water should not fall freely through the water.

The tremie pipe shall be used for casting.

(3) Selection of Concrete Batching Plant

When using batching plant, it must be confirmed that following points are conformed to.

1) The factory must have permanently-stationed engineers who have a thorough knowledge of concrete techniques.
2) The plant must be located close enough for it to take less than 120 minutes from the start of mixing till completion of casting when the temperature is below 25 ^oC, or less than 90

minutes when the temperature is above 25 °C. (Defined by JASS 5)

3) The product must be of the quality required in this project.

(4) Quality Control of Concrete

1) System of Quality Control for concrete work

Quality control for concrete will conform to the procedure shown in the table below.

Table 2-26 Quality Control for Concrete Works

Process	Test Item	Control Item	Record Method
Control of concrete casting	Quality of fresh concrete	In accordance with Table 2-27	Concrete Casting Control Table
Control of test piece curing	Ambient temperature	Average Temperature	Temperature Control Table
	Temperature of curing water	Average Water Temperature	Temperature Control Table
Control of strength	Confirmation of strength at removal of formwork	Equal to or greater than Characteristic Strength	Strength Control Table
	Confirmation of Structural Concrete	In accordance with Table 2-30	Strength Control Table

2) Test for Quality Control of Fresh Concrete

Pre-casting inspection and confirmation will be carried out for the items given in the table below.

Table 2-27 Quality Control Test for Fresh Concrete

Test Item	Test Method	Timing/Frequency	Criterion of Judgement
Slump Value	In accordance with Table 2-24	Each Batch	Tolerance of ±25mm, and conform to Table 2-24
Air Content	JIS A 1128 Equivalent		Tolerance of ±1.5%
Temperature of concrete	Measurement by Thermometer		40°C or below
Segregation	Visual Inspection		No segregation visible
Chloride Content	In accordance with Table 2-23 (IS 456-2000, Clause 8.2.5.2)	First Batch Everyday	In accordance with Table 2-23.

3) Control of Concrete Strength

Sampling methods and methods of curing used to test the strength of the concrete are summarized in the table below.

Table 2-28 Control of Concrete Strength

Purpose of Test		Confirmation of Strength of Structural Concrete	Confirmation of Strength at Removal of Formwork
Sampling	Sampling Method	IS 1199 Equivalent Test pieces taken on site	IS 1199 Equivalent Test pieces taken on site
	Frequency of Test	Each casting day and defined by Table 2-29	Every cast day Normally twice a day. Three test pieces each time
	Number of samples	Three each time	Three each time
	Form of sample	150 mm Cube	150 mm Cube
Curing of samples	Method of curing	In curing water on site or in normal water curing	In sealed condition on site or in curing water on site
	Place of curing	On site	On site
Strength test	Place of Test	At an official institution or on site	At an official institution or on site
	Witness to Test	Consultant Engineer, Contractor	Contractor

・Confirmation of Concrete Strength

Table 2-29 Sampling Frequency

(IS 456-2000 Clause 15.2.2)

Quantity of Concrete in the Work (m^3)	Number of Samples
1～5	1
6～15	2
16～30	3
31～50	4
51 and above	4 plus one additional sample for each additional 50m^3or part thereof

Table 2-30 Characteristic Compressive Strength Compliance Requirement

(IS 456-2000 Clause 16.1 and 16.3)

Specified Grade	Mean of the Group of 4 Non-Overlapping Consecutive Test Results in N/mm^2	Individual Test Results in N/mm^2
M15	≧ f_{ck}＋0.825×established standard deviation (rounded off to nearest 0.5 N/mm^2) or f_{ck}＋3 N/mm^2, whichever is greater	≧f_{ck}-3 N/mm^2
M20 or above	≧ f_{ck}＋0.825×established standard deviation (rounded off to nearest 0.5 N/mm^2) or f_{ck}＋4 N/mm^2, whichever is greater	≧f_{ck}-4 N/mm^2

$\bar{x} - R$ Quality Control Chart shall be used.

(5) Quality Control during Casting Concrete

- The maximum permissible free fall of concrete may be taken as 1.5 m. (IS 456-2000 Clause 13.2)
- Exposed surfaces of concrete shall be kept continuously in a damp or wet condition for at least 7 days.
- Casting of concrete shall not be executed in rain conditions.
- In case of the ambient temperature rising above 40 ^{o}C, casting of concrete is prohibited.

2-2-4-6 Procurement Plan

(1) Procurement of construction material and equipment

The objective of the Project is construction of a research facility. Construction material and equipment shall be procured that meet minimum performance requirements for the use of the facilities, such as cleanliness, ease of cleaning and maintenance and strength and durability. In addition, ingredients and material that can be maintained by the Indian side after completion and transfer of the facilities shall be selected. The basic principles for selection of construction materials are described below.

1) Local procurement

For other facilities on the hospital premises, there are many materials that are procured locally excluding glass and furniture. However, as the quality of the existing interior finishing materials are generally not good, the Project will allow for procurement of products made in a third country or Japan to maintain the intended purpose and efficiency of the Project facilities.

As a result of investigation of local makers using imported material, it has been found that very little stock is kept and arrangements are made after an order is received. In case when there is no stock, in most cases it takes two to three months after an order is placed before delivery to site. Therefore, timing of orders needs to be monitored so as not to delay the construction schedule. Since local products vary widely in quality and have many problems with material used, sufficient examination on delivery is necessary for their use.

2) Procurement by import

Even if material or equipment is good in quality and performance and can be locally procured, it is necessary to consider procurement from a third country if the price is lower. With repair taken into account, however, the consumables must also be easily procured.

As quality of domestic glass is bad, glass shall be procured from a third country for the Project.

Iron goods such as manholes and inspection openings shall be those made in a third country. Steel products shall be procured from a third country because they are in short supply.

Almost all heavy machinery for construction can be locally procured.

Manufactured products for which precision is required will be procured from a third country as they are not generally produced in India.

3) Transportation Plan

Material and equipment from a third country will be transported by sea to the nearest port of Haldia in India. Inland transportation from the port of Haldia to the construction site of NICED in Kolkata City will be on trucks. The land transportation of 90 km requires about six hours. Since road conditions are not very good, a transportation program must be prepared with all circumstances fully taken into account.

As materials and equipment include those which are susceptible to reduced functions due to impact shock, humidity or high temperature, it is necessary to pack them in such a manner that they can withstand long transportation.

It should be remembered that the number of days required for procurement from a third country is uncertain, and may be between one and two months in some cases, partly because of circumstances of the party from whom equipment or material will be procured.

As for marine transportation from Japan, there is a regular liner from the port of Yokohama once a month as well as two or three irregular services a month. The required sea time is about one month.

4) Procurement plan

The following table shows the main construction equipment and materials divided into local procurement, procurement from a third party and procurement from Japan.

Table 2-31 Procurement Plan of Major Construction Materials

Classification of works	Name of equipment/material	Local procurement	Procurement from Japan	Procurement from a third country	Remarks
Reinforced concrete work	Portland cement	○			Equipment and materials which conform to BS and Indian standards are produced in Kolkata; local products have no problem.
	Fine aggregate	○			Local products have no problem.
	Coarse aggregate	○			"Same"
	Fresh concrete	○			To use fresh concrete of fresh concrete suppliers, it is necessary to carry out quality control fully.
	Deformed bar		○	○	From the viewpoint of quality and prices, deformed bars will be imported from Japan or a third country.
	Form	○			Number of reuses of forms is relatively low.
Steel work	Steel		○	○	As supply from local manufacturers is short, steel will be imported from Japan or a third country.
Masonry work	Concrete block	○			Concrete block cannot be adopted for bearing walls.
	Brick	○			Local products have no problem.
Waterproofing work	Asphalt waterproofing	○			Because expertise is poor regarding execution technique, it is necessary to carry out execution management carefully.
	Coating film waterproofing	○			Although a past record seems to exist, the number of examples of execution is small.
	Sealant		○	○	Since many products that can be procured in the market have many elapsed years, they have a problem with quality (particularly weather resistance).
Plastering	Cement mortar	○			It is necessary to take heed because there is failure of masonry due to poor proportion.
Tile work	Earthenware tile	○		○	As dimensional precision is also poor, imported tiles from Southeast Asia are distributed. Because of short supply, however, procurement from a third party will be discussed.
	Porcelain tile	○		○	"Same"
Masonry	Stone	○			Stone produced locally is distributed at low price.
	Terrazzo	○			Terrazzo is also generally used locally.

Classification of works	Name of equipment/material	Local procurement	Procurement from Japan	Procurement from a third country	Remarks
Carpenter's work	Lumber	○		○	Heed shall be paid to local products because they have a problem of bowing.
	Laminated lumber	○		○	"Same"
	Plywood	○			Local products have no problem.
Metalcraft	Light-weight ceiling bed			○	To be procured from a third country as local products have a problem with quality and strength.
	Dressed metallic material/hand rails		○	○	Local products have a problem with quality.
Wooden fitting work	Door, frame for fittings			○	To be procured from a third country because finish of local products is rough to some degree and they have a problem of bowing.
Metal fitting work	Aluminium fittings			○	To be procured from a third country as those locally assembled are poor in accuracy, air-tightness and water-tightness.
	Steel fittings			○	To be procured from a third country as local products have a problem with accuracy and quality.
Glazing work	Common glass		○	○	To be procured from Japan or a third country because there is a small choice of local products and there is fluctuation of quality among them.
	Glass block		○	○	"Same"
Painter's work	Internal paint	○			Local products have no problem.
	External paint		○	○	To be made in Japan with quality taken into consideration.
Interior finish work	Plaster board		○	○	It is difficult to adopt local products because they vary in terms of quality.
	Rock wool soundboard	○	○	○	Local boards are of the 600mm x 600mm panel type only.
	Rock wool		○	○	No local products.
	Asbestos slate-board		○	○	"Same"
	Coated plywood board		○	○	Though there are local products, to be procured from Japan or a third country because local products have a problem with quality.

Classification of works	Name of equipment/material	Local procurement	Procurement from Japan	Procurement from a third country	Remarks
Finish unit work	Sink, sink for medical care	○	○	○	As for sink, because of poor durability of local products, they will be procured from a third country or Japan and others will be locally procured.
	Wall cabinet			○	In consideration of the product precision and durability, they will be procured from a third country.
	Wooden interior furnishing			○	"Same"
	Sign			○	"Same"
Outside structure work	Paving (asphalt)	○			Local products have no problem.
	Interlocking Block	○			Local products will be used. Attention shall be paid to variations of size and precision.
	Curb stone	○			Local products will be used, but there are no side ditches.
Mechanical equipment work	Air conditioner (reheat humidification unit)			○	Small air conditioner can be procured locally, but there is not a special type for research room, it will be procured from a third country.
	Blower and exhauster			○	To be procured from a third country because local products have problems with quality and durability.
	Nozzle/port			○	"Same"
	Filter			○	To be procured from a third country
	Duct material	○		○	Local products will be used. Special items will be made in a third country.
	Pump			○	To be procured from a third country
	Electric water heater			○	"Same"
	Sanitary fixture	○	○		Local products will be used for maintenance. Special items will be made in Japan.
	FRP panel tank			○	To be procured from a third country because local products have problems with quality and durability.
	Copper pipe		○	○	To be made in a third country as local products have a problem with quality. Coated copper pipe with heat insulation will be procured from Japan.
	Steel pipes			○	To be procured from a third country because local products have problems with quality/durability and product items and supplied sizes are limited.

Classification of works	Name of equipment/material	Local procurement	Procurement from Japan	Procurement from a third country	Remarks
	PVC pipe			○	"Same"
	Insulating material	○	○		Local products will be used. Special items will be made in Japan.
	Incinerator	○			Local products will be used.
	Central supervision equipment		○		To be procured from Japan because local products have problems with quality and durability.
	Waste water treatment device		○		"Same"
Electric equipment facilities work	Electrical transformer			○	To be procured from a third country because local products have a problem with quality.
	Electric generator	○			Local products have a quality problem and foreign products are commonly used. To be made in a third country with heed taken of technical backup.
	AVR		○		To be procured from Japan, as types of large-volumetric products are limited.
	Boards			○	Local products have a quality problem and foreign products are commonly used. To be made in a third country.
	Conduit pipe			○	To be procured from a third country or locally, because production items and supplied sizes are limited.
	Boxes			○	"Same"
	Electric wire			○	To be procured from a third country because local products have a problem with quality.
	Cable		○	○	To be procured from a third country in the case of those of large size.
	Light fixture		○	○	To be procured from a third country mainly, because some local products have a problem with quality. Special ones such as those with cleanliness specifications shall be made in Japan.
	Wiring accessories			○	To be procured from a third country.
	Phone equipment	○			To be procured locally because foreign products are also distributed at local agencies, or to be made in Japan.
	Broadcast equipment		○		Local products have quality problems and foreign products are commonly used. To be made in Japan.

Note: In the case of the same conditions of quality, etc., products made in a country where the price is lower were chosen.

(2) Procurement of Equipment

Operation and maintenance of existing equipment and materials being used at NICED (procured by NICED or by the technical cooperation project) are reliably carried out with care taken to minimize disturbances at all times. The equipment planned for the Project include those of a technical level both similar to and more advanced than existing equipment. Therefore, more detailed periodic inspection will be absolutely necessary. To carry out periodic inspections and replacement of parts requires engineers with expertise. As it is very difficult to enable present NICED electrical engineers take charge of wide-ranging maintenance and inspection of equipment used in the research laboratories, it is indispensable to procure products of makers who have proper engineers in India, including suppliers.

If products are limited to procurement from Japan, fair competitive bidding might not be realized. Accordingly, it is necessary to expand countries eligible for procurement to third countries.

Countries for procurement of main equipment are shown in the following table.

Table 2-32 Procurement Plan of Main Equipment

Name of equipment/material	Local procurement	Procurement from Japan	Procurement from a third country
Atomic force microscope, biological microscope, phase contrast microscope, inverted phase-contrast microscope, laser unit for conforcal microscope, scanning electron microscope		○	○
Multi angle laser light scattering photometer, automated proteomics workstation with LC/MS/MS, fluorescence spectrophotometer, Fourier transform infrared spectrophotometer, UV/VIS spectrophotometer		○	○
UV transilluminator, UV cross linker, differential scanning and titration calorimeter, high performance liquid chromatograph, first performance liquid chromatograph		○	○
PCR, real time PCR, gel documentation system, gel blot and imaging system, DNA array system, DNA sequencer, ELISA reader, ELISpot reader		○	○
Magnetic cell sorter, preparation cell, multipurpose flow cytometer, pulse-field electrophoresis apparatus, isoelectric focusing 2-D electrophoresis apparatus, mini sub-cell GT electrophoresis apparatus, vertical slab gel electrophoresis apparatus, ultrasonicator, gel dryer, vacuum blot instrument		○	○
CO_2 incubator, deep freezer (-185^{o}C)		○	○
Analytical ultracentrifuge, high-speed centrifuge, micro-centrifuge (non-refrigerated type), micro-centrifuge (refrigerated type)		○	○
Lyophilizer, water purification system, shaker cum incubator, cage system for infected animals, operating table for animal		○	○
Table top centrifuge, safety cabinet, incubator, refrigerator, deep freezers (vertical, -20℃, -80℃), autoclave, autoclave (pass-through type), ice flake machine, hot air oven, microwave oven, hybridization oven, electronic balance, dry block bath, ultrasonic cleaner, vacuum concentrator, electrophoresis apparatus, pH meter, vacuum pump, micropipettes, shaking water bath, platform shaker, breeding tools, operation tool set for animal, breeding cages, vacuum cleaner and clipper, therapy chamber, infantmeter, electronic thermometer, sphygmomanometer, stethoscope, LCD projector, overhead projector, desk top computer with printer, laser printer, scanner		○	
Furniture for Seminar room, Surveillance Network room, Meeting room, and Workshop	○		

2-2-4-7 Implementation Schedule

The implementation schedule after Exchange of Notes for the Project is concluded is shown in the following table. It consists of detailed design, preparation for tender by consultants, and construction works by contractors of facility construction and equipment work, and construction supervision management of the construction work and equipment work to be carried out by a consultant.

(1) Detailed Design

ICMR, NICED and a Japanese national consultant will enter into a Consultant Agreement for detailed design of the Project, preparation of tender documents for construction of the facilities and equipment work for the Project, and Consultant Agreement for construction supervision, and will obtain verification of the contract from the Government of Japan. Then, a detail design will be prepared based on this basic design study, tender documents will be prepared and approval of the ICMR and NICED will be obtained. It is assumed that the period involved in these activities will be 2 months.

(2) Tender Preparations

It is assumed that the period involved in bidding will be 2.5 months.

(3) Construction works by facility construction contractors, procurement of equipment work and construction supervision of the works by the consultant

ICMR, a Japanese construction company and a Japanese equipment supplier will enter into a contract for construction and procurement of equipment, and after verification is obtained from the Government of Japan, the respective contractors commence their respective works.

It is supposed that the period of construction will be 17 months.

The implementation schedule for the Project absolutely requires operational and technical assistance from now being executed. It is judged to be desirable, from the contents and the scope of the activities, that final completion of the Project facilities be at a time earlier than May 2006 when T. C. Phase 2 will end. A well thought preparation of the quality control plan for construction, an appropriate assignment plan for the staff of the executing contractor and a rational plan for temporary construction must be implemented so that no problem will arise in scheduling of construction, quality control or safety control.

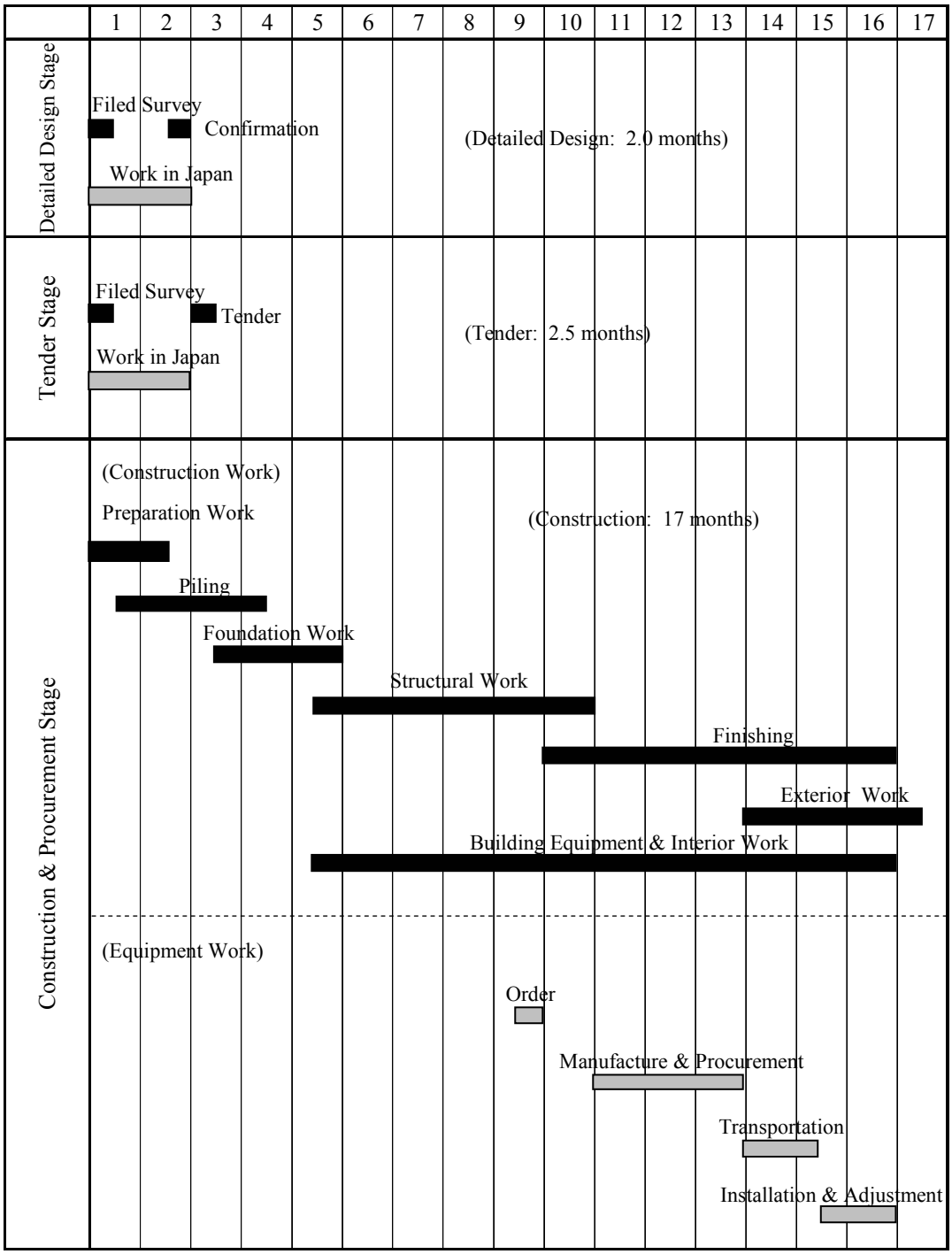


Figure 2-24 Implementation Schedule

2-3 Obligations of Recipient Country

The following matters to be undertaken by the Indian side shall be carried out under the responsibility of ICMR and NICED:

1) To complete procedures necessary on the Indian side in accordance with the Project schedule.
2) To apply for and obtain all licenses and approvals for construction and facility design, based on laws and standards of India, West Bengal Province and Kolkata regarding the Project, and to obtain various kinds of authorization necessary for construction works, etc. This is to be done by the counterpart on the Indian side.
3) To make Banking Arrangements (B/A) to cover the obligations incurred under the consultancy agreement with a Japanese consultant and the contracts for construction works and procurement of equipment with a contractor/supplier. Also, to issue an Authorization to Pay (A/P) to authorize payments under the contracts. To bear advising commissions and payment commissions resulting from the above actions.
4) To take all steps for tax exemption or payments among government offices which may be required in India, which are concerned with the Project, including import tax and ad valorem duty.
5) To settle payments based on a consultant agreement with a Japanese consultant.
6) To settle payments based on a contract for construction works with a Japanese contractor.
7) To ensure all expenses and prompt execution for unloading, customs clearance at port of disembarkation and internal transportation of the products purchased under Grant Aid.
8) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contract, such facilities, such as entry visas and work permits, as may be necessary for their entry into India and stay therein for the performance of their work.
9) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in India with respect to the supply of the products and services under the Verified Contracts.
10) To take budgetary measures to facilitate effective use, operation and maintenance of the facilities to be constructed and equipment to be procured under grant aid.
11) To remove any existing facilities in the planned site and level the land for construction works.
12) To provide a temporary site for construction work.
13) To carry out works for fences, gates and other outside structures not included in the works of the Japanese side.

14) To carry out lead in works for electric power, city water, a sewage line and the main telephone line to the planned site.
15) To move and install the equipment in the existing facilities which are to be relocated to the planned facilities.
16) To purchase and install general furniture.
17) To bear other costs and expenses as required other than those to be procured under the grant aid.

The cost to be borne by the Indian side is as follows.

Table 2-33 Expenses borne by the Government of India

Items	Expenses(Rs)
1. Preparation of construction site and site clearance, Relocation, demolition and diversion of existing structures including any underground object, ID Hospital incinerator, sewer piping, water supply piping and electrical cabling.	75,000
2. Infrastructure connection work	3,144,000
3. Landscape work	450,000
4. Furniture and equipment	750,000
5. Related Authority approval and application of design drawings	3,500,000
6. Relocation of existing laboratory equipment (safety cabinet, CHEF mappah, multi-image analyzer, DNA sequencer, FACS flow sight meter, spectrophotometer, semi-auto analyzer, filtration unit, eutectic microscope, high-performance liquid chromatography, and transmission electron microscope; 65 days/person x Rs2,560/day = Rs166,400) (Other equipment: 100 days/person x Rs5,120/day = Rs512,000)	166,400 512,000
Total	8,597,400 (approx. 22,353,000yen)

2-4 Project Operation Plan

2-4-1 Approximate Cost of the Cooperation Project

This cost estimate is provisional and would be further examined by the Government of Japan for the approval of the Grant.

Table 2-34 Approximate Cost of the Japanese Obligation Works

(Approx. 2,134 million yen)

Item of Expenditure		Approximate Cost (million yen)		
Facilities	Laboratory	1,393	1,420	1,947
	Generator Room	14		
	Incinerator	6		
	Sewage Treatment Plant	7		
Equipment			527	
Detail Design / Supervisory services for Construction, Procurement and Installation				187
Total				2,134

2-4-2 Project Operation and Maintenance Plan

(1) Operation and Maintenance Plan

1) Present State of Operation and Maintenance

The current facilities, equipment and materials of the NICED are operated and maintained by the Technical, Operation and Maintenance Division belonging to General Affairs Department. Under a chief engineer, five people (in charge of operation and maintenance of facilities, equipment and materials) are assigned to the Technical, Operation and Maintenance Division. The chief engineer also supervises telephone operators and outsourced security guards.

Figure 2-23 is a new maintenance organization table for NICED. As facilities, equipment and materials in three facilities, i.e. the existing facilities, a new building and the Project facilities, will be operated and maintained, five staff members at minimum, including the assistant engineer, staff in charge of mechanical systems, staff in charge of building and exterior maintenance, staff in charge of electrical systems and staff in charge of plumbing systems, will be necessary to be assigned, in addition to the current organizational system,.

Almost all maintenance of equipment and consumables is outsourced by a yearly maintenance agreement. The staff mentioned above will operate and maintain the entire facilities and equipment of NICED including periodic maintenance and repairs in the case of failure.

The current workshop of the Technical, Operation and Maintenance Division is housed in an electric room on NICED premises. They do not carry out plumbing and repair of equipment since there are no lathes, screw-thread cutter, welder or cutting instruments. Although the existing emergency generator and the distribution board in the electricity and machine facilities appear to have been renewed recently, it was observed that it took considerable time to recover from a trouble of the distribution board which seemed to result from the design. Therefore, it is considered that the maintenance staff of NICED will require some training to upgrade their technical skills prior to completion of the Project facilities.

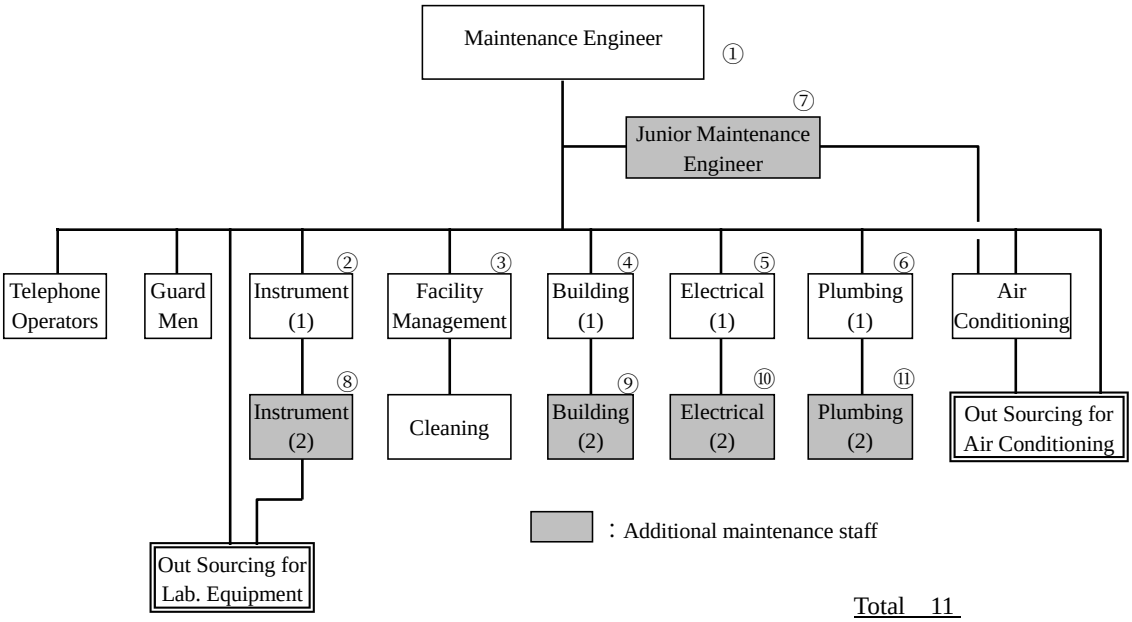


Figure 2-25 New Maintenance Organization Chart for NICED

2) Formulation of Maintenance Plan

① Maintenance of Facilities

Among the project facilities, maintaining of environmental cleanliness by means of the air conditioning system is indispensable to carry out planned activities of research facilities and the Animal House in particular. The laboratory facilities must have cleanliness suitable for study of cells at the molecular level. Although it is not necessary to keep rooms at negative pressure, it is necessary to maintain pressure of each zone in a manner that room pressure will not be higher (positive pressure) than their surrounding vicinity to prevent air outflow from a room. It is required that the system shall be able to remove by filtering minute particles contained in supply air in order to maintain cleanliness to the required degree. As the filter becomes clogged when used continuously, periodical cleaning and replacement are necessary and it is important to monitor the operational condition of the air conditioning system at all times. For the 24-hour air conditioning system to control temperature and humidity in a cell culture rooms and the Animal House, more sophisticated maintenance is required.

Since the mechanical systems for the Project facilities is different from the existing facilities, it is necessary to appoint a person exclusively in charge of operation and maintenance of mechanical systems (air-conditioning equipment, freezers and refrigerators, etc.).

Maintenance personnel need to fully master the method of operation and maintenance of mechanical systems prior to the completion of the Project facilities. Therefore, it is important to appoint people in charge including new staff members at an early stage and provide them with appropriate training.

Table 2-37 shows table of new maintenance staffing of NICED.

Table 2-35 New Maintenance Staff of NICED

	Current NICED staff	Staff for facilities including NICED's new facilities	Increase in the number of staff due to NICED's new facilities
Maintenance Engineer	1	1	0
Junior Maintenance Engineer	0	1	+1
Instrument (Lab. Equipment)	1	2	+1
Facility Manager	1	1	0
Building Staff	1	2	+1
Electrical	1	2	+1
Plumbing	1	2	+1
Sub Total	6	11	**+5**

② Maintenance of Equipment

Equipment and materials planned for this project include precision instruments required for molecular biological diagnosis, such as an atomic-force microscope, a scanning electronic microscope, a polyangular laser-light scattering photometer, a liquid chromatographic analyzer, a high-performance liquid chromatography, a high-speed liquid chromatography, a DNA array system, a MACS cell sorter and multi-flow sight meter. Maintenance of these instruments so as to leave them functioning in perfect condition for research is not easy.

For operation and maintenance of instruments, NICED has been contracting yearly maintenance contracts with instrument suppliers and under close cooperation, have given maximum attention to the operation and maintenance system for research instruments. It is necessary to continue the existing cooperation with suppliers for maintenance and inspection of instruments.

2-4-3 Management, Maintenance and Operation Costs

(1) Maintenance and Operation Costs

The following table shows results of trial calculation of annual operation and maintenance cost in the fiscal year for the Project facilities after the second year of operation.

Table 2-36 Calculation of Maintenance and Operation Costs

Unit: Rs

Item of Expenditure	After the second year
1) Electricity charges	2,952,912
2) Telephone charge	212,640
3) Fuel expenses for generator	380,160
4) Water charge	465,600
5) Butane gas charge	384,000
6) Nitrogenous gas charge	120,960
7) CO_2 gas charge	133,920
8) Building maintenance cost	576,000
9) Cost of replacement parts (Exchange of filter)	1,200,000
Subtotal 1)～9) （Facility maintenance cost）	6,426,192
10) Equipment maintenance cost	3,008,415
11) Maintenance contract cost for existing equipment	6,092,594
12) Outsourcing (Cleaning/ Security)	6,148,000
Total	21,675,201 ¥56,355,523

1) Electricity charges ·····2,952,912 Rs/year

The contract demand of the Project facilities can be estimated in accordance with the size of the facilities and the usage assumptions as shown in Table 2-39. Average electricity usage is estimated at approximately 60% of the contract demand.

Table 2-37 Estimated Load Capacity

	Contract load (kW)	Used load (kW)
Research facilities	350	245
Animal house	150	105
Total	500	350

Fee structure	Basic charge (1)	2,000 Rs/month
	Basic charge (2)	100 Rs/kW
	Usage charge	3.8 Rs/kWh

Electricity charges

	Charge (Rs)	Quantity consumed (kW)	Time (h)	Day	Month	Load factor	Total
Research facilities							
Basic charge (1)	2,000	—	—	—	12	1.0	24,000
Basic charge (2)	100	245	—	—	12	1.0	294,000
Usage charge	3.8	245	8	20	12	0.6	1,072,512
Subtotal							1,390,512
Animal House							
Basic charge (1)	—	—	—	—	—	—	
Basic charge (2)	100	105	—	—	12	1.0	126,000
Usage charge	3.8	105	20	30	12	0.5	1,436,400
Subtotal							1,562,400
Total							2,952,912

2) Telephone charge ····· 212,640 Rs/year

Since the telephone charge depends on the usage, the frequency of use has been assume and calculated for each facility as below.

Fee structure	Connection fees		250 Rs/line/month
	Domestic call charge	Local call	1.2 Rs/3min
		Out-of-town call	4.0 Rs/min
	International call charge		24.0 Rs/min

Telephone charges

	Charge (Rs)	Number of line	Call time (min/time)	Number of times (times/ day)	Day	Month	Load factor	Total
Connection fees	250	20	—	—	—	12	1.0	60,000
Local call	1.2	—	—	200	20	12	1.0	57,600
Out-of-town call	4.0	—	3	30	20	12	1.0	86,400
International call	24.0	—	3	0.5	20	12	1.0	8,640
Total								212,640

3) Fuel expenses for generator ····· 380,160 KShs/year

In Kolkata, there were 4 times/month of power outages in 2001. It is assumed that power outages are 2 hours/time, and 96 hours/year. We will estimate the fuel cost based on the assumption.

The capacity of generator in this program is designed to be 500kVA.

Fee structure　　Consumption of fuel for generator　　180 ℓ/h

Unit price of fuel　　22 Rs/ℓ

Fuel Cost

	Charge (Rs)	Quantity consumed (L)	Time (h)	Day	Month	Annual quantity consumed (L)	Load factor	Total (Rs)
Consumption of generator fuel per year	22	180	2	4	12	17,280	1.0	380,160
Total								380,160

4) Water charge ·····465,600 Rs/year

Water consumption in the Project facilities is estimated as follows.

Table 2-38　Estimated Water Charge

	Water consumption/day (m^3/day)
Research facilities	40
Animal House	10
Total	50

Fee structure　　Water usage charge （Average）　　10 Rs/m^3

Water basic charge　　600 Rs/month･m^3

Water charge

	Charge (Rs)	Water supply	Day	Month	Charge of water use in the City	Load factor	Total
Research facilities							
Water basic charge	600	50		12		1.0	360,000
Water usage charge	10	40	20	12	0.8	1.0	76,800
Animal House							
Water usage charge	10	10	30	12	0.8	1.0	28,800
Total							465,600

5) Butane gas charge ·····384,000 Rs/year

Butane gas is used for experiments and research. The gas consumption is estimated as follows.

Table 2-39 Estimated Butane Gas Consumption

Name of Facility	Purpose	Daily consumption (kg/day)
Research facilities	For experiments	40
Total		40

Fee structure Butane gas charge 40 Rs/kg

Butane gas charge

	Charge (Rs)	Quantity consumed (kg)	Day	Month	Annual quantity consumed (kg)	Load factor	Total (Rs)
Butane gas charge	40	40	20	12	9,600	1.0	384,000
Total							384,000

6) Nitrogen gas charge ·····120,960 Rs/year

Nitrogen gas is used for experiments and research. The gas consumption is estimated as follows.

Table 2-40 Estimated Nitrogenous Gas Consumption

Name of Facility	Purpose	Daily consumption (kg/day)
Research facilities	For experiments and manufacture	3
Total		3

Fee structure Nitrogenous gas charge 280 Rs/kg

Nitrogenous gas charge

	Charge (Rs)	Quantity consumed (kg)	Day	Month	Annual quantity consumed (kg)	Load factor	Total (Rs)
Nitrogenous gas charge	280	3	20	12	432	0.6	120,960
Total							120,960

7) CO_2 gas charge ·····133,920 Rs/year

CO_2 gas is used for experiments and research. The gas consumption is estimated as follows.

Table 2-41 Estimated CO_2 Gas Consumption

Name of Facility	Purpose	Daily consumption (kg/day)
Research facilities	For experiments and manufacture	3
Total		3

Fee structure CO_2 gas charge 310 Rs/kg

CO_2 gas charge

	Charge (Rs)	Quantity consumed (kg)	Day	Month	Annual quantity consumed (kg)	Load factor	Total (Rs)
CO_2 gas charge	310	3	20	12	432	0.6	133,920
Total							133,920

8) Building maintenance cost·····576,000 Rs/year

Interior and exterior finishing materials with easy maintenance and upkeep were chosen for the Project facilities. It is assumed that building maintenance expenses, including the expenses for interior/exterior finish and the procurement cost of repair parts and replacement parts of electrical equipment, plumbing equipment and air-conditioners are about 1/2 to 1/3 of maintenance cost in Japan.

Fee structure 8 Rs/m^2/day

Building maintenance cost

	Cost (Rs)	Area (m^2)	Day	Month	Load factor	Total (Rs)
Building maintenance cost	8	6,000	—	12	1.0	576,000
Total						576,000

9) Cost of replacement parts (Replacement of filter)·····1,200,000 Rs/year

High- and medium-performance filters shall be fixed to air conditioners in the research facilities and the Animal House. Each air conditioner shall be equipped with a pre-filter. A deodorant filter is provided for exhaust from the Animal House. Special exhaust shall be treated similarly.

Frequency of replacement of each filter is assumed to be as shown below. Cost of replacement shall not be required for pre-filters, because recycled pre-filters are used.

Fee structure	Pre-filter:	About twice a month, cleaning
	Medium-performance filter:	About once a year (Rs 10,400 per filter)
	High-performance filter:	About once a year (Rs 11,000 per filter)
	Deodorant filter:	About once a year (Rs 75,000 per filter)
	Special exhaust filter:	About once a year (Rs 20,000 per filter)

Cost of replacing filters

	Cost (Rs)	No. of pieces	Load factor	Total (Rs)
Medium-performance filter	10,400	25	1.0	260,000
High-performance filter	11,000	10	1.0	110,000
Deodorant filter	75,000	10	1.0	750,000
Special exhaust filter	20,000	4	1.0	80,000
Total				1,200,000

10) Equipment Maintenance Cost ·····3,008,415 Rs/year

Name of equipment and materials	Quantity	Maintenance cost/year/per equipment (Rs)	Yearly maintenance cost by equipment (Rs)	Remarks
Differential scanning calorimeter	1	32,300	32,300	Sample cell
Liquid chromatograph mass spectrometer	1	303,450	303,450	Reagents
MACS magnetic cell sorter	1	48,450	48,450	Reagents
DNA sequencer	1	283,475	283,475	Reagents
DNA array system	1	323,850	323,850	Reagents
Multi-flow sight meter	1	145,775	145,775	Reagents
Atomic-force microscope	1	121,550	121,550	General replacement part
Scanning electron microscope	1	250,750	250,750	Printing paper
High-performance liquid chromatograph (with accessories)	3	121,550	364,650	Column filler
High-speed liquid chromatograph (with accessories)	3	76,925	230,775	Column filler
Water purifying apparatus	7	21,888	153,216	Filter paper
Ultracentrifuge for analysis	1	29,963	29,963	Disposable microtube
High-speed centrifuge	5	9,775	48,875	Disposable microtube
Automatic PCR device	2	14,450	28,900	Disposable microtube
PCR device	7	14,450	101,150	Disposable microtube
Safety cabinet	9	12,113	109,017	HEPA filter
Gel documentation system with a CCD camera	3	2,423	7,269	Printing paper
Other equipment and materials			425,000	
		Total	3,008,415 (¥7,821,879)	

11) Maintenance contract cost ·····6,092,594 Rs/year

This cost includes maintenance fee for equipments to be procured by the Project.

Chapter 3 Project Evaluation and Recommendations

CHAPTER 3. PROJECT EVALUATION AND RECOMMENDATIONS

3-1 Project Effect

(1) Projected Direct Benefits

Implementation of the Project (including both the Japanese and Indian scope of works) is expected to bring about the following direct benefits, through the provision of facilities and equipment to enable the smooth conduction of T.C Phase 2 activities.

1. Increase in number of diarrheal cases identified at the molecular level

   The Project will provide efficient examination and diagnosis at the molecular level for scientists, thereby increasing the number of identified cases and strengthening of immunological surveillance of disease pathogens.

2. Increase in number of persons acquiring diagnostic technology

   The Project will enable conducting training for identification and diagnosis at the molecular level for domestic researchers and students from throughout India. Number of training programs and trainees will also increase due to the new training facilities included in the Project.

3. Increase in number of diagnostic sera and strain specimens and incorporation into database

   The Project will provide dramatic increase in storage capacity for diagnostic sera and strain specimens. This will enhance the establishment of a database and increase the speed of identification and diagnosis.

(2) Projected Indirect Benefits

Implementation of the Project is expected to bring about the following indirect merits.

1. The Project will provide facility for surveillance network by enabling information linking between NICED and domestic research centers. This will enable constant epidemiological surveillance of disease pathogens.
2. Provide improvement of technology for infectious disease researchers throughout India.
3. Increase the number of trainees coming from neighbouring countries. This will help enable further promotion of control measures for infectious diseases in South Asia and South East Asia through promulgation of disease control measures developed at the Project facilities.
4. Enable shortening of time required to prescribe appropriate medicine according to prompt identification and diagnosis.

(3) Evaluation Criteria

The criteria for evaluation of the Project will be based on the numbers of diarrheal disease diagnosis at the molecular level at NICED, the number of technologists trained at NICED in diagnostic techniques and the stored numbers of diagnostic sera and strains.

3-2 Recommendations

It is essential that the Indian scope of works are completed in a timely manner in accordance with the schedule of the Project facilities. Such works as legal acquisition of additional project site, provision of temporary site for construction and approval for detour road for ID Hospital must be completed before the works of the Japanese side can be commenced. Moreover, lead-in work for electricity, water supply, drainage and telephone lines must be coordinated with Japanese construction schedule.

In order for the facilities and equipment to be provided by the Project to be smoothly and effectively managed, it is recommended that the following improvements or arrangements be made by Indian side.

1. It is recommended that necessary number of staff must be assigned in order to maintain good condition of facilities and equipment,
2. In order to maintain facilities and equipment in best condition and ensure continuous high performance for research, it is recommended to establish a maintenance organization and promote activities to enhance technical levels of maintenance staff.
3. The Equipment Supplier, at the time of commissioning, must provide technical guidance for operation of the equipment in addition to explanation of the maintenance/inspection manual, operation manual, circuit diagram and others. Furthermore, the Supplier must provide instructions on the effective use of the manuals for the effective maintenance of the equipment.
4. It is recommended to keep track of dates of delivery, frequency of use, repair history, etc. and record these events on a ledger (record book) for each piece of equipment. It is also recommended to formulate a spare part purchase plan and equipment renewal plan, and to formulate long- and medium-range budgets based on these plans.
5. It is recommended that, after completion of the project, an annual report be prepared every year on the management and operation of the Project. The preparation of the annual report will help appraisal of the management and operation of the Project facilities and will serve as a reference in the planning of improvements in operation of the facilities.