Chapter 2. Contents of the Project

CHAPTER 2.　CONTENTS OF THE PROJECT

2-1　Basic Concept of the Project

In the wake of the SARS outbreak in 2003, avian influenza is presently causing serious damage to the people and fowls in Viet Nam. In 2005, this country recorded the highest number of deaths for human avian influenza. Under the circumstances, the government of Viet Nam is taking urgent and intensive infectious disease control measures. In 'the Government Action Program' as of 5th October 2005, the government of Viet Nam mentions strengthening of manufacturing of various medicines and the technology for the examination and analysis of high-risk pathogens as measures against emerging and re-emerging infectious diseases such as avian influenza. The high-risk pathogens including avian influenza virus, SARS corona virus, and HIV at present are mainly handled in the Bio-Safety Level 2 (BSL -2) laboratories at National Institute of Hygiene and Epidemiology (NIHE), the core institution in the infectious disease control, in Viet Nam.

The high-risk pathogens are to be handled in the high-level safety inspection laboratories in the BSL-3 laboratories in accordance with the recommendation of the World Health Organization (WHO). However, there is no BSL-3 laboratory in Viet Nam and it is impossible to ensure safety for scientific staff and the surrounding environment.

In this Project, four (4) BSL-3 laboratories, BSL-2 laboratories and chemical laboratories to support them will located on the third floor of the High-Tech Center Building under construction in the premises of NIHE. Essential experimental equipment and materials will be procured, in order to ensure that NIHE maintains the experiments and diagnoses of high-risk pathogens in a safe and appropriate way.

In parallel to the above project, Viet Nam has made the request for technical cooperation associated with the project. The establishment and operation of Bio-Safety Rules and the improvement in the technology for handling high-risk pathogens will allow the safe and secure inspection and diagnosis of high-risk pathogens in accordance with applicable international standards.

This Technical Cooperation Project is outlined in Table 2-1.

Table 2-1　Outline of the Grant Aid Project

Classification	Composition of Facilities	Principal Equipment
BSL-3 Laboratories	Diagnosis Laboratory	Pass Through Type Autoclave, Biosafety Cabinet, Pass Box, Sink with Decontamination Tank, Centrifuge, CO_2 Incubator, Deep Freezer -80℃, Vertical Autoclave, etc.
	Research Laboratory (Including development of vaccines, etc.)	
	Back Up Laboratory	
	Animal Experiment Laboratory	Pass Through Type Autoclave, Biosafety Cabinet, Animal Cage System with Biosafety Cabinet, etc.
	Storage, back corridor, etc.	—
Associated Facilities	[4 Chemical Laboratory Rooms]	
	RNA Extraction Room (Laboratory-1)	Biosafety Cabinet, Automatic RNA Extraction System, Refrigerated Microcentrifuge, Medical Refrigerator, etc.
	Reagent Preparation Room (Laboratory-2)	Refrigerated Microcentrifuge, PCR Workstation, Dry Block Bath, etc.
	DNA Amplification Room (Laboratory-3)	Real Time PCR, PCR Machine, etc.

Classification	Composition of Facilities	Principal Equipment
	Electrophoresis Room (Laboratory-6)	Electrophoresis Apparatus, Vertical Autoclave, Ice Maker Machine, Medical Refrigerator, Electronic Balance, etc.
	[2 BSL-2 Laboratory Rooms]	
	Multipurpose Diagnosis/ Research Room (Laboratory-4)	Biosafety Cabinet, Floor Type Ultracentrifuge, Spectrofluorometer, DNA Sequencer, etc.
	Tissue Culture Preparation Room (Laboratory-5)	Biosafety Cabinet, Inverted Microscope, Centrifuge, CO_2 Incubator, Freezer -20℃, etc.
	[Control Rooms]	
	Biosafety Control Center	—
	Control Panel Room	—
	Specimen Storage	Deep Freezer -80℃
	Common Storage, Corridor, Toilet, Elevator Hall	—
Soft Component	Technical training for appropriate operation and maintenance of the equipment and systems provided in the BSL-3 experimental facilities.	

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

(1) Basic Policy

The Project is planned to establish BSL-3 laboratories and associated facilities on the third floor of the High Tech Center Building, which is under construction with the budget of the government of Viet Nam (while the structure and exterior works had been almost completed as of May 2006).

1) The site survey made by the basic design study team has made clear that there is not sufficient space necessary for the BSL-3 laboratories originally planned to be set up on the ground floor of the High Tech Center Building. As a result, it has been re-planned that the BSL-3 laboratories will be established on the third floor and that the associated machinery and electric equipment will be accommodated on the fourth floor. The study team further verified the structural strength of the High Tech Center Building to clarify the requirement for the modification of its roof structure. As a result, it has been re-planned to dismantle the existing roof and rebuild it.

2) As this Project is planned to construct the BSL-3 experimental facilities in the existing High Tech Center Building, it is necessary to define the scopes of responsibility for the alteration works which will be borne by the Japanese side and the Vietnamese side respectively. It has been decided that the modification design and construction of the High Tech Center Building will be implemented by the Vietnamese side while the technical cooperation for the modification design will be furnished by the Japanese side.

   It is also necessary that the modification design and the verification of the construction work will be implemented by the Japanese side in order to accomplish the modification work securely.

3) The equipment and materials to be accommodated in the BSL-3 laboratories and associated facilities including the BSL-2 laboratories are planned to be those which are not only required for action against avian influenza, but also are usable for the inspection and research into other BSL-3 pathogens.

4) The building and equipment programs have been planned to ensure that NIHE secures their technical and financial independence and development while taking into consideration their operating capacity (including the number of researchers, technical levels, financial power of responsibility, availability of consumables and spare parts).

5) In keeping in mind that this Project will be implemented in connection with the Technical Cooperation Project, it is planned to maintain the integrity with the items and schedule of the technical cooperation project. Moreover, the content of assistance should not overlap with those that are to be conducted by other donors and by development programs based on research in Japan (by Nagasaki University, for example).

6) In focusing on the action against avian influenza, as described in the Field Report on the Preliminary Verification Study of the Technical Cooperation Project, this Project is required to construct four BSL-3 laboratories.

   - BSL Diagnosis Laboratory (one room): The quantity of clinical specimens on avian influenza that NIHE will accept after 2008 when the BSL-3 laboratories and other associated facilities will be established and put into use is estimated to be about 20 to 30 per day on average.

- BSL-3 Research Laboratory (one room): It is necessary to provide a dedicated research laboratory because a single laboratory cannot be put into common use for research experiments and for diagnostic inspection due to the cross contamination issues.
- BSL-3 Animal Experiment Laboratory (one room): It is necessary to provide an animal experiment laboratory because animal experiments are required in the research processes such as the virulence inspection of avian influenza virus in the diagnostic processes and research process such as vaccine developments.
- BSL-3 Back-up Laboratory (one room): The back up laboratory is indispensable in case of emergency such as the spread of avian influenza, and is normally to be used as an experimental room for inspection of other high-priority pathogens.

7) In making the diagnosis and research into avian influenza, BSL-2 and chemical laboratories other than the BSL-3 laboratories as shown in Figure 2-1 and Figure 2-2 are required. The infectious clinical specimens and virus culture/isolation are handled in BSL-3 laboratories, but specimens including viruses that have been inactivated in one of the BSL-3 laboratories and the non-infectious cells are handled in laboratory other than the BSL-3 laboratories. Therefore, the following rooms associated with the BSL-3 laboratories are required:

- RNA Extraction Room, Reagent Preparation Room and DNA Amplification Room (Chemical Laboratories): These rooms are used to handle the specimens that have been pre-processed and inactivated in one of the BSL-3 laboratories.
- Multi-purpose Diagnosis/Research Room (BSL-2 Laboratory): This room is used for serodiagnosis and immunologic research for avian influenza.
- Tissue Culture Preparation Room (BSL-2 Laboratory): This room is used to prepare cells for cultivation of avian influenza virus to be made in one of the BSL-3 laboratories.
- Electrophoresis Room (Chemical Laboratory): This room is used to identify avian influenza virus.

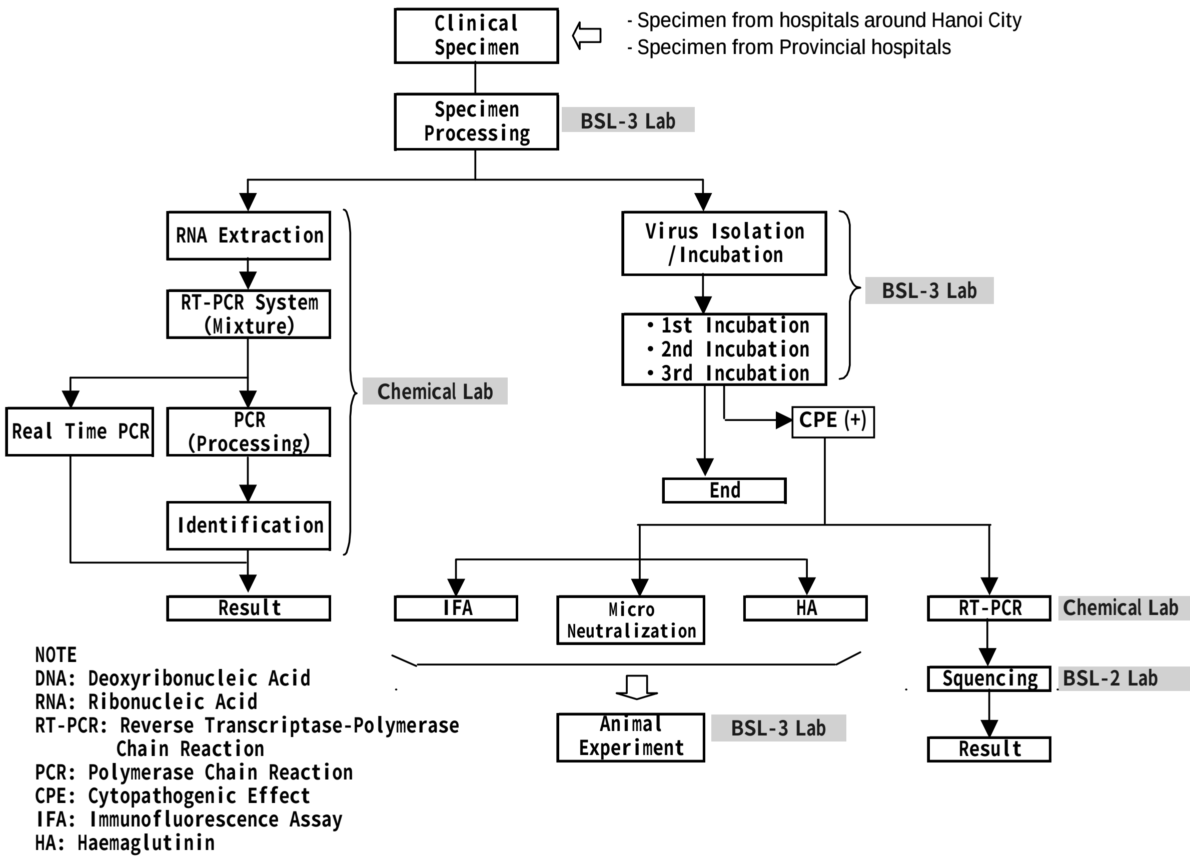


Figure 2-1 Flow Chart for Diagnosis of Avian Influenza

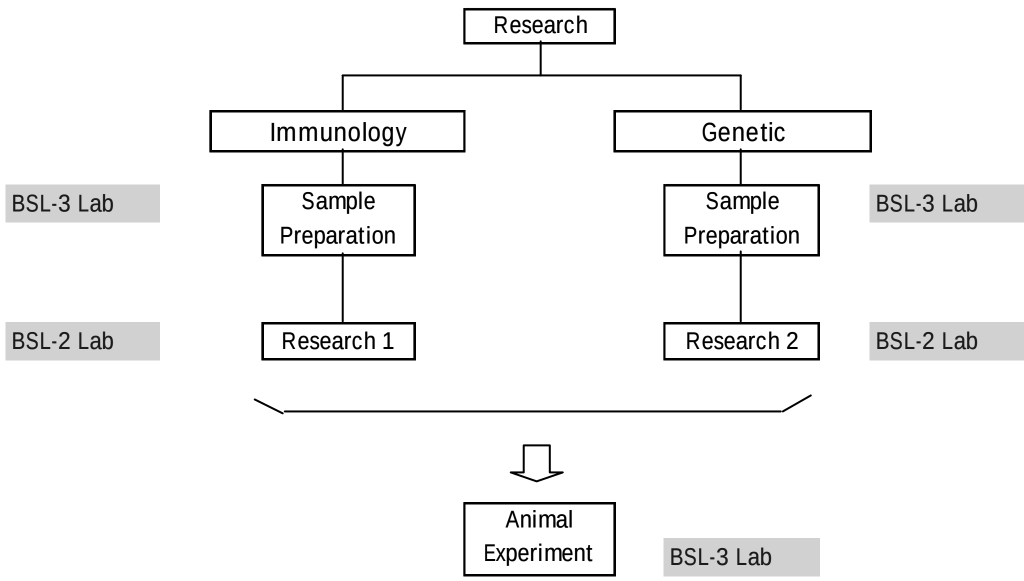


Figure 2-2 Flow Chart for Research of Avian Influenza

(2) Policy toward the natural conditions

Hanoi is located in the Temperate Monsoon Climate Zone. The average temperature in the summer (in June) is 32.8℃, which is 5.7℃ higher than the corresponding figure in Tokyo (in August), 27.1℃. Humidity is also higher in Hanoi than in Tokyo. From May to September, humid and hot condition persists in Hanoi. As the design exterior air temperature used for air-conditioning is 4℃ higher in Hanoi (36-37℃) than in Tokyo (32-33℃), the plan is to keep the running cost of the air-conditioning system low by constructing a system in which the air-conditioning system is sub-divided, so that each sub-divided system can be switched off frequently.

The easterly wind is prevalent in Hanoi throughout the year. In order not to deliver the exhaust air from the bio-safety facilities directly to the residential area adjacent to the south, the air will be taken into the High Tech Center Building from the south side and will be exhausted from the north side. The positions of louvers will be decided accordingly.

As the axis of the High Tech Center Building is approximately aligned in the east-west direction, its design includes measures to prevent the strong southern sunshine from entering the rooms by placing eaves above the windows.

As the Vietnamese side is responsible for the structural work of the High Tech Center Building, the main work of the Project implemented by the Japanese side will be the interior work. However, a certain level of vibration prevention measures will be required. In practice, bracing will be applied to the partition and ceiling works, installation of facilities and equipments, and the duct and plumbing works.

(3) Policy toward the socio-economic conditions

Viet Nam has driven economic development with active introduction of foreign capital since the adoption of the Doi Moi policy in 1986. However, the SARS and avian influenza epidemics have led to human and economic losses and these diseases are feared to become large negative factors in the future. Under the circumstances, the construction of the BSL-3 facilities aiming mainly at the diagnosis and research of avian influenza virus will establish a system capable of examining large numbers of samples safely, accurately, and quickly in Viet Nam. By taking appropriate infectious disease control measures based on the examination results, it will become possible to control the spread of infectious disease. Thus, the early implementation of the Project is recommended. At present, the commencement of the work in March 2007 and the completion in December 2007 are assumed. In order to meet the schedule, the flawless schedule management of the Japanese side and the prompt procedural and budgetary measures of the Vietnamese side are essential.

(4) Policy toward the construction/procurement conditions or special conditions/ business practices of the industry

The construction technology and mechanization in Viet Nam has improved remarkably with the entry of foreign companies driven by the economic liberalization. The Vietnamese construction companies have executed many projects financed by foreign investment in joint venture with the construction companies of various foreign countries. As a consequence, the number of local engineers who are experienced with Japanese execution and management methods has been increasing. Their capabilities have also improved with the progress of technology transfer from various foreign countries to the construction companies and mechanization of construction works. At present, there are many sites of large-scale construction of buildings with 14 to 20 stories in Hanoi. At these sites, the construction work is executed with various construction machinery including large and heavy equipment. The Vietnamese economy is growing at a high rate and the subsequent construction boom has kept the prices of construction materials high. Taking into consideration the trench of escalating costs, the project will be planned to avoid increase of unit construction costs by very careful selection of the materials to be used. With the exception of specialized materials, most of the major construction materials can be procured in and around Hanoi and their supply is relatively stable.

(5) Policy on the use of local contractors

The contractor of the construction work of the Project will be a Japanese general contractor company. Under normal circumstances, Vietnamese construction companies and various kinds of Vietnamese laborers will be involved in the construction work under the supervision of the Japanese contractor. Although Vietnamese laborers have learned the Japanese technology through their work with Japanese construction companies, the number of skilled workers for the construction of specialized facilities and the works which require highly sophisticated technology is still small. Therefore, dispatch of specialized engineers from Japan will be required for technical guidance and execution management in works which demand high technical level such as this Project. Appropriate management and guidance on these points by Japanese enterprises will be required when using local construction companies.

(6) Policy toward the operation, maintenance, and management capabilities of the implementing agency

1) Facilities

NIHE consists of approximately 20 buildings. Although they are old, they have maintained the elegant appearance which incorporates the colonial design of France, the former colonial ruler. The facilities appear well maintained and clean. However, although the latest experimental equipment are used widely in most of the laboratories, the facilities remain at the proto-modern level with limited consideration for the safety of researchers. For example, there is no installation of mechanical ventilation systems.

In addition, the maintenance and management of the entire building and facility complex at NIHE is done by a maintenance/management organization which consists of only eight people. All the repair works except for simple ones are commissioned to external companies.

The maintenance and management system is to be strengthened after the completion of the High Tech Center Building projects including the Project facilities. The maintenance and management of the BSL-3 laboratories equipped with the particularly highly sophisticated air conditioning system requires highly sophisticated operation techniques. Thus, an increase in the number of the maintenance/management personnel and upgrading of their technical abilities is essential. Therefore, in the Project, technical training of an electric facility engineer and a machine/facility engineer to be hired by the Vietnamese side is required. The training will be implemented under the Technical Cooperation Project which has started in March 2006 and the software component of the Grant Aid Cooperation.

2) Equipment

The existing equipment is operated, maintained, and managed by the three maintenance staff of NIHE and external maintenance companies or agents. The equipment provided in the Project will be maintained and managed in the same way. As NIHE does not have a maintenance department, there is a need to reorganize the maintenance and management system before the completion of the equipment procurement in the Project.

At present, NIHE concludes temporary contracts with external equipment agents for the maintenance and management of the existing equipment, when need arises. However, for the maintenance and management of the major equipment to be procured in the Project, NIHE needs to conclude long-term (one to two years) maintenance and management contracts with the supplier/agents.

It is essential that the performance of the planned equipment is consistent with the examination and research program. On the other hand, to reduce the maintenance and management expenses, it is important that reagents and consumables for the equipment are obtainable at reasonable prices.

(7) Policy toward the setting of grades of facilities and equipments

1) Construction Plan

In the Project, the BSL-3 facilities will be constructed in the High Tech Center Building, which is already in the process of construction under Vietnamese responsibility. This project will be the first introduction of BSL-3 laboratories to Viet Nam. Therefore, prior to the commencement of Grant Aid Cooperation, development of the regulations on bio-safety facilities and preparation of manuals for their operation are scheduled in the Technical Cooperation Project. This will become the model case for the establishment of BSL-3 laboratories in Viet Nam in the future. The regulations and manuals will be based on Japanese standards which will be modified to meet the conditions in Viet Nam. When establishing the bio-safety regulations, not only the BSL-3 facilities provided by the Japanese side, but also the entire High Tech Center Building must comply with these regulations. The Japanese side will provide appropriate technical advice to the components which are constructed by the Vietnamese side in order to maintain the consistency of facility and equipment performance with the potions done by the Japanese side.

2) Equipment Plan

The equipment incidental to the BSL-3 laboratories, the disinfecting equipment and materials for the BSL-3 laboratories and the minimum necessary equipment for avian influenza diagnosis and research are to be provided. For grade specifications, the specifications equivalent to those of the equipment and materials used at present in the inspection rooms of the NIHE departments will basically apply to the laboratory equipment, which will be limited to the equipment that can be operated and maintained in the existing technical level of the staff members.

(8) Policy on the construction/procurement methods and construction period

1) Policy on the construction methods

Masonry wall reinforced with RC pillars and girders is the common building structure in Hanoi. The High Tech Center Building (constructed by the Vietnamese side) in which the facilities of the Project are to be constructed is also composed of pile foundations, RC frame structure, and brick masonry walls.

As the laboratories on the first and second floors which are outside the scope of the Project are scheduled to be in operation during the construction work of the Project, consideration should be given to adopting construction methods and measures with less vibration and noise.

2) Policy on the procurement methods

The majority of materials can be procured in and around Hanoi. Materials of various qualities and standards imported from Japan, Europe, Southeast Asia, and China are available in Viet Nam. For the ease of maintenance, management, and repair after the completion of facility construction, materials and equipment will be procured locally as much as possible. When procuring locally, the quality and availability of the materials/equipment will be thoroughly investigated to ensure that the quality and availability do not affect the progress of construction.

The materials and equipments required for the specialized facility function of a high safety laboratory are to be procured through import from Japan or third countries and will be shipped to Haiphong Port in Viet Nam by sea and transported over land by vehicles from the port to the construction site in Hanoi. A packaging method securing full resistance to damage from shock, humidity, and high temperature will be adopted for certain equipment and materials.

3) Policy on the construction period

The site of the Project is located within Hanoi City. The traffic flow of large vehicles is banned during the daytime in Hanoi. Thus, as the transport of materials and equipment during the daytime may be hindered by the ban, working at night and weekends will be considered. The implementation plan should be prepared so that the construction work of the Project can be executed without interfering with the activities already in operation on the first and second floors of the High Tech Center Building.

2-2-2 Basic Plan

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

(1) Changes in the request contents

1) The contents of the original request

The contents of request described in the request form dated 20th June 2005 included

① the construction/establishment of BSL-3 laboratory facility of the total floor area of 400m^2, which consisted of four main facility rooms (two BSL-3 laboratories, an animal room, and an equipment room), and the rooms associated with the facility on the first floor and

② the procurement of required equipment to the BSL-3 laboratories and the associated rooms

of the High Tech Center Building, which was under construction in the National Institute of Hygiene and Epidemiology (NIHE).

2) The partial revision of the request contents of the Project made during the preliminary evaluation study for 'the Project for Capacity Development for the National Institute of Hygiene and Epidemiology to Control Emerging and Re-emerging Infectious Disease in Vietnam'

During the preliminary study for the above Technical Cooperation Project, which was conducted in December 2005, consultation was held in connection with this Grant Aid Cooperation project. As the result of the consultation, the both sides agreed to change the request contents as follows:

① The BSL-3 laboratories consisting of four main facility rooms (Diagnostic, Research, Back-up, and Animal Laboratories) and other rooms including Control Room

② The BSL-2 laboratories consisting of PCR Laboratory, Tissue Culture Preparation Room, and Diagnosis/Research Room and the associated rooms essential to the experiments and research in the BSL-3 laboratories

③ Construction and establishment of ① and ② of the total floor area of 800m^2 on the third floor of the High Tech Center Building

3) The request contents discussed during the field study

On the basis of the above-mentioned changes in the request contents, the Basic Design Study of the Project was implemented from 11th to 27th January 2006. The following are the outcomes of the discussion with the Vietnamese side and related study discussions.

① BSL-3 laboratories and the associated rooms

Both sides confirmed that, the establishment of the four BSL-3 laboratories, 'Diagnosis Laboratory,' 'Research Laboratory,' 'Back-up Laboratory,' and 'Animal Laboratory,' was essential to the Project, as both sides had agreed at the time of the Preliminary Evaluation Study for the Technical Cooperation Project, which is to be implemented in collaboration with the Project.

Both sides also confirmed the necessity of the BSL-2 laboratories and the associated rooms.

The examination and research into the control of avian influenza requires BSL-2 laboratories and associated rooms, in addition to the BSL-3 laboratories. These BSL-2 laboratories are used for the detection of the avian influenza virus genes by RT-PCR method and others as well as for the preparation of cells used for virus culture to be used in the BSL-3 laboratories.

As the construction of the BSL-3 and -2 laboratories requires space to install air-conditioning and mechanical systems both in the ceiling plenum and in upper loft floors, the original plan of NIHE has to be modified to accommodate the laboratories and the associated rooms on the third floor and the Mechanical systems on the fourth floor.

② Equipment list

At the beginning of the study in Viet Nam, NIHE requested the Japanese side to provide the equipment required for the entire High Tech Center Building. Through the discussions with the Vietnamese side, it was agreed upon that the Project covered principally the equipment required for the control of avian influenza.
Based on the information on the contents, methods and processes of the equipment used in various processes of the avian influenza diagnosis made by NIHE at present, the "Avian Influenza Diagnosis Flowchart" and the "Avian Influenza Research Flowchart" as shown below were prepared in order to examine the types and quantities of required equipment and materials in this Project. These flowcharts will be outlined as follows:

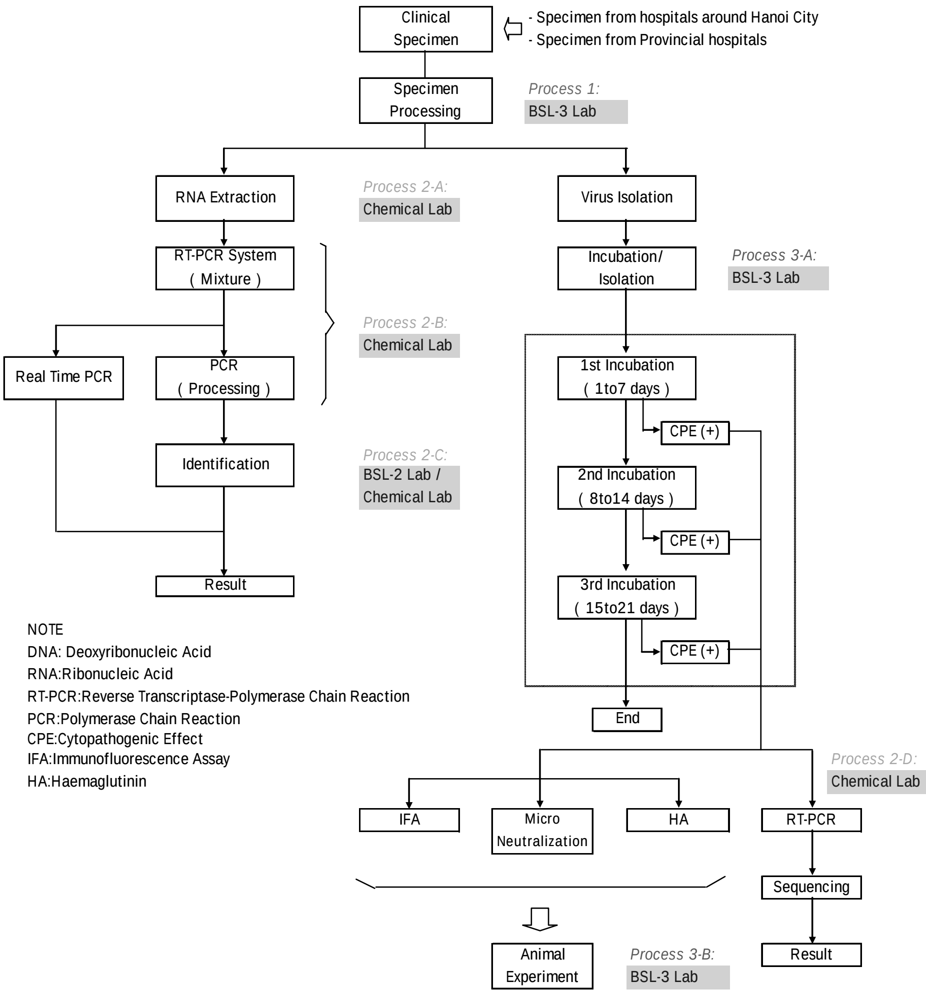
<u>Avian Influenza Virus Diagnosis Flowchart</u>

a) The clinical specimens delivered from hospitals in Hanoi and the Provincial Hospital are treated in the safety cabinet in BSL-2+ Diagnosis Laboratory and then centrifuged. Part of the centrifuged specimens is inactivated. Part of the non-inactivated specimens is used for isolation culture and the remaining part is stored in a deep freezer -80°C.
b) The inactivated specimens undergo the RNA extraction and the PCR tests in the RNA Extraction Room and PCR Laboratory respectively, and then the electrophoresis tests are made in the Electrophoresis Room and the specimens are observed with an UV trans-illuminator.
c) On the other hand, the non-inactivated specimens which have been centrifuged in the BSL-3 laboratory, are incubated with the cells prepared in Tissue Culture Preparation Room (a BSL-2 laboratory) in an incubator or a CO_2 incubator in the same BSL-2+ laboratory. If any cytopathic effect (CPE) is confirmed, the avian influenza virus is detected using the Immunofluorescence Assay (IFA) or other methods.
d) If the avian influenza viruses are detected, the viruses are inoculated in mice using an animal test cage with a safety cabinet in order to inspect the toxicity of avian influenza virus.

<u>Avian Influenza Virus Research Flowchart</u>

a) Clinical specimens such as the blood of patients infected with avian influenza virus are handled, centrifuged and pre-treated in the safety cabinet in the BSL-3 Research Laboratory. The pre-treated research samples are, as is the case for the virus diagnosis mentioned above, handled as inactivated samples, or as samples for isolation culture and storage.
b) The samples inactivated in the BSL-3 Research Laboratory are used for epidemiologic and genetic researches on the control of avian influenza and for the research and development of diagnosis kits and vaccines in the BSL-2 laboratories and the associated rooms using various types of equipment.

To define the equipment used in the processes on the avian influenza diagnosis and research flowcharts clearly and to examine the quantities of each of the equipment, the equipment layout plan of each laboratory was prepared and the discussion on the plans was held with the relevant counterparts. As a result, the following items, which had not been included in the original list of requested materials, were added to the list: ① rotary shaker, ② vortex mixer, ③ microwave, ④ safety cabinet for the BSL-2 laboratories, ⑤ freezers -20℃, ⑥ medical refrigerator (with temperature display), ⑦ spin-down, ⑧ multi-purpose flow cytometry and ⑨ laboratory tables.



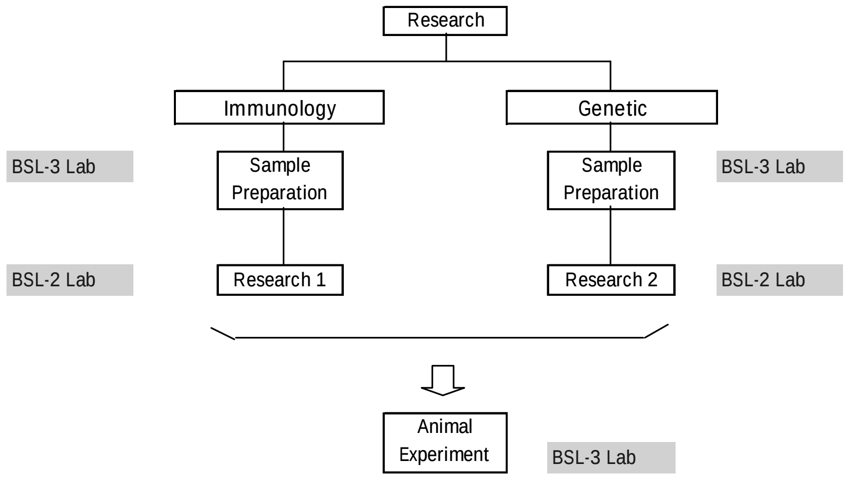
【Principal Equipment Used in Each Process】

	Process	Principal Equipment
BSL3	Process 1	+ Biosafety Cabinet
		+ Centrifuge
		+ Medical Refrigerator
		+ Deep Freezer -80℃
		+ Vertical Autoclave
BSL2/Chem. Lab	Process 2-A	+ Freezer -20℃
		+ Medical Refrigerator
		+ Automatic RNA Extraction System
		+ Refrigerated Microcentrifuge
		+ Vertical Autoclave
		- Vortex Mixer
		- Spin Down
	Process 2-B	+ Biosafety Cabinet
		+ PCR Workstation
		+ Freezer -20℃
		+ Medical Refrigerator
		+ PCR Machine
		+ Real Time PCR
		+ Dry Block Bath
		+ Vertical Autoclave
		- Vortex Mixer
		- Spin Down

	Process	Principal Equipment
BSL2/Chem. Lab	Process 2-C	+ Medical Refrigerator
		+ Electrophoresis Apparatus
		+ UV Transilluminator
		+ Image Acquis. Workst. f/ Electroph.
		+ Vertical Autoclave
		+ Ice Maker Machine
		+ pH Meter
		+ Electronic Balance
		- Microwave Oven
	Process 2-D	+ PCR Machine
		+ DNA Sequencer
		+ Others
	Others	+ Fluorescence Microscope
		+ Others
BSL3	Process 3-A	+ Incubator
		+ CO_2 Incubator
		+ Inverted Microscope (Observation)
		+ Shaking Water Bath
		+ Medical Refrigerator
	Process 3-B	+ Animal Cage S. w/Biosafety Cabinet
		+ Biosafety Cabinet
		+ Vertical Autoclave

Note: + Equipment to be procured under the Project
- Equipment to be transferred from the existing laboratories (NIHE Responsibilities)

Figure 2-3 Flow Chart for Diagnosis of Avian Influenza



【Principal Equipment Used in Each Process】

	Field	Principal Equipment
BSL3 Lab	Sample Preparation	+ Biosafety Cabinet + Medical Refrigerator + Ultrasonicator + Centrifuge + Refrigerated Microcentrifuge + Inverted Microscope + Incubator + CO2 Incubator + Shaking Water Bath + Vertical Autoclave + Ultrasonicator
	Animal Experiment	+ Animal Cage S. w/Biosafety Cabinet + Biosafety Cabinet + Vertical Autoclave

	Field	Principal Equipment
BSL2 Lab	Research 1	+ Spectrophotometer + Spectrofluorometer + FTIR Spectrophotometer + Multipurpose Flow Cytometry + PCR Machine + Electrophoresis Apparatus + UV Transilluminator + Image Acquis. Workst. f/ Electroph.
	Research 2	+ Ultracentrifuge + PCR Machine + DNA Sequencer + Electrophoresis Apparatus + UV Transilluminator + Image Acquis. Workst. f/ Electroph. + Lyophilizer

Note: + Equipment to be procured under the Project

Figure 2-4 Flow Chart for Research of Avian Influenza

(2) The final request contents

The following are the final request contents of facilities and equipment agreed upon by the two sides in accordance with the results of the field study.

1) Facility Plan

Objective: Establishment of the minimum of the BSL-3 laboratories and the associated facilities required for experiments and research on the avian influenza virus

Location of the facilities: The third floor, the High Tech Center Building (approximately 800m^2)

Components of the Facilities: Four BSL-3 laboratories (for laboratory diagnosis, vaccine development research, animal experiments, and back-up), and the associated facilities (Biosafety Control Room, Control Room, PCR Room, and BSL-2 laboratories)

Facility layout: The following drawing was attached to the Minutes.

Figure 2-5 The third floor of the High Tech Center Building (BSL-3 laboratories)

2) Equipment Plan

The items and quantities of the finally requested equipment and materials as determined as a result of consultations with the counterparts as described above are shown in Table 2-2.

Table 2-2 Final Equipment Request List

No.	Description	Priority	Q'ty	Tentative Allocation
I.	**Equipment for BSL-3 Laboratory**			
I-1	Autoclave, Pass Through Type	A	4	Diagnosis (1), Research (1), Animal experiment (1), Back up (1)
I-2-1	Biosafety Cabinet A	A	6	Diagnosis (2), Research (2), Back up (2)
I-2-2	Biosafety Cabinet B	A	1	Animal experiment (1)
I-3	BSL-3 Pass Box	A	4	Diagnosis (1), Research (1), Animal experiment (1), Back up (1)
I-4	Sink with Drain Decontamination Tank	A	4	Diagnosis (1), Research (1), Animal experiment (1), Back up (1)
I-5	Formaldehyde Decontamination Unit	A	3	Common use for Diagnosis, Research, Animal experiment, Back up
I-6	Animal Cage Unit (Autoclaveble)	C	-	-
I-7	Animal Cage with Biosafety Cabinet Unit	A	2	Animal experiment (1)
I-8	UV Locker	C	-	-
I-9	Safety Cabinet for Centrifuge	C	-	-
II.	**Laboratory Equipment**			
II-1	Laser Scanning Microscope and Specimen Preparation System	C	-	-
II-2	Spectrofluorometer	B	1	Laboratory 4 (1)
II-3	FTIR Spectrophotometer	A	1	Laboratory 4 (1)
II-4	Spectrophotometer	A	1	Laboratory 4 (1)
II-5	High Perfermancer Liquid Chromatograph (HPLC)	C	-	-
II-6	Electrophoreisis with Supply Unit	A	1	Laboratory 6 (1)
II-7	Real Time PCR	A	1	Laboratory 3 (1)
II-8	PCR Machine-Thermal Cycler	A	3	Laboratory 3 (2), Laboratory 4 (1)
II-9	DNA Sequencer	A	1	Laboratory 4 (1)
II-10	ELISA System	A	1	Laboratory 4 (1)
II-11	Biological Microscope	C	-	-
II-12	Fluorescence Microscope	A	1	Laboratory 4 (1)
II-13	Inverted Microscope	A	4	Diagnosis (1), Research (1), Back up (1), Laboratory 5 (1)
II-14	Ultracentrifuge, Floor Type	A	1	Laboratory 4 (1)
II-15	Ultracentrifuge, Bench-top Type	C	-	-
II-16	Centrifuge	A	5	Diagnosis (1), Research (1), Back up (1), Laboratory 4 (1), Laboratory 5 (1)
II-17	Microcentrifuge, Non Refriguated Type	C	-	-
II-18	Microcentrifuge, Refriguated Type	A	5	Diagnosis (1), Research (1), Back up (1)Laboratory 1 (1), Laboratory 2 (1)
II-19	Deep Freezer, -80°C	A	7	Diagnosis (1), Research (1), Back up (1), Specimen Storage (4)
II-20	Deep Freezer, -150°C	C	-	-
II-21	Ultra Pure Water System	C	-	-
II-22	PCR Workstation	A	1	Laboratory 2 (1)
II-23	CO_2 Incubator	A	4	Research (1), Back up (1), Laboratory 4 (1), Laboratory 5 (1)
II-24	Incubator, 37°C	A	5	Diagnosis (1), Research (1), Back up (1), Laboratory 4 (1), Laboratory 5 (1)
II-25	Vertical Autoclave	A	6	Diagnosis (1), Research (1), Animal experiment (1), Back up (1), Laboratory 4 (1), Laboratory 6 (1)
II-26	Dry Sterilizing Oven	A	1	Laboratory 4 (1)
II-27	Ultrasonicator	A	2	Research (1), Laboratory 4 (1)
II-28	Electronic Balance	A	2	Laboratory 4 (1), Laboratory 6 (1)
II-29	pH Meter	A	1	Laboratory 4 (1)
II-30	Shaking Water Bath	B	5	Diagnosis (1), Research (1), Back up (1), Laboratory 4 (1), Laboratory 5 (1)
II-31	Dry Block Bath	A	2	Laboratory 2 (1), Laboratory 4 (1)
II-32	UV Transilluminator	A	1	Laboratory 6 (1)
II-33	Ice Maker	A	1	Laboratory 6 (1)
II-34	Lyophilizer, Bench-top Type	A	1	Laboratory 4 (1)
II-35	Automatical RNA Extraction	A	1	Laboratory 1 (1)
II-36	Image Acquisition Workstation for Electrophoresis Application	A	1	Laboratory 6 (1)
II-37	Concentrator DNA, DNA quantitative machine	C	-	-
II-38	Personal Computer	A	3	Biosefety Control Center
II-39	Scanner	C	-	-
II-40	Laser Printer	A	1	Biosefety Control Center
II-41	Rotary Incubator	C	-	-
II-42	Vortex Mixer	C	-	-
II-43	Laboratory Table	A	1	BSL-3 Laboratory, Laboratory
II-44	Microwave	C	-	-
II-45	Biosafety Cabinet C	A	3	Laboratory 1 (1), Laboratory 4 (1), Laboratory 5 (1),
II-46	Freezer, -20°C	A	3	Laboratory 1 (1), Laboratory 4 (1), Laboratory 5 (1)
II-47	Medical Refrigerator	A	8	Diagnosis (1), Research (1), Back up (1), Laboratory 1 (1), Laboratory 4 (2), Laboratory 5 (1), Laboratory 6 (1)
II-48	Spin Down	C	-	-
II-49	Multipurpose Cytometry	A	1	Laboratory 4 (1)

The following are the main reasons for the omission of items, which were included in the original equipment request list, from the items to be provided in the Project (Priority C items).

・Necessity of the items in the Project is low.
Animal cage units, UV lockers, high-performance liquid chromatograph, biological microscope, deep freezer -150℃, and scanner

・It will become unnecessary with procurement of biosafety-specification equipment.
Safety cabinet for centrifuge
・Another item in the list can do its work.
Tabletop ultracentrifuge and micro centrifuge
・Equipment in the existing laboratories can be shared or transferred.
Ultra-pure water system, DNA centrifugal concentrator, and DNA quantitative analyzer.
・ The item is not cost-effective and its installation is very difficult in terms of the vibration and electromagnetic radiation control.
Laser scanning microscope

Moreover, among the equipment in the additional request, four items were excluded from the Project (Priority C), as the need for ① the rotary shaker is low and the existing ②vortex mixers, ③microwave ovens, and ④spin-downs can be transferred to the new facilities.

(3) Examination of the request contents

1) Construction Plan

① Consistency with the High Tech Center (HTC) Building Project

The objective of the HTC Building Project is to construct up-to-date facilities for the centralized research on infectious diseases independent from the superannuated and overcrowded NIHE Main Building, putting together elite researchers, and to establish the base of the infectious disease research and become the exemplary facility for the BSL-3 laboratories which are to be built later in this country. Construction of the HTC building commenced in December 2004. As of January 2006, the exterior work had been completed and the interior and facility works were about to commence. However, because of the low story height, the ceiling plenum is too small to accommodate all of duct works for the laboratories.
Taking this situation into consideration and from the viewpoint of building 'the up-to-date facility' being the fundamental objective of the HTC Building Project, it was decided to adopt the following policy. 'The bio-safety level-3 laboratories,' the main objective of the requested project, are to be constructed on the third floor. The space under the roof is altered to be the fourth floor to accommodate and install the mechanical systems which support the function of the laboratories downstairs. (In the original plan for the HTC Building Project prepared by the Vietnamese side, this space was to be an attic space where brick walls are erected to support the roof.)
The Vietnamese side requested to support their desire to design the laboratory and office floors on the first and second floors, which are outside the scope of the Project, in line with the same design concept as the third floor. In response, the study team advised the Vietnamese side to adopt the modified plan with clear separation of the 'living area' including offices and the 'laboratory area', which is the basic concept of designing laboratories for infectious disease experiments. The Vietnamese side accepted the advice.

② The requested Japanese assistance (construction)

As mentioned above, the request contains the establishment of the four BSL-3 laboratories on the third floor of the HTC Building. They are a laboratory for the diagnosis of the avian influenza virus, a laboratory for research, an animal laboratory for the toxicity test essential to the diagnostic experiments, and a back-up laboratory for redundancy in preparation for explosive spread of avian influenza or regular inspection of the other laboratories. The entire floor area of the facilities under the Project becomes approximately 800m^2, with the addition of the BSL-2 laboratories for the pretreatment of samples and the associated experiments, Freezer Room, Document Management Room, and Control Room,. The attic space on the fourth floor will be used as a space to install mechanical systems such as air-conditioning facilities. Heat source equipment such as the boiler and chiller will be installed in the Energy Plant

Block on the site opposite to the HTC Building. The heat sources such as steam and cold water will be supplied to the HTC Building through a trench.

③ Prerequisite for the requested Japanese assistance - 1

The above-mentioned modification of the request contents was made after the verification of the structural strength of the HTC Building on site.
The additional load to the slabs, beams, and girders of the fourth floor, on which the facilities are to be installed in the Project, can be compensated with the load reduction with the removal of the existing brick walls. With this measure, the load can be kept within the allowable range.
The Japanese side will provide information regarding measurements and shapes of mechanical systems components on the roof and the locations and sizes of slab penetration openings. The Vietnamese side will design the work in accordance with such conditions provided by the Japanese side and execute the work.

④ Prerequisite of the requested Japanese assistance – 2 (The HTC alteration works by the Vietnamese side)

In principle, the requested Japanese assistance in the Project is limited to the interior works and related mechanical/electrical works. Therefore, 'the alteration works' on the HTC Building Project, which is already completed to the structure and exterior works, has to be done completely under the responsibility of the Vietnamese side before the commencement of the Japanese works. The Vietnamese side is also responsible for the structural work of the Energy Plant Block and the trench work. The Vietnamese side has promised to these works consistent with the work of the Project to be implemented by the Japanese side.

2) Equipment Plan

This Project will provide the minimum necessary equipment and materials to be used for the diagnosis and research into for the control of avian influenza. The planned equipment and materials will be selected, with stress placed on the items below, in accordance with the "Rules of Equipment Selection" and taking into consideration the characteristic objective of the Project of establishing high level bio-safety laboratories.

- The minimum of equipment required for the diagnosis and research into the control of avian influenza
- Equipment in accordance with the biosafety control standards
- Equipment operable with the existing level of technical in NIHE
- Equipment which can be easily operated, maintained, and managed
- Equipment on which the maintenance/management contract can be easily concluded
- Equipment for which spare parts, reagents, and consumables are readily procured

The following are the results of the examination of the requested equipment for ①the BSL-3 laboratories and ②the associated facilities other than the BSL-3 laboratories in accordance with the above-mentioned policies.

① BSL-3 laboratories

- BSL-3 Diagnosis Laboratory, BSL-3 Research Laboratory, and BSL-3 Back-up Laboratory

Table 2-3 Equipment Plan for BSL-3 Laboratory

Name of Equipment	Q'ty	Name of Equipment	Q'ty
Autoclave, Pass Through Type	1 un.	Deep Freezer -80℃ (A)	1 un.
Biosafety Cabinet, (A)	2 un.	CO_2Incubator (A)	1 un.
Pass Box	1 un.	Incubator	1 un.
Sink with Decontamination Tank	1 un.	Vertical Autoclave	1 un.
Inverted Microscope	1 un.	Shaking Water Bath	1 un.
Centrifuge, Refrigerated	1 un.	Medical Refrigerator	1 un.
Refrigerated Microcentrifuge	1 un.	Laboratory Table（Various）	1 set
Ultrasonicator ※	1 un.		

*Only 1 (one) unit for BSL-3 Laboratory for Research

A BSL-3 laboratory must be equipped with the four items, a pass-through type autoclave, a safety cabinet (A), a pass box, and a sink with drain decontamination tank. These items are essential for safe experiments.
An inverted microscope, a refrigerated centrifuge, a refrigerated microcentrifuge, a deep freezer -80℃, a CO_2 incubator (A), an incubator, a vertical autoclave, a shaking water bath, a medical refrigerator, and a laboratory table are basic and essential equipment used in the experiment for various diagnoses and research.

- BSL-3 Animal Laboratory

The following are the standard equipments to be provided

Table 2-4 Equipment Plan for BSL-3 Animal Laboratory

Name of Equipment	Q'ty	Name of Equipment	Q'ty
Autoclave, Pass Through Type	1 un.	Sink with Decontamination Tank	1 un.
Biosafety Cabinet (B)	1 un.	Vertical Autoclave	1 un.
Pass Box	1 un.	Animal Cage System with Biosafety Cabinet	1 un.
Laboratory Table	1 un.		

In addition to a pass-through type autoclave, a safety cabinet (B), a pass box, and a sink with drain decontamination tank, an animal cage system with safety cabinet, and a laboratory table are required for animal experiments.

- Common equipment for the BSL-3 laboratories

The request includes three formaldehyde fumigators (two for the laboratories and one for the safety cabinets). The following common equipment is required for the operation, maintenance, and management of the BSL-3 laboratories established in the Project.

a) Equipment for disinfection and sterilization of the BSL-3 laboratories (including BSL-3 Animal Laboratory): Formaldehyde decontamination unit, a formaldehyde gas oxidization treatment unit, and a densitometer for formaldehyde gas are required. For a large laboratory, two fumigators and two analyzers may be required. However, as the sizes of the BSL-3 laboratories in the Project is not so large (the volume of each laboratory is approximately $100m^3$.), one each will be sufficient.

b) Equipment for disinfection and sterilization of the safety cabinets: Instead of the formaldehyde decontamination unit described in a), a safety cabinet requires designated equipment. One such decontamination unit will be provided as common equipment for all the safety cabinets installed in the BSL-3 laboratories and the associated rooms.

② Other associated facilities including BSL-2 laboratories

As is shown in the Diagnosis Flowchart and Research Flowchart, the diagnosis and research of the avian influenza virus requires a PCR machine, a real time PCR apparatus, and a DNA sequencer in the associated rooms including the BSL-2 laboratories, in addition to the above-mentioned equipment used in the BSL-3 laboratories. Table 2-5 shows the equipment required in each laboratory. The types and numbers of equipments in the table are those which are minimally required. However, a computer and a laser printer requested for Control Room will not be provided in the Project because they are the equipment associated with the building services plan of the laboratory facilities.

Table 2-5 Equipment of Chemical Laboratory, BSL-2 Laboratory and Specimen Storage

Room Name	Name of Equipment	Q'ty	Room Name	Name of Equipment	Q'ty
Laboratoy-1: RNA Extraction Room	1. Refrigerated Microcentrifuge	1 un.	Laboratory-4: Multipurpose Diagnosis/ Research Room	15. Electronic Balance	1 un.
	2. Automatic RNA Extraction System	1 un.		16. pH Meter	1 un.
	3. Freezer -20°C	1 un.		17. Shaking Water Bath	1 un.
	4. Medical Refrigerator	1 un.		18. Dry Block Bath	1 un.
Laboratory-2: Reagent Preparation Room	1. Refrigerated Microcentrifuge	1 un.		19. Lyophilizer	1 un.
	2. PCR Workstation	1 un.		20. Freezer -20°C	1 un.
	3. Dry Block Bath	1 un.		21. Medical Refrigerator	2 un.
	4. Vertical Autoclave	1 un.		22. Multipurpose Flow Cytometry	1 un.
Laboratory-3: DNA Amplification Room	1. Real Time PCR	1 un.	Laboratory-5: Cell Culture Preparation Room	1. Inverted Microscope	1 un.
	2. PCR Machine	2 un.		2. Centrifuge	1 un.
	3. Freezer -20°C	1 un.		3. CO2 Incubator (B)	1 un.
	4. Medical Refrigerator	1 un.		4. Incubator	1 un.
Laboratory-4: Multipurpose Diagnosis/ Research Room	1. Spectrofluorometer	1 un.		5. Shaking Water Bath	1 un.
	2. FTIR Spectrophotometer	1 un.		6. Freezer -20°C	1 un.
	3. Spectrophotometer	1 un.		7. Medical Refrigerator	1 un.
	4. PCR Machine	1 un.	Laboratory-6: Electrophoresis Room	1. Electrophoresis Apparatus (A) ※	1 un.
	5. DNA Sequencer	1 un.		2. Electrophoresis Apparatus (B) ※	1 un.
	6. ELISA System	1 set		3. Electrophoresis Apparatus (C) ※	1 un.
	7. Fluorescence Microscope	1 un.		4. Vertical Autoclave	1 un.
	8. Ultracentrifuge, Floor Type	1 un.		5. Electronic Balance	1 un.
	9. Centrifuge	1 un.		6. UV Transilluminator	1 un.
	10. CO_2 Incubator (B)	1 un.		7. Ice Maker Machine	1 un.
	11. Incubator	1 un.		8. Image Acquisition Workstation for Electrophoresis Application	1 un.
	12. Vertical Autoclave	1 un.			
	13. Dry Sterilizing Oven	1 un.		9. Medical Refrigerator	1 un.
	14. Ultrasonicator	1 un.	Specimen Storage	1. Deep Freezer -80°C (B)	4 un.

* 1 (one) set of Electrophoresis Apparatus with different specifications was separated into Electrophoresis Apparatus A, B, and C

For most of the equipment for the BSL-3 laboratories, the timing of their transport and installation has to be coordinated with the construction work schedule. In addition, as shown in Table 2-6, the connection and coordination with the interior works and facilities/equipments of the BSL-3 laboratories provided in the Facility Plan and the architectural measures associated with installation sites of heavy equipment is very important. Therefore, the installation of the following equipment is to be included in the Facility Plan.

Table 2-6 Reasons for inclusion in Architectural Works

Name of Equipment	Q'ty	Reasons why they will be included in Architectural Works
Autoclave, Pass Through Type	4 un.	- For installing the autoclave there are complicated interfaces between the autoclave and walls that will support pressures differential of BSL-3 laboratory. - The space for installation of heavy autoclave is limited and the installation of such autoclave shall be done together with construction works of BSL-3 laboratory. - The works of piping connecting the autoclave located in the 3rd floor and the compressors located on the 4th floor can not be carried out independently from the construction of BSL-3 laboratory. - The installation of autoclave has many related works with supply and drainage of water and steam, ventilation and electrical matters.
Biosafety Cabinet (A)	6 un.	- The installation of biosafety cabinet will have a direct effect an air balance and room pressure of the laboratories. - Bio-safety cabinets must be carefully adjusted with ventilation system. - Connection of duct from the biosafety cabinet to the exhausting duct to be provided by mechanical work will be required.
Biosafety Cabinet (B)	1 un.	
Biosafety Cabinet (C)	3 un.	- To ensure easier and more efficient after sales service by manufacturers (especially in the supply of HEPA filters), it is important that 1 (one) manufacturer supply the three types of Biosafety Cabinets (A), (B) and (C).
Pass Box	4 un.	- For installing the pass box there are complicated interfaces of pass box and walls that will support pressures of BSL-3 laboratory.
Sink with Decontamination Tank	4 un.	- Included differential in Architectural works because the device is incorporated in the sink that is in scope of Architectural Works.
Animal Cage System with Biosafety Cabinet	1 un.	- Same reason as for Biosafety Cabinet (A) mentioned above.
Laboratory Table	1 set	- Including in Architectural Works instead of Equipment Works reduces costs.

On the basis of the above-mentioned results of the examination of the requested equipments and following the evaluation criteria for the equipment selection described below, the necessity and relevance of each of the requested equipments was examined in more detail.

① Equipment required for the diagnosis and research of the avian influenza virus

〇 Essential to the diagnosis and research of the avian influenza virus

△ Though there is necessity for the equipment, it will be used infrequently or its function can be performed by other equipment.

× Little necessity in the diagnosis and research of the avian influenza virus

② Equipment compatible with the technical level of the research

○ Usable with the current technical level of the NIHE researchers

△ With training at procurement stage, the equipment can be used with the current technical level of the researchers

× Difficult to operate with the technical level of the current NIHE researchers.

③ Equipment which can be maintained and managed

○ Can be maintained and managed with the current system and budget for the maintenance and management

△ Can be maintained and managed if the current maintenance and management system of NIHE is improved and maintenance and management contracts are concluded with the agents.

× Because of high maintenance and management expenses, the operation of the equipment thought difficult at present.

(Overall evaluation)

○ Equipment whose procurement in the Project deemed relevant.

× Equipment which will not be included in the Project.

Table 2-7 lists the results of this examination.

Table 2-7 Results of this Examination

Req. No.	Name of Equipment	Priority	Req. Q'ty	Evaluation Items ①	②	③	Evaluation	Planned Q'ty	Remarks
I.	Equipment for BSL-3 Laboratories								
I-1	Autoclave, Pass Through Type	A	4	○	△	△	○	4	To be included in Facility Plan
I-2-1	Biosafety Cabinet (A)	A	6	○	○	○	○	6	Idem
I-2-2	Biosafety Cabinet (B)	A	1	○	○	○	○	1	Idem
I-3	Pass Box	A	4	○	○	○	○	4	Idem
I-4	Sink with Decontamination Tank	A	4	○	○	○	○	4	Idem
I-5	Formaldehyde Decontamination Unit	A	3	○	△	○	○	1	Refer to Study of Equipment of Common Use for BSL-3 Laboratories
I-7	Animal Cage System with Biosafety Cabinet	A	2	○	△	○	○	1	To be included in Facility Plan. One unit each will be enough
II.	Equipment for Diagnosis/Research								
II-2	Spectrofluorometer	B	1	○	△	○	○	1	Can be used without difficulties after receiving operation training in the installation period
II-3	FTIR Spectrophotometer	A	1	○	△	○	○	1	Idem
II-4	Spectrophotometer	A	1	○	△	○	○	1	Idem
II-6	Electrophoresis Apparatus	A	1	○	○	○	○	1	Will be classified in Electrophoresis Apparatus (A) (B) and (C) due to the composition of equipment of different specifications
II-7	Real Time PCR	A	1	○	○	○	○	1	With data processing hardware
II-8	PCR Machine	A	3	○	○	○	○	3	
II-9	DNA Sequencer	A	1	○	○	○	○	1	
II-10	ELISA System	A	1	○	○	○	○	1	
II-12	Fluorescence Microscope	A	1	○	○	○	○	1	
II-13	Inverted Microscope	A	4	○	○	○	○	4	
II-14	Ultracentrifuge, Floor Type	A	1	○	○	○	○	1	
II-16	Centrifuge	A	5	○	○	○	○	5	3 units for BSL-3 laboratories should be refrigerated centrifuge
II-18	Refrigerated Microcentrifuge	A	5	○	○	○	○	5	
II-19	Deep Freezer -80℃	A	7	○	○	○	○	7	Will be classified in (A) and (B) because will be needed deep freezers with different capacities
II-22	PCR Workstation	A	1	○	○	○	○	1	

Req. No.	Name of Equipment	Priority	Req. Q'ty	Evaluation Items			Evalua-tion	Planned Q'ty	Remarks
				①	②	③			
II-23	CO_2 Incubator	A	4	○	○	○	○	5	To increase flexibility one unit will be added in BSL-3 laboratory for Research. Will be classified in (A) and (B) because will be needed CO2 incubators with different capacities
II-24	Incubator	A	5	○	○	○	○	5	
II-25	Vertical Autoclave	A	6	○	○	○	○	7	1 unit will be added for Reagent Preparation Room
II-26	Dry Sterilizing Oven	A	1	○	○	○	○	1	
II-27	Ultrasonicator	A	2	○	○	○	○	2	
II-28	Electronic Balance	A	2	○	○	○	○	2	
II-29	pH Meter	A	1	○	○	○	○	1	
II-30	Shaking Water Bath	B	5	○	○	○	○	5	
II-31	Dry Block Bath	A	2	○	○	○	○	2	
II-32	UV Transilluminator	A	1	○	○	○	○	1	
II-33	Ice Maker Machine	A	1	○	○	○	○	1	
II-34	Lyophilizer	A	1	○	△	○	○	1	Can be used without difficulties after receiving operation training in the installation period
II-35	Automatic RNA Extraction System	A	1	○	△	△	○	1	Idem
II-36	Image Acquisition Workstation for Electrophoresis Application	A	1	○	○	○	○	1	
II-38	Computer	A	3	△	○	○	×	0	Will not be included in Equipment Plan since it is a unit related with Mechanical Work
II-40	Laser Printer	A	1	△	○	○	×	0	Idem
II-43	Laboratory Table	A	1	○	○	○	○	1	To be included in Facility Plan
II-45	Biosafety Cabinet (C)	A	3	○	○	○	○	3	Idem
II-46	Freezer -20°C	A	3	○	○	○	○	3	
II-47	Medical Refrigerator	A	8	○	○	○	○	9	1 unit will be added for DNA Amplification Room
II-49	Multipurpose Flow Cytometry	A	1	○	○	○	○	1	

2-2-2-2 Site Plan

(1) Shape and use of the site

The implementing agency of the Project, the National Institute of Hygiene and Epidemiology (NIHE), is a medical research institute under the jurisdiction of the Ministry of Health and the core institution for infectious disease research in Viet Nam, similar to the National Institute of Infectious Diseases in Japan.

The institute is located in the central part of Hanoi City (Figure 2-6). The Main Building stands at the northern side of its large premises. The experiments and analyses on avian influenza virus are presently being conducted in this building.

The High Tech Center (HTC) Building, the subject of the requested Japanese assistance, is located on the eastern side of the premises. On the south of the HTC Building, which is being constructed under the budget of the Vietnamese government, there is a residential area separated from the institute by a road (Figure 2-7).

The plan is to construct/establish the facilities under the Project on the third and fourth (attic) floors of the HTC building with the budget of the Japanese side. The Vietnamese side is responsible for the construction of the Energy Plant Block on the west of the Experimental Animal Building, which is located in the center of the premises of the institute. The block will accommodate an emergency generator, which will be installed by the Vietnamese side, a boiler and a chiller, which will be procured by the Japanese side. The mechanical pipes and electrical wirings will be connected to the High Tech Center Building through an underground trench.

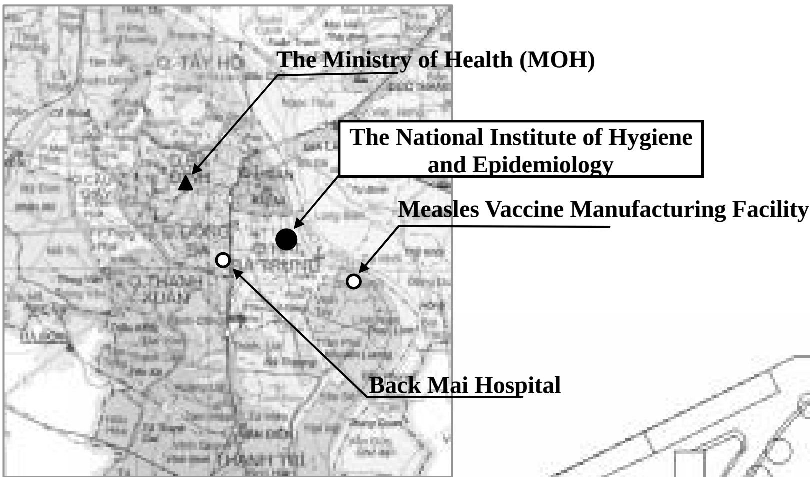


Figure 2-6 Project Site

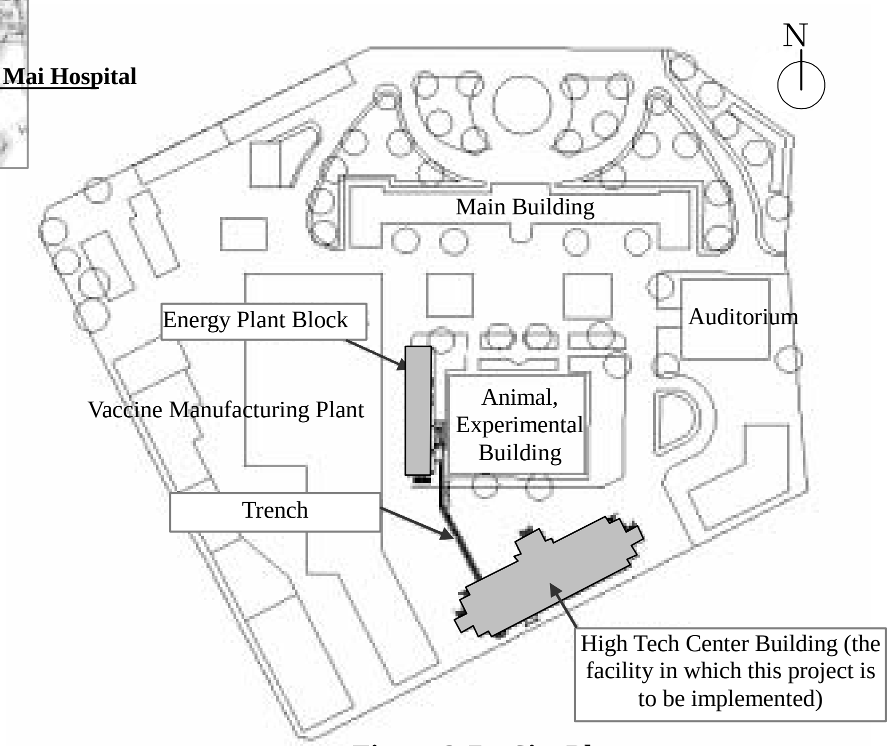


Figure 2-7 Site Plan

(2) Surrounding environment and infrastructure development

The High Tech Center Building is free of negative influence such as environmental pollution from the surrounding area. An unplanned market for fresh food has developed along the road on the south of the center between the center and the residential area. As the sewerage facility has not been developed, stagnant dirty water on the roadsides emits bad odors. The stench of animals and their feed is always spreading from the Experimental Animal Building, which is located on the north of the High Tech Center Building, to the surrounding area.

The 380/220V transformers of the total capacity of 1,400KVA supply electricity to NIHE. However, as the transformers do not have the capacity to supply electricity to the facilities under the Project, upgrading of the power receiving capacity is planned. Although power failure occurs infrequently at approximately four times a year, NIHE has two back-up emergency generators. NIHE is planning installation of a new large-capacity emergency generator for the High Tech Center Building including the capacity required for the facility under the Project. As voltage fluctuation of -20% occurs during power shortages in the summer, equipment is prone to the damage caused by voltage fluctuation and must be equipped with AVRs (automatic voltage regulators).

Two water supply lines supply water to the existing NIHE facilities. The water supply is stable with few cases of interruption. A water supply tower with the height of 30m and the capacity of $50m^3$ is situated on the side of the Headquarters Building adjacent to the east side of the Center Building. The water will be supplied from this tower to the Center Building including the facility under the Project.

The sewerage treatment facility has not been developed in Hanoi. Although there are sewerage mains, untreated wastewater is directly drained into rivers. Therefore, the wastewater from NIHE, which includes the contaminated water from the High Tech Center Building, will be treated in a septic tank newly constructed for the High Tech Center Building with the budget of Viet Nam and then drained into the nearest sewerage main.

2-2-2-3 Architectural Plan

(1) Facility component

The components of the project facilities to be established in the High Tech Center (HTC) Building are as follows:

Table 2-8 Components of the Project Facility

<table>
<tr><th colspan="2">Building/floor</th><th colspan="2">Component</th></tr>
<tr><td rowspan="4">HTC Building</td><td rowspan="2">3rd floor</td><td>BSL-3 laboratories</td><td>Diagnosis Laboratory, Research Laboratory, Back-up Laboratory, Animal Laboratory, corridor, rear corridor, sample store, etc.</td></tr>
<tr><td>Associated facilities</td><td>Chemical Laboratory Rooms (RNA Extraction Room, Reagent Preparation Room, DNA Amplification Room and Electrophoresis Room)

BSL-2 Laboratory Rooms (Multipurpose Diagnosis/ Research Room, Tissue Preparation Room)

Control Rooms (Biosafety Control Center and Control Panel Room)

Specimen store, corridors, elevator hall, toilets and common store</td></tr>
<tr><td>4th floor</td><td colspan="2">Mechanical/Electrical equipment for BSL-3 laboratories and associated facilities</td></tr>
<tr><td>Basement 1st floor</td><td colspan="2">Sterilization tank unit and CO_2 gas cylinder depot (to be established outside)</td></tr>
<tr><td colspan="2">Energy Plant Block and Trench</td><td colspan="2">Boilers and chillers, plumbing, and wiring (The Vietnamese side will be responsible for the generator.)
Block building and trench to be constructed by the Vietnamese side</td></tr>
</table>

(2) Establishment of the size and numbers of facilities

<u>BSL-3 laboratories</u>

In general, to avoid cross-contamination of samples, a process of diagnosis and research is not desirable to operate in the same room simultaneously. Also, the diagnostic processes are significantly different from the research activities in terms of work flow and items as well as reagents and instruments. The laboratories for respective uses should be separated in principle. In addition, a necessity of a ‘Back-up Laboratory’ for Diagnosis Laboratory is assumed for the cases in which a huge number of samples have to be handled during a large-scale epidemic of an emerging/re-emerging infectious disease. This Back-up Laboratory will be used also for the diagnosis of high-risk pathogens other than the avian influenza viruses, such as SARS and anthrax viruses when they emerge. In addition to the three BSL-3 laboratories, an ‘Animal Laboratory’ is required for the toxicity testing of the avian influenza viruses.
Therefore, the Project design includes four BSL-3 laboratories in total.

The ideal size of a BSL-3 laboratory is 8,200 x 6,400 mm. This size allows a space of the width of 1,500mm on either side of the central laboratory table as shown in Figure 2-8 below. In the Project, as 4 BSL-3 laboratories have to be designed in the limited area on the third floor of the HTC Building constructed by the Vietnamese side, each BSL-3 laboratory will have the minimally required area of 8,200 x 5,600 mm as shown in Figure 2-9. However, this size will cause no problem in working in this laboratory because the number of researchers working in a

BSL-3 laboratory is smaller than that in a BSL-2 laboratory and their lines of flow are limited. Making the minimum size of the BLS-3 laboratories to the minimum will also lead to the reduction in maintenance/ management expenses.
The Diagnosis, Research, and Back-up Laboratories are planned to have the same area and the equipment required in each laboratory will be installed in a layout considered for the laboratory.

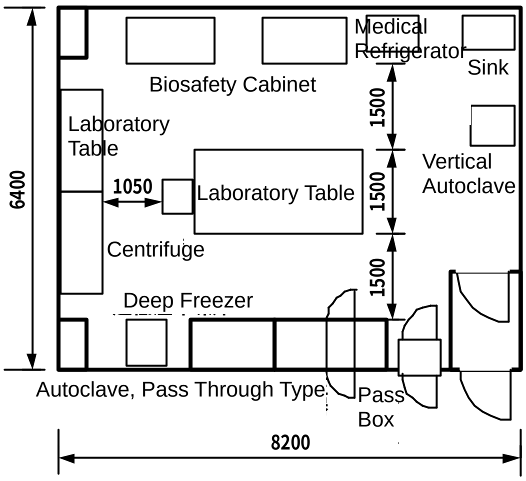


Figure 2-8 Standard BSL-3 laboratory layouts

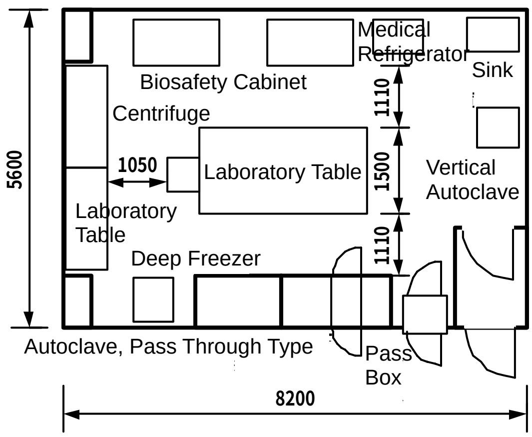


Figure 2-9 BSL-3 laboratory layout in the Project

Associated facilities
As mentioned above, the BSL-2 laboratories, consisting of RNA Extraction Room, Reagent Preparation Room, DNA Amplification Room, Multipurpose Diagnosis/Research Room, and Electrophoresis Room, are required for RNA extraction, preparation, adjustment, and mixing of reagents, and amplification and sequencing of DNA for the identification of the samples inactivated in the BSL-3 laboratories. In addition to these BSL-2 laboratories, a 'Tissue Culture Preparation Room' is required for the preparation of cells used for incubation and isolation of viruses in the BSL-3 laboratories. These BSL-2 laboratories will be used for both diagnosis and research of the avian influenza viruses.
As 6 laboratories have to be also designed in the limited area on the third floor of the HTC Building, the size of each laboratory should be kept at the minimum required level. The actual size of each laboratory will be 3,600 x 5,600mm, except for the Multipurpose Diagnosis/Research Room, which requires a space of 8,800 x 5,600mm to accommodate precise equipment such as various spectrophotometers, a floor-type ultracentrifuge, and a multipurpose flow cytometry, in addition to diagnosis equipment.
In addition to the above-mentioned laboratories, Common Store, which requires controlled air conditioning for the storage of the reagents and consumables used in the BSL-2 and -3 laboratories, and Sample Stores with -80℃ deep freezers for the storage of avian influenza virus samples are required.

Fourth floor
The fourth floor will be used mainly for the installation of the air conditioning equipment for the BSL-2 and -3 laboratories on the third floor. In the western half of the floor, 5 air conditioners called air-handling units, the ducts for air supply, exhaust, and ventilation associated with exhaust fans, and the pipes for the steam, cold water, and drainage for the BSL-3 laboratories will be installed on the steel frames. 2 compressors for 4 autoclaves in the BSL-3 laboratories will also be installed in the same manner. In the central part of this area, a passage for the transport of equipment will be made for replacement and repair work of equipment in future. The live load of heavy equipment, pipes, and ducts will be spread evenly over the entire floor by installing them on the frames which are placed over to straddle beams and girders.
On the other hand, in the eastern half of the floor, blower fans for the BSL-2 laboratories on the third floor will be installed. At present, there seems to be ample room in this equipment

installation space. However, the same type of equipment required for the laboratories on the first and second floors constructed by the Vietnamese side will also be installed in this area.
The Vietnamese side will remove the heavy arch-shaped brick walls on the fourth floor supporting the existing roof and replace them with relatively light steel frame structures. Some measures to improve the waterproofing performance of the roof surface, e.g. installation of roofing tiles on the waterproofing sheets laid on sheathing roof boards to be added newly to the roof construction, will be taken to prevent water leakage from damaging the air conditioning equipment.
Structural reinforcement of the floor will be required where ducts and pipes penetrate through it. The existing wooden louvers will be replaced with the aluminum ones so that the ducts can be connected to the louvers.
The Vietnamese side will install large doors which enable transport of large equipment in the building. The floor will be finished with waterproof coating so that water leakage from the air conditioning system will not damage on the BSL laboratories on the third floor. The details of this work will be found in Section 2-2-4-3 Scope of Works below.

<u>Basement floor</u>
This space is currently used as motorcycle and car parking. Sterilization tank unit for the treatment of the infectious wastewater discharged from the BSL-3 laboratories will be installed in 3.0m x 2.0m space of the floor.

<u>Exterior of the building</u>
Establishment of a CO_2 gas cylinder depot to supply CO_2 gas to the laboratories is planned at a site adjacent to the southern exterior wall of the HTC Building.

<u>Energy Plant Block</u>
As the heat sources mainly used for the BSL-3 laboratories, 2 steam boilers and 2 chillers, as well as their associated equipment, will be installed in the Energy Plant Block. An emergency generator for the entire HTC Building will also be installed in the block. Among these equipment, the boilers, chillers and the associated equipment will be within the scope of work of the Japanese side, while the building itself and the emergency generator system including an underground fuel tank will be under the responsibility of the Vietnamese side.

<u>Trench</u>
This is the space to install the pipes for the steam and cold water, the heat sources of the HTC Building, and electric wiring from the Energy Plant Block connecting to the HTC Building. As shown in Figure 2-10, it must be easily maintained from the ground level. The trench will be made of reinforced concrete and its covers will be required to have the strength to withstand the passage of vehicles. The Vietnamese side will be responsible for the trench construction.

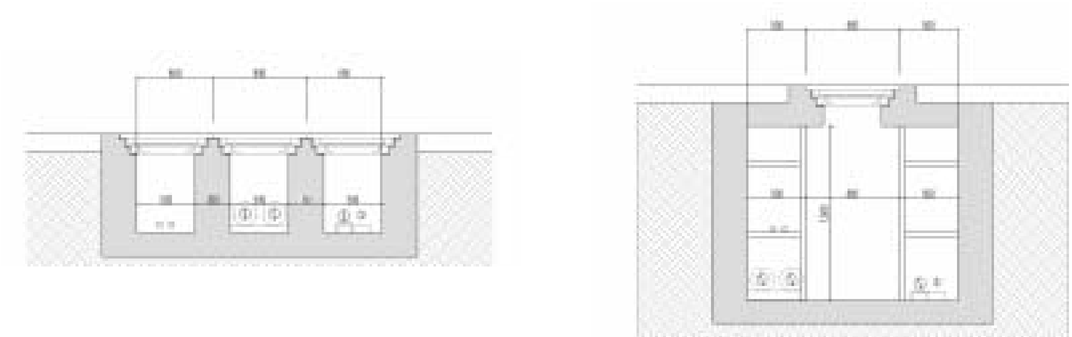


Figure 2-10 Section of the trench

Table 2-9 shows the floor area of each room in the project facilities calculated as mentioned above.

Table 2-9 Details and size of the facilities

Room name		Design floor area (m^2)	Remarks (Calculation criteria, etc.)
BSL-3 laboratories	[Diagnosis Laboratory]		Appropriate area in accordance with the research program of each room, equipment/ furniture layout, panel construction detail, and equipment connection.
	Pass room	2.34	
	Laboratory	40.09	
	[Research Laboratory]		
	Pass room	2.34	
	Laboratory	40.09	
	[Animal Laboratory]		
	Pass room	2.34	
	Laboratory	40.09	
	[Back-up Laboratory]		
	Pass room	2.34	
	Laboratory	40.09	
	Airlock Room 1	9.85	
	Airlock Room 2	3.14	
	Corridor 1	51.76	
	Rear corridor	40.08	
	Autoclaves (1, 2, 3, and 4)	13.95	In accordance with the standard equipment space
Subtotal (1)		288.50	
Associated facilities	[BSL-2 Laboratory Rooms]		Appropriate area in accordance with the research program of each room, equipment/furniture layout, and equipment connection
	Laboratory 4 (Multipurpose Diagnosis/ Research Room)	51.73	
	Laboratory 5 (Tissue Culture Preparation Room)	20.56	
	[Chemical Laboratory Rooms]		
	Laboratory 1 (RNA Extraction Room)	21.41	
	Laboratory 2 (Reagent Preparation Room)	21.41	
	Laboratory 3 (DNA Amplification Room)	21.09	
	Laboratory 6 (Electrophoresis Room)	20.73	
	[Control Rooms]		
	Biosafety Control Center	50.77	
	Control Panel Room	18.61	
	Corridor 2	41.49	
	Pass room 1	4.45	
	Pass room 2	4.53	
	Specimen Storage	20.73	
	PS・EPS	14.12	
	Elevator hall	45.50	

Room name		Design floor area (m^2)	Remarks (Calculation criteria, etc.)
	Toilets 1 and 2 Common Store Storage (1) Storage (2) EPS	44.83 14.64 20.83 21.42 21.09	
	Subtotal (2)	479.94	
4th Floor	Space for the air conditioning machinery		Appropriate area in accordance with the construction, structure, electric and mechanical equipment connection, and ease of work division
Energy Plant Block			Appropriate area in accordance with the machine layout
Trench			Appropriate dimension taking the pipe layout and the level of local construction into consideration
	Total（1＋2）	768.44	The floor area within the scope of the work of the Japanese side

(3) Floor Plan

BSL-3 laboratories on the third floor

4 BSL-3 laboratories (Diagnosis, Vaccine Research, Back-up, and Animal Laboratories), corridor, airlock rooms, rear corridor (for the inspection of the interior of the BSL-3 laboratories from outside), and sample store will be located in the western part of the third floor.

The construction method will be studied and determined in consideration of a higher level of air-tightness performance and pressure differential in accordance with the biosafety standards as well as the standard workmanship procurable in the vicinity of Hanoi.

This floor area is the minimum required in terms of the layout and installation space of the equipment in each laboratory and the maintenance space (rear corridors) around the interior walls which delineate the BLS-3 laboratories.
Taking into account the consistency of the pillars, beams, and girders on the third floor of the High Tech Center Building constructed by the Vietnamese side, it is necessary to adopt a construction method of walls and ceilings for installing ducts that is simple and adjustable to any conflicts.

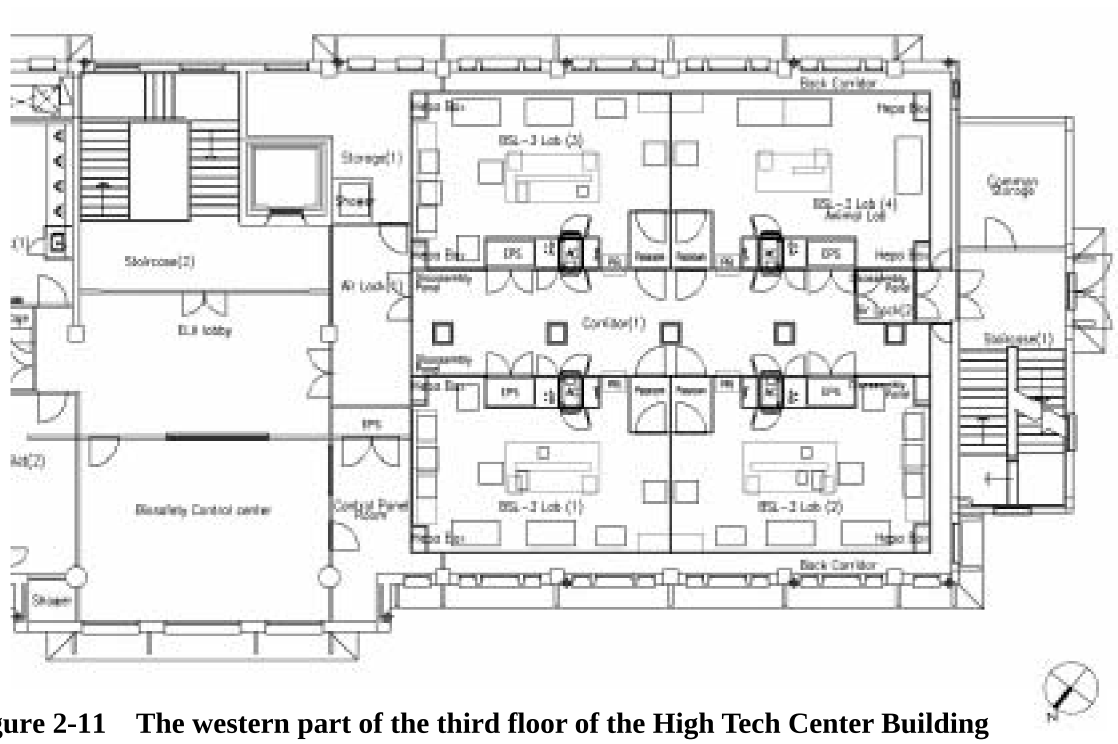


Figure 2-11 The western part of the third floor of the High Tech Center Building (The BSL-3 laboratories)

The associated facilities including the BSL-2 and Chemical laboratories on the third floor

Among the associated facilities, the Control Department will be located in the central part of the third floor, while the Experiment Department including the BSL-2 laboratories will be located in the eastern parts of the floor. The Control Department will include Biosafety Control Center and Control Panel Room. These rooms will be located at the place easily found from the elevator and staircase. The security and air conditioning systems will be controlled in Control Panel Room.
While the Vietnamese side will be responsible for the construction of the elevator hall and staircase, the Japanese side will be responsible for the construction of the toilets.

The Experiment Department including the BSL-2 laboratories will be used for various supporting works for the experiments and research conducted in the BSL-3 laboratories. RNA Extraction Room, Reagent Preparation Room, DNA Amplification Room, Multipurpose Diagnosis/Research Room, Tissue Preparation Room, Electrophoresis Room, Sample Stores, and corridor will be provided.

The design of each room will adopt the minimum required space for equipment installation and effective equipment layout.
As mentioned-above, there is a need to adopt a construction method of walls and ceilings for installing ducts that is simple and adjustable to any conflicts made by the construction consistency of the pillars, beams, and girders.

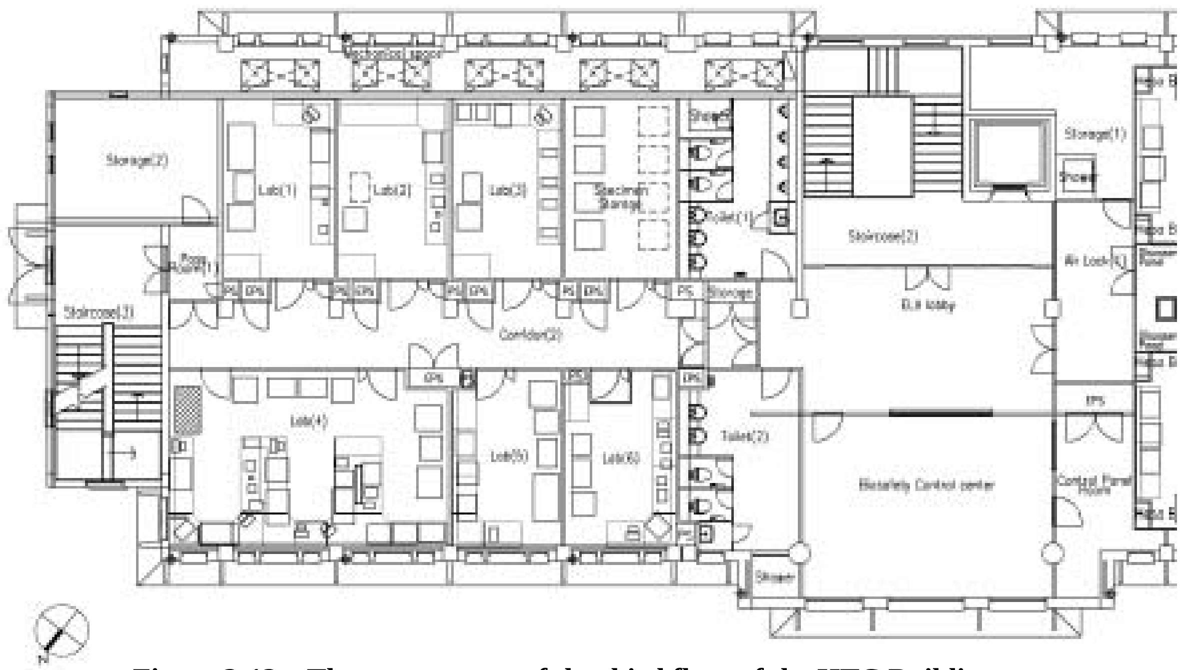


Figure 2-12 The eastern part of the third floor of the HTC Building (the associated facilities including the BSL-2 laboratories)

Air Conditioning Machine Room on the fourth floor

The fourth floor will accommodate the air conditioning systems for the BSL-3 laboratories. It will also include the space for the air conditioning systems for the laboratories on the first and second floors to be prepared by the Vietnamese side.
Taking the additional load on the floor created by the equipment installation into consideration, the Japanese side proposed to the Vietnamese side to reduce the load by replacing the existing brick walls, which supported the existing roof, with steel frame structures. The Vietnamese side accepted the proposal.
Furthermore, the Japanese side will bear the cost of the installation of the multipurpose steel frame trestles which bear the foundations of machines, air conditioning ducts and pipes, and electric racks.
The construction of the openings on the slab of the fourth floor, such as duct openings, pipe sleeves, and inspection holes, and the reinforcement of the floor around these openings will be under the responsibility of the Vietnamese side. Meanwhile, the Japanese side will construct waterproof rises, install doors on the inspection holes, and apply waterproof coating (mortar repair) on the slab.
Louvers will be installed on the roof by the Vietnamese side, while the Japanese side will connect chambers to the louvers with the trestles to support chambers.

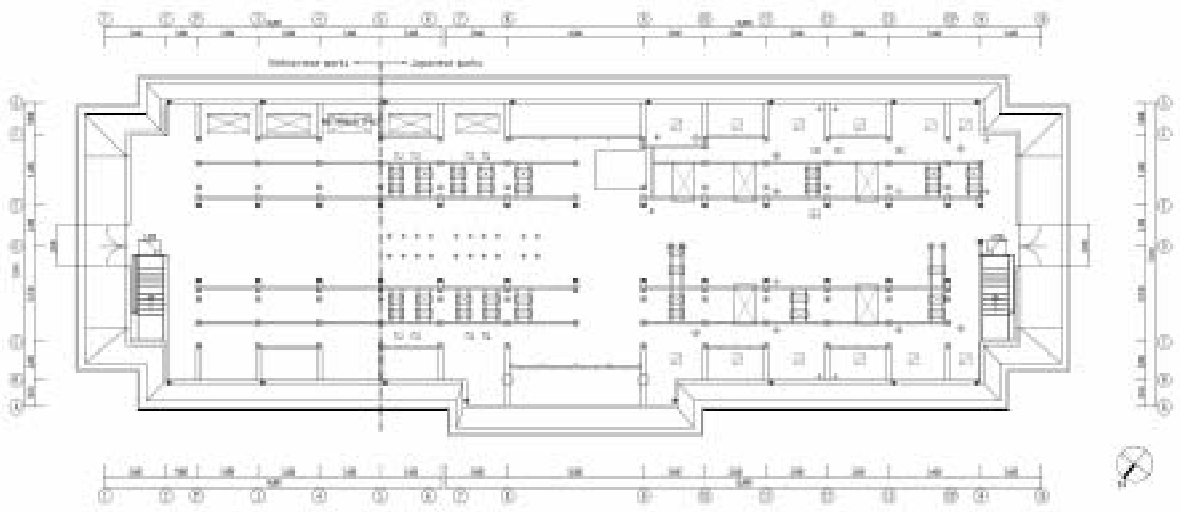


Figure 2-13 The fourth floor of the High Tech Center Building (Air Conditioning Machine Room)

Facilities on the basement, first, and second floors

The preparation of the basement, first, and second floors will be under the responsibility of the Vietnamese side. Among them, the basement floor will be a parking space mainly for motorcycles.
The electric wires and pipes for the steam and cold water will be connected to the mechanical space in the southern part of the HTC Building from the Energy Plant Block, which is under the responsibility of Vietnamese side, through the trench. The wires and pipes will be drawn into the HTC Building at the ceiling level of the basement floor.
The first and second floors of the HTC Building are designated as laboratories and administrative spaces under the responsibility of the Vietnamese side.

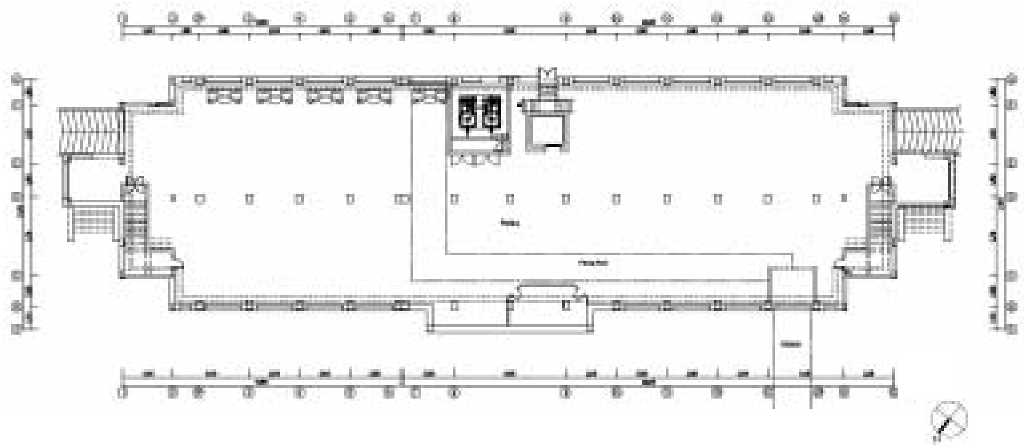


Figure 2-14 The basement first floor of the High Tech Center Building

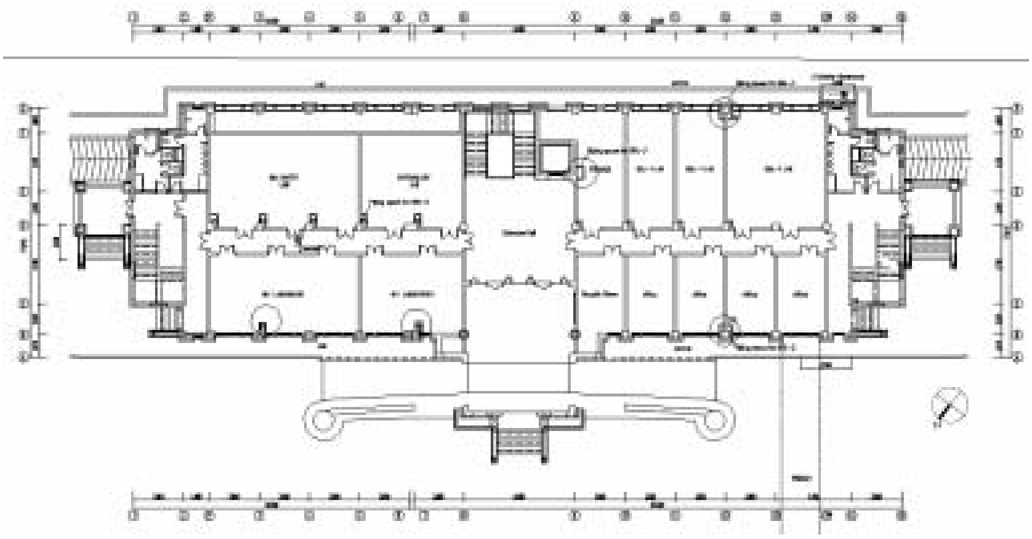


Figure 2-15 The first floor of the High Tech Center Building

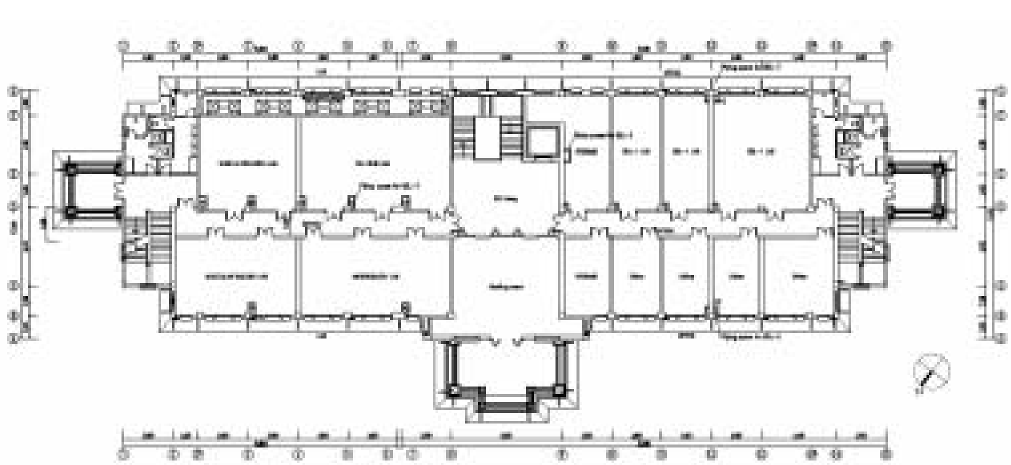


Figure 2-16 The second floor of the High Tech Center Building

(4) Elevations

As the elevations (on the east, west, south, and north sides) of the third floor of the HTC Building designed and executed by the Vietnamese side are based on a French classic design, the exterior design will not be altered with the exception of the minimal modifications required for the construction of the Project facilities. Such exceptions include the modification on the roof and installation of the equipment door and windows of the BSL-3 laboratories on the third floor. The Vietnamese side will be responsible for both the design and execution of the roof modification.

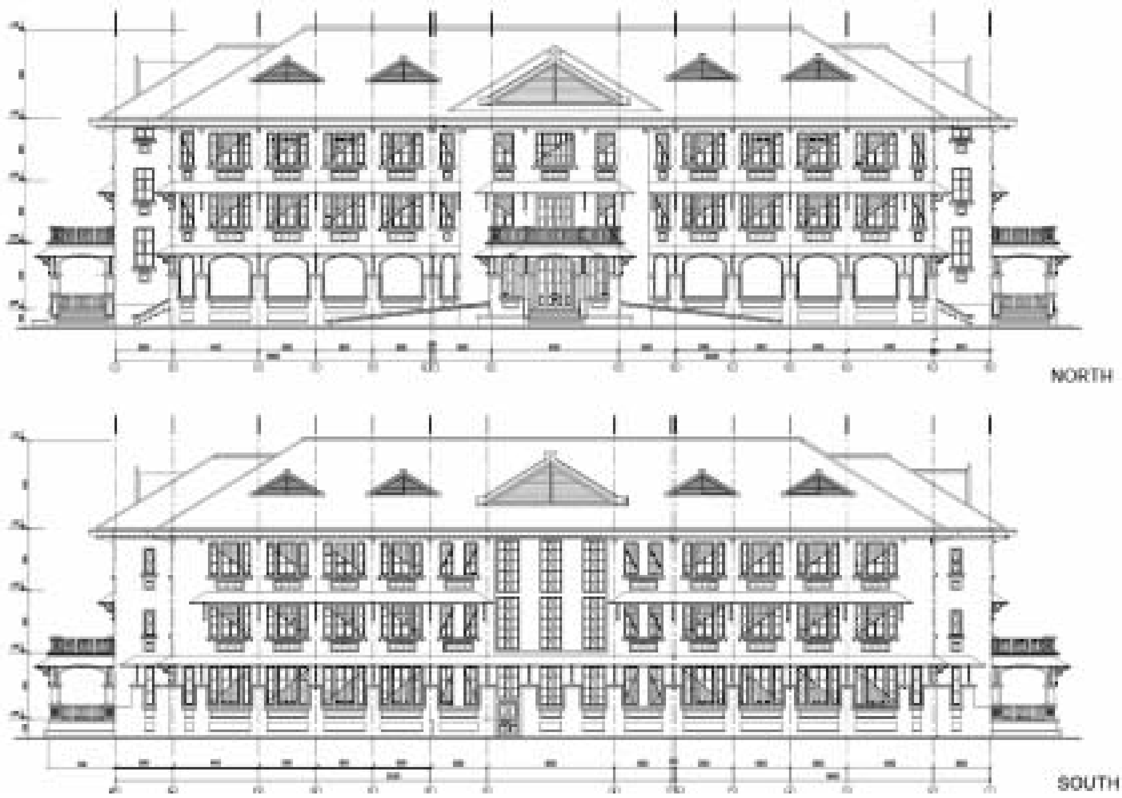
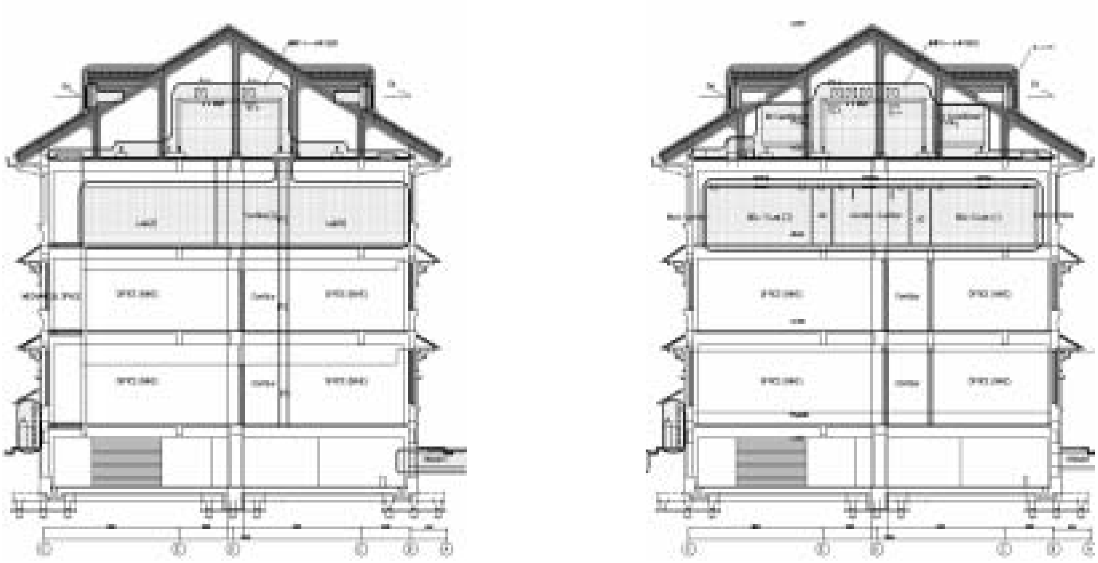


Figure 2-17 Elevations of the north and south sides of the High Tech Center Building

(5) Sections

The Vietnamese side will execute replacement of the roof and installation of openings on the fourth floor slabs and mechanical and piping spaces on the first, second, and third floors. These works are required for the Japanese side to construct the BSL-3 laboratories and the associated facilities on the third floor and install the air conditioning system equipment on the fourth floor



Note) Dotted areas are the works borne by the Japanese side and gray areas are the works borne by the Vietnamese side

Figure 2-18 Sections of the eastern and western parts of the High Tech Center Building

(6) The Energy Plant Block

The Japanese side will be responsible for the boilers and chillers, while the Vietnamese side will be responsible for the Energy Plant Block work for the installation of the emergency generator and the above-mentioned equipment and the trench work. The Japanese side will be responsible for the facility plumbing and electrical wiring from the block to the HTC Building.

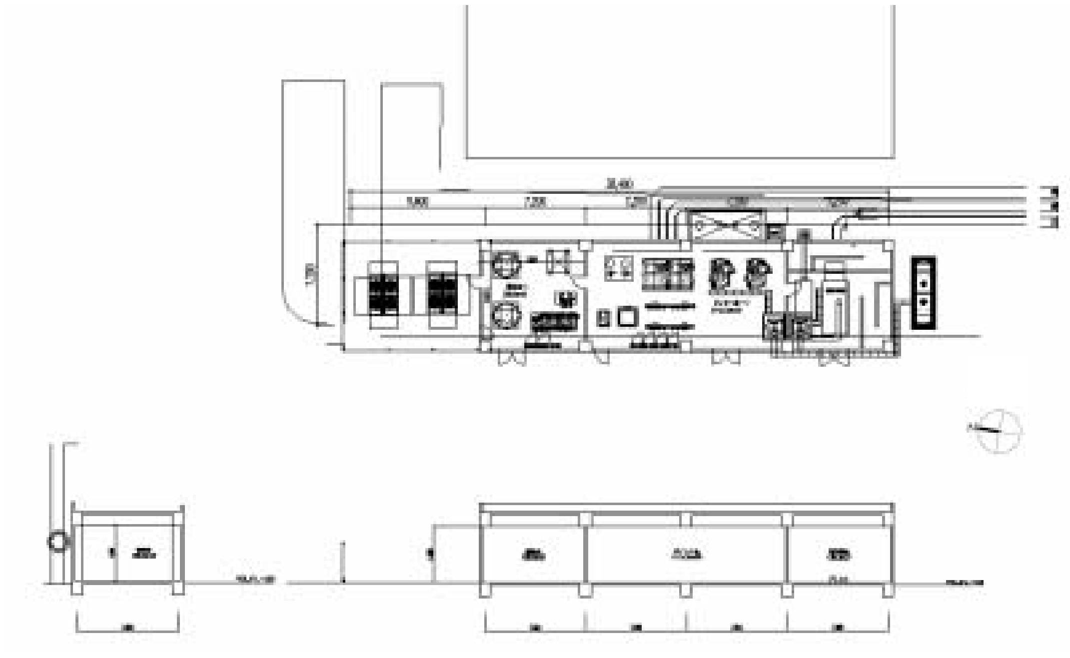


Figure 2-19 The Energy Plant Block

2-2-2-4 Structure Plan

In the Project, new laboratories will be constructed on the third floor of the High Tech Center (HTC) Building. The HTC building is designed, built by Vietnamese side with their own funding. The details structural designs were examined by the consultant to determine the structural feasibility to introduce the laboratories of the Project. The results of the study are shown as follows:
It is also noted that partial reinforcement is required to the area where heavy equipment is installed.

(1) Structural design of the HTC Building

The following is a summary of the structural design of the HTC Building

- In Viet Nam, it is the standard to use the ultimate strength design method with the load factor method in the structural design. The ultimate strength design method is fundamentally different from the allowable stress method used in Japan. As this building also has the size and shape of Vietnamese standard, it is designed with the ultimate strength design method.
- It seems customary in Viet Nam to compile a structural calculation sheet for a building of the size of the HTC Building after the completion of the construction. Therefore, the sheet was not available at the time of the field study.
- In Viet Nam, buildings with 7 stories or higher are obligated to adopt earthquake resistant design. As the HTC Building is three-storied, earthquake resistance design was not adopted.
- The structural frame of the building is divided into 2 sections in the middle, in accordance with the Vietnamese bylaws on building structure.
- The floor loads used in the design are as follows:

Table 2-10 Load table for the High Tech Center Building

Room type	Nature of loading	Unit Load
Parking (On the first basement level)	Floor load: equal to live load Ceiling	500 kg/m^2 75 kg/m^2
Laboratory and other rooms	Floor load: equal to live load Wall: conversion to unit load for floor Ceiling	200 kg/m^2 100 kg/m^2 75 kg/m^2
Corridor	Floor load: equal to live load Wall: conversion to unit load for floor Ceiling	300 kg/m^2 100 kg/m^2 75 kg/m^2
Conference room	Floor load: equal to live load Step floor: dead load to make step floor Ceiling	500 kg/m^2 200 kg/m^2 75 kg/m^2
4th floor	Floor load: equal to live load	150 kg/m^2

- The weight of the roofing tile (roofing tiles and brick walls which support the tiles) and exterior walls is considered separately from the above load table.
- The design bearing capacity of a pile is 30t.

(2) Structural Analysis for the construction of the Project facilities

In the Project, the BSL-3 laboratories and the associated facilities will be constructed on the third floor and the air-conditioning system equipment will be installed on the fourth floor.
From past experience, the floor load capacity of 300kg/m^2 is recommended for medical research institutes. The floor load capacity of the fourth floor should be considered making reference to the proposed Arrangement Plan of the air-conditioning equipment.
The load capacity of the building frames was analyzed from the structural drawing of the HTC Building and the information obtained in interviews with the relevant people. As standard practice in Japan, the allowable stress design method, which is different from the ultimate strength design method used in Viet Nam, was used in the analysis. The results of the analysis are as follows:

1) Third Floor

The live load on each of the laboratories is 200kg/m^2. This figure takes the weight of partition walls and the load of the ceiling into consideration. As a result of the reverse calculation using the allowable unit stress method, there is no problem with proof stress if the live load of the floor slabs, beams, and girders is 300kg/m^2, excluding the dead load of the frames and the minimum finish, was applied. However, if masonry is used for the partition walls as common practice in Viet Nam, the live load on some parts of the beams will exceed the allowable stress for sustained loading. Therefore, dry walls will be used for the partition to reduce the weight. Heavy items such as autoclaves (approximately 1.6t) will be installed on beams and girders. However, necessity for reinforcement has to be examined on a case-by-case basis.

2) Fourth Floor

The proposed Air-conditioning Equipment Arrangement Plan assumes the load per span (3.6m x 7.7m) at approximately 2300kg and 1000kg for the air-conditioning equipment and pipes, and the steel frame trestles, respectively. These figures give the live load of 120kg/m^2. The load of approximately 50kg/m^2 must be assumed for the weight of the header ceiling of the third floor. Therefore, the floor load capacity of 170kg/m^2 or more will be required for the fourth floor.
At the time of the design, only the live load of 150kg/m^2 was considered. However, as a result of the reverse calculation using the allowable unit stress method, the live load of the floor slabs and beams are acceptable in terms of the stress if it is 300kg/m^2, excluding the dead load of the frames and the minimum finish.
As all the arch-shaped brick wall frames which support the tiled roof above are on the girders, there is no extra tolerance in girder load capacity, which is approximately 150kg/m^2. Therefore, the installation of air-conditioning equipment may cause a structural safety problem as the load created by the installation exceeds their allowable resistance for sustained loading. The effective measure to enable the installation is modification of the structure of the parts concerned, which support the tiled roof, with the replacement of the brick walls with the steel frames, as the modification reduces the load borne by the girders significantly. (See the figures below).

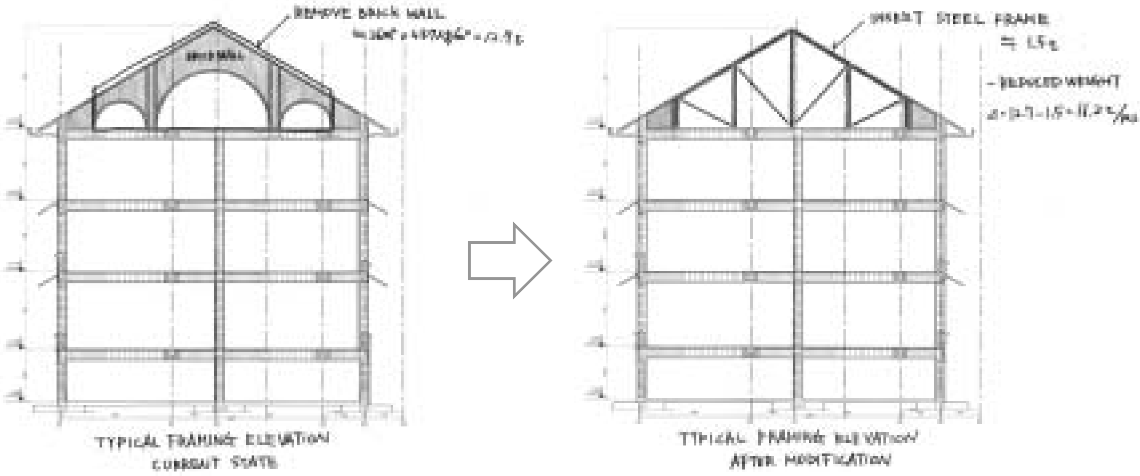


Figure 2-20 Comparison between the existing brick wall structure and partially modified steel frame structure of the fourth floor

After having reduced the bearing load on the girders as mentioned above, the necessity for the reinforcement of the floor slabs and beams on the fourth floor should be looked into with reference to the final weight and the Arrangement Plan of the air-conditioning equipment to be installed. The necessity for reinforcement of the floor around the required openings on the fourth floor should also be examined.

3) Pillars on floor and piles

The existing pillars on each floor and piles will not suffer any structural safety problem as they are, as the removal of the brick walls proposed above will free extra weight in the load capacity

On the basis of the above-mentioned analysis results, attention should be paid to the following issues in the preparation of the facility design for the establishment of the project facilities.

① The partition walls on the third floor will be made light by constructing them with the dry construction method, instead of masonry walls commonly used in Viet Nam.

② Heavy equipment such as autoclaves should be placed near the beams/girders or on the reinforced floor area designated for the equipment.

③ The brick walls on the fourth floor which support the tiled roof will be replaced with steel roof supporting frames to reduce the load.

④ Steel frames will be used as the foundations of machines such as air-conditioners to reduce the load

⑤ Large floor openings will be avoided. Concentration of holes in a certain area will also be avoided. The openings will be distributed evenly on the floor.

2-2-2-5 Mechanical and Electrical Plan

(1) Overview of the High Tech Center Building Facility Plan

In principle, the M/E systems in the High Tech Center (HTC) Building are similar to those in the existing NIHE M/E systems. At the time of the Basic Design Team field study, the electrical and mechanical works had not commenced. Therefore, the following main features of the M/E systems were derived from the information obtained from interviews with the relevant NIHE personnel and the M/E drawings.

Table 2-11 Summary of the HTC Building Facility Plan

Item	Main details
Electrical system	・ Low voltage (380/220V) electric power will be provided. The emergence power source will supply power to certain areas. ・ Electric lighting fixtures, mainly of fluorescent bulbs, and wall outlets of the two-round-pin/flat-parallel-pin types with ground terminals will be installed. ・ No telephone switchboard will be installed. Only direct-line telephones will be used. ・ There is no plan for public address, interphone, or TV co-viewing system. ・ An automatic fire alarm system with heat and smoke detectors and manual fire alarm system will be installed. ・ There is no plan for access control by cards or mechanical security system during the night. ・ A computer network with wireless LAN is planned ・ Lightning rods will be installed.
Mechanical system	・ City water will be provided from the existing water supply tower. ・ Electric water heaters will be used to supply hot water to shower rooms. ・ Wastewater will be drained into the sewer main of the city after primary treatment in a septic tank (sedimentation separation tank). ・ Western-style toilets, urinals with automatic sensors, washstands, and hot-air hand driers will be installed. ・ Indoor fire hydrants and fire extinguishers will be installed. ・ Multi-type wall-hanging separate air-conditioners will be used in the laboratories and offices. ・ Natural ventilation through windows will be used, in principle. However, ventilation fans will be installed at certain places.

(2) Characteristics of the Mechanical System in the Project

The Project will be implemented in cooperation with the Technical Cooperation Project which provides assistance to the preparation of the first biosafety standard of Viet Nam, which is based on Japan’s biosafety operation rules and manuals. Therefore, the Facility Plan of the Project should be consistent with these rules and manuals.

The most important facilities in the Project are the BSL-3 laboratories, which require physical containment to ensure safety to the experiment personnel and surrounding environment. Most special parts of the mechanical system are found in the air-conditioning system, as listed in the table below.

Table 2-12 Characteristics of the BSL-3 laboratories in the Facility Plan

Item	Characteristic
Air conditioning	• HEPA filters will be installed at the exhaust air outlets to control spread of pathogens. • The air will flow from the anteroom to the laboratory. • The flow of air supply will be from the entrance to the back of the laboratory. • The laboratories will be kept depressurized. • Biosafety cabinets will be installed on the back of the laboratories so that the air supply will not directly affect them.
Water supply and sewage	• Wastewater including hand-washing wastewater will be drained after having been sterilized.

The above-mentioned characteristics and the local condition in Viet Nam should be reflected in the design of the air conditioning system. The system will be a simple one with low operation cost, which is easy to maintain and manage.

(3) Electrical System

1) Power supply

The 380V/220V electric power will be provided from the NIHE's power receiving and transformer facility to the project facilities. The BSL-3 laboratories and the associated facilities on the third floor of the HTC Building, Machine Room on the fourth floor, and the Energy Plant Block will be within the scope of the work of the Project. The ordinary power and emergency power during power failure will be provided to each of these facilities. The Vietnamese side will be responsible for the primary electrical work, the wiring up to the terminals on the main switchboard to be installed in the project facilities. The Japanese side will be responsible for the secondary work, the wiring from the main switchboard. The Japanese side will supply automatic voltage regulators (AVRs) and uninterruptive power supplies (UPSs) to the required equipment.
As the capacity of the existing power receiving and transformer facility of NIHE is insufficient to supply power to the project facilities, the Vietnamese side will upgrade the capacity. The Vietnamese side is also planning to install an additional emergency back-up generator in the new Energy Plant Block.

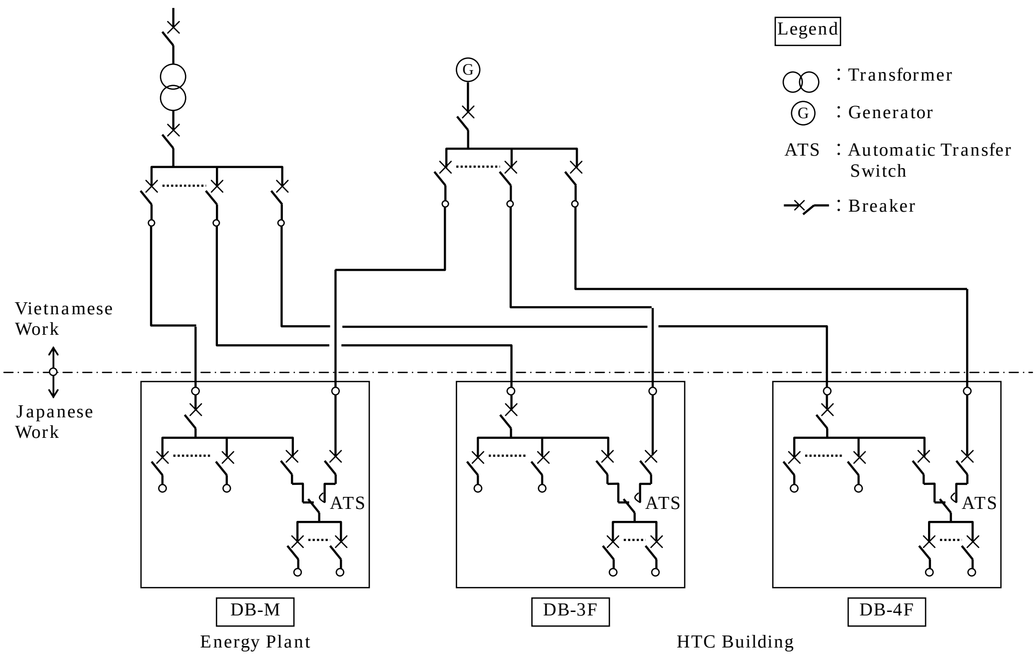


Figure 2-21 Main Power System

2) Electric lighting fixtures and wall outlets

Fluorescence lights will be used for the majority of the lighting in the project facilities. At the time of power failure, the generator will supply power to some of the emergency lighting fixtures, experimental equipment, and wall outlets. The lighting fixtures equipped with batteries, evacuation leading lights, and exit indicator lights will be installed for emergency evacuation.

The standard wall outlet will be two-round-pin/flat-parallel-pin types with ground terminals commonly used in Viet Nam. Sealing work will be required for the installation of lighting fixtures and wall outlets in the BSL-3 facilities for air-tightness as a biosafety measure.

3) Telephone

An independent telephone system will be constructed for the project facilities (the BSL-3 laboratories and the associated facilities). The required numbers of lines are assumed at three and 30 for the external and extension lines, respectively.

A PABS (telephone switching machine) will be installed in the Control Panel Room in the project facilities. The Japanese side will be responsible for the installation of telephone receivers and the conduit and wiring works in the facilities. The Vietnamese side will be responsible for the conduit and cable connection works from the external lead-ins to the terminal box.

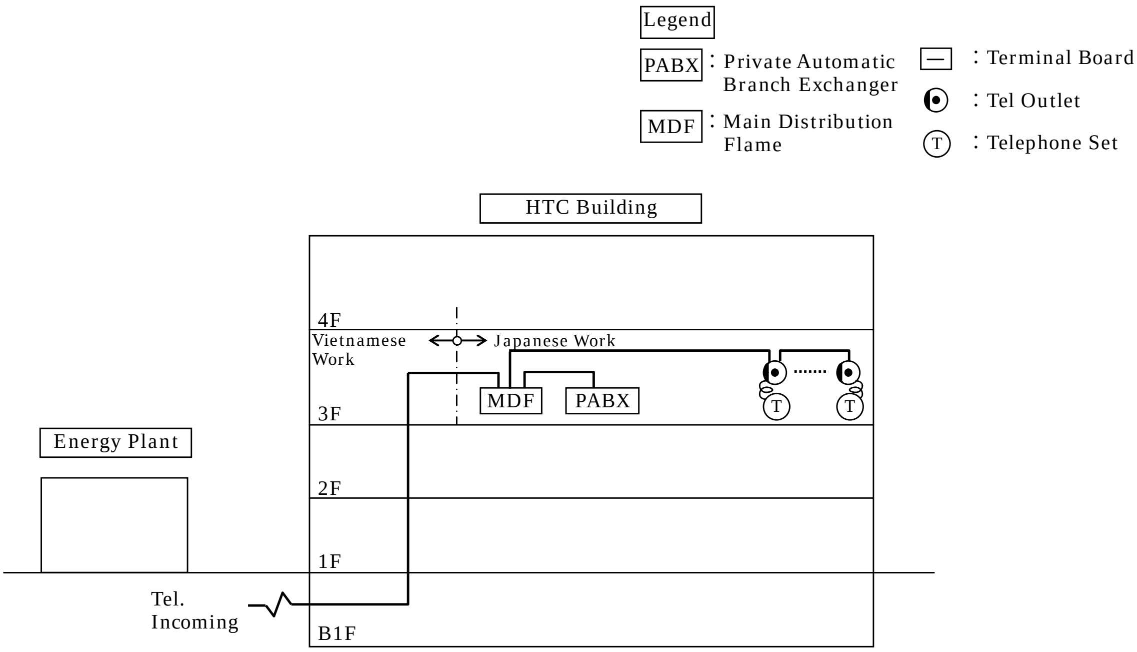


Figure 2-22 Telephone System Scheme

4) Interphone

A BSL-3 facility specific interphone system will be installed for communication for maintenance work between BSL-3 Control Panel Room on the third floor of the HTC Building, the machine room on the fourth floor and the Energy Plant Block.

5) Fire alarms

Following the system designed for the HTC Building by NIHE, the fire alarm system for the project facilities on the third floor will be designed as part of the NIHE's system. An automatic fire sensor system with heat and smoke detectors compliant with the laws/regulations and standards of Viet Nam and a manual fire alarm system will be installed. The fire alarm systems on the basement first, first, second, and fourth floors of the HTC Building, including the fire alarm boards, and those in the Energy Plant Block will be included in the scope of work of the Vietnamese side. Meanwhile, the systems in the BSL-3 facilities including the terminal board will be included in the scope of the work of the Japanese side.

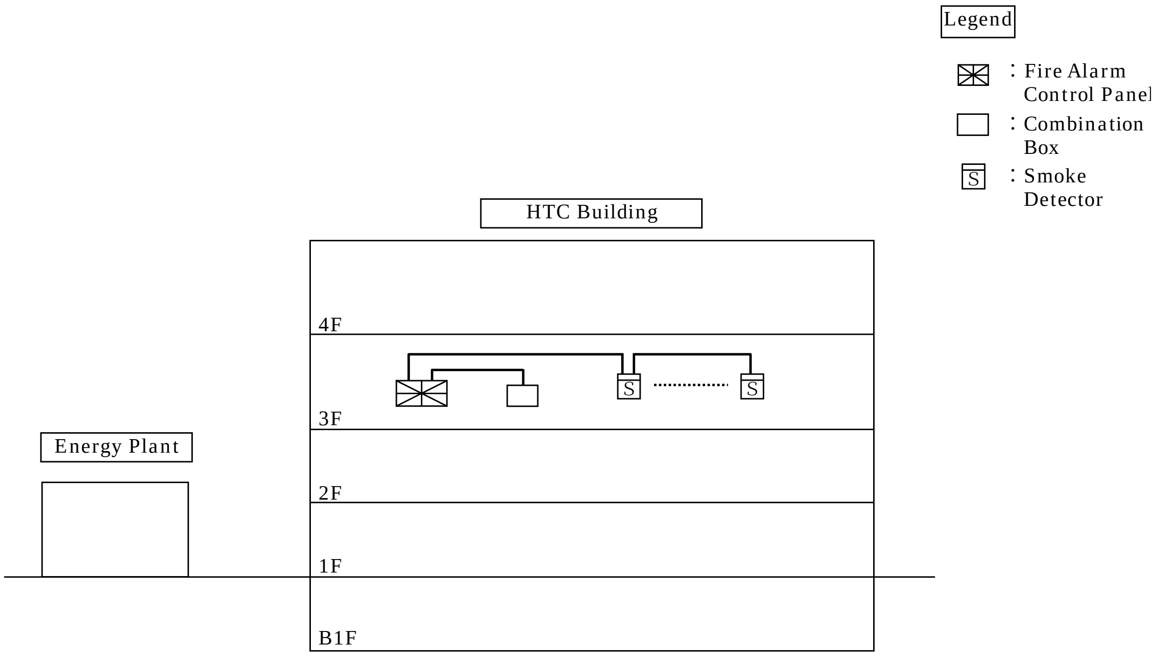


Figure 2-23 Fire Alarm System

6) Public address system

An independent public address system required for personnel inquiries and emergency evacuation in the project facilities will be installed. The amplifier of the system will be installed in the Panel Room in the BSL-3 facilities.

7) Security

The Vietnamese side is required to construct the security system for the entire HTC Building to ensure its safety as a biosafety facility. Within the umbrella of this system, the security system, which ensures higher safety required for the BSL-3 laboratories, will be designed specifically for the project facilities.
The card-key system, which has been effectively used in Viet Nam, will be adopted for the access to the laboratories. The central security equipment will be installed in the Control Panel Room in the BSL-3 facilities. Using this equipment, the movement of people in the experiment facilities will be monitored.
To prevent unauthorized entry into the experiment facilities, infrared invasion sensors will be installed. In addition, remote monitoring with CCTV (TV camera monitoring system) will be conducted from the Control Panel Room in the BSL-3 facilities. The monitoring cameras will be installed inside the BSL-3 laboratories, in the corridors, and at the main entrance.

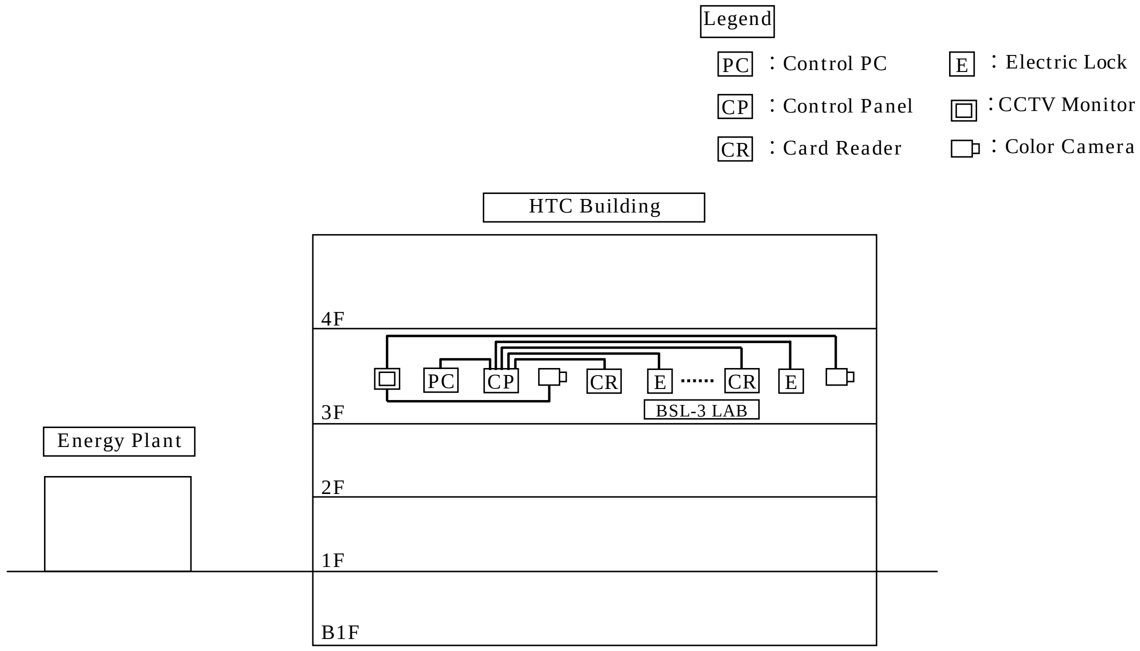


Figure 2-24 Security System

8) Centralized monitoring

The system operation, displays, malfunctions, and warnings of the mechanical and electric facilities in the project facilities will be monitored in a centralized fashion. The equipment to be monitored by the centralized monitoring system and monitoring items are shown in the table below. The Central Monitoring Panel will be included in the air condition facility work.

Table 2-13 Centralized monitoring system

Items	Contents	Remarks
Boiler, Chiller, Fan, Oil Tank, etc.	Operation, Temperature, Alarm	Misfire, Over load, etc.
Air Conditioner, HEPA Filter, etc.	Operation, Temperature, Differential Pressure, Alarm	Over load, etc.
BSL-3 Lab	Temperature, Humidity, Differential pressure, Alarm	
Sterilization Tank	Operation, Alarm	
Lab. Equipment (Autoclave, Safety Cabinet, Freezer, etc.)	Alarm	

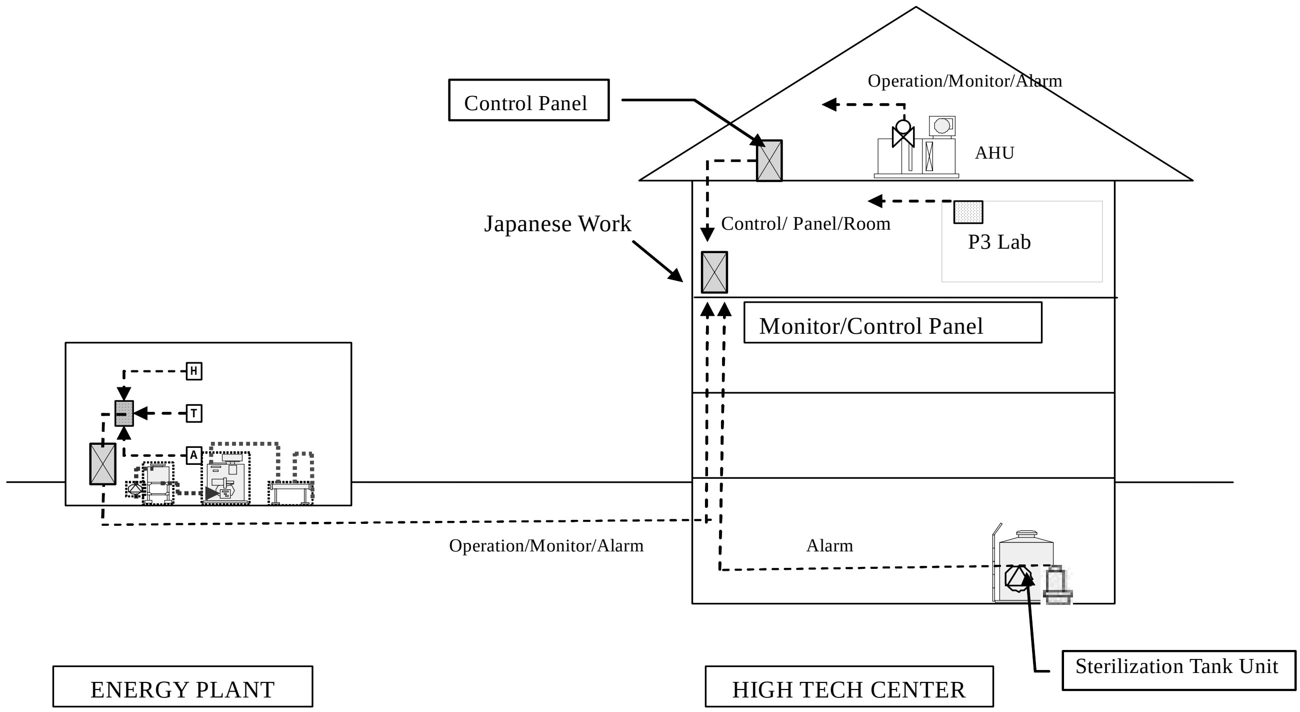


Figure 2-25 Automatic Control / Monitor System

9) LAN

In order to construct a computer network in the project facilities, racks and conduits for LAN will be installed. However, the cabling work within BSL-3 laboratories will be done by the Japanese side while the other cabling work and server installation will be included in the scope of works of Viet Nam.

10) Grounding

The ground facilities will be provided to the experimental, electric power, and communication equipment under the responsibility of the Japanese side.

(4) Mechanical facility plan

1) Water supply

City water will be supplied to the HTC Building from the NIHE's existing water supply tower. The tower has the capacity of 50m3. Its height of 30m will guarantee the water pressure sufficient to supply water to the project facilities. The Vietnamese side will be responsible for the water supply up to the project facilities, while the Japanese side will be responsible for the plumbing after the main valve.

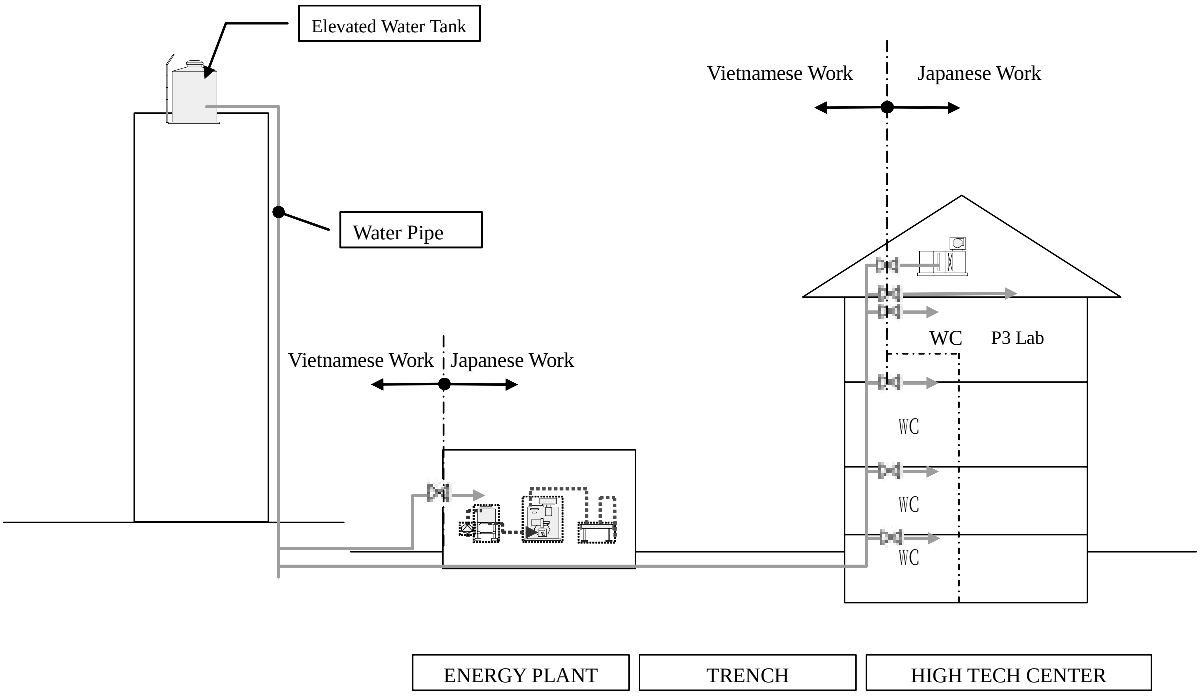


Figure 2-26 Water Supply System

2) Hot water supply

An independent electric water heater with hot-water tank will provide hot water to the shower room in each toilet on the third floor of the HTC Building. The hot water system will be within the scope of work of the Japanese side.

3) Sanitary instruments

The Japanese side will install sanitary equipment such as western-style toilets, urinals, washstands, and showers in the project facilities. Western-style toilets with flush valves will be used because they are less likely to break down. Spray nozzles will be provided separately for washing after use. To match in the existing facilities, urinals with sensor flush valves will be installed. Hot-air driers will be installed near the washstands.

4) Wastewater

All the polluted water and other wastewater from the HTC Building will be treated in the septic tank (sedimentation separation tank) designed by the Vietnamese side. The drainage work from the project facilities to the horizontal branch pipes will be within the scope of the Project and the remaining work from the vertical pipes will be within the scope of the work of the Vietnamese side. The wastewater from infectious experiments will be treated in the septic tank constructed by the Vietnamese side after having been treated in a sterilization tank. The drainage system for the infectious experiment wastewater including the sterilization tank will be within the scope of the work of the Japanese side.

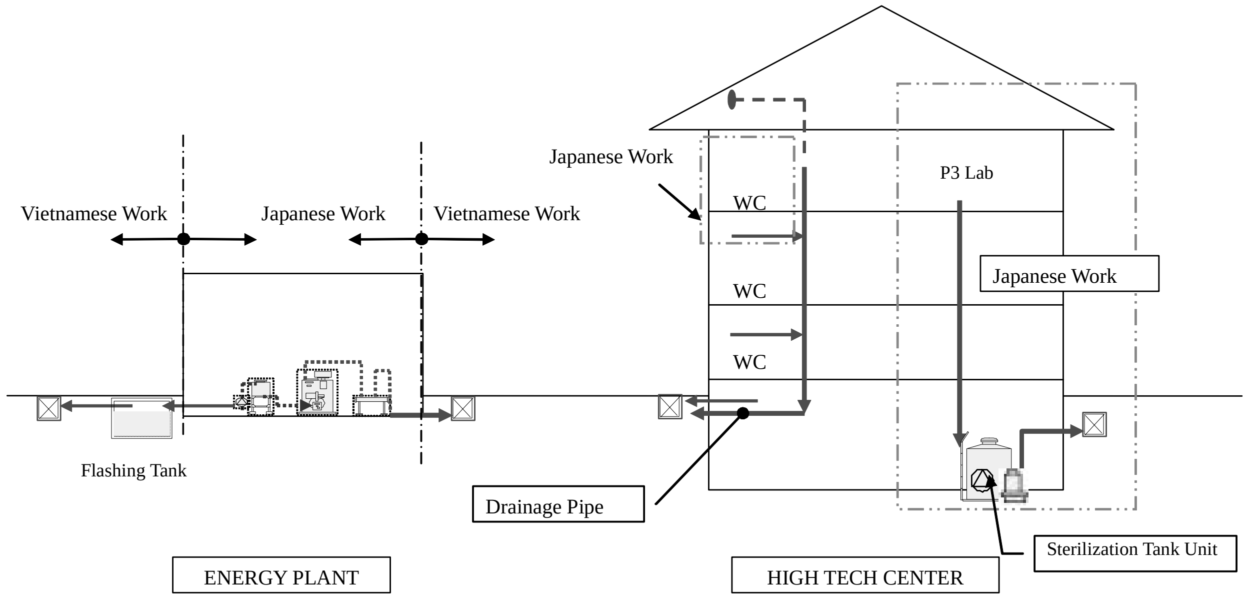


Figure 2-27 Wastewater System

5) Fire fighting

The fire fighting system of the HTC Building and the Energy Plant Block to be constructed by the Vietnamese side should be compliant with the applicable laws/regulations and standards of Viet Nam on the whole. The Vietnamese side plans to install indoor fire hydrants and fire extinguishers. The installation of the fire fighting systems are in the scope of the work of the Vietnamese side and installed in the following locations: BSL-3 laboratories, associated facilities on the 3rd floor, machine room on the 4th floor and energy plant block. . For the ease of handling, powder-type fire extinguishers will be provided, in principle.

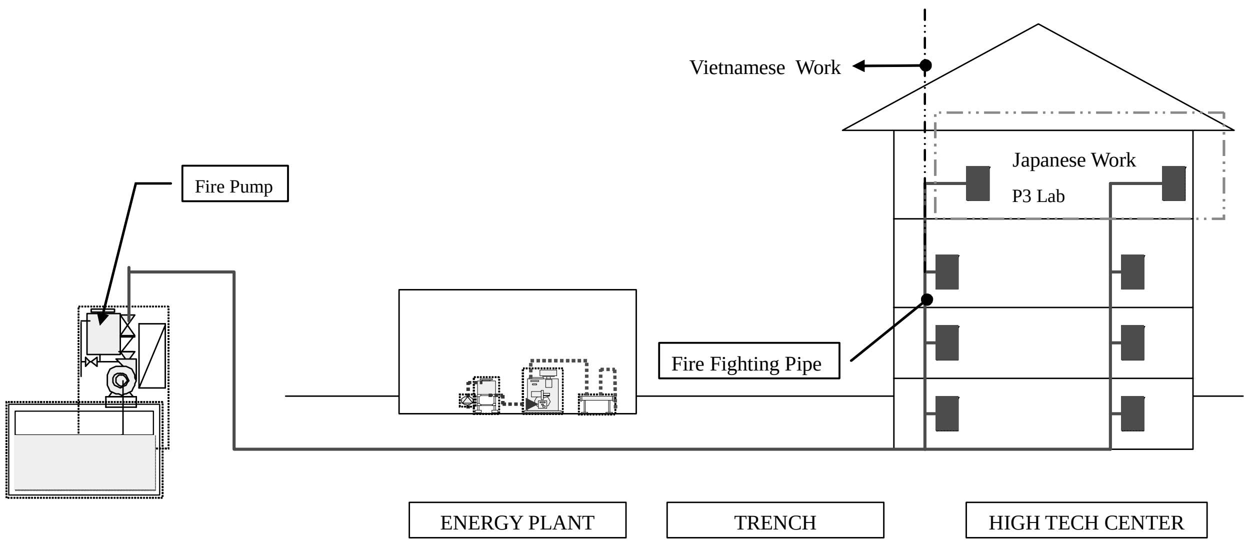


Figure 2-28 Fire Fighting System

6) CO_2 gas

The CO_2 gas used in the project facilities will be provided to each laboratory from the central supply facility with cylinders. The Japanese side will be responsible for the installation of the central supply facility with automatic switches outside the HTC Building and plumbing to the experimental equipment on the third floor.

7) Air conditioning

<u>Air conditioning system</u>

The air conditioning system has to be designed for the entire building under the integrated specifications in accordance with the levels of the research contents, in principle. Therefore, there is need to request modification to the air conditioning system on the first and second floors being designed by the Vietnamese side in accordance with the specification of the Project.
The air conditioning in biosafety facilities has a direct consequence on human life as it is meant to ensure the safety of the experiment personnel in the BSL-3 laboratories and residents around the center. Therefore, guaranteeing the appropriate air balance and pressure differential is essential. In order to guarantee the safety, the concept of the system design should be based on “the construction of facility systems to enhance safety (dual safety systems)” taking the level of maintenance and management capacity of the Vietnamese side into consideration. The air conditioning system in the Project will be as simple as possible while prioritizing the laboratory functions.

In the project facilities, the air conditioning in the BSL-3 laboratories will be equipped with the exclusive outdoor-air handling unit system, which uses the cold water from the chillers and the steam from the boilers as the heat sources. Designing each laboratory as an independent air conditioning zone has advantages of easy maintenance of the air balance and independent formaldehyde fumigation (sterilization) of each laboratory. In addition, the corridor in front of the laboratories will be also considered as an independent air conditioning zone. Thus, five air conditioners will be installed for the five independent zones.
The air conditioning in the BSL-3 laboratories should follow the specifications compatible with Japan’s standard biosafety regulations. Maintenance of the negative barometric pressure differential of 20Pa in the laboratories compared with the surrounding rooms requires regulation of the air volume blown into the laboratories with a constant air volume (CAV) system and installation of relief dampers.
The air-conditioned air will be supplied to the laboratories through high efficiency particle air (HEPA) filters. The exhaust air from the laboratories, including that from the biosafety cabinets, will be discharged outside through HEPA filters.
In principle, the air conditioning in the rooms other than the BSL-3 laboratories will be with air-cooled separate air conditioners, the system NIHE has designed for the first and second floors of the HTC Building. However, air supply and exhaust by mechanical ventilation will be also used. Among the BSL-2 laboratories, Laboratories (2) and (3) will be used for PCR experiments. Therefore, these laboratories will have to maintain a certain level of cleanliness and the positive pressure of 5Pa inside. However, there is no need for differential pressure for the other laboratories.
The equipment such as air conditioners and blower fans for the project facilities will be installed in the Machine Room on the fourth floor. The outdoor air will be taken in from and exhausted through the roof surface. The installation space for activated charcoal filters will also be considered to remove the odour from the exhaust air from the Animal Laboratory in the future.

The concept drawings of the air conditioning systems are shown in the following page.

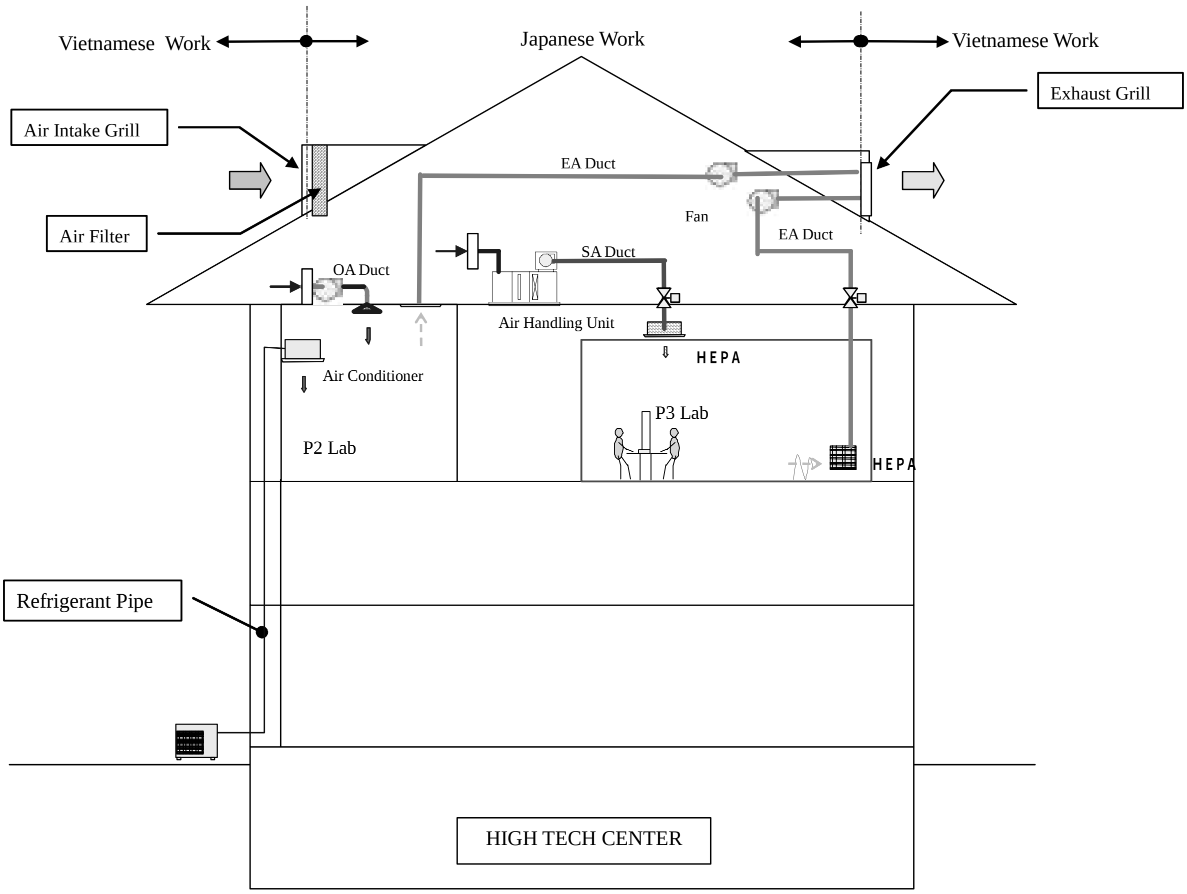
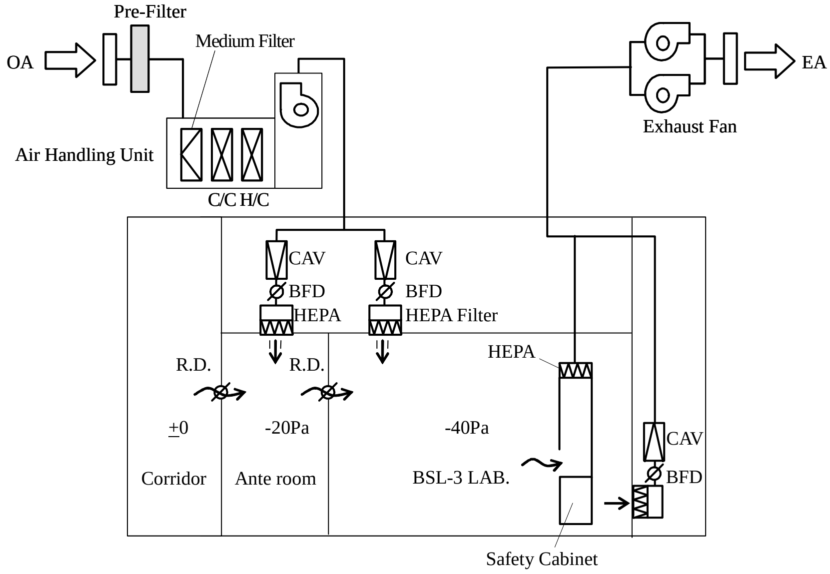
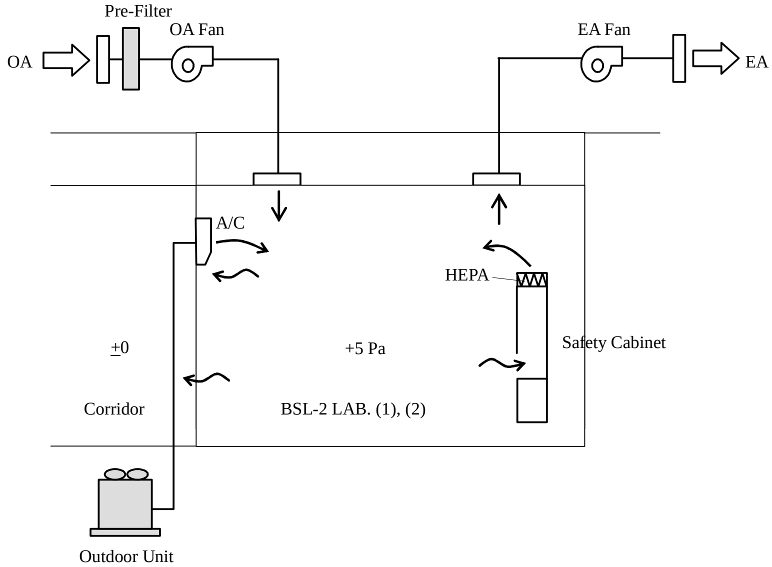


Figure 2-29　Air conditioning system

BSL-3 laboratories



☐ BSL-2 laboratories (Laboratories 1,2 and 3)



☐ The other BSL-2 laboratories and Chemical laboratories

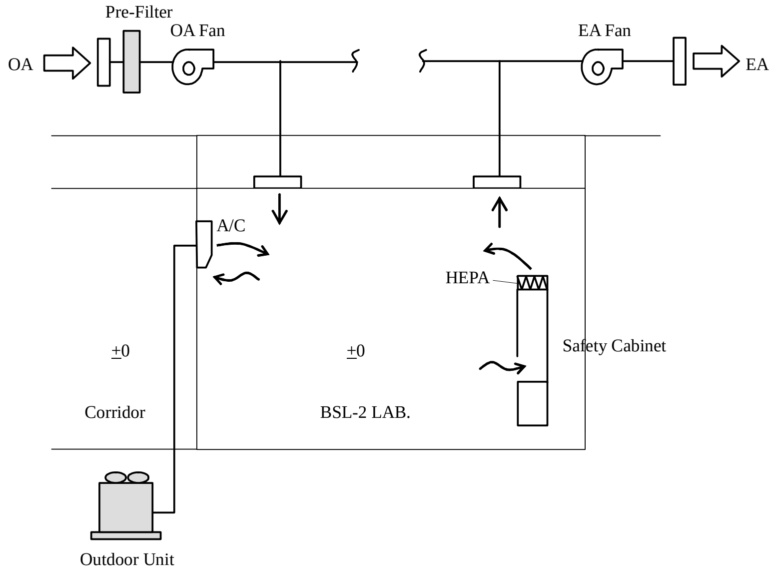


Figure 2-30 Air conditioning system concept drawings

Heat source system

Taking the operation, maintenance, management, and operational costs into general consideration, the air-cooled chillers and diesel-fueled steam boilers will be installed as the heat sources for the air conditioning. The steam will be also used as the heat source for the autoclaves in the BSL-3 laboratories.

The air-cooled chillers, steam boilers, water tanks, water softener, and pumps will be installed in the Energy Plant Block to be constructed adjacent to the existing Animal Building by the Vietnamese side. While the Vietnamese side will install the emergency generator in the Energy Plant Block and outdoor-underground fuel tanks, the Japanese side will be responsible for the installation of the heat source equipment, such as air-cooled chillers, steam boilers, water tanks, water softener, and the associated plumbing work.

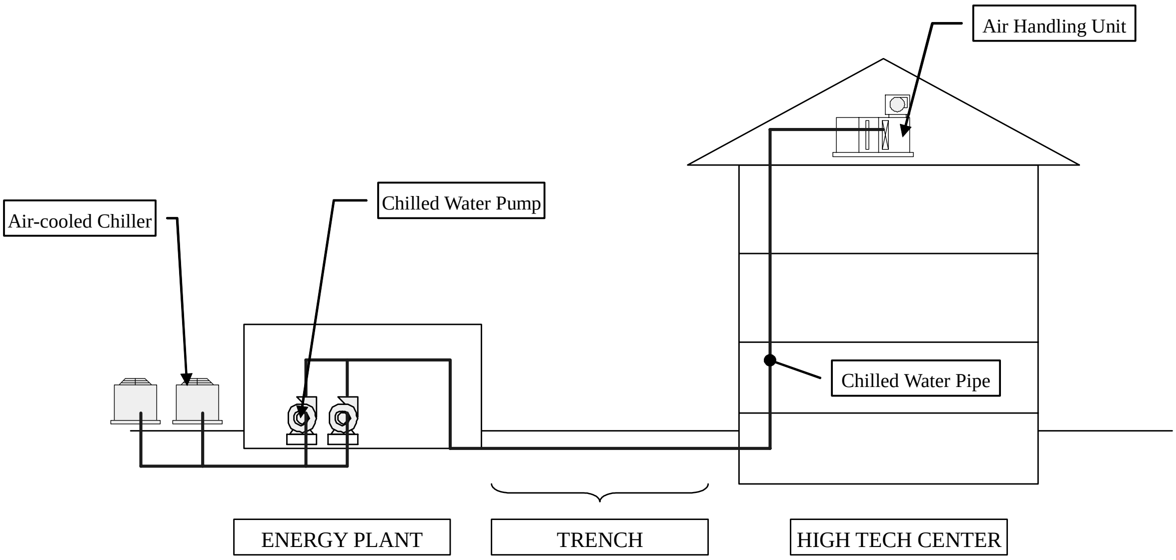


Figure 2-31 Chiller Source/Chilled Water Pipe System (Japanese Work)

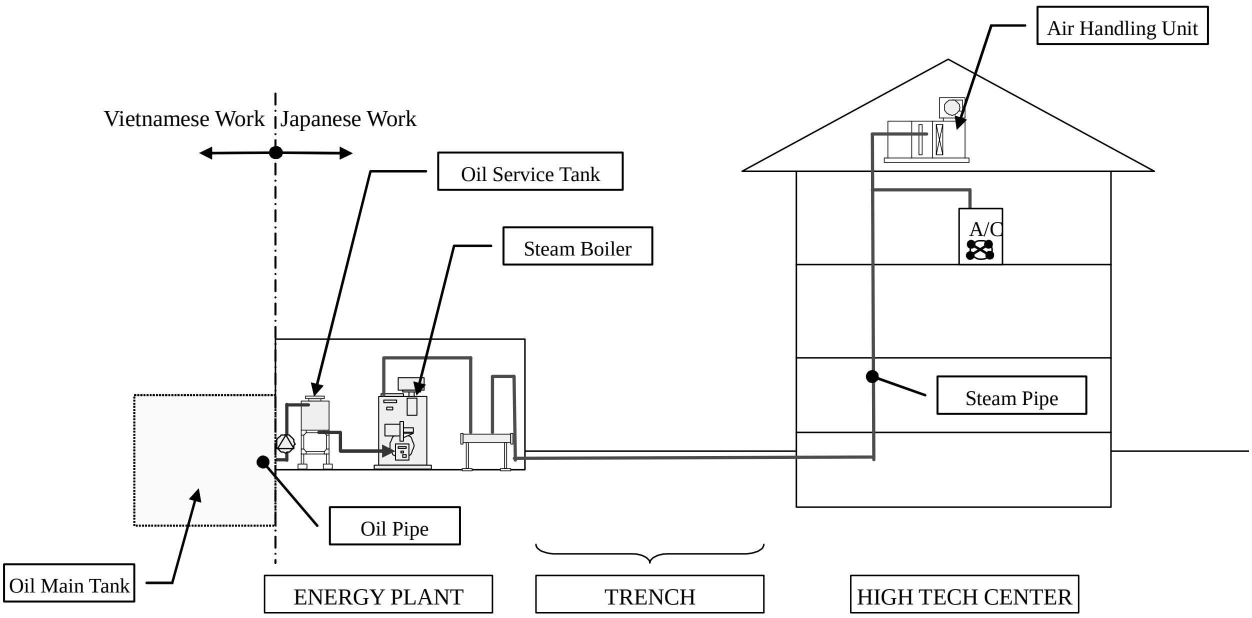


Figure 2-32 Heat Source/Steam Pipe/Oil Pipe System

2-2-2-6 Construction material plan

For the parts essential to the performance of the laboratories including the BSL-3 laboratories, the construction methods and materials required to guarantee the performance will be selected. For the other parts, the materials and construction methods commonly used in Viet Nam will be used for the ease of maintenance and management after the completion of the project.

The following are the basic points for consideration in selecting materials.

(1) Exterior finish materials

1) Roof

The Vietnamese side will replace the roof. Steel frame structure will be adopted as the roofing structure because of the load condition. The roof will be finished with roofing tiles as the existing roof. However, the Japanese side will request the Vietnamese side to use asphalt roofing substrate on sheathing roof boards to guarantee waterproofing.

2) Louvers and doors on the exterior walls

The Japanese side will request the Vietnamese side to install the doors for machine installation on the third and fourth floors, the control door for the fourth floor staircase, and installation of the louvers on the roof. The Japanese side will connect the chambers to the louvers.

(2) Interior finish materials and fittings

1) BSL-3 laboratories

The walls and ceiling of the BSL-3 laboratories will be composed of steel panels, as there is need to consider the air-tightness performance, pressure differential, and the construction skills and work management of the Vietnamese side. The main advantages of this method are as follows:

- The construction period from the commencement to the completion of the work can be shortened.
- This method requires fewer types of laborers to complete the work than the method using light gauge steel (LGS) walls. (construction supervision is easier.)
- Steel panel structure has heat-insulation effect.
- It is more responsive to additional work, such as installation of opening for equipment.
- It is more responsive to the change in dimensions of various openings for the louvers, pass boxes, and autoclaves.
- The use of ceiling panels will enable infrequent walking on the ceiling and make the facility work and inspection in the space above the ceiling easier.

Long-roll vinyl sheeting will be laid on the floors of the laboratories after they are repaired with mortar.

2) The associated facilities

There is no need for steel panel partitions in the BSL-2 laboratories because the air pressure differential is not required in these rooms. These walls will have LSG studs to reduce the floor load. They will be finished with decorated calcium silicate boards for the ease to enable easy cleaning by wiping of the entire surface. The floor will be finished with long-roll vinyl sheeting after mortar repair. Decorated calcium silicate boards will be used on the ceiling.
Decorated calcium silicate boards with LGS studs will be used on the walls of the offices. The offices will have a free-access floor with tile carpets, as wiring is required on the floor. Decorated calcium silicate boards will be used on the ceiling. A protective concrete layer

with asphalt waterproofing will be applied on the floor of the toilets. In the toilets, the floor will be finished with tiles and the walls will be finished with tiles up to the height of 2 m, following the common specifications in Viet Nam.

3) Machine Room on the fourth floor

Floor will be finished with waterproof coating after mortar repair to reduce damage from water leakage from mechanical installations. The gutters on the exterior walls will be equipped with overflows. Concrete rises will be installed around opening, sleeves, and inspection holes on the floor of the fourth floor and finished with waterproof coating. Meanwhile, the trestles and foundations for the installation of facility equipment will be designed with steel frames.

4) Doors and windows

A steel door will be installed to the inspection room on the third floor, as the door has to be equipped with an electric lock for air tightness and security. Although the original design of window frames are wood on the windows on the third floor, aluminum sashes will be used on the interior of the window for air-tightness.

Table 2-14 Finish materials and construction methods

Part	Local Method	Adopted Method of Construction	Reason for adoption
BSL-3 Laboratory		Mortar repair t=30 Polyvinyl Chloride Sheet	Mortar repair is adopted for taking account of condition of floor slab Polyvinyl Chloride Sheet is adopted for prevent staining ,wear resistance
		Ceiling Wall Finish Steel panel	The entire BSL-3 laboratories are required to be kept at a negative pressure and to make the air flow from the room outside to the inside, so that the air tightness and atmospheric pressure difference will be taken into consideration. The constructability of each site will also be considered.
Related facilities BSL-2 Laboratory	Floor Finish Ceramic tile	Mortar repair t=30 Long-roll Polyvinyl Chloride Sheet	Mortar repair is adopted for taking account of condition of floor slab Easily cleaned surface
	Wall Finish Paint finish	Decorated calcium silicate board	Reduction of live load Easy to cleaning surface
Administ-ration	Ceramic tile	OA floor Tile carpet	For wiring
Toilet	Ceramic tile Asphalt water proof with cinder concrete	Ceramic tile Asphalt water proof with cinder concrete	Standard method Easy to maintain
Hall	Ceramic Tile	Ceramic Tile	Standard method Easy to maintain
Door	Wood	Steel	Standard method For easy processing, Durability

(3) Equipment and materials for M/E systems

Much of the equipment for M/E systems has a design life of approximately 15 years, which is significantly shorter than the lifespan of the construction materials. Therefore, the principle is to use materials and equipment available locally as much as possible with the anticipation of repair and replacement after the completion of the work. However, as few locally manufactured materials and equipment for the M/E systems are available in Viet Nam, most of them will be procured from third countries.

As the Project is involved in biosafety facilities with immediate and direct consequences for people's lives, the priority in the selection of materials and equipment for M/E systems will be on their quality and performance. While general-purpose equipment will be procured from third countries, the automatic regulation system for the accurate regulation of the air-balance and the pressure in the rooms, an important issue for the air conditioning facilities, and the security system, which guarantees the safety of the facilities, will be designed assuming the procurement of equipment from Japan after considering their prices, management and past records of use.

(4) Equipment and materials included in facility plan

The equipment and materials to be included in the facility plan are shown in Table below.

It is necessary to fix this equipment and materials onto the floor or walls, and to connected them to the air ventilation system, the water supply and drain systems or power sources. These systems will be included in the purchase order placed by the facility side in order to coordinate the connections with these systems and match the construction timing on the facility side.

Table 2-15 Proposed equipment list for the equipment included in the Facility Plan

No.	Name of Equipment	Allocation												Total Quantity
		BSL-3 Laboratories					BSL-2 Laboratories/Chemical Laboratories							
		Diagnosis	Research	Back-Up	Animal	Commun	RNA Extraction	Reagent Preparation	DNA Amplification	Multipurpose	Tissue Culture	Electrophores is	Specimen Storage	
1	Autoclave, Pass Through Type	1	1	1	1									4
2	Biosafety Cabinet (A)	2	2	2										6
3	Biosafety Cabinet (B)				1									1
4	Biosafety Cabinet (C)						1			1	1			3
5	Animal Cage System with Biosafety Cabinet				1									1
6	Pass Box	1	1	1	1									4
7	Sink with Decontamination Tank	1	1	1	1									4

The specifications and uses of the main equipment will be described below

Table 2-16 Specifications and purposes of use of the equipment included in the Facility Plan

No.	Name of Equipment	Q'ty	Main Specification	Purpose of Use
1	Autoclave, Pass Through Type	4	Effective chamber dimensions: approx. 500(W)x 500(H)x900(D)mm/ Operating temperature: 105-135°C/ Equipped with sterilization tank for drain/ Compressors included	Sterilization of used glassware, material, etc. after using in BSL-3 laboratory.
2	Biosafety Cabinet (A)	6	Class II type B3 at JIS K 3800-2000/ 99.99% efficient for particle 0.3µm/ External dimensions: approx.1,500(W)×800(D)×2,000(H)mm	Handling of specimens infected with avian influenza virus, etc.
3	Biosafety Cabinet (B)	1	Class II type B3 at JIS K 3800-2000/ 99.99% efficient for particle 0.3µm/ External dimensions: approx.1,800(W)×800(D)×2,000(H)mm	For experiment animals, etc.
4	Biosafety Cabinet (C)	3	Class II type B1 at JIS K 3800-2000/ 99.99% efficient for particle 0.3µm/ External dimensions: approx.1,500(W)×800(D)×2,000(H)mm	Preparation of cells, reagents, etc. to be used in diagnosis and research.
5	Animal Cage System with Biosafety Cabinet	1	Class II type B3 at JIS K 3800-2000/ 99.99% efficient for particle 0.3µm/ Biosafety cabinet external dimensions: approx.1,500(W)×800(D)× 2,000(H)mm/ Animal cage system external dimensions: approx.1,700(W)×800(D)× 2,200(H)mm	For experiment animal to verify the toxicity of virus.
7	Sink with Decontamination Tank	4	External dimensions: approx. 1,000(W)×600(D)× 950(H)mm/ Equipped with decontamination tank/ Material: stainless steel	Mainly to wash hands in BSL-3 laboratory.

2-2-2-7 Equipment Plan

The following are the proposed equipment lists and the tables of the specifications and purposes of use of the major equipment.

Table 2-17 Proposed equipment list for the equipment included in the Equipment Plan

No.	Name of Equipment	Allocation												Total Quantity
		BSL-3 Laboratories					BSL-2 Laboratories/Chemical Laboratories							
		Diagnosis	Research	Back-Up	Animal	Commun	RNA Extraction	Reagent Preparation	DNA Amplification	Multipurpose	Tissue Culture	Electrophoresis	Specimen Storage	
1	Formaldehyde Decontamination Unit (A)					1								1
2	Formaldehyde Decontamination Unit (B)					1								1
3	Spectrofluorometer									1				1
4	FTIR Spectrophotometer									1				1
5	Spectrophotometer									1				1
6	Electrophoresis Apparatus (A)											1		1
7	Electrophoresis Apparatus (B)											1		1
8	Electrophoresis Apparatus (C)											1		1
9	Real Time PCR								1					1
10	PCR Machine								2	1				3
11	DNA Sequencer									1				1
12	ELISA System									1				1
13	Fluorescence Microscope									1				1
14	Inverted Microscope	1	1	1							1			4
15	Ultracentrifuge, Floor Type									1				1
16	Centrifuge, Non-Refrigerated									1	1			2
17	Centrifuge, Refrigerated	1	1	1										3
18	Refrigerated Microcentrifuge	1	1	1			1	1						5
19	Deep Freezer -80°C (A)	1	1	1										3
20	Deep Freezer -80°C (B)												4	4
21	Freezer -20°C						1		1	1	1			4
22	Medical Refrigerator	1	1	1			1		1	2	1	1		9
23	PCR Workstation							1						1
24	CO2 Incubator (A)	1	1	1										3
25	CO2 Incubator (B)									1	1			2
26	Incubator	1	1	1						1	1			5
27	Vertical Autoclave	1	1	1	1			1		1		1		7
28	Dry Sterilizing Oven									1				1
29	Ultrasonicator		1							1				2
30	Electronic Balance									1		1		2
31	pH Meter									1				1
32	Shaking Water Bath	1	1	1						1	1			5
33	Dry Block Bath							1		1				2
34	UV Transilluminator											1		1
35	Ice Maker Machine											1		1
36	Lyophilizer									1				1
37	Automatic RNA Extraction System						1							1
38	Image Acquisition Workstation for Electrophoresis Application											1		1
39	Multipurpose Flow Cytometry									1				1

Table 2-18 Specifications and purposes of use of the equipment included in the Equipment Plan

No.	Name of Equipment	Q'ty	Main Specification	Purpose of Use
2	Formaldehyde Decontamination Unit (B)	1	Composition: Formaldehyde decontamination unit, neutralization unit and densitometer for formaldehyde gas	Fumigation of BSL-3 laboratory.
3	Spectrofluorometer	1	Composition: Main unit, data processing hardware and data processing software/ Wavelength: 220-900nm approx./ Light source: xenon lamp	Qualitative and quantitative analysis, structural analysis, interaction analysis of protein, nucleic acid, etc.
4	FTIR Spectrophotometer	1	Composition: Main unit, data processing hardware and data processing software/ Wavelength: 7,800-350 cm-1, 12,500-240 cm-1 approx./ Optical system: single beam optics	Identification of refined components, detection of minute materials, structure analysis and quantitative analysis of materials, etc.
5	Spectrophotometer	1	Composition: Main unit, data processing hardware and data processing software/ Wavelength: 190-1,100 nm approx./ Optical system: double beam optics	To analyze high-order structure of nucleic acid, protein, quantitative analysis of matrix and metabolic products, etc.
9	Real Time PCR	1	Composition: Main unit, data processing hardware and data processing software/ Sample capacity: 96 wells/ Wavelength: 470 -500nm/ Sample volume: approx. 25-100μL	Making big quantities of copies of DNA from an infinitesimal amount and obtaining diagnostic and research results.
11	DNA Sequencer	1	Composition: Main unit, data processing hardware and data processing software/ Detection method: fluorescence based capillary electrophoresis system/ No. capillary array: at least 4/ System: fully automated polymer delivery, sample injection, separation, detection and data analysis	Analysis of DNA base sequence in diagnosis and research.
12	ELISA System	1	Composition: micro plate reader and micro plate washer/ Wavelength 400-750nm approx./ Microplate:96-well	To be used in diagnosis (Micro-Neutralization), etc.
13	Fluorescence Microscope	1	Magnification: 40x-1,000x/ Objective lens: 5 types/ Light source: halogen lamp and mercury lamp/ Fluorescence filters: blue, green, etc.	To be used in diagnosis (Inmunofluorescence Assay).
15	Ultracentrifuge, Floor Type	1	Maximum speed: 100,000rpm/ Maximum RCF: approx. 800,000×g/ Temperature range: approx. 0 +40°C/ Biosafety specifications/ Rotors: angle rotor and swing rotor	Isolation/separation of cells of plasmid DNA, RNA, etc.
16	Centrifuge, Non-Refrigerated	2	Maximum speed: approx. 10,000rpm/ Maximum RCF: approx. 11,000×g/ Rotor: swing rotor15mL×40 approx./ Biosafety specifications (aerosol-tight cap)	Centrifugation of virus, cells, etc.
17	Centrifuge, Refrigerated	3	Maximum speed: approx. 10,000rpm/ Maximum RCF: approx. 11,000×g/ Temperature range: approx. -9 to +40°C/Rotor: swing rotor15mL×40 approx./ Biosafety specifications (aerosol-tight cap)	Centrifugation of clinical specimens, separation of virus, cells, etc.
19	Deep Freezer -80°C (A)	3	Type：vertical/ Capacity: 500L approx./ Temperature range: -50 to -86°C approx.	To storage specimen, sera,etc.
20	Deep Freezer -80°C (B)	4	Type：vertical/ Capacity: 690L approx./ Temperature range: -50 to -86°C approx.	Idem
25	CO_2 Incubator (B)	2	Type: water-jacket type/ Capacity: 320L approx./ Operating temperature range: Room temp. +5°C to +50°C approx.	Incubation of virus, etc.

No.	Name of Equipment	Q'ty	Main Specification	Purpose of Use
29	Ultrasonicator	2	Power supply unit: output 550W approx. / Tips: 1/8" microchip probe, 1/2" tapped horn, etc.	To be used in the preparation of anti-bodies, to break down cell membranes, etc.
36	Lyophilizer	1	Cooling temperature: max. -80°C/ Dehumidifying capacity: 4L/time approx./ Vacuum pump ultimate vacuum degree: approx. 0.0667Pa	Freeze and dry specimens to be stored.
37	Automatic RNA Extraction System	1	Composition: Main unit, data processing hardware and data processing software/ Max. sample capacity: approx. 48/ Sample volume: approx. 25-1,000μL	Extract nucleic acid in a short period of time.
38	Image Acquisition Workstation for Electrophoresis Application	1	Composition: Main unit, data processing hardware and data processing software/ CCD camera resolution: approx. 760x490μm/ Excitation source: 254, 302, 365nm, etc.	Analysis of DNA, nucleic acid, protein composition, etc.
39	Multipurpose Flow Cytometry	1	Composition: Main unit, data processing hardware and data processing software/ Type: 4-color type/ Analysis system lasers: 488nm argon laser, 635nm diode laser, both air-cooled/ Fluorescence sensitivity: FITC approx. 200MESF	Determine and identify the type of cells, obtain highly precise information on the identified cells in a short period of time.

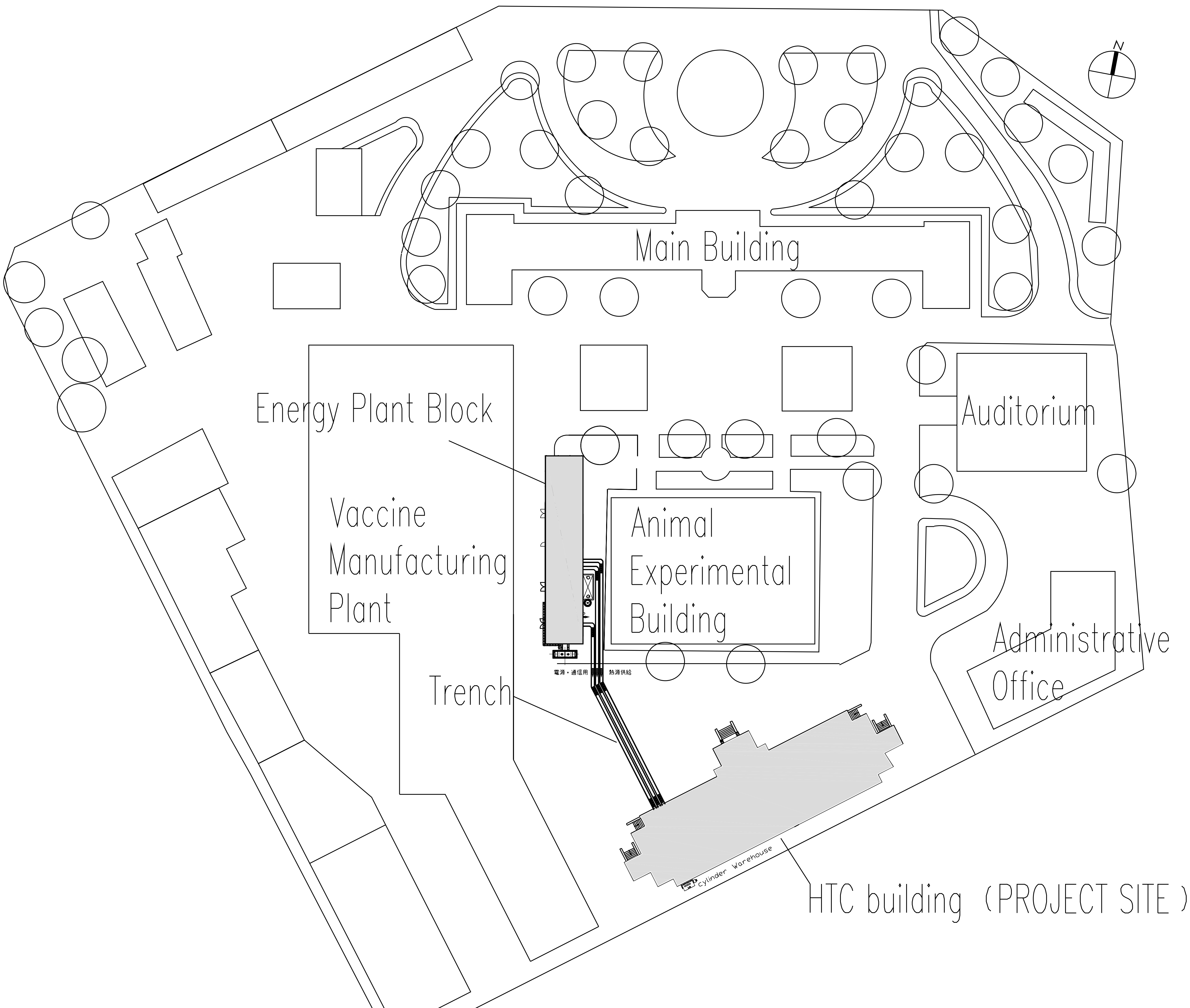
As the voltage is stabilized in NIHE, the automatic voltage regulator (AVR) is not included in the plan, but the Real Time PCR, DNA Sequencer, Spectrofluorometer, Floor Type Ultracentrifuge, Automatic RNA Extraction System and Multi-Purpose Flow Cytometry which are sensitive to voltages will be equipped with uninterruptible power supply (UPS).

Much of the equipment that will be procured in this Project is similar to the existing equipment. For the maintenance of the main equipment, NIHE plans to enter into maintenance agreements with the agents of such equipment. Reagents and consumables that are required after the equipment installation and adjustment are presently used in the testing laboratories of NIHE. Therefore, only the consumables required for the trial operation and training for maintenance and operation which the Japanese equipment suppliers will conduct after installation of the equipment will be included in the Project, but other reagents and consumables will be procured by the Vietnamese side. The maintenance costs for the equipment will be secured by NIHE, and the spare parts for the project equipment and systems will not be included in the Project.

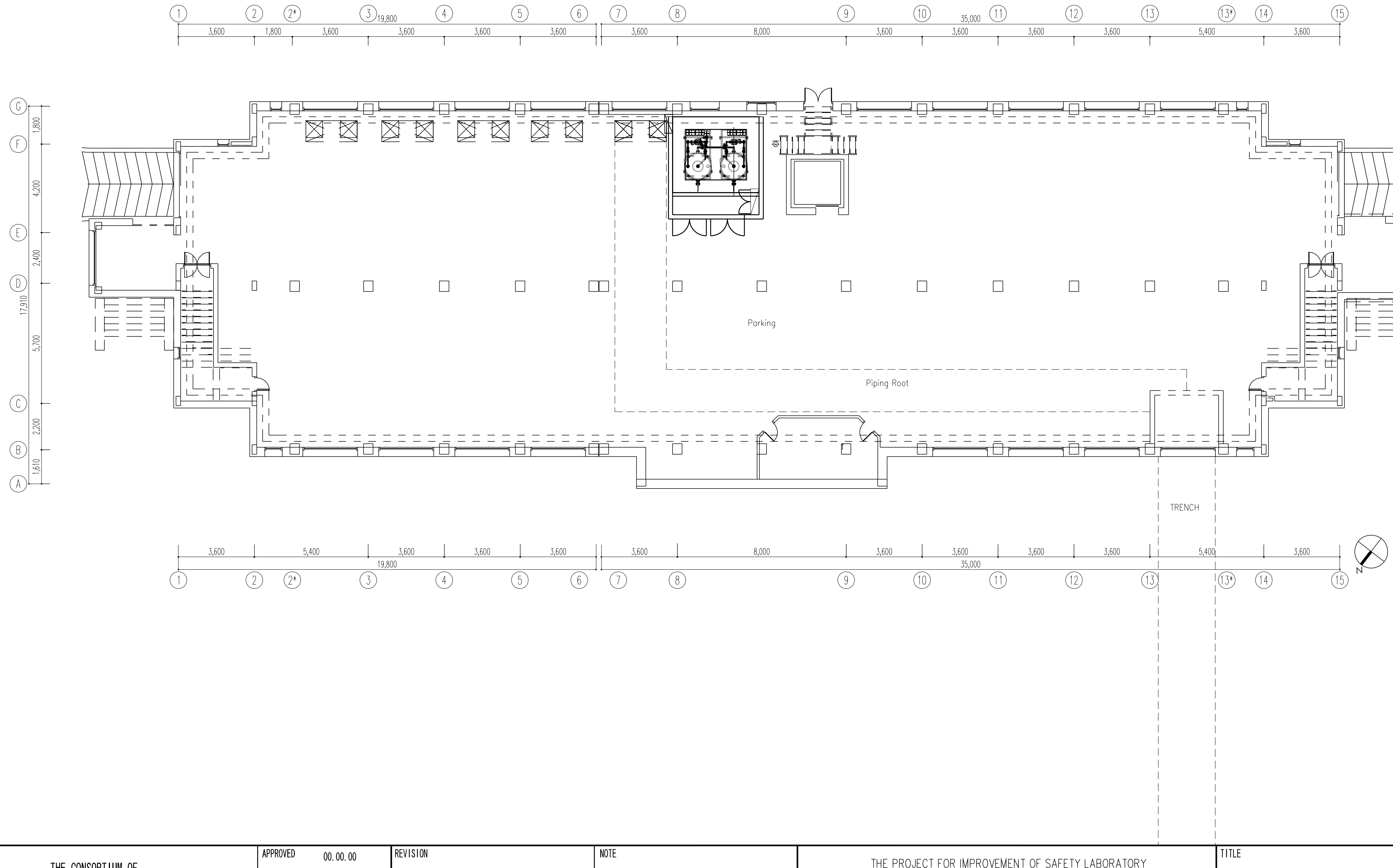
2-2-3 Basic Design Drawings

Table 2-19 List of drawings

	Facilities	Drawing	Scale
1	Site Plan		1/800
2	High Tech Center	Basement Plan	1/200
3		1st Floor Plan	1/200
4		2nd Floor Plan	1/200
5		3rd Floor Plan	1/200
6		4th Floor Plan	1/200
7		Roof Plan	1/200
8		Section 1	1/100
9		Section 2	1/200
10		Elevation 1	1/200
11		Elevation 2	1/200
12	Energy Plant Block	Plan, Section	1/200
13	Trench	Plan, Section	1/200



THE CONSORTIUM OF NIHON SEKKEI, INC. AND FUJITA PLANNING CO., LTD	APPROVED 00.00.00 CHECKED 00.00.00 DRAWN 00.00.00	REVISION	NOTE	THE PROJECT FOR IMPROVEMENT OF SAFETY LABORATORY FOR NATIONAL INSTITUTE OF HYGIENE AND EPIDEMIOLOGY	TITLE SITE PLAN SCALE 1/800	NO. ARCHTECTURE	



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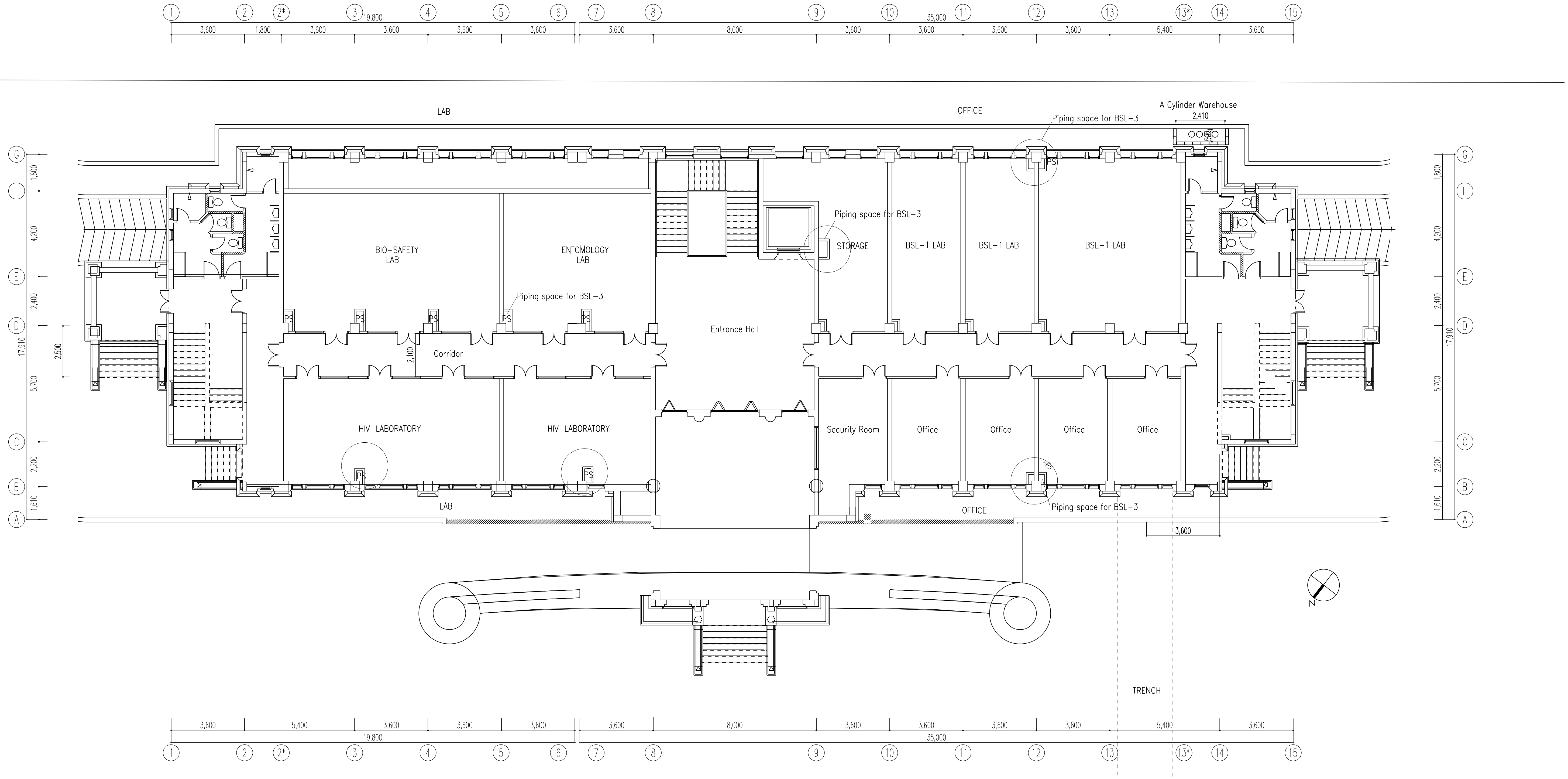
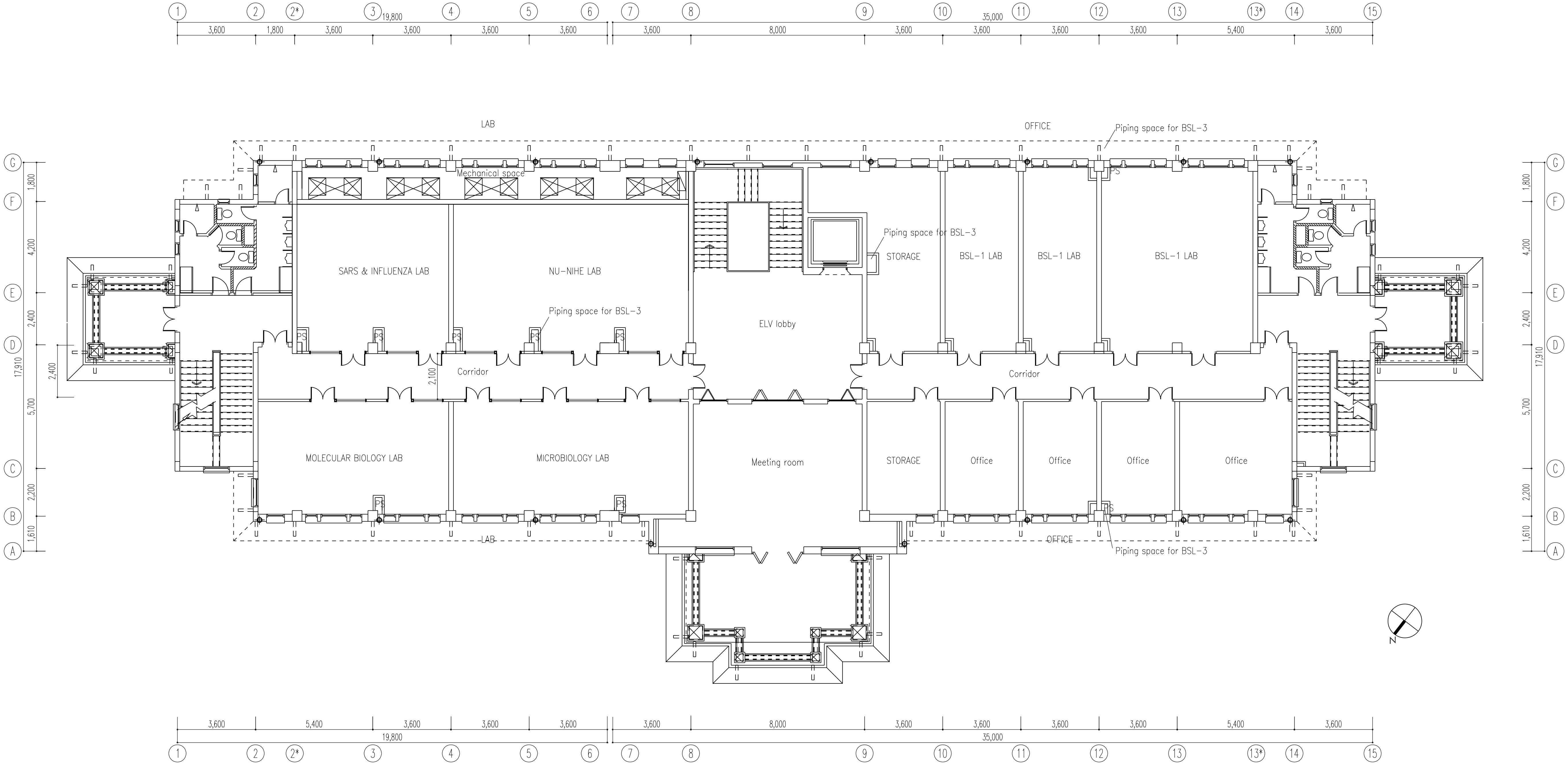
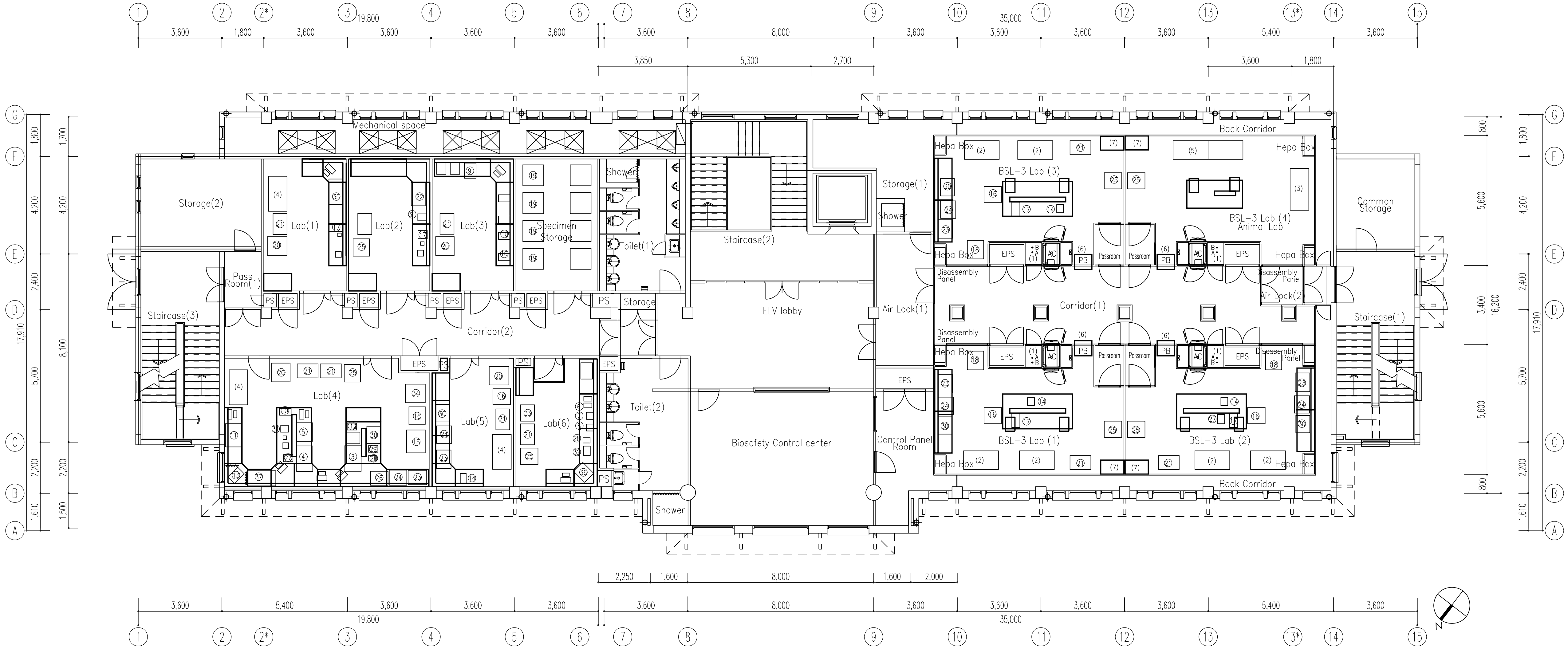


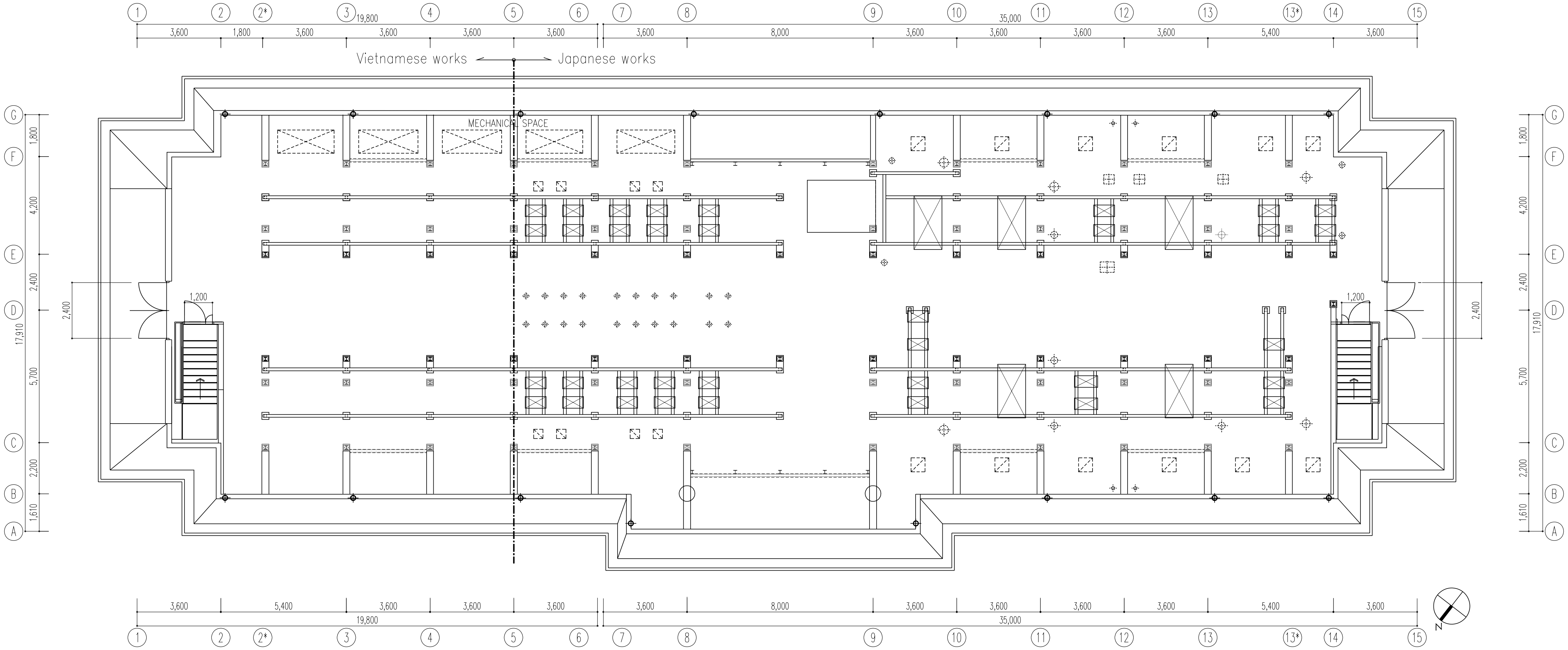
THE CONSORTIUM OF NIHON SEKKEI, INC. AND FUJITA PLANNING CO., LTD	APPROVED 03. 10. 03 CHECKED 03. 09. 29 DRAWN 03. 09. 22	REVISION	NOTE	THE PROJECT FOR IMPROVEMENT OF SAFETY LABORATORY FOR NATIONAL INSTITUTE OF HYGIENE AND EPIDEMIOLOGY	TITLE 1st FLOOR PLAN SCALE 1/200	NO. ARCHITECTURE



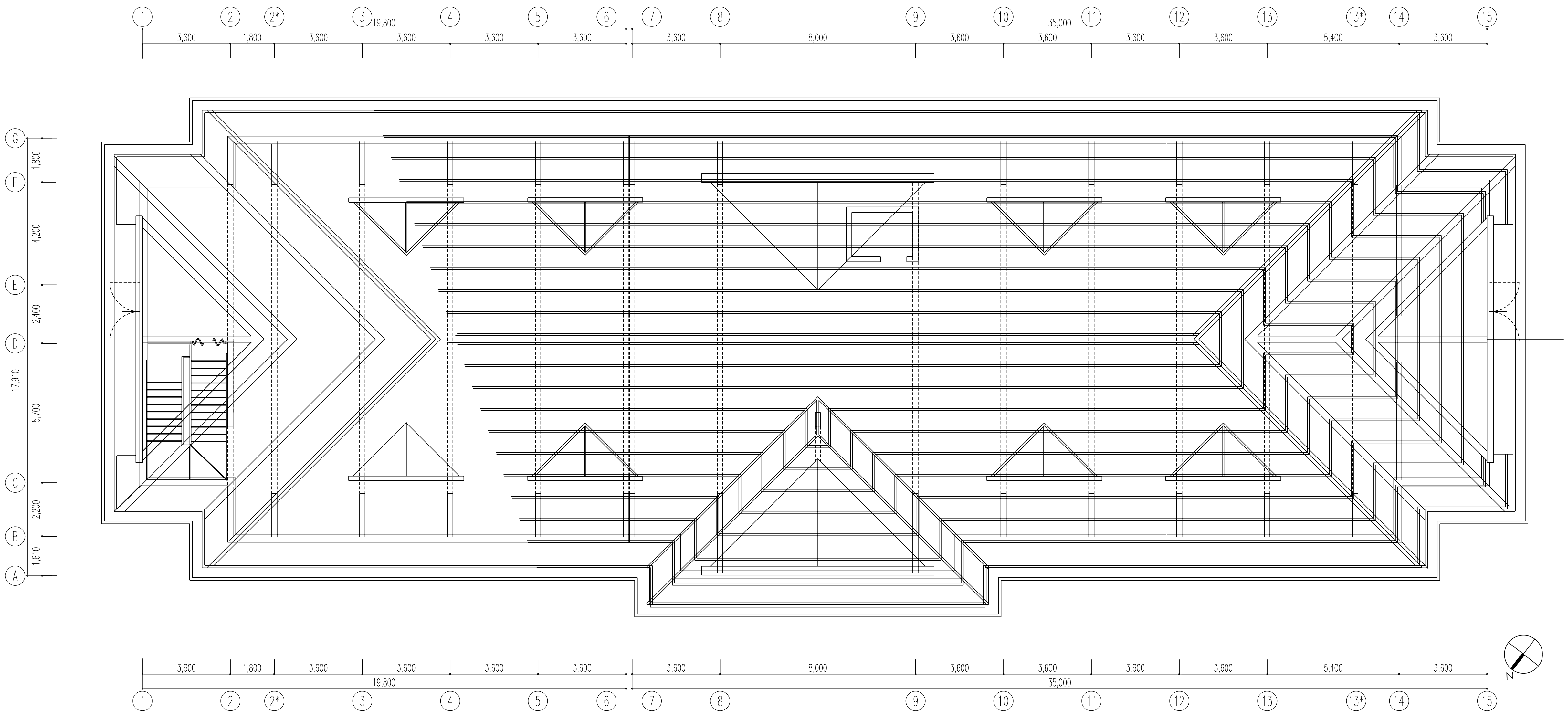
THE CONSORTIUM OF NIHON SEKKEI, INC. AND FUJITA PLANNING CO., LTD	APPROVED 00.00.00 CHECKED 00.00.00 DRAWN 00.00.00	REVISION	NOTE	THE PROJECT FOR IMPROVEMENT OF SAFETY LABORATORY FOR NATIONAL INSTITUTE OF HYGIENE AND EPIDEMIOLOGY	TITLE 2nd FLOOR PLAN SCALE 1/200	NO. ARCHTECTURE



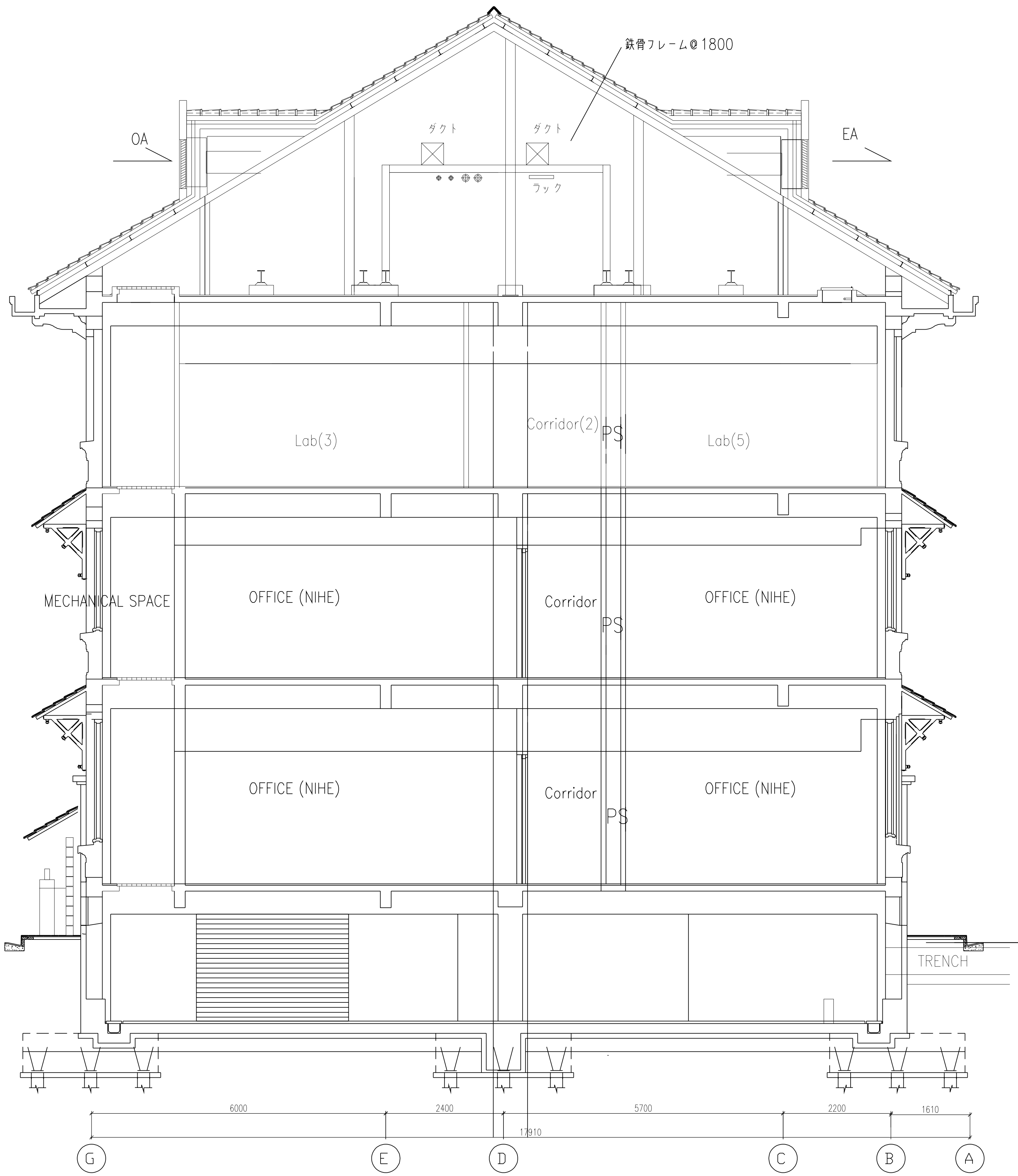
THE CONSORTIUM OF NIHON SEKKEI, INC. AND FUJITA PLANNING CO., LTD	APPROVED 00.00.00 CHECKED 00.00.00 DRAWN 00.00.00	REVISION	NOTE	THE PROJECT FOR IMPROVEMENT OF SAFETY LABORATORY FOR NATIONAL INSTITUTE OF HYGIENE AND EPIDEMIOLOGY	TITLE 3rd FLOOR PLAN SCALE 1/200	NO. ARCHITECTURE

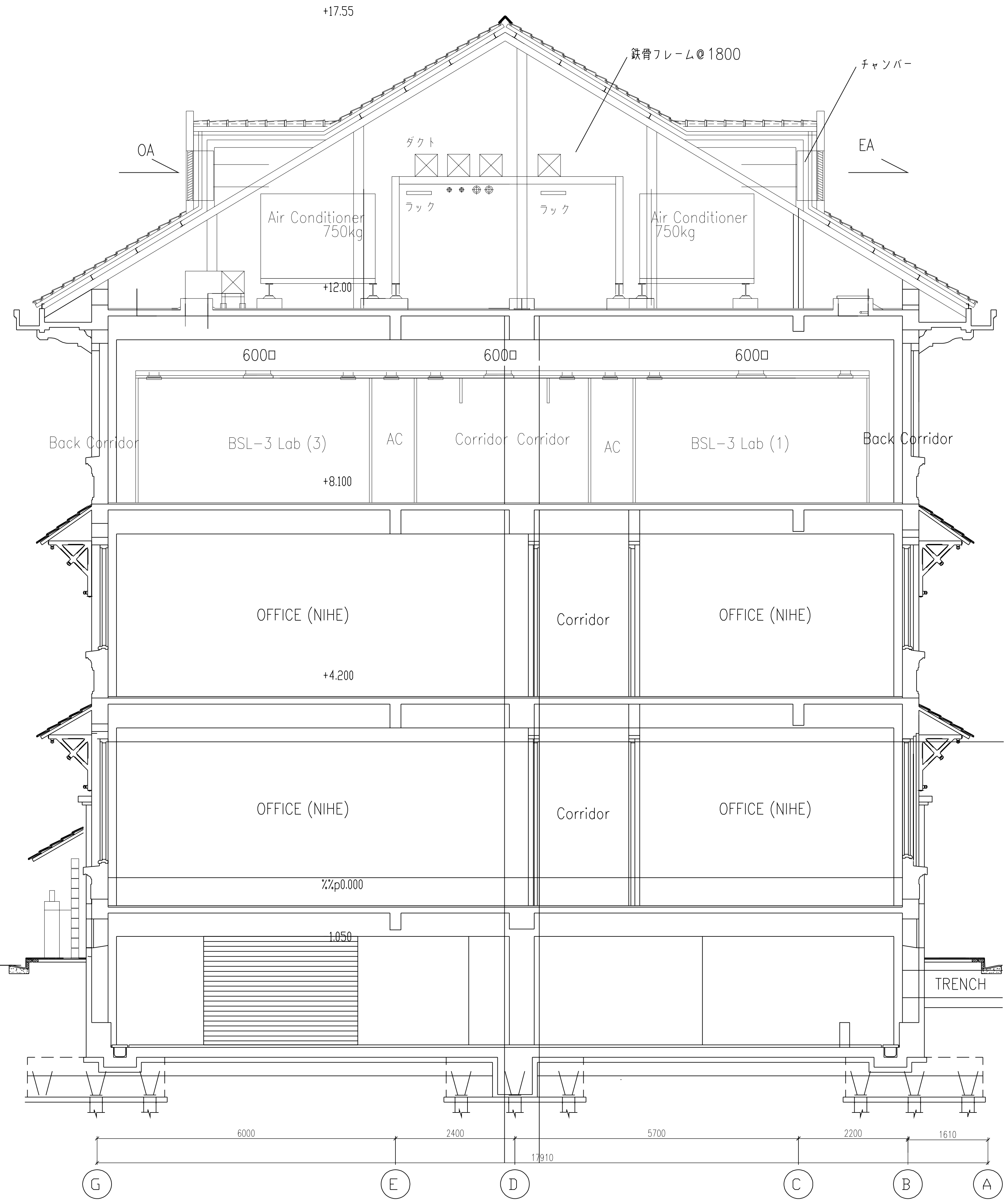


THE CONSORTIUM OF NIHON SEKKEI, INC. AND FUJITA PLANNING CO., LTD	APPROVED 00.00.00	REVISION	NOTE	THE PROJECT FOR IMPROVEMENT OF SAFETY LABORATORY FOR NATIONAL INSTITUTE OF HYGIENE AND EPIDEMIOLOGY	TITLE 4th FLOOR PLAN	NO.
	CHECKED 00.00.00					
	DRAWN 00.00.00				SCALE 1/200	ARCHTECTURE

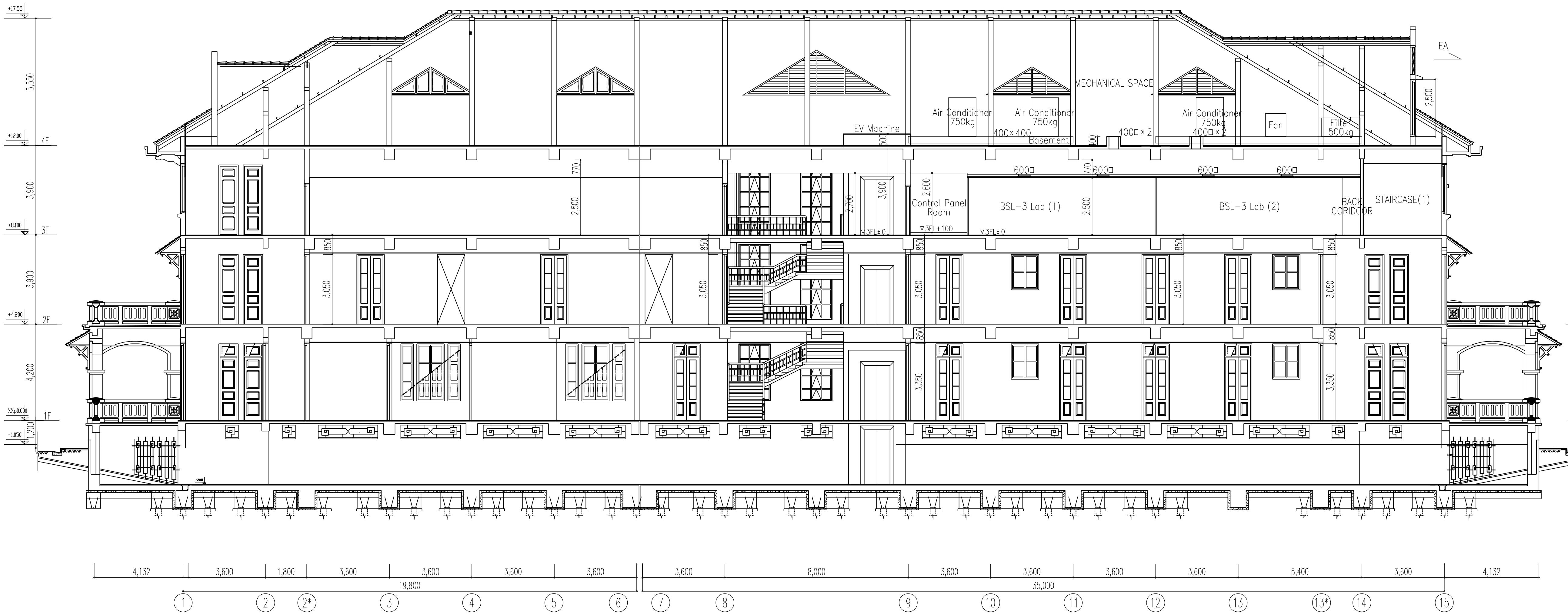


THE CONSORTIUM OF NIHON SEKKEI, INC. AND FUJITA PLANNING CO., LTD	APPROVED 00.00.00 CHECKED 00.00.00 DRAWN 00.00.00	REVISION	NOTE	THE PROJECT FOR IMPROVEMENT OF SAFETY LABORATORY FOR NATIONAL INSTITUTE OF HYGIENE AND EPIDEMIOLOGY	TITLE ROOF PLAN SCALE 1/200	NO. ARCHTECTURE





THE CONSORTIUM OF NIHON SEKKEI, INC. AND FUJITA PLANNING CO., LTD	APPROVED	00.00.00	REVISION	NOTE	THE PROJECT FOR IMPROVEMENT OF SAFETY LABORATORY FOR NATIONAL INSTITUTE OF HYGIENE AND EPIDEMIOLOGY	TITLE SECTION 1	NO.
	CHECKED	00.00.00					
	DRAWN	00.00.00				SCALE 1/100	ARCHTECTURE



C–C' SECTION

THE CONSORTIUM OF NIHON SEKKEI, INC. AND FUJITA PLANNING CO., LTD	APPROVED 00.00.00 / CHECKED 00.00.00 / DRAWN 00.00.00	REVISION	NOTE	THE PROJECT FOR IMPROVEMENT OF SAFETY LABORATORY FOR NATIONAL INSTITUTE OF HYGIENE AND EPIDEMIOLOGY	TITLE SECTION 2 / SCALE 1/200	NO. / ARCHTECTURE

Elevation3 1/100

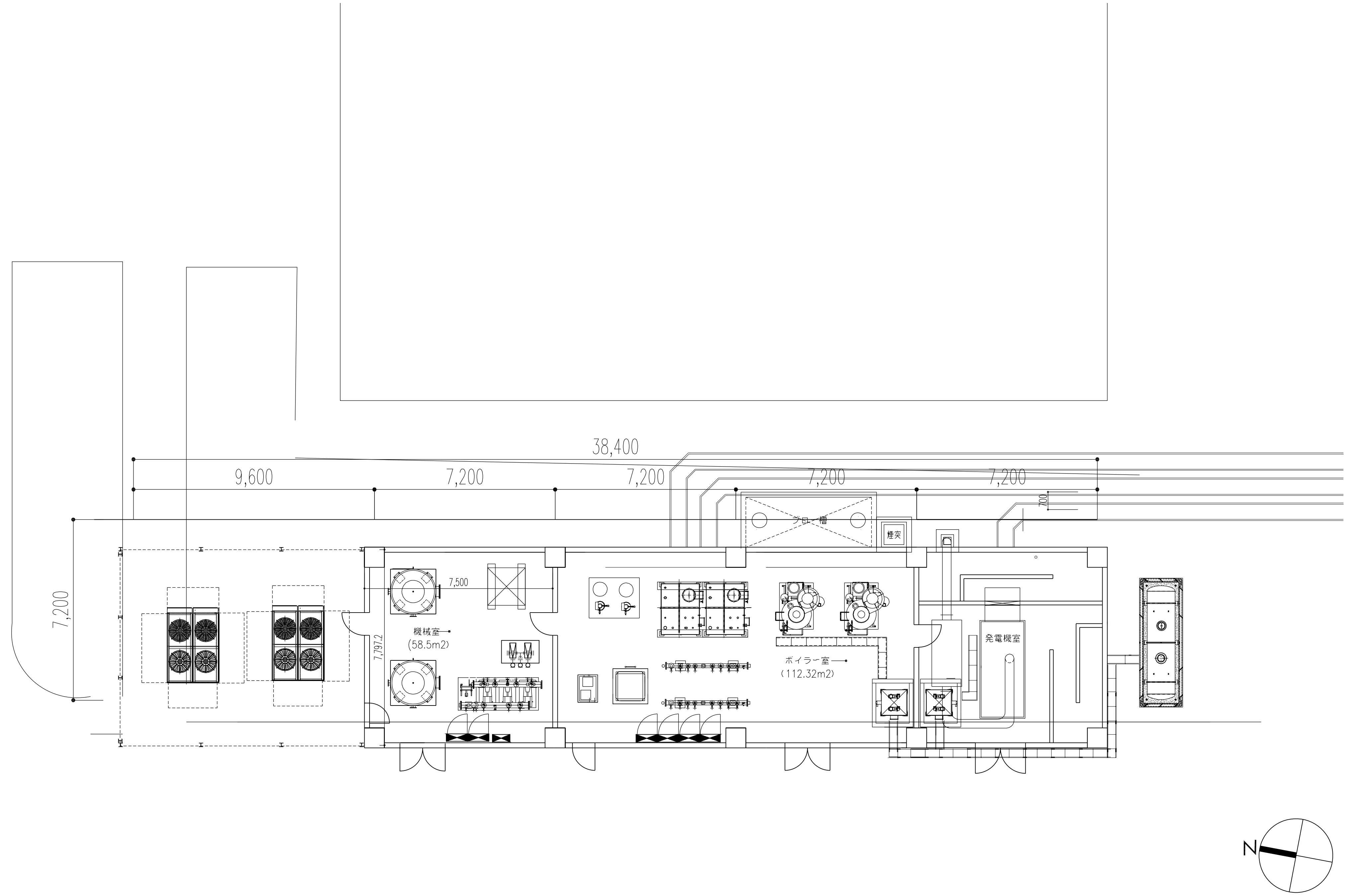
Elevation4 1/100

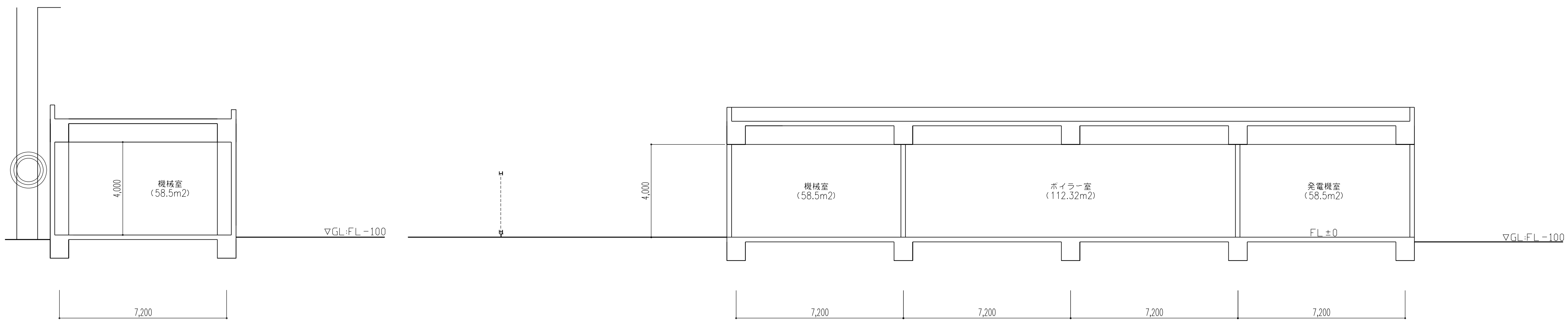
THE CONSORTIUM OF NIHON SEKKEI, INC. AND FUJITA PLANNING CO., LTD	APPROVED 00.00.00 CHECKED 00.00.00 DRAWN 00.00.00	REVISION	NOTE	THE PROJECT FOR IMPROVEMENT OF SAFETY LABORATORY FOR NATIONAL INSTITUTE OF HYGIENE AND EPIDEMIOLOGY	TITLE ELEVATION-1 SCALE 1/200	NO. ARCHTECTURE

Elevation3 1/100

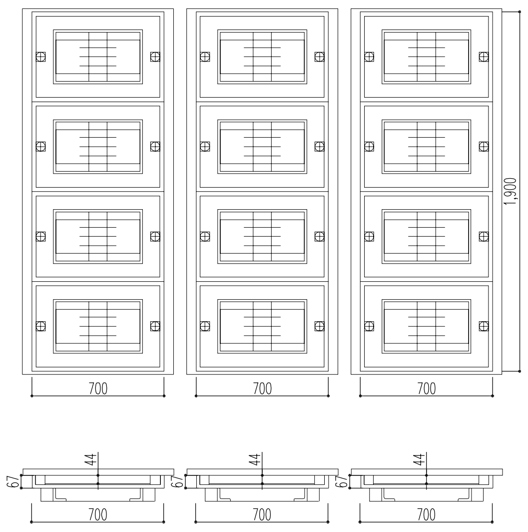
Elevation4 1/100

THE CONSORTIUM OF NIHON SEKKEI, INC. AND FUJITA PLANNING CO., LTD	APPROVED 00.00.00 CHECKED 00.00.00 DRAWN 00.00.00	REVISION	NOTE	THE PROJECT FOR IMPROVEMENT OF SAFETY LABORATORY FOR NATIONAL INSTITUTE OF HYGIENE AND EPIDEMIOLOGY	TITLE ELEVATION-2 SCALE 1/200	NO. ARCHTECTURE

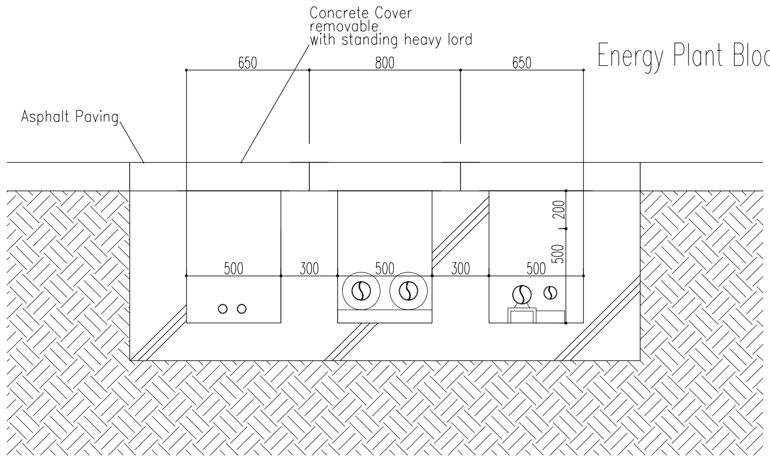




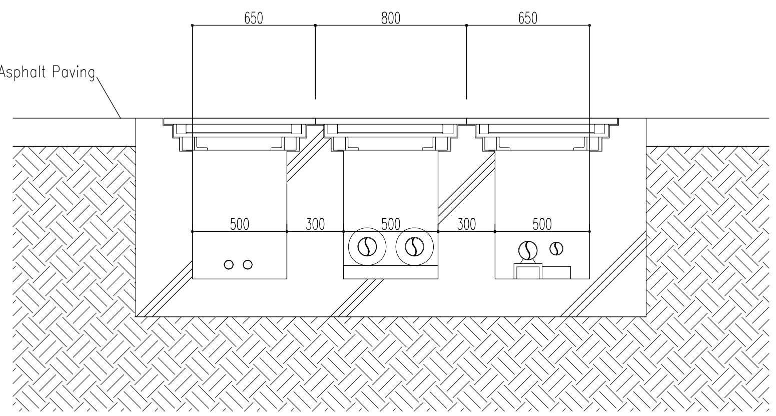
THE CONSORTIUM OF NIHON SEKKEI, INC. AND FUJITA PLANNING CO., LTD	APPROVED 03.10.03 CHECKED 03.09.29 DRAWN 03.09.22	REVISION	NOTE	THE PROJECT FOR IMPROVEMENT OF SAFETY LABORATORY FOR NATIONAL INSTITUTE OF HYGIENE AND EPIDEMIOLOGY	TITLE ENERGY PLANT BLOCK SCALE 1/200	NO. ARCHITECTURE



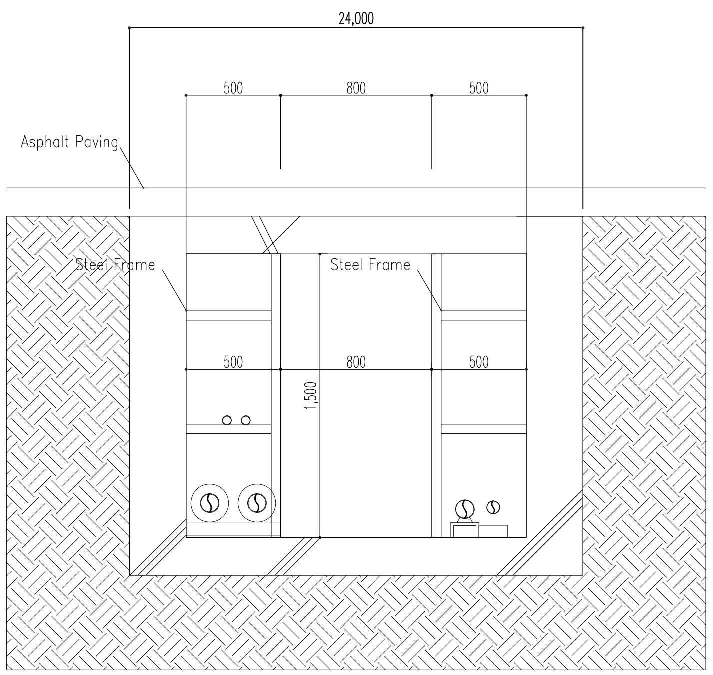
MACHINE HATCH 1/20



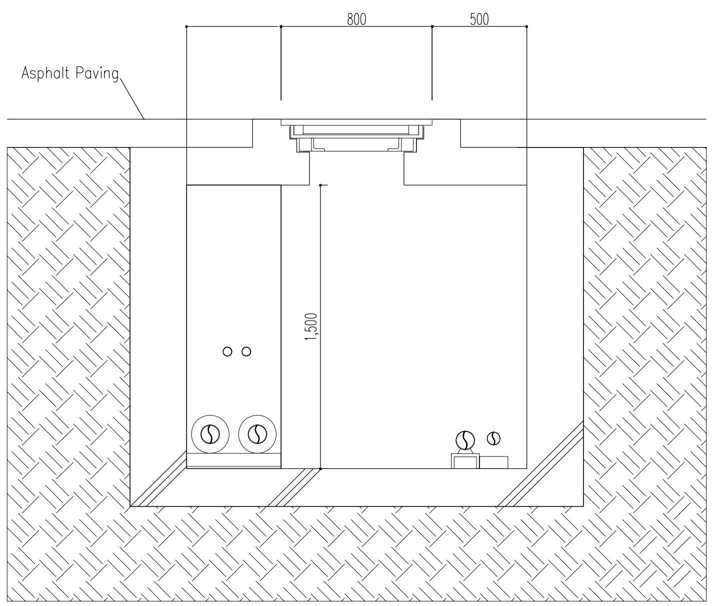
TRENCH DETAIL A 1/20 一般部



TRENCH DETAIL A 1/20 マシンハッチ部

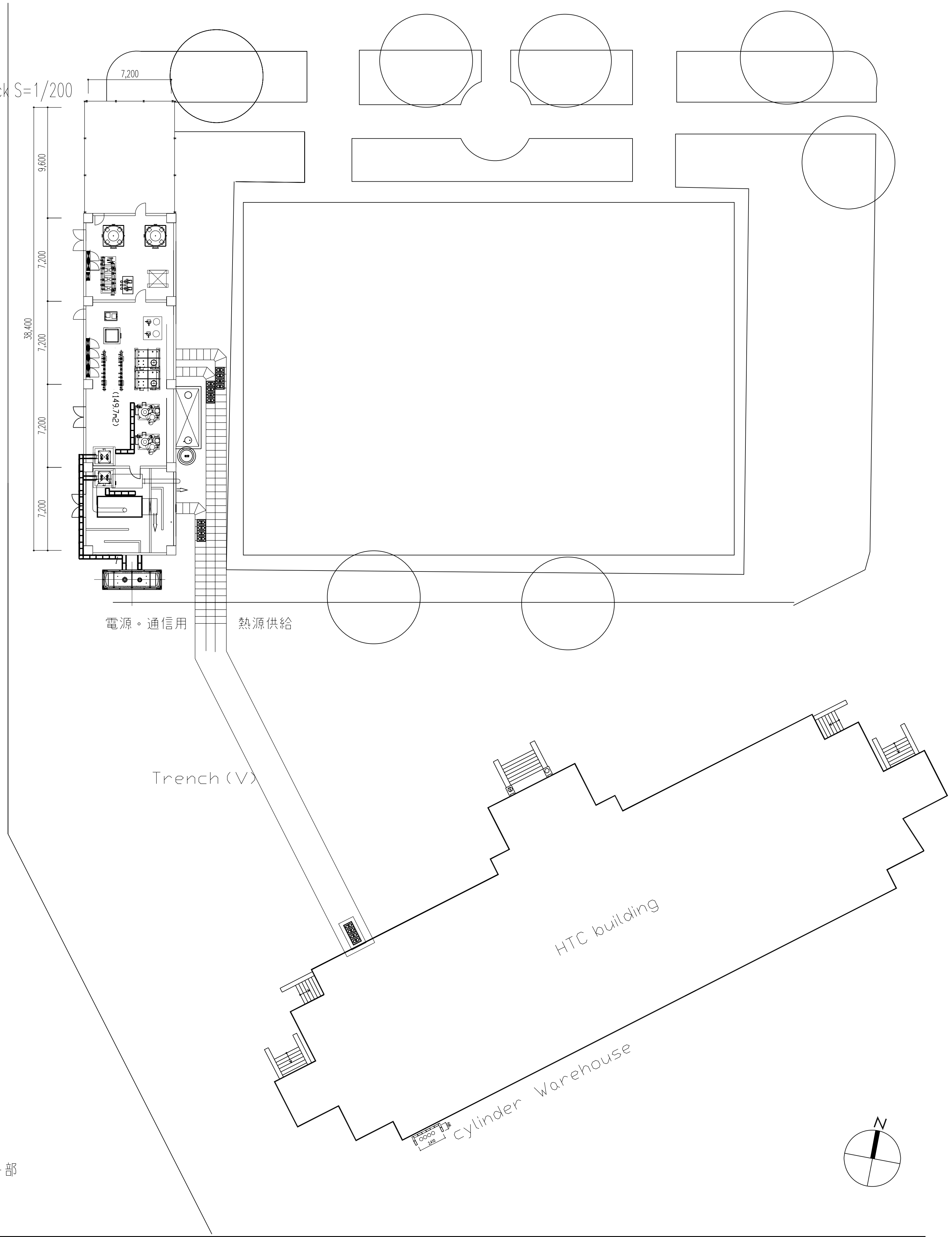


TRENCH DETAIL B 1/20 一般部



TRENCH DETAIL B 1/20 マシンハッチ部

Energy Plant Block S=1/200



THE CONSORTIUM OF NIHON SEKKEI, INC. AND FUJITA PLANNING CO., LTD	APPROVED	03.10.03	REVISION	NOTE	THE PROJECT FOR IMPROVEMENT OF SAFETY LABORATORY FOR NATIONAL INSTITUTE OF HYGIENE AND EPIDEMIOLOGY	TITLE: TRENCH PLAN	NO.
	CHECKED	03.09.29					
	DRAWN	03.09.22				SCALE: 1/400	ARCHTECTURE

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

(1) Organization for Project Implementation

The Project will be implemented in accordance with the Grant Aid System of the Government of Japan after execution of the Exchange of Notes (E/N) between the Socialist Republic of Viet Nam and the Government of Japan following the decision by a Cabinet meeting of the Government of Japan.

The responsible agency on the Vietnamese side for implementation of the Project is the Ministry of Health (MOH) (Department of Preventive Medicine) and the implementing agency is the National Institute of Hygiene and Epidemiology (NIHE). The Contractual signing on the Vietnamese side is made by NIHE, which will enter into the Consultant Agreement and the Construction/Equipment Agreement and implement the works for the Project to be borne by the Vietnamese side.

The relationship between the responsible and implementing agencies with the Japanese Contractors are shown in Figure 2-33 below.

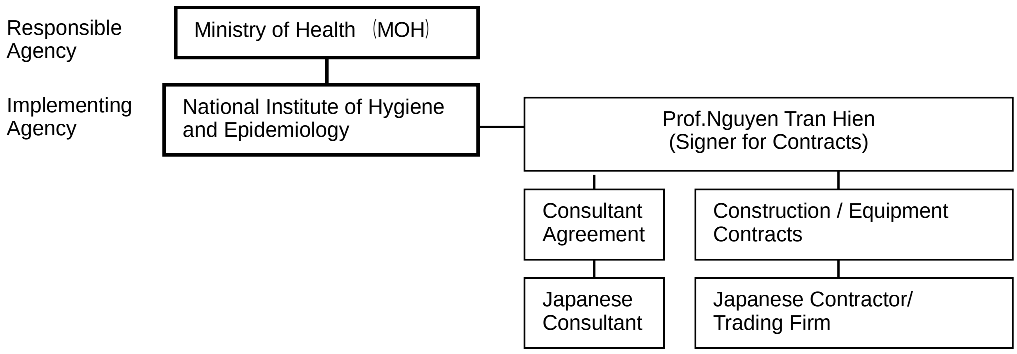
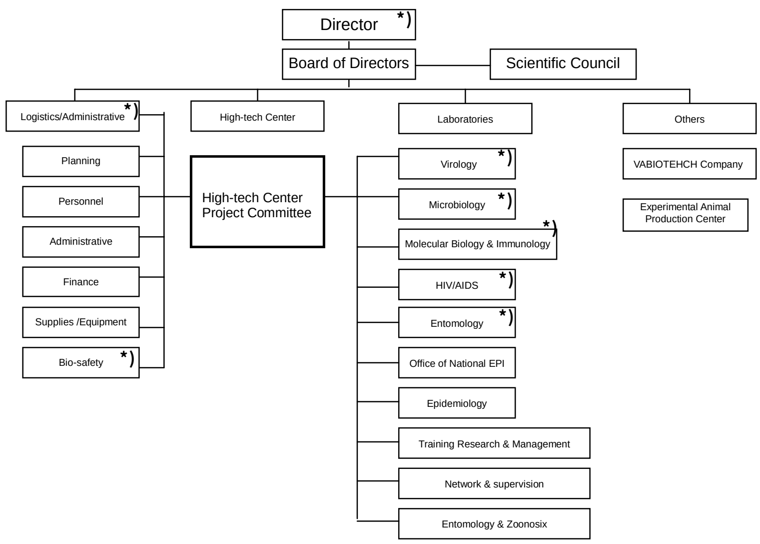


Figure 2-33 Organization for Implementation of the Project

For smooth promotion of the Project, it has been confirmed that the Project Committee will be organized consisting of the departments of NIHE and the departments and bureau's of MOH as shown in Figure 2-34 below.



*) Project Committee

Figure 2-34 Organization of the Project Committee

Project Committee for Construction of High Tech Center
Chairperson: Director General of NIHE
Vice Chairperson: Vice Director General of NIHE
Members
- Department of International Cooperation, MOH
- Department of Preventive Medicine
- Representatives from the following groups in NIHE:
  Administration
  Virology
  Bacteriology
  Molecular Biology/Immunology
  HIV/AIDS
  Bio-Safety Control
  Entomology

Functions of Project Committee
- Promotion activities including tenders and contracts for the Project
- Execution of Banking Agreements (B/A) and issue of Authorization to Pay (A/P)
- Exemption of customs duty and various taxes
- Acquisition of permits including Construction Permit
- Prompt unloading at unloading ports and guarantee for customs clearance
- Appointment of staff (including salaries) related to the Project
- Other necessary matters for smooth implementation of the Project

The Project Committee will perform the inspection of the contents of tender documentation (including detailed design drawings and specifications) and the work inspection through the coordination by NIHE. Ministry of Health and NIHE will approve the Project based on the reports made by this Committee. This procedure is illustrated in Figure 2-35 below.

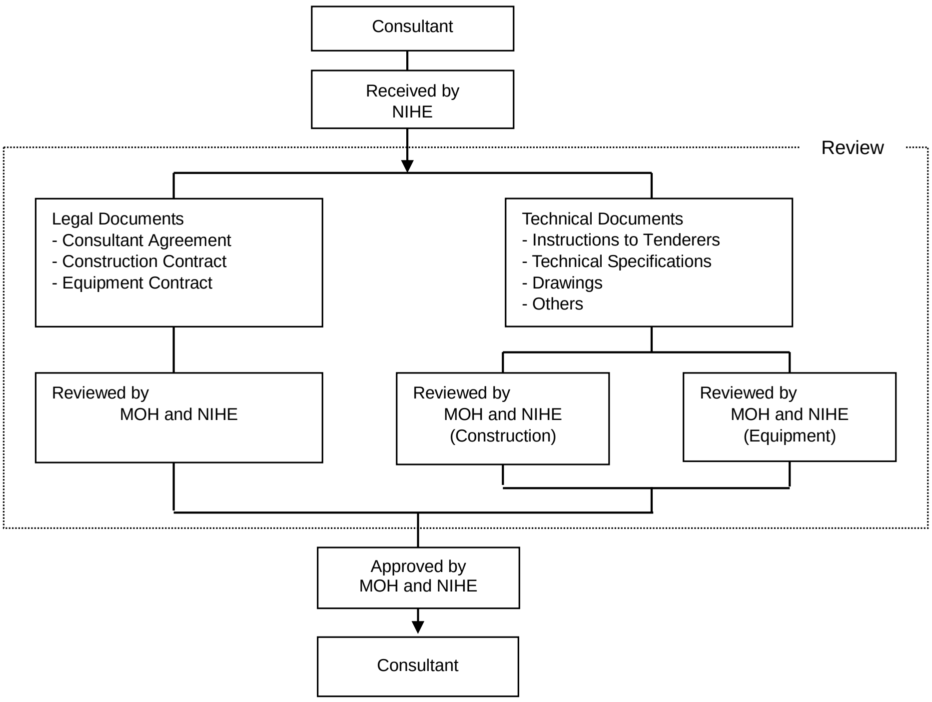


Figure 2-35 Approval Procedure of the Project

The procedures for construction permits and approvals to be acquired under the laws and regulations of Viet Nam will be taken by NIHE.

(2) Consultant

After execution of the Exchange of Notes, NIHE will enter into the Consultant Agreement for detailed design and project supervision with a Japanese consultant corporation, which will be validated after authorization by the Government of Japan. For smooth implementation of the Project, it is important to enter into the Consultant Agreement promptly after execution of the Exchange of Notes. It will be necessary for the Consultant to prepare the tender documentation (detailed design drawings and specifications) based on the Report of the Basic Design Study through discussions with NIHE after conclusion of the Consultant Agreement and acquire the confirmation by the Vietnamese side on the contents of the tender documentation in accordance with the above-mentioned procedure of approval. The tender formalities and work supervision activities will be made in accordance with the contents of the tender documentation.

(3) Methods of ordering construction works/equipment procurement

The Project will consist of the construction works to construct facilities and the equipment procurement works including procurement, installation and commissioning of medical equipment and materials. The prime contractor for each work will be limited to a Japanese national or corporation having a given qualification and will be selected by a general competitive tender with pre-qualification.

NIHE will enter into the respective contracts with the contractors for construction works and equipment procurement, which will be authorized by the Government of Japan. After that, the contractors for construction works and equipment procurement will be able to start the respective works and perform the respective works in accordance with each contract.

(4) Use of local consultant

For the work superintendence, local construction engineers will be employed in addition to the Japanese resident superintendents because the works employ the local engineering methods. In the Project, local equipment engineers will also be employed because the facilities have a higher work ratio for electrical and mechanical equipment than common buildings.

(5) Use of local construction engineers and dispatch of Japanese technical experts

The typical scale of a construction company based in Viet Nam top rank employs approximately 18,000 employees (including 5,000 employees dispatched abroad), of which a total of about 1,000 are engineers, and its annual revenue of constructions amounts to about 16 billion yen. There are several major construction companies in Hanoi City, which have had experience in construction works in which Japanese companies have been involved. They are aware of the construction methods that Japanese construction companies use, but do not have sufficient numbers of engineers who have practical knowledge and skills. Therefore, the technical guidance by prime contractors (such as Japanese general contractors) will be required. For this purpose, it is necessary for the prime contractors to employ local engineers working under the leadership of Japanese engineers and to check on work schedules, quality and safety control and the guidance of the local engineers on those items in a detailed manner.
Since the Project includes a very advanced research laboratory, the construction work will a high level of quality control. Therefore, it is indispensable that Japanese technical experts with deep experience in this field to take charge of the technical guidance and construction management. Especially for the special laboratory in BSL-3, it is planned to dispatch technical experts from Japan.

2-2-4-2 Implementation Conditions

(1) Temporary building plan

The temporary offices for the Consultants, construction contractors and subcontractors, materials storage yards and working plants and storehouses will be constructed in the open space adjacent to the project site through discussions with NIHE.

The main construction materials will be procured from Hanoi City and its suburbs. Concrete will be purchased from ready-mixed concrete plants in Hanoi City and its suburbs.

The project site is located in the premises of NIHE. As research activities will be continue in the existing NIHE facilities including 1st and 2nd floors of High Tech Center during the planned construction period, the line-of-flow plan for the works within the premise of NIHE will be formulated in selecting the materials move-in routes and working yards with sufficient consideration in order to secure high work efficiency and safety.

In order to prevent NIHE-related persons and third parties from unauthorized access to the work areas, it is also necessary to keep guards at the entrances and exits of High Tech Center. Further, to avoid work-related vehicles disturbing the traffic in the premises and neighboring areas, traffic safety personnel will be deployed to prevent possible accidents at necessary points on the front road and other roads in the premises.

(2) Equipment Procurement

The majority of important equipment and materials can procured in the site area, Hanoi City and its environs. At present, many products with various standards and quality levels from Europe, Far East Asia and China are distributed throughout Viet Nam. The required equipment and materials will be procured locally to the maximum possible extent in order to facilitate maintenance and repairs after completion of the planned facilities. In this case, the quality and quantity of procured equipment and materials will be fully examined to ensure that the work schedules will not be affected by procurement troubles.

The equipment and materials to be imported from Japan and any third countries will be transported by sea to Haiphong port in Viet Nam, and on land by truck from the port to the construction site in Hanoi City. However, the land transportation will be made only in the nighttime because the entry of large vehicles into Hanoi City is prohibited during the daytime. For some of the equipment and materials, a packing method that is durable enough against the impacts from shocks, humidity and high temperatures will be adopted.

(3) Building Method

The Project is for the construction works to build a BSL-3 laboratory and related facilities within the High Tech Center that has been designed and constructed by Vietnamese side. These buildings are very high-level research institute buildings, for which an engineering method to ensure minimum adjustment to the existing High Tech Center buildings and later additional construction will be selected. Dry wall construction method using LGS stud partition walls will be used to reduce the live load on the 3rd floor.

(4) Legal Matters

In implementation of the Project, some modification works such as removal of the roof support walls on the 4th floor (attic floor) of the High Tech Center will require the permits by MOH and related ministries and agencies. Applications for the permits will be made by NIHE, but 1) the rational reasons for such modifications, 2) costs of modification works and 3) modification design documentation will be required. In relation to preparation of these applications, the facility design data within the scope of work undertaken by Japanese contractors should be provided timely to the Vietnamese side.

2-2-4-3 Scope of Works

In order to implement the Project, the building works are divided into two parts. One is covered by the Japanese side under the Grant Aid Scheme. The other is covered by Vietnamese side, namely NIHE and MOH of Vietnamese Government. The scope of works on each side is listed in the Table 2-20. It should be noted that obligations of the recipient country is not limited to those mentioned herewith but included such items mentioned in Table 2-4.

Table 2-20 Scope of Works

Design works under Japanese Responsibility	Design works under Vietnamese Responsibility	
	HTC Base Building	**Design for Alteration and Additional Works**
Design works for the portion provided under Japanese Grant Aid Scheme	Design for HTC Base Building	Design for Alteration and Additional Works
Transfer of design conditions and information required for Alterations and Additonal Works to be done under Vietnamese responsibilities. Design advice for laboratories to be located on 1st and 2nd floor when it is required by Vietnamese side	Design for 1st and 2nd floor	Alteration Design and its cost estimate
Verification of Alteration Designs done by Vietnamese side. If necessary, requirement will be submitted to NIHE to amend it in view of the design conditions transfered to Vietnamese side prior to the start of the design.		
		Construction Permit for Ateration Work.. Procedure to get MOH Approval for Aleration Works

Construction Works		
To be covered by Japanese Side	**To be covered by Vietnamese Side**	
Works under Japanese Grant Aid	**HTC Base Building Works**	**Alteration work & Additional works to HTC Base Building**
Inspect and verify the Alteration Works. Submit to NIHE any correction works to be required		Adjustment or corrections works if required
	Interior works and Mechanical/Electrical works on 1st & 2nd floor	
	Connecting roads to outside the site. Landscaping and planting	

Construction Works		
To be covered by Japanese Side	**To be covered by Vietnamese Side**	
Works under Japanese Grant Aid	**HTC Base Building Works**	**Alteration work & Additional works to HTC Base Building**
To construct the following works; a) BSL-3 laboratories, associated laboratories on the 3rd floor and related Mechanical/Electrical systems on the 4th floor (Hereinafter called **Target facilities**) b) Facilities defined in the following 2), 3) Electrical and Mechanical Works.	To construct the base building; 1) Interior works on 1st and 2nd floor including Architectural, Electrical and Mechanical Work 2) Any systems for entire HTC building, such as Security system, information etc. but excluding systems provided in Target facilities.	To construct the following works;
1) Architectural Works Interior works including partitions and fixed furniture in the Target facilities on the 3rd floor. Furniture. Laboratory equipment-List A (Separate from the listed equipment defined in the Equipment Works) List –A Autoclaves (procurement and installation) Pass-boxes(procurement and installation) Safety boxes(procurement and installation) Laboratory tables Signage works for target facilities Miscellaneous works Interface works including adjustment and repairs in connection with Alteration Works Bases and Steel Frames to support and fix Mechanical and Electrical Equipment and its cables for Target facilities, Energy Plant Block and Trench. *) Floor openings and reinforcement shall follow attached drawings showing scope of works for respective parties. Curtain rails on 3rd floor	Overall Signage Works	1) Architectural Works a) Alterations of Roof and its supporting structure to accommodate Target facilities including temporary demolition and reconstruction. b) Creating holes and openings to the 4th floor slabs and related reinforcement in accordance with the Design conditions. c) Construction of Energy Plant Block including related refurbishing trees and landscaping. d) Construction of the Trench including refurbishing pavement of roads. Curtains and Blinds to be provide by Vietnamese side
2) Electrical Works Power Supply, Lighting and Socket Outlet, Lightning Protection and Grounding, Telephone, Public Address, Intercom, Fire Alarm, Master TV Antenna, Piping for PC Network, Central Control Equipment Security System in Target facilities. Secondary power supply after receiving at MDB to main equipment of the Project in Energy Plant Block.	2) Electrical System Works All electrical works for HTC building other than in Target facilities and Japanese Works in Energy Plant Block and Trench including power supply, lighting & Consent Outlets, Lightning Arrestors & Grounding, Telephone, Automatic Fire Alarm	2) Electrical System Works Any required extensions and additions to the connecting points for electrical systems for the use of Target facilities including power supply, lighting & Consent Outlets, Lightning Arrestors & Grounding, Telephone, Automatic Fire Alarm
3) Mechanical Works Water Supply, Drainage, Hot Water Supply, Sanitary Fixture, Fire Fighting, Air Conditioning, Ventilation in Target facilities and Energy Plant Block. Installation of Boiler, Chillers and their associated equipment with piping for heat source supply to the target facilities.	3) Mechanical Systems All mechanical works for HTC building other than in Target facilities and Japanese Works in Energy Plant Block and Trench for Water Supply, Drainage, Hot Water Supply, Sanitary Fixture, Fire Fighting, Air Conditioning, Ventilation other than BSL-3 facilities	3) Mechanical Systems Any required extensions and additions to the connecting points for Water Supply, Drainage, Hot Water Supply, Sanitary Fixture, Fire Fighting, Air Conditioning, Ventilation other than BSL-3 facilities
4) Other Utilities CO_2 Gas System, Sewage Treatment Plant and Drainage System for contaminated drains		

Construction Works		
To be covered by Japanese Side	**To be covered by Vietnamese Side**	
Works under Japanese Grant Aid	**HTC Base Building Works**	**Alteration work & Additional works to HTC Base Building**
To provide facilities for the distribution of electricity, water supply, drainage and others 1) Electricity a. The conduit pipe and wiring after main breaker in Target facilities and Energy Plant Block		To provide facilities for the distribution of electricity, water supply, drainage and others 1) Electricity a. Low voltage power supply up to main breakers in BSL-3 and Energy Plant Block b. Provision of Emergency Generator for BSL-3 and Energy Plant facilities including oil tank
2) Water Supply a. The supply system after shut-off valve in Target facilities and Energy Plant Block		2) Water Supply a. The city water distribution main up to valve in Target facilities and Energy Plant Block
3) Drainage a. Horizontal drainage in Target facilities and Energy Plant Block b. Sewage treatment plant and drainage system for contaminated drainage system		3) Drainage a. Vertical drains in Target facilities and Energy Plant facilities b. Connection drainage system after sewage treatment plant
4) Telephone system a. Extensions after the outlet panel in Target facilities		4) Telephone system a. Inlet and connections up to Outlet Panel in BSL-3 facility
5) Furniture and Equipment on 3rd floor a. Curtain Rail on 3rd floor b. Experiment tables on 3rd floor c. Supply and installation of Laboratory Equipment on 3rd floor	Equipment Transfer of existing equipment from NIHE laboratories to HTC	5) Furniture and Equipment a. Blind b. General furniture

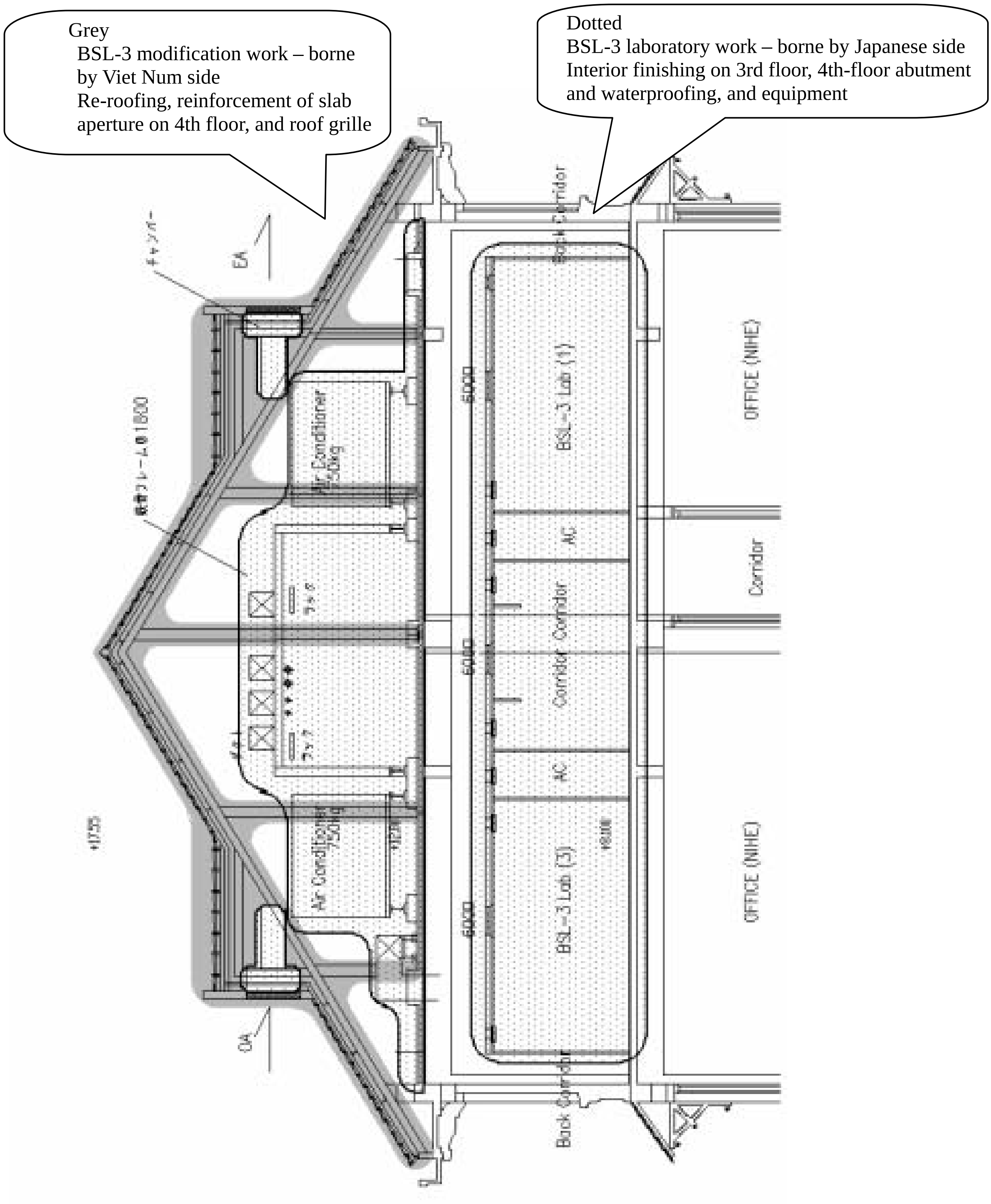


Figure 2-36   Building work division 1 (BSL-3 laboratory side)

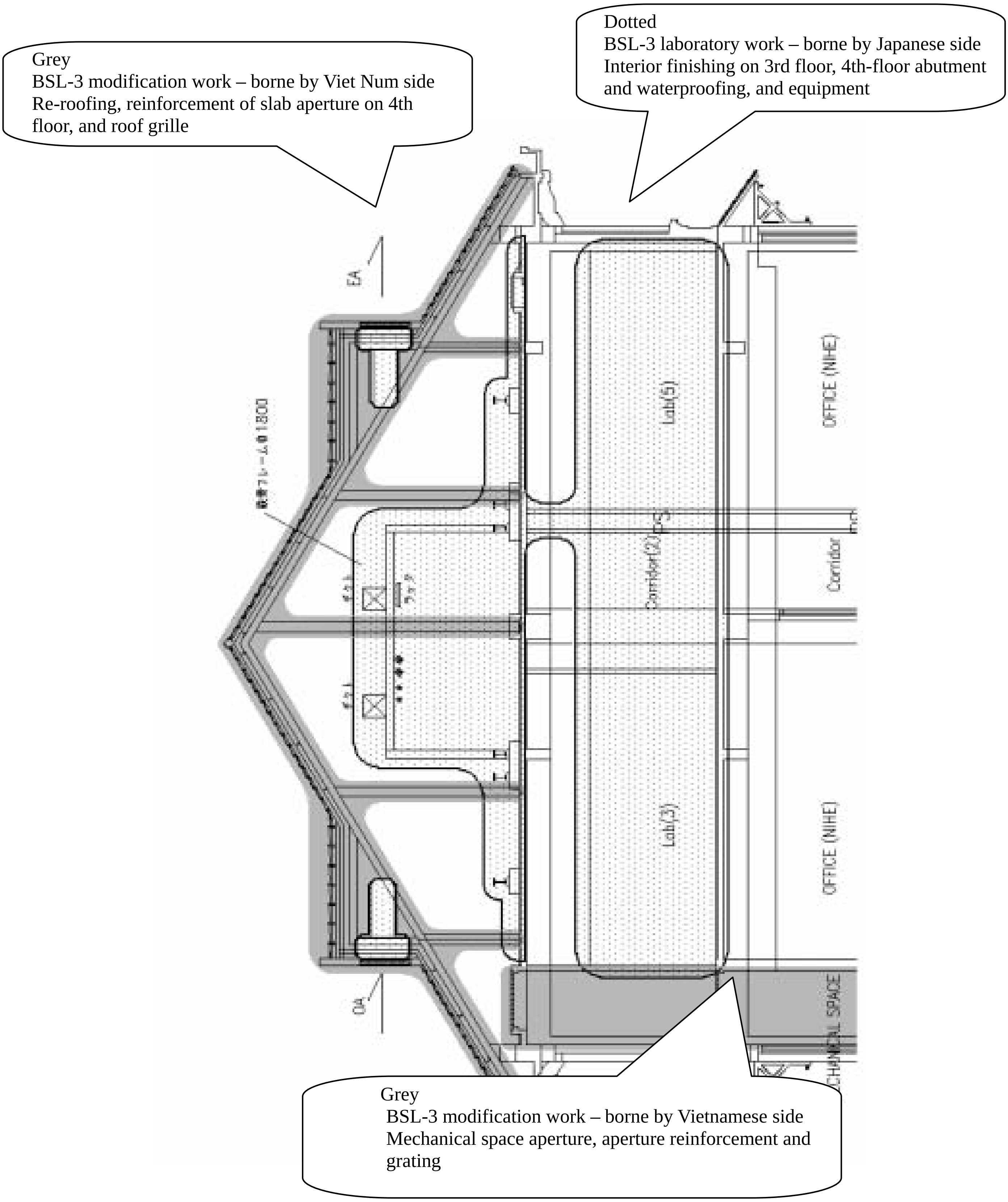


Figure 2-37 Building work division 2 (East side)

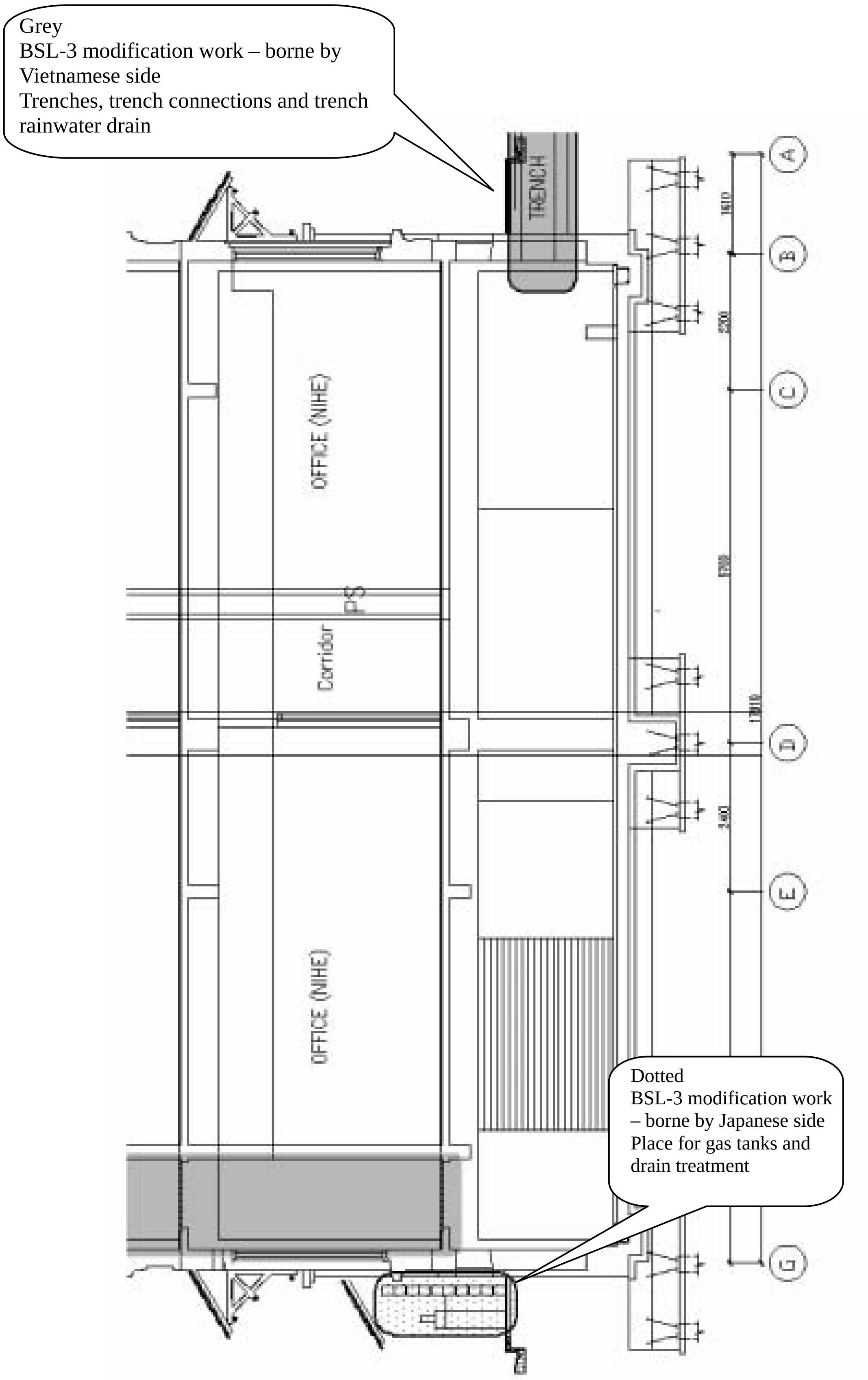


Figure 2-38 Building work division 3 (Underground building)

2-2-4-4 Construction Supervision

The Japanese consultant company will enter into the Consultant Agreement with NIHE to undertake the detailed design (including preparation of the tender documentation)) and the tender and construction supervision activities for the Project.

Construction supervision will secure the due performance of the terms and conditions of the work contracts including determination of whether any work under the Project is carried out in accordance with the design documentation. The consultants will supervise the works to secure the specified quality and control the work schedules in making guidance, advice and coordination during the construction period of each work. The construction supervision will consist of the following activities:

(1) Cooperation in Tender and Contract Award

The consultant will prepare the tender documentation necessary to determine the contractor for each construction or equipment work and render tender services including tender announcement, receipt of tender applications, examination of qualification, holding of a pre-bid meeting, distribution of bidding documents, receipt of bids and evaluation of bids. In addition, the consultant will give advice and cooperation to conclude the contracts for construction and equipment works between the successful contractors and NIHE.

(2) Guidance, Advice and Coordination to Work Contractors

The consultant will examine the construction processes, construction schedule, building materials procurement plan, equipment procurement/installation plan, etc. and give guidance, advice and coordination to the successful contractors.

(3) Inspection and Confirmation of Construction and Manufacturing Drawings

The consultant will examine the construction or manufacturing drawings and documents submitted by the successful contractor and give any necessary instructions and issue the confirmation of the work.

(4) Check and Confirmation of Building materials and Equipment

The consultant will examine the compliance of the building materials or equipment to be procured by the successful contractor with the contract documents and give the approval thereof.

(5) Inspection of works

To the extent it is required, the consultant will attend the factory inspection of the building materials or equipment at the respective factories of the manufacturers and the work acceptance tests to confirm the quality and performance of the materials and equipment to be produced as specified.

(6) Progress Report of Works

The consultant will supervise the conditions of the manufacturing processes and the construction sites and produce progress reports on the work to related agencies of both governments from time to time.

(7) Test Run and Completion Inspection

The consultant will attend the test run and completion inspection for buildings, electrical and mechanical systems and laboratory requirement to ensure that performance compliance is achieved satisfactorily as specified in the contract documents and submit the completion reports to NIHE.

(8) Construction Supervision System

The consultant will deploy a full-time a resident architect to execute the above activities. Although the facility under the Project is relatively small-scale, the coordination between the Vietnamese works and the Works under the Project is extensively required to achieve the performance of the high-level medical laboratory. In addition, the consultant will dispatch engineers of specific fields to the work sites according to the progress of the works, and give necessary consultation, inspection, guidance and coordination.

The consultant will also provide engineers in charge of the Project in Japan to carry out technical coordination and communication with the work site. The consultant will also make reports to the Government of Japan and the related agencies on necessary matters on the progress status, the payment procedures, the completion and handover of the Project.

The construction supervision system under the Project is shown in Figure 2-39 below.

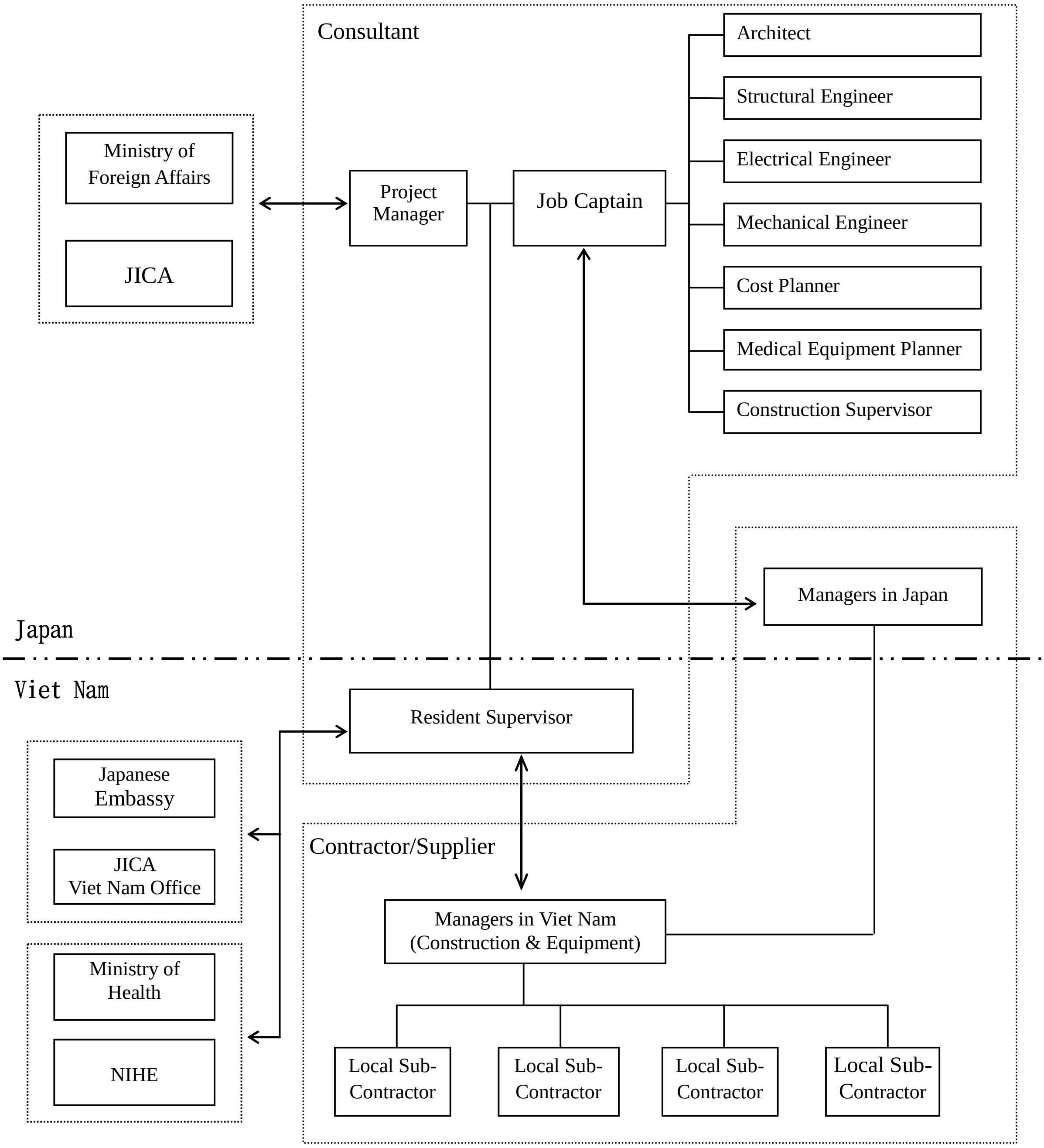


Figure 2-39 Supervision System

2-2-4-5 Quality Control Plan

(1) BSL-3 Laboratory

The BSL-3 experiment facility shall secure the performance in compliance with the bio-safety regulations.

- Air-tightness and atmospheric pressure differentials
  The wall panels, doors and air conditioning ducts shall have the appropriate air-tightness performance, and structural integrity to withstand any atmospheric pressure differentials.
  It is to be confirmed by leakage test using the Leak Test Method.

- Exhaust air and Drainage/Sewage
  Treatments for exhaust air and drainage/sewage shall be specified and confirm to the specific regulations.

(2) Coordination with Works by Vietnamese side

The alteration works for the High Tech Center will be implemented by the Vietnamese side in accordance with requirements arising from the works under the Grant Aid. Timely and in-depth discussions between both parties will be required to secure the integrity between the two works.

As soon as commencement of the Works under the Project begins, the contractor will inspect the status of the alteration works and confirm its completion relative to the alteration design documents prepared by the architect of NIHE.

2-2-4-6 Procurement Plan

(1) Procurement of Building Equipment and Materials

As the objective of the Project is to build a research institute, long-lasting and durable products will be procured in order to achieve the required performance of the facilities in consideration of reduced maintenance, inspection and cleaning. With this in mind, the following procurement policies will be adopted:

1) Local procurement

In consideration of convenience for maintenance and repairs after completion of the facility, equipment and materials to be used will be procured locally to the maximum possible extent after checking availability in terms of their quality and quantities. The equipment and materials that are already imported and available in the local markets in Viet Nam, which can be distributed anytime in the markets with no need for import procedures, will be deemed to be local products and positively adopted for the Project.

2) Import procurement

Any necessary equipment and materials that are difficult to obtain locally, or do not meet the quality requirements, or the supply is unstable in the required quantities will be procured from Japan or a third country. In this case, the contractors shall coordinate with NIHE for import and customs clearance in order to smoothly implement the tax exemption measure and other procedures.

Should any products equivalent or similar to the locally procured products can be procured from Japan or any other country, consideration will be given to import such similar products, if “prices plus the costs of packing and transportation” are lower than “prices for local procurement”

3) Transportation plan

Equipment and materials to be imported from Japan or a third country will be transported by sea to Haiphong port in Viet Nam and by land from the port to the construction site in Hanoi City. However, land transportation will be made only at night because the entry of large vehicles into Hanoi City is restricted during daytime. For some of the equipment and materials, packing methods securing freedom from impact such as shocks, humidity and high temperatures will be adopted.

4) Procurement plan

The major items of building equipment and materials to be procured will be classified and listed in terms of local procurement, procurement from the third country and from Japan in Table 2-21. The main equipment and materials for electrical and mechanical equipment will be procured from Japan or a third country.

Table 2-21 Procurement Plan for Main Building Materials

Work category	Material and equipment	Local	Japan	Third country	Note
Reinforced concrete work	Portland cement	○			Local product conforming to JIS Standard can be manufactured.
	Fine aggregate (sand)	○			Local procurement
	Coarse aggregate	○			Local procurement
	Deformed bars	○			Products conforming to JIS Standard are available.
	Form work	○			Local procurement
Steel work	Structural Steel	○			Products conforming to JIS Standard are available.
Masonry	Bricks	○			Local procurement
Water-proofing work	Asphalt waterproofing	○			Products by Japanese manufactures will be procured locally
	Liquid-applied membrane waterproofing	○			Ditto
	Sealing compound	○			Ditto
Plastering work	Terrazzo	○			Local procurement
Tile work	Earthenware tiles	○			Local procurement
	Porcelain tiles	○			Local procurement
Panel work	Metallic panels		○		Local products have quality problems and Japanese products will be procured.
	Fibre reinforced calcium silicate board		○		Ditto
Carpentry	Wood	○			Local procurement
	Glued laminated wood	○			Local procurement
	Plywood	○			Local procurement
Metal work	Light steel frame backing	○			Local procurement
	Decorated metal ware	○			Ditto
	Finished metal products	○			Ditto
Plastering work	Cement mortar	○			Local procurement
	Plaster	○			Ditto
Wooden fitting work	Hinged doors	○			Local procurement
	Wooden fitting frames	○			Ditto
	Fixture metals	○			Ditto
Metallic fitting work	Aluminum windows		○	○	Local products have quality problems and third country or Japanese products will be procured.
	Steel fittings			○	Local products have quality problems and third country products will be procured.
Glass work	Plain sheet glass	○			Local procurement
Painting work	Interior painting	○			Local procurement
	Exterior painting	○			Ditto
Interior finish work	Plaster board	○			Local procurement
Furniture	Counters, tables	○			Local procurement
	Locker, shelves	○			Local procurement
Miscellaneous works	Laboratory table		○		Portions for which high performance is required will be Japan made.
	Pass boxes		○		
	Biosafety Cabinets		○		Ditto
	Autoclaves		○		Ditto

Work category	Material and equipment	Local	Japan	Third country	Note
Electrical Works	Wiring devices	○			Available locally
	Lighting fixtures	○	○		Special type from Japan
	Board	○			Available locally
	Wire, Cables, etc.	○	○		Special type from Japan
	Telephone exchange system	○			Available locally
	Intercom system		○		No local materials meeting the performance requirement
	Paging		○		- ditto -
	Automatic fire alarm system	○			Available locally
	Security system		○		No local materials meeting the performance requirement
	Monitoring camera system		○		- ditto -
Mechanical Works	Air-cooled chiller		○		No local materials meeting the performance requirement
	Steam boiler	○			Available locally
	Air conditioner		○		No local materials meeting the performance requirement
	Fan	○	○		Special type from Japan
	Diffuser & intake	○	○		- ditto -
	Air filter	○			Available locally
	Duct materials	○			- ditto -
	Pump	○			- ditto -
	Automatic control		○		No local materials meeting the performance requirement
	Sanitary fixtures	○			Available locally
	Fire fighting equipment	○			- ditto -
	Infectious waste water treatment		○		No local materials meeting the performance requirement
	Pipe materials	○			Available locally
	Insulation materials	○			- ditto -

(2) Equipment Procurement

1) Procurement Plan

It is important to secure appropriate maintenance and operation of the equipment to be procured for the Project in order to obtain accurate and stable test results required for medical diagnoses and researches using the equipment. Engineers having professional knowledge will be required to make regular maintenance and check the replacement of parts. For this purpose, it is important to procure products from manufacturers which have such engineers resident in Viet Nam.

If it is difficult to make proper competitive tenders for products by procuring such products from Japan only, equally should maintenance of products without agents in Vietnam be problematical, such products will be procured from another third country. Table 2-22 shows the country of procurement for main equipment and materials.

Table 2-22 Procurement Plan for Main Equipment and Materials

Name of Equipment	Japan	Third Countries	Remarks
Formaldehyde Decontamination Unit, Spectrofluorometer, FTIR Spectrophotometer, Spectrophotometer, Electrophoresis Apparatus, Real Time PCR, PCR Machine, DNA Sequencer, ELISA System, Fluorescence Microscope, Inverted Microscope, Ultracentrifuge, Centrifuge, Refrigerated Microcentrifuge, Deep Freezer -80°C, Freezer -20°C, Medical Refrigerator, PCR Workstation, CO_2 Incubator, Incubator, Ultrasonicator, Electronic Balance, pH Meter, Shaking Water Bath, Dry Block Bath, UV Transilluminator, Lyophilizer, Automatic RNA Extraction System, Image Acquisition Workstation for Electrophoresis Application, Multipurpose Flow Cytometry, Vertical Autoclave, Dry Sterilizing Oven, Ice Maker Machine	○	○	To encourage competitive tendering, etc.
Biosaftey Cabinet, Animal Cage System with Biosafety Cabinet, Pass Box, Sink with Decontamination Tank	○		Considering the performance of the equipment, etc.

2) Transportation Plan

The transportation route for the equipment and materials procured through the import from Japan and any third country will be the same sea route to Haiphong Port of Viet Nam as for the building materials and equipment, and the inland route from that port to each site will be by vehicle transportation. For the equipment and materials that may be subject to functional deterioration due to impacts or ambient humidity and temperature, packing methods that are not affected by such impacts or ambient conditions will be adopted.

The period of transportation is estimated to take 2 months for export application formalities and one month for customs clearance and transportation.

3) Installation of Equipment

Of the equipment under this Project, it is only an ice machine that will be fixed at its place of installation and related to the installation work. For equipment other than the ice machine as shown in Table 2-23, the electrical connection work will be carried out. In such cases, installation and adjustment by specialist engineers will be required for various models of equipment and will take a relatively long time for installation. The installation and adjustment of such equipment and systems will be carried out by the engineers dispatched from the manufacturers or agents of respective equipment in the period in which the facility construction works is being completed. The installation costs of such equipment and systems are included in the equipment procurement plan.

Table 2-23 Installation Work Items for Equipment

Name of Equipment	Q'ty	Water	Drain	Steam	Ventila-tion	Remarks
Ice Maker Machine	1	○	○			
Ultracentrifuge, Floor Type	1					Mainly related with electrical work. However, a relatively long period for installation is required.
DNA Sequencer	1					
Automatic RNA Extraction System	1					
Multipurpose Flow Cytometry	1					

2-2-4-7 Implementation Schedule

The project implementation schedule after execution of the Exchange of Notes is shown in Figure 2-40. The project will consist of three types of work: detailed design work by the consultants, the tender-related work, and the contractors' works and the consultants' construction supervision work.

(1) Detailed Design Work

The consultant agreement for the Project will be entered into between NIHE and a Japanese consultant company, and will be authorized by the Government of Japan. After that, the consultants will prepare the tender documentation (detailed design and bidding documents) in accordance with the Report on the Basic Design Study through consultations with NIHE and submit the documentation to NIHE for its approval.

The period of preparation of this tender documentation is scheduled for 3 months.

(2) Tender-related Work

The period required for the tender-related work is estimated to be 2 months.

(3) Contractors' Works and Consultants' Construction Supervision Work

After the work contracts (for building/equipment procurement) are awarded, the contractors will start the respective works. Simultaneously, the consultants will start their construction supervision works.

For these works, a work period of 10 months is estimated as shown in Figure 2-40. The work items are shown in Table 2-8.

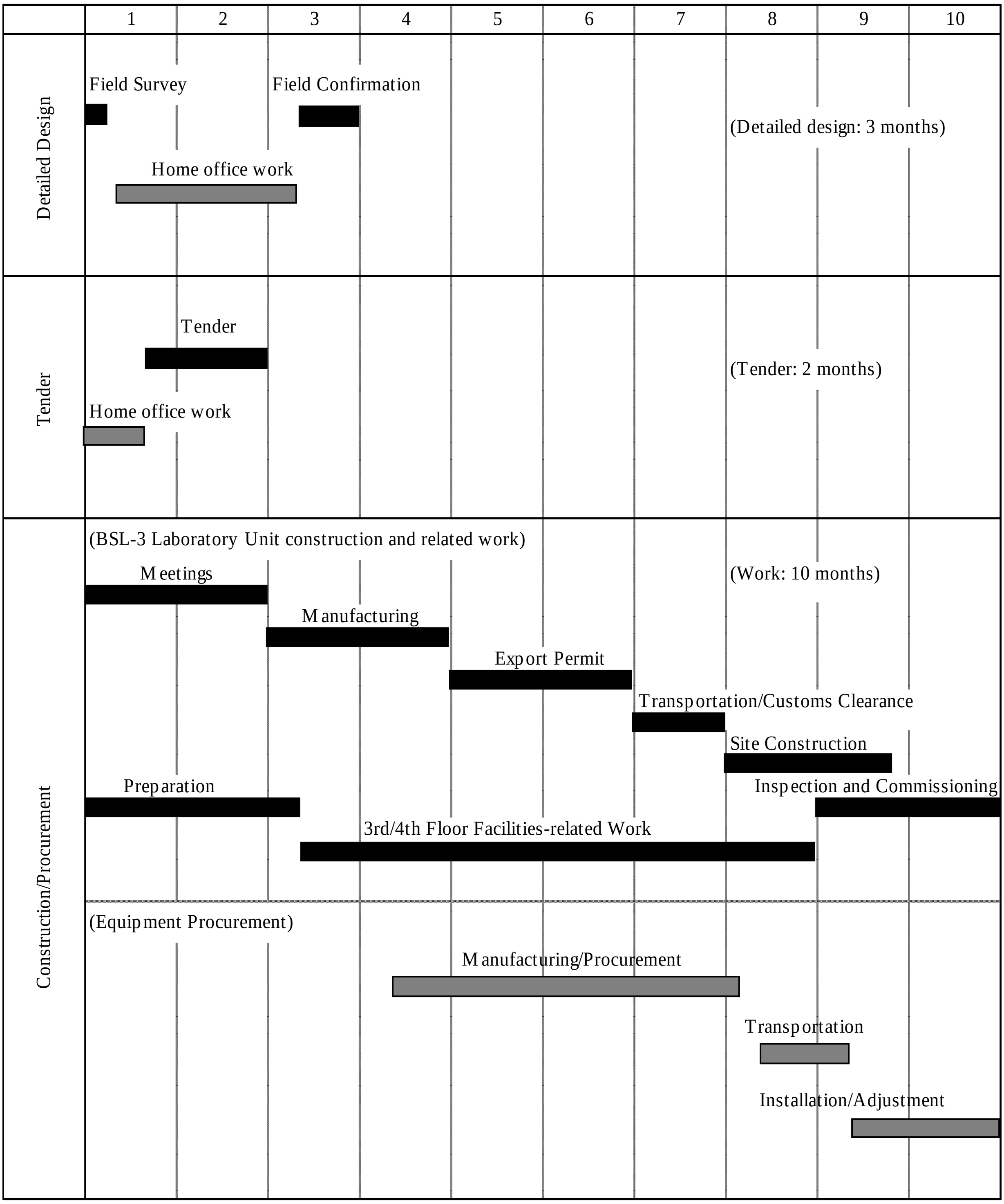


Figure 2-40 Work Schedule

2-3 Obligations of Recipient Country

The scope of work to be borne by the Vietnamese side will cover the following activities:

1) The work to be borne by the Vietnamese side including the construction work division and the procurement/installation work as in Scope of Works, as well as modification design;
2) Exemption of all taxes imposed on the Project;
3) Application for acquirement of permits and approvals necessary for buildings and works under the Project;
4) Banking Agreements (B/A) and issue of Authorization to Pay (A/P) as well as payment of their commissions;
5) Guarantee for prompt unloading of equipment and materials, tax exemption and customs clearance at an unloading port, as well as securing of speedy inland transportation;
6) Providing the Japanese persons engaged in supply of equipment and materials and performing various activities under the authorized contracts with necessary facilities for their entry and staying in Viet Nam;
7) Exemption of all customs duties and taxes imposed on the Japanese persons engaged in supply of equipment and materials and performing various activities under the authorized contracts;
8) Budgeting measures necessary for effective operation and maintenance of the facilities to be built and the equipment and materials to be procured under the Grant Aid;
9) Work of laying electric power, water supply, sewage and telephone trunk lines to branch points;
10) Relocation and re-installation of the equipment in the existing facilities to the new building to be built under the Project;
11) Purchase and installation of laboratory tables and office furniture for the office other than the laboratory equipment procured under the Project; and
12) Bearing of the costs necessary for other goods than those to be procured under the Grant Aid.

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

Table 2-24 Cost breakdown and amounts shared by the Vietnamese side

Unit: VND

Cost Breakdown	
1. Modification Work	
1) Modification design cost and supervision cost	200,000,000
2) Modification work cost	4,462,000,000
3) Contingency cost	464,000,000
I. Total	5,126,000,000
II. Additional work cost for 1st and 2nd floors (Modification work)	7,500,000,000
Total (I + II)	12,626,000,000

2-4 Project Operation Plan

2-4-1 Estimation of Project Cost

Cost of Japanese Scope of Works

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

Table 2-25 Approximate Estimation of Project Cost

Approx. 887.8 million yen

(Total floor area of the building: Approx. 1,948.1 m^2)

<table>
<tr><th colspan="2">Cost Item</th><th colspan="3">Approximately estimated Project Cost (million yen)</th></tr>
<tr><td rowspan="2">Facility</td><td>High Tech Center Building</td><td>498.5</td><td rowspan="2">590.6</td><td rowspan="3">756.1</td></tr>
<tr><td>Energy Plant Block</td><td>92.1</td></tr>
<tr><td colspan="2">Equipment</td><td colspan="2">165.5</td></tr>
<tr><td colspan="2">Detailed Design /
Construction Supervision /
Soft Component</td><td colspan="3">131.7</td></tr>
</table>

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

2-4-2 Project Operation and Maintenance/Administration Plan

(1) Organization Control

The organization that NIHE is planning for the operation of the High Tech Center including the facilities to be built under the Project is shown in the chart below.

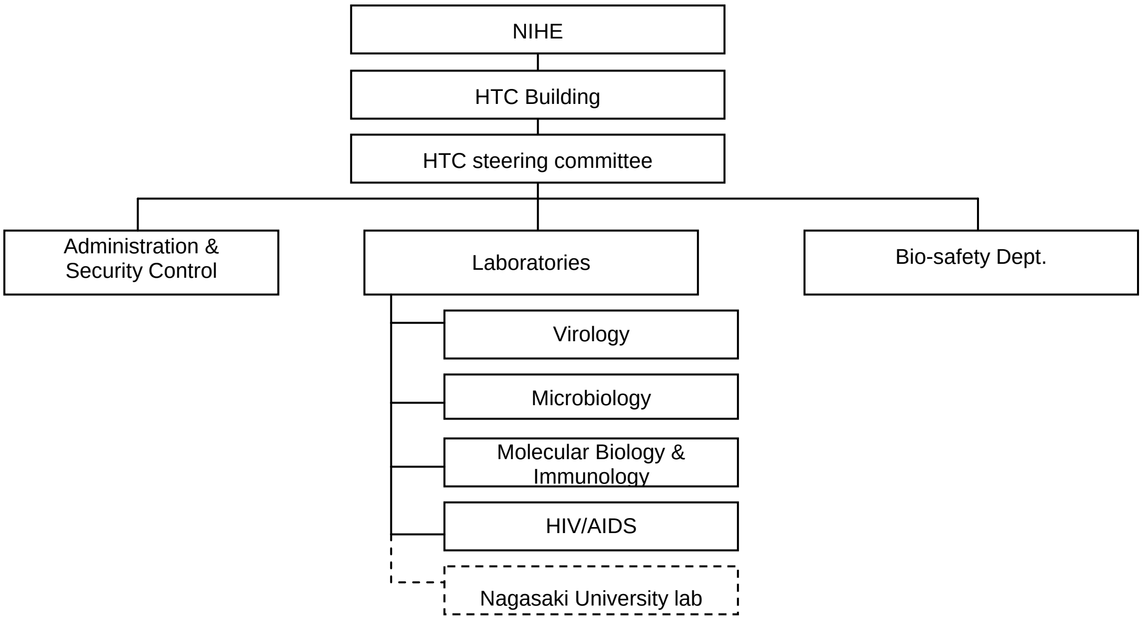


Figure 2-41 Organization Chart Plan for HTC Building

(2) Personnel Plan

The personnel deployment plan for the High Tech Center that NIHE was still under deliberation at the time of the field survey is shown in the table below.

Table 2-26 Personnel Plan for HTC Building

	Admi. & Secutiry office	Bio-safety	Laboratories				Nagasaki University	Total
			Virology	Microbiology	Molecular Biology/ Immunology	HIV/AIDS		
Full time	2	6	6	6	4	6	6	36
Contract/Part time	2	2	2	2	2	2	2	14
Total	4	8	8	8	6	8	8	50

(3) Maintenance/Administration Plan

1) Facilities

As shown in Fig. 2-42 above, the maintenance of NIHE's facilities and equipment is undertaken by the maintenance group under the control of NIHE. The maintenance group consists of a total of 8 personnel, of whom 3 personnel including the chief of the group being an electrical engineer are assigned to the Engineering Section to take care of the practical maintenance of the facilities and equipment.

The request for the technical training of those maintenance personnel for enhancement of their technical level of operation and maintenance of the equipment under the Project was requested from the Vietnamese side. The request was examined and decided by the Japanese side to furnish the technical training using the Grant Aid soft component scheme.

The engineers to be newly employed will be stationed in the Control Panel Room for the BSL-3 Laboratories and assigned mainly to the operation and maintenance of the equipment installed in the BSL-3 Laboratories.

2) Equipment

The operation and maintenance of the existing equipment and materials of NIHE is undertaken by the Materials Procurement Section, which administers the register of materials and equipment and controls the procurement of replacement parts, reagents and consumables. In principle, the reagents and consumables used in the laboratories of each department are purchased every 6 months. However, the storerooms to store these materials are insufficient in NIHE at present, so NIHE uses the system in which the suppliers of those materials are entrusted to store them in their storehouses, from which some kinds of reagents and consumables are supplied to NIHE once a week.

The maintenance and repair of the existing equipment of NIHE is undertaken by 3 engineers belonging to Materials Procurement Section, but for the major equipment such as Safety Cabinets, Centrifuge and DNA Sequencer that the NIHE engineers find difficult to maintain, NIHE enters into a short-time inspection and repair agreement with the agents of the respective suppliers or an equipment maintenance company case by case.

At present, NIHE plans to procure the additional equipment including particle counter, anemometer, humidity and temperature measuring instruments, and temperature recorder, all of which are necessary for the function test for safety cabinet, in order to improve maintenance equipment, aiming at a higher level of equipment maintenance capability. For the maintenance personnel, 3 engineers or technicians are to be employed, who are capable of appropriate maintenance by the time of equipment procurement under this Project.

For the advanced, principal instruments such as DNA sequencer and multi-purpose flow cytometry, etc. that will be procured in the Project, it is planned that NIHE will enter into a long-time maintenance agreement with each equipment agent to maintain adequate maintenance.

As described above, the regular maintenance and check and repair of the dignostic and research equipment to be procured in the Project will be undertaken by 3 maintenance engineers of NIHE. For the 11 items of equipment including a pass through autoclave, safety cabinets, a real-time PCR, a DNA sequencer, floor type ultracentrifuge and a multi purpose flow cytometry, the maintenance agreements with each equipment agent or maintenance company will be arranged to ensure appropriate maintenance thereof.

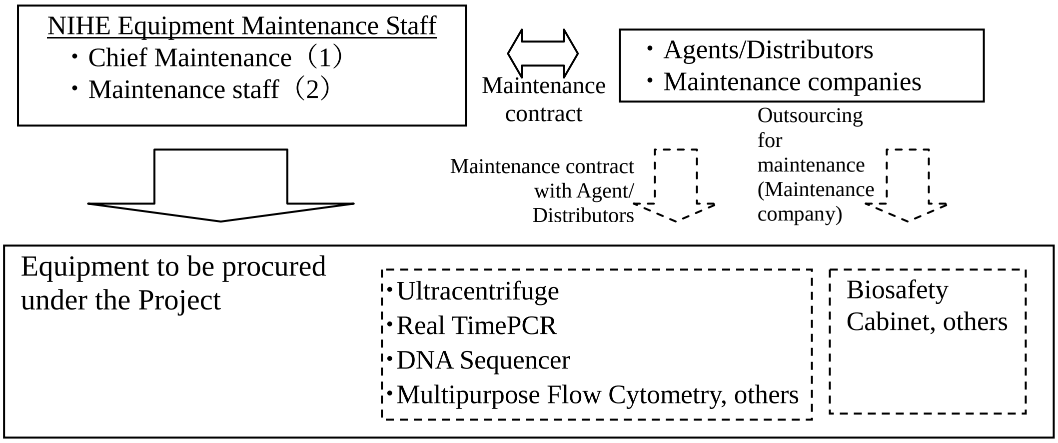


Figure 2-42　Maintenance System for Various Types of Equipment

2-4-3 Operation and Administration/Maintenance Costs

(1) Administration/Maintenance Cost

The operational costs of the Project facilities to be located on the third and fourth floor of HTC building are calculated in this section.

Table 2-27 Calculation of Maintenance and Operation Costs for the Facilities on the Third and Fourth Floor of HTC Building

Unit: Vietnamese Dong (VND)

Item	Initial fiscal year	Following fiscal years	Note
① Electric charge	706,000,000	706,000,000	
② Telephone charge	16,000,000	16,000,000	
③ Water charge	7,000,000	7,000,000	
④ Gas charge	0	0	
⑤ CO_2 gas charge	5,000,000	5,000,000	
⑥ Diesel fuel oil cost	675,000,000	675,000,000	
⑦ Cost of replacing parts (filters)	0	178,000,000	Required after 2nd year
⑧ Building maintenance cost	0	80,000,000	Required after 2nd year
Sub-total	1,409,000,000 (10,144,800 yen)	1,667,000,000 (12,002,400 yen)	
⑨⑩⑪ Equipment	3,884,195,000 (27,966,204 yen)	4,849,417,000 (34,915,802 yen)	⑨Cost of consumables and Reagents ⑩Cost of spare parts ⑪Maintenance contract cost
Sub-total	5,293,195,000 (38,111,004 yen)	6,516,417,000 (46,918,202 yen)	
Contingency (10%)	530,000,000	640,000,000	
Total	5,823,195,000 (41,927,004 yen)	7,156,417,000 (51,526,202 yen)	

(Exchange rate: 1VND／0.0072 Japanese yen)

① Electric charge .... 706,000,000 VND/year

According to the rules of the Hanoi Electricity Company, the following electricity charging system will be applicable to the facilities under the Project:

Basic charge: Not required

Specific charge: 900 VND/kWh (including tax)

As to the capacity of approximately 400kW of the transformer that will be additionally installed at the High Tech Center Building by the Vietnamese side, it is estimated that the average power consumption used by the facilities under this Project will be about 60% of the contacted capacity, 240W. In addition, the electric charge for ventilation will be counted because the ventilation-related equipment in the BSL-3 Laboratories will be put into 24-hour service:

Specific charge: 900 VND/kWh×240kW×8h×30 days×12 months = 622,080,000 VND/year

Electric charge for ventilation: 900 VND/kWh×16.3kW×16h×30 days×12 months

= 84,499,200 VND/year

Thus, the total yearly electric charge will be 706,579,200 → 706,000,000 VND/year.

② Telephone charge ……………………………………………………… 16,000,000 VND/year

The frequencies of using telephone lines are estimated as follows:

Hanoi City:	3 minutes/time	20 times/day
Toll:	3 minutes/time	3 times/day
International:	5 minutes/time	5 times/month (mainly to Japan)

The calculation formula is shown as follows:

Hanoi City:

400 VND/min.×3 min./time×20 times/day×25 days×12 months =

7,200,000 VND/year

Toll: 1,200 VND/min.×3 min./time×3 times/day×25 days×12 months =

3,240,000 VND/year

International: 13,500 VND/min.×5 min./time×5 times/month×12 months =

4,050,000 VND/year

Total 14,490,000 VND/year

Grand Total (incl. 10% tax): 14,490,000/year×1.1 = 15,939,000 VND/year

Thus, the total yearly telephone charge will be 15,939,000 → 16,000,000 VND/year.

③ Water charge ……………………………………………………… 7,000,000 VND/year

According to the rules by Hanoi Water Supply Company, the water charging system applicable to the Laboratory is as follows:

Basic charge: Not required

Specific charge: 4,500 VND/m^3

Based on the number of researchers, the water quantity to be used by the facilities under the Project is estimated to be approximately 5 m^3/day (50 researchers×100ℓ/person). The calculation formula is given as follows:

Specific charge: 4,500 VND/m^3×5 m^3/day×25 days×12 months = 6,750,000 VND/year

Thus, the total yearly water charge will be 6,750,000 → 7,000,000 VND/year.

④ Gas charge ………………………………………………………………………0

The facilities under the Project will not use gas.

⑤ CO_2 gas charge ……………………………………………………… 5,000,000 VND/year

The facilities under the Project will use CO_2 gas for CO_2 incubator and the CO_2 gas consumption is estimated to be 20kg per month.

Yearly consumption

CO_2 gas 20kg/month×12 months = 240 kg/year

CO_2 gas charge: 20,500 VND/kg×240 kg/year = 4,920,000 VND/year

Thus, the total yearly CO_2 gas charge will be 4,920,000 → 5,000,000 VND/year.

⑥ Diesel fuel oil cost ……………………………………………… 675,000,000 VND/year

Diesel oil will be used as the fuel for the steam boiler and the emergency-use diesel power generator for the facilities under the Project. The fuel oil quantity for the boiler is estimated to be 200ℓ/h for 3 months in the winter season and 110ℓ/h for 9 months in other seasons based on the oil use for 2 hours per day. The fuel oil quantity for the emergency-use diesel power generator is estimated to be 80ℓ/h (fuel consumption of 300kVA) on the conditions of 1 time of power failure/month and 2 hours of operation per month considering the commissioning time. The unit price of diesel oil is equal to 8,000 VND/ℓ.

Yearly fuel oil quantity:

220ℓ/h×2h/day×25 days/month×3 months/year + 110ℓ/h×2h/day×25 days/month×9 months/year

+ 80ℓ/h×2h/month×12 months/year = 84,420ℓ/year

Yearly fuel oil cost: 8,000 VND/ℓ×84,420ℓ/year = 675,360,000 VND/year

Thus, the total yearly fuel oil cost will be 675,360,000 → 675,000,000 VND/year.

⑦ Cost of replacing parts (filters) ……………………… .... 178,000,000 VND/year

In the BSL-3 Laboratory, a HEPA filter will be installed for ventilation. Each air conditioner will be provided with a pre-filter and a middle-performance filter. In the animal experiment laboratory, an activated carbon filter will be installed for air exhaust.

The frequency of filter replacements is estimated as listed below. The pre-filter is of recycling type, requiring no replacement cost.

Times of replacement:

Pre-filter:	About once/month of cleaning
Middle-performance filter:	About once/year (3,000,000 VND/piece)
HEPA filter:	About 0.5 time/year (7,000,000 VND/piece)
Filter:	About once/year (12,000,000 VND/piece)

Yearly filter replacement cost:

Pre-filter:	3,000,000 VND/piece×20 pieces/year =	60,000,000 VND/year
HEPA filter:	7,000,000 VND/piece×10 pieces/year =	70,000,000 VND/year
Activated carbon filter:		
12,000,000 VND/piece×4 pieces/year =		48,000,000 VND/year

Thus, the total yearly cost of replacing parts will be 178,000,000 VND/year.

⑧ Building maintenance cost…………… .... 80,000,000 VND/year

For the facilities under the Project, the internal finishing materials to facilitate the maintenance of the buildings will be selected. Long-type vinyl chloride sheets will be used for floors and steel panels for walls and ceilings. Therefore, the building maintenance cost including interior repair cost, charges of electric power, water supply and drainage, and purchase cost of repair and replacing parts for air conditioning systems is estimated to be 1/2 to 1/3 of that in Japan, amounting to 100,000 VND/m^2/year.

Thus, the total yearly building maintenance cost will be:

100,000 VND/m^2/year×800 m^2 = 80,000,000 VND/year

However, this cost will be not needed for the first year because the facilities will be new buildings, but it will be required in the second year and subsequent years after completion of the facilities.

⑨ Cost of reagents and consumables（Initial fiscal year） 3,760,153,000VND/year
Idem（Following fiscal years） 4,421,917,000VND/year

〔Initial fiscal year〕

(1)Sink with Decontamination Tank	(Hypochlorite soda)	4 units	×	@ 315,000	=	1,260,000
(2)Formaldehyde Decontamination Unit（B）	(Formalin)	4 rooms	×	@ 24,000	=	96,000
	(Recording paper)	4 rooms	×	@ 2,000	=	8,000
	(Chemical)	4 rooms	×	@ 8,000	=	32,000
(3)Real Time PCR	(Reagent, tubes etc.)	1,240 cases	×	@ 2,300	=	2,852,000
(4)PCR Machine	(Reagent, tubes etc.)	5,490 cases	×	@ 1,700	=	9,333,000
(5)DNA Sequencer	(Reagent, etc.)	780 cases	×	@ 6,300	=	4,914,000
(6)ELISA System	(Recording paper)	1 unit	×	@ 10,000	=	10,000
(7)Fluorescence Microscope	(Oil)	1 unit	×	@ 5,500	=	5,500
(8)UV Transilluminator	(Film)	4,500 pcs.	×	@ 130	=	585,000
(9)Automatic RNA Extraction System	(Reagent, etc.)	6,270 cases	×	@ 600	=	3,762,000
(10)Multipurpose Flow Cytometry	(Reagent, etc.)	1 year	×	@2,926,409	=	2,926,409
(11)PPE, etc.	(gown, masks, etc.)	1 year	×	@1,289,195	=	1,289,195
Sub-total						¥27,073,104
						VND3,760,153,000

〔Following fiscal years〕

(1)Autoclave, Pass Through Type	(Filters)	4 units	×	@ 527,400	=	2,109,600
	(Door packing)	4 units	×	@ 54,000	=	216,000
	(Strainer)	4 units	×	@ 4,500	=	18,000
	(Recording paper)	4 units	×	@ 27,000	=	108,000
(2)Biosafety Cabinet（A）	(HEPA filter) *1	6 units	×	@ 144,000	=	864,000
	(Fluorescent lamp) *2	6 units	×	@ 18,000	=	108,000
	(UV lamp) *2	6 units	×	@ 36,000	=	216,000
(3)Biosafety Cabinet（B）	(HEPA filter) *1	1 unit	×	@ 144,000	=	144,000
	(Fluorescent lamp) *2	1 unit	×	@ 18,000	=	18,000
	(UV lamp) *2	1 unit	×	@ 36,000	=	36,000
(4)Biosafety Cabinet（C）	(HEPA filter) *1	3 units	×	@ 99,000	=	297,000
	(Fluorescent lamp) *2	3 units	×	@ 18,000	=	54,000
	(UV lamp) *2	3 units	×	@ 36,000	=	108,000
(5)Animal Cage System with Biosafety Cabinet	(HEPA filter) *1	1 unit	×	@ 99,000	=	99,000
	(Fluorescent lamp) *2	1 unit	×	@ 18,000	=	18,000
	(UV lamp) *2	1 unit	×	@ 36,000	=	36,000
	(Glove) *3	1 unit	×	@ 90,000	=	90,000
(6)Pass box	(UV lamp) *2	4 units	×	@ 18,000	=	72,000
(7)Sink with Decontamination Tank	(Hypochlorite soda)	4 units	×	@ 315,000	=	1,260,000
(8)Formaldehyde Decontamination Unit（B）	(Formalin)	4 rooms	×	@ 24,000	=	96,000
	(Recording paper)	4 rooms	×	@ 2,000	=	8,000
	(Chemical)	4 rooms	×	@ 8,000	=	32,000
(9)Real Time PCR	(Reagent, tube etc.)	1,240 cases	×	@ 2,300	=	2,852,000
	(Lamp)	1 unit	×	@ 37,500	=	37,500
	(Spectral calib. kit)	1 unit	×	@ 90,000	=	90,000
(10)PCR Machine	(Reagent, tube etc.)	5,490 cases	×	@ 1,700	=	9,333,000
(11)DNA Sequencer	(Reagent, etc.)	780 cases	×	@ 6,300	=	4,914,000
(12)ELISA System	(Recording paper)	1 unit	×	@ 10,000	=	10,000
(13)Fluorescence Microscope	(Oil)	1 unit	×	@ 5,500	=	5,500
(14)PCR Workstation	(Pre･HEPA filter)	1 unit	×	@ 210,000	=	210,000
	(Fluorescent lamp)	1 unit	×	@ 30,000	=	30,000

	(UV lamp)	1 unit	×	@	35,000 =	35,000
(15)CO2 Incubator	(Packing)	5 units	×	@	15,000 =	75,000
(16)Incubator	(Packing)	5 units	×	@	15,000 =	75,000
(17)Vertical Autoclave	(Packing)	7 units	×	@	15,000 =	105,000
(18)pH Meter	(pH Electrode)	1 unit	×	@	26,000 =	26,000
	(ORP Electrode)	1 unit	×	@	30,000 =	30,000
	(pH solution)	1 unit	×	@	3,000 =	3,000
	(Refilling solution)	1 unit	×	@	1,000 =	1,000
	(ORP solution)	1 unit	×	@	3,000 =	3,000
(19)UV Transilluminator	(Ruler)	1 unit	×	@	4,000 =	4,000
	(Lamp)	1 unit	×	@	42,000 =	42,000
	(Film)	4,500 pcs.	×	@	130 =	585,000
(20)Automatic RNA Extraction System	(Reagent, etc.)	6,270 cases	×	@	600 =	3,762,000
(21)Multipurpose Flow Cytometry	(Reagent, etc.)	1 year	×	@	2,086,116 =	2,086,116
(22)PPE, etc.	(gown, masks, etc.)	1 year	×	@	1,516,086 =	1,516,086

Sub-total ¥31,837,802
VND4,421,917,000

⑩ Cost of spare parts（Following fiscal years） 61,111,000VND/year

〔Following fiscal years〕

(1)Autoclave, Pass Through Type	(Trap) *3	4 units	×	@	3,300 =	13,200
	(Element for trap) *3	4 units	×	@	3,600 =	14,400
	(Check valve) *3	4 units	×	@	1,800 =	7,200
	(Electrode) *3	4 units	×	@	800 =	3,200
	(Solenoide valve) *3	4 units	×	@	12,800 =	51,200
	(P. reducing valve) *3	4 units	×	@	7,300 =	29,200
	(Ball valve) *3	4 units	×	@	3,400 =	13,600
(2)Spectrofluorometer	(Cell)	1 unit	×	@	42,000 =	42,000
	(Xenon lamp)	1 unit	×	@	75,600 =	75,600
(3)Spectrophotometer	(Cell)	1 unit	×	@	15,600 =	15,600
	(Tungsten halogen lamp)	1 unit	×	@	3,500 =	3,500
	(Heavy hydrogen lamp)	1 unit	×	@	33,600 =	33,600
(4)Fluorescence Microscope	(Halogen lamp)	1 unit	×	@	14,400 =	14,400
	(Mercury lamp)	1 unit	×	@	91,200 =	91,200
(5)Inverted Microscope	(Halogen lamp)	4 units	×	@	8,000 =	32,000

Sub-total ¥439,900
VND61,097,000

⑪ Maintenance contract cost（Initial fiscal year） 124,028,000VND/year
Idem（Following fiscal years） 366,389,000VND/year

〔Initial fiscal year〕

(1)Real Time PCR	(3 Times/year)	1 year	×	@	92,000 =	92,000
(2)DNA Sequencer	(3 Times/year)	1 year	×	@	207,500 =	207,500
(3)Ultracentrifuge, Floor Type	(3 Times/year)	1 year	×	@	207,500 =	207,500
(4)Automatic RNA Extraction System	(3 Times/year)	1 year	×	@	201,700 =	201,700
(5)Multipurpose Flow Cytometry	(3 Times/year)	1 year	×	@	184,400 =	184,400

Sub-total ¥893,100
VND124,028,000

〔Following fiscal years〕

(1)Autoclave, Pass Through Type	(1 time/year)	1 year × @ 545,000 =	545,000
(2)Biosafety Cabinet, etc.	(1 time/year)	1 year × @1,200,000 =	1,200,000
(3)Real Time PCR	(3 times/year)	1 year × @ 92,000 =	92,000
(4)DNA Sequencer	(3 times/year)	1 year × @ 207,500 =	207,500
(5)Ultracentrifuge, Floor Type	(3 times/year)	1 year × @ 207,500 =	207,500
(6)Automatic RNA Extraction System	(3 times/year)	1 year × @ 201,700 =	201,700
(7)Multipurpose Flow Cytometry	(3 times/year)	1 year × @ 184,400 =	184,400

Sub-total ¥2,638,100
VND366,403,000

〔Initial fiscal year〕 Related with Equipment ⑨+⑩+⑪ Sub-total ¥27,966,204
VND3,884,195,000

〔Following fiscal years〕 Related with Equipment ⑨+⑩+⑪ Sub-total ¥34,915,802
VND4,849,417,000

* 1. In case they are replaced every 2 years.
* 2. In case they are replaced 2 times a year.
* 3. In case they are replaced every 4 years.

(2) Financial Situation

The total budget plan for the High Tech Center Building including the expenses for the portions on the first and second floors and the expenses based on the trial calculation of the maintenance cost of the BSL-3 Laboratories and related facilities to be constructed on the third floor as calculated above, and the forecast results of the total budget for NIHE are as follows:

Table 2-28 Expenses Project for HTC Building

(Unit: Billion VND)

Descriptions \ Year			2007	2008	2009
Expenditure	1	Personnel Cost	0.25	0.42	0.42
	2	Maintenance Cost	1.30	6.80	7.92
	1)	Facility	0.46	1.97	2.23
	a)	Electric power	0.41	1.04	1.04
	b)	Water	0.01	0.02	0.02
	c)	Gas	0.00	0.00	0.00
	d)	Others	0.03	0.92	1.17
	2)	Equipment	0.84	4.83	5.69
	a)	Consumables	0.79	4.73	5.45
	b)	Spare parts	0	0.02	0.06
	c)	Maintenance contract	0.05	0.07	0.17
	3	Guard, Cleaning	0.13	0.19	0.19
	4	Others	0.08	0.28	0.34
	Total		1.76	7.69	8.88

Source: Results of calculation by IHE

Table 2-29   NIHE Budget Projection

(Unit: Billion VND)

	Year	Actual			Projection			
	Description	2003	2004	2005	2006	2007	2008	2009
Revenue	Allocated by MOH (①+②	12.60	23.10	23.20	31.15	20.92	21.26	24.17
	Rate of annual grwoth (%)	-	183.33%	100.43%	134.27%	67.14%	101.65%	113.69%
	①Reguar budget	8.60	9.70	12.00	12.75	14.03	15.43	16.97
	②Additional budget	4.00	3.00	11.20	7.50	6.89	5.832	7.20
	③Special budget		10.40	0.00	10.90			
	Donation	12.90	12.20	11.00	12.00	12.00	12.00	12.00
	Rate of annual growth (%)	-	94.57%	90.16%	109.09%	100.00%	100.00%	100.00%
	Services	0.83	0.70	0.80	1.00	1.08	1.16	1.16
	Rate of annual growth (%)	-	84.34%	114.29%	125.00%	107.87%	107.87%	100.00%
	Total (A)	26.33	36.00	35.00	44.15	33.99	34.42	37.33
	Rate of annual growth (%)	-	136.73%	97.22%	126.14%	77.00%	101.26%	108.46%
Expenditure	Personnel Cost	2.30	2.25	3.50	4.00	4.25	4.42	4.42
	Rate of annual growth (%)	-	97.83%	155.56%	114.29%	106.25%	104.00%	100.00%
	Maintenance Cost	2.84	3.13	5.05	5.90	7.19	12.70	13.81
	Rate of annual growth (%)	-	110.21%	161.34%	116.83%	121.86%	176.63%	108.74%
	Facility	1.03	1.37	1.60	2.10	2.55	4.08	4.33
	Electric power	0.85	1.20	1.40	1.90	2.31	2.94	2.94
	Water	0.18	0.17	0.20	0.20	0.21	0.22	0.22
	Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Others	-	-	-	-	0.03	0.92	1.17
	Equipment	1.81	1.76	3.45	3.80	4.64	8.62	9.48
	Consumables	1.30	1.30	2.70	3.00	3.79	7.73	8.45
	Spare parts	0.11	0.13	0.30	0.30	0.30	0.32	0.36
	Maintenance contract	0.40	0.33	0.45	0.50	0.55	0.57	0.67
	Transport	0.12	0.15	0.22	0.25	0.32	0.41	0.52
	Rate of annual growth (%)	-	125.00%	146.67%	113.64%	128.00%	128.00%	128.00%
	Guard, cleaning	0.20	0.20	0.20	0.20	0.33	0.39	0.39
	Rate of annual growth (%)	-	100.00%	100.00%	100.00%	165.00%	118.18%	100.00%
	Investment	1.40	1.20	1.20	1.40	1.40	1.40	1.40
	Rate of annual growth (%)	-	85.71%	100.00%	116.67%	100.00%	100.00%	100.00%
	Small Project	11.40	10.20	9.00	10.00	11.40	11.40	11.40
	Rate of annual growth (%)	-	89.47%	88.24%	111.11%	114.00%	100.00%	100.00%
	Others	1.40	1.30	1.00	1.00	1.08	1.28	1.34
	Rate of annual growth (%)	-	92.86%	76.92%	100.00%	108.20%	118.30%	104.69%
	sub total (B)	19.66	18.43	20.17	22.75	25.97	32.00	33.28
	Rate of annual growth (%)	-	93.74%	109.44%	112.79%	114.16%	123.21%	104.01%
Balance (A) - (B)		6.67	17.57	14.83	21.40	8.02	2.42	4.05
	Rate of annual growth (%)	-	263.42%	84.41%	144.30%	37.48%	30.21%	167.10%

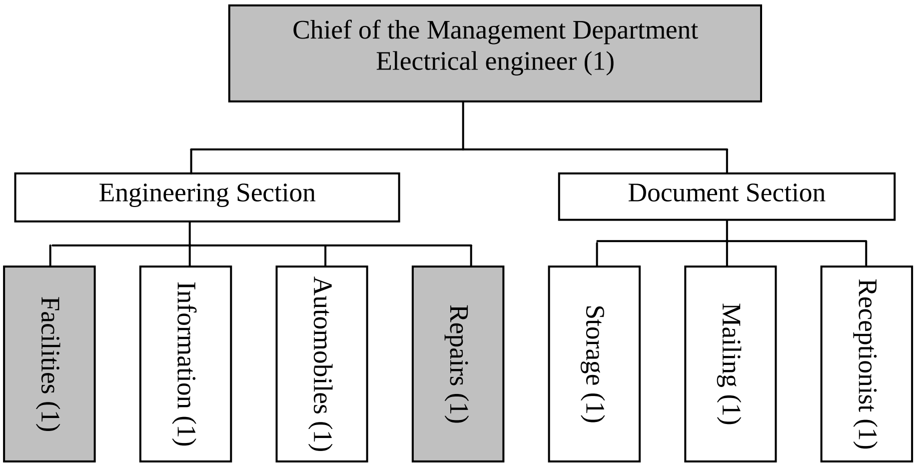
As seen from the revenue and expenditure balance of the total budget of NIHE as shown in Table 2-29, the budget expansion in Health Ministry, the diagnosis and research activities against emerging and re-emerging infectious diseases, and the increase of revenue from tests owing to the increased number of testing cases are expected. As a result, surplus amounts of approximately 2.4 billion dong (approx. 17 million yen) in 2008 and approximately 4.0 billion dong (approx. 29 million yen) in 2009 can be counted, even after deducting the costs borne by Vietnamese side for the Project. Therefore, no difficulty in maintenance of the facilities and equipment will be foreseen.

2-5 Other Relevant Issues

Soft Component

(1) The background for planning the Software Component

At present, the maintenance/management of the facilities and equipment in the NIHE is under the responsibility of the Management Department under the jurisdiction of the NIHE organization. The Management Department consists of eight workers. Three of them, including an electrical engineer, who is the chief of the Department, are assigned to the Engineering Section and are responsible for the actual maintenance/management of the facilities/equipment. The diagram below shows the current organizational diagram of the maintenance/management of the NIHE facilities/equipments.



( ): The numbers in the parentheses indicate the number of worker(s).

The shaded boxes indicate that the workers in these boxes are responsible for the actual maintenance/management of the facilities/equipment in NIHE.

Figure 2-43 Organization for the maintenance/management of the facilities/equipment in NIHE

NIHE is planning to strengthen the maintenance/management mechanism by establishing a committee chaired by the director of NIHE after the completion of the construction of the HTC Building.

The Vietnamese side requested technical training of its personnel for the upgrading of technical capacity in the operation and maintenance/management of equipment to be provided in this project. After the discussion in Japan detailed below, it was decided that the technical training was to be provided using the Software Component Scheme of Grant Aid Cooperation.

Although the existing research facilities in NIHE have separate-type air-conditioners and fans, they are not equipped with a complicated central system. Therefore, the personnel of NIHE conduct only minor repairs, and the repairs of serious malfunctions have been commissioned to the manufacturers. In this way, the maintenance has been done with the limited number of personnel.

However, when the construction of the BSL-3 laboratories in this project is completed, NIHE will have air-conditioning systems for the bio-safety facilities, (which the existing research facilities do not have. As the basic feature of this system, which is to ensure the safety of laboratory workers and residents of surrounding areas), directly concerns people's lives, it is fundamental for the system to maintain negative pressure in the interior of the laboratories and essential to ensure appropriate air balance and pressure differential. As the operation and maintenance/management of the systems require highly sophisticated technology, it will be essential to increase the number of personnel and upgrade their technical capacity.

In the air-conditioning system to be adopted in this project, a chiller and a boiler will be used as the heat sources. Cold water and steam will be sent to air-conditioners called Air-handling Units.

The supply air either, chilled or heated in the air-conditioners, will be sent to the laboratories through ducts and the air inside the laboratories will be exhausted by the exhaust fans. The risk of contamination of the exhaust with dangerous pathogens will be eliminated by capturing the particles to which such pathogens attach with the high performance filters called HEPA installed in the exhaust outlets. To maintain negative pressure in the interior of the laboratories, the appropriate balance between the amount of air supply and that of exhaust has to be maintained. To ensure the balance, a system called CAV (Constant Air Volume system) will be installed. If it becomes impossible to maintain negative pressure in the interior of a laboratory, it will be necessary to take emergency action to prevent dispersion of dangerous pathogens outside the laboratory, such as stopping the air-conditioner and operating only the exhaust fan at the sound of the alarm.
This system will usually be operated automatically. However, the manual operation of each route in the system will be required when the system has to be operated by an air-conditioning zone at the time of laboratory sterilization and overtime works. The maintenance system will have to be designed under the assumption that the equipment itself and its control systems malfunction. Manual switching to the back-up operation will be required at the time of malfunction and emergency. Therefore, the capacity to respond flexibly to the situation will be required of the maintenance/ management staff.
The air-conditioning system in the mobile BSL-3 laboratory, so-called mobile lab, which will be provided in advance in the Technical Cooperation project, is an integrated device with a separate-type air-conditioning system without the heat sources installed in the laboratory for the maintenance of the negative interior pressure and HEPA filter installed in the exhaust system. As this air-conditioning system is different from the one to be adopted in this project, the technical training under the Software Component will be essential for the operation and maintenance/management of the equipment with different characteristics to be provided in this project. However, as the training provided in the Technical Cooperation project includes strengthening of the maintenance/management strategy, the training under the Software Component will be focused on the equipment systems related to the operation of the characteristic air-conditioning equipments for the BSL-3 laboratories specifically. When deciding the contents of the training, duplication with instruction on the operation of equipment itself provided by the contractor and manufacturers will have to be avoided.

The expected number of participants of the Software Component training is five, including the three personnel currently engaged directly in the maintenance/management of the facilities/equipment of NIHE and, at least, two engineers (for mechanical and electric equipment), whom NIHE has committed to hire. The electric engineer completed a five-year university course and received a technical qualification. The technician responsible for repairs graduated from a three-year technical college. His expertise does not include air-conditioning facilities. The engineers to be employed will be stationed permanently in the Control Panel Room of the BSL-3 laboratories and operate and maintain/manage facilities related to the BSL-3 laboratories. The participants of the Software Component training are listed in the table below.

Table 2-30 Participants of the Software Component training

Specialty	Qualification, etc.
Electric equipment	48 years old, graduate of an engineering university, qualified automatics engineer
Facilities	42 years old, graduate of a construction university, qualified construction engineer
Repairs of facilities/equipment	37 years old, gradate of a technical college
Mechanical equipments	To be hired, responsible mainly for the air-conditioning equipment in the BSL-3 laboratories and the associated facilities
Electric equipment	To be hired, responsible mainly for the electric equipment in the BSL-3 laboratories and the associated facilities

(2) The target of the Software Component

The following is considered as the target of the Software Component so that the BSL-3 facilities to be constructed under the Grant Aid Cooperation can be operated effectively in cooperation with the Technical Cooperation project to be implemented in parallel.

To be able to operate and maintain/manage the equipment systems (mainly the mechanical and electric equipment) in the BSL-3 laboratory facilities appropriately

(3) Outputs (direct impacts) of the Software Component

Direct impacts are expected on the following two items at the completion of the Software Component.

① Understanding of the equipment systems for the BSL-3 facilities

② Expertise in operation and handling of the equipment systems for the BSL-3 facilities

(4) Verification methods of the effectiveness

The effectiveness of the Software Component can be measured for the items listed in the table below.

Table 2-31 Verification methods of the effectiveness

Training contents	Item for the verification of the effectiveness
Understanding of the equipment systems	To be able to understand the routes and flows of the equipment systems; To be able to understand the functions of the equipment systems; To be able to understand the specifications of the equipment systems which correspond to BSL-2 and -3; and To be able to understand the meanings of the monitoring and alarm displays.
Able to operate and handle the systems	To perform the automatic, route, and back-up operation of the equipment systems; To be able to switch the mode of operation at the time of emergency and malfunction; To be able to measure the temperature, pressure, pressure differential, and flow volume of the equipment systems appropriately; To be able to prepare the daily operation report; and To be able to operate the monitoring and warning panels.

(5) Activities of the Software Component (Input Plan)

As this project is to provide the highly sophisticated systems including the BSL-3 laboratories, the inputs of the Japanese side will include a trainer at the level of the engineer in mechanical or electric equipment who has full knowledge of the design contents of this project.
As the inputs of the Vietnamese side, the above-mentioned maintenance/management personnel of NIHE will be the direct counterparts in the training.

Table 2-32 Input Plan of the Software Component

Item	The Japanese side	The Vietnamese side	Duration
Understanding of the equipment systems Operation and handling of the systems	Trainer: Consultant equipment engineer	Trainees: NIHE Maintenance/Management personnel	0.6M/M (18 days)

(6) Procurement methods of the resources for the Software Component implementation

The Software Component of this project is technical training for the operation and maintenance/management of the equipment, mainly the air-conditioning equipment, related to the BSL-3 facilities. In other words, an equipment engineer who is responsible for the planning, designing, and supervision of the equipment system construction in this project and who understands the cooperation with the Technical Cooperation project is considered as an ideal trainer. Thus, the engineer responsible for the mechanical or electric equipment of the Japanese consultant responsible for the designing and implementation supervision of the BSL-3 facilities project is considered as the ideal trainer.

(7) Implementation schedule of the Software Component

The venue of the training will be in the NIHE facilities and the consultant will implement an 18-day technical training course during the implementation period of the construction work (assumed at 10 months). The training will be conducted when full-scale trial operation of the equipment and machines begins after they have been carried in and installed as the facilities work progresses.

Table 2-33 Implementation schedule of the Software Component

Item \ Month	1	2	3	4	5	6	7	8	9	10
Facilities work	start of work									Completion
Software Component										▬

▬ Work at the site

In the fist half of the training, the understanding of the equipment systems provided in this project by the staff who will actually operate and maintain/manage the systems will be deepened. The details of the systems will be explained with drawings, specifications, and catalogs. As the trial operation of the machines to be installed in the facilities in this project (boiler, chiller, air-handling units, air-conditioners, pump, ventilation fans, HEPA filters, automatic control systems, infectious wastewater treatment, security system, etc.) will be conducted at this time, the trainees will deepen the understanding of this equipment and machines as systems while confirming them on site.

In the latter half, the training will focus on the operation and management of the equipment systems. The emphasis of the training will be on the manual operation of the systems, enabling the trainees to perform the route operation and the back-up operation of the systems at the time of emergency. Training will also be provided on matters directly related to actual operation, such as measuring the temperature, pressure, pressure differential, and water volume of the systems and recording them in the daily report. Training in the maintenance/management aspect including the replacement of filters, cleaning methods, replenishment of chemicals, response to malfunctions, and the procurement methods of replacement and consumable parts will be also provided.

(8) Output items of the Software Component

Verification of training activities can be summarized by means of output items below.

Table 2-34 Output items of the Software Component

Item	Output items
Understanding of the equipment systems	System Flow Chart, Normal, Route-specific, and Emergency System Operation Charts, and Emergency Response Manual
Operation and handling of the equipment systems	System Operation Manuals, Machine Management Inventory, Daily Operation Report, various forms (such as standard values for the conditions of air conditioning in each room, the standard operational values of each machine and equipment), and Maintenance Plan (*e. g.* the timing of replacement of parts and consumables)
Overall	Training Reports from the counterparts.

At the completion of the education and training, the persons in charge and responsible for the maintenance/management of NIHE will be obliged to submit reports.

(9) Responsibilities of the implementing agency of the recipient country

The purpose of this Software Component is to ensure the sustainability of the Vietnamese side. Therefore, methods which promote voluntary activities of the Vietnamese side as much as possible will be required in each training course. Thus, the full understanding of and cooperation in this Software Component of the responsible and implementing organizations will be required.

In practice, the first requirement will be the understanding of and consideration to the target of this cooperation and the essential points in its implementation by the responsible persons of the Ministry of Health and NIHE. As the most important point is to secure the personnel necessary for the implementation of the Software Component, the Japanese side requested the assignment of the personnel during the Basic Design Study. In response, the Vietnamese side promised the employment of at least one technician each for mechanical and electric equipment as the facilities maintenance/management technicians with a certain level of technical capacity. The Japanese side will provide technical training and cooperation to these technicians through the implementation of this Software Component. The respective responsible persons including the Ministry of Health and the director of NIHE, as the managers responsible for the facilities concerned, will be required to implement continuous training and management on the maintenance/management of the facilities during and after the implementation of the Software Component.

Thus, the Japanese side proposes submission of regular (annual) reports on the conditions of the maintenance/management to the Resident Representative of JICA Viet Nam Office, after the completion of the implementation of the Software Component.