BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR REHABILITATION
OF
THE CHILDREN HOSPITAL ISLAMABAD
IN
THE ISLAMIC REPUBLIC OF PAKISTAN

MARCH 2003

JAPAN INTERNATIONAL COOPERATION AGENCY

K.ITO ARCHITECTS & ENGINEERS INC.

PREFACE

In response to a request from the Government of The Islamic Republic of Pakistan, the Government of Japan decided to conduct a basic design study on The Project for Rehabilitation of The Children Hospital Islamabad and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Pakistan a study team from 8th to 21st January 2003.

The team held discussions with the officials concerned of the Government of Pakistan, and conducted a field study at the study area. After the team returned to Japan, further studies were made. As this result, the present report was finalized.

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

I wish to express my sincere appreciation to the officials concerned of the Government of The Islamic Republic of Pakistan for their close cooperation extended to the teams.

March 2003

Takao Kawakami
President
Japan International Cooperation Agency

March 2003

Letter of Transmittal

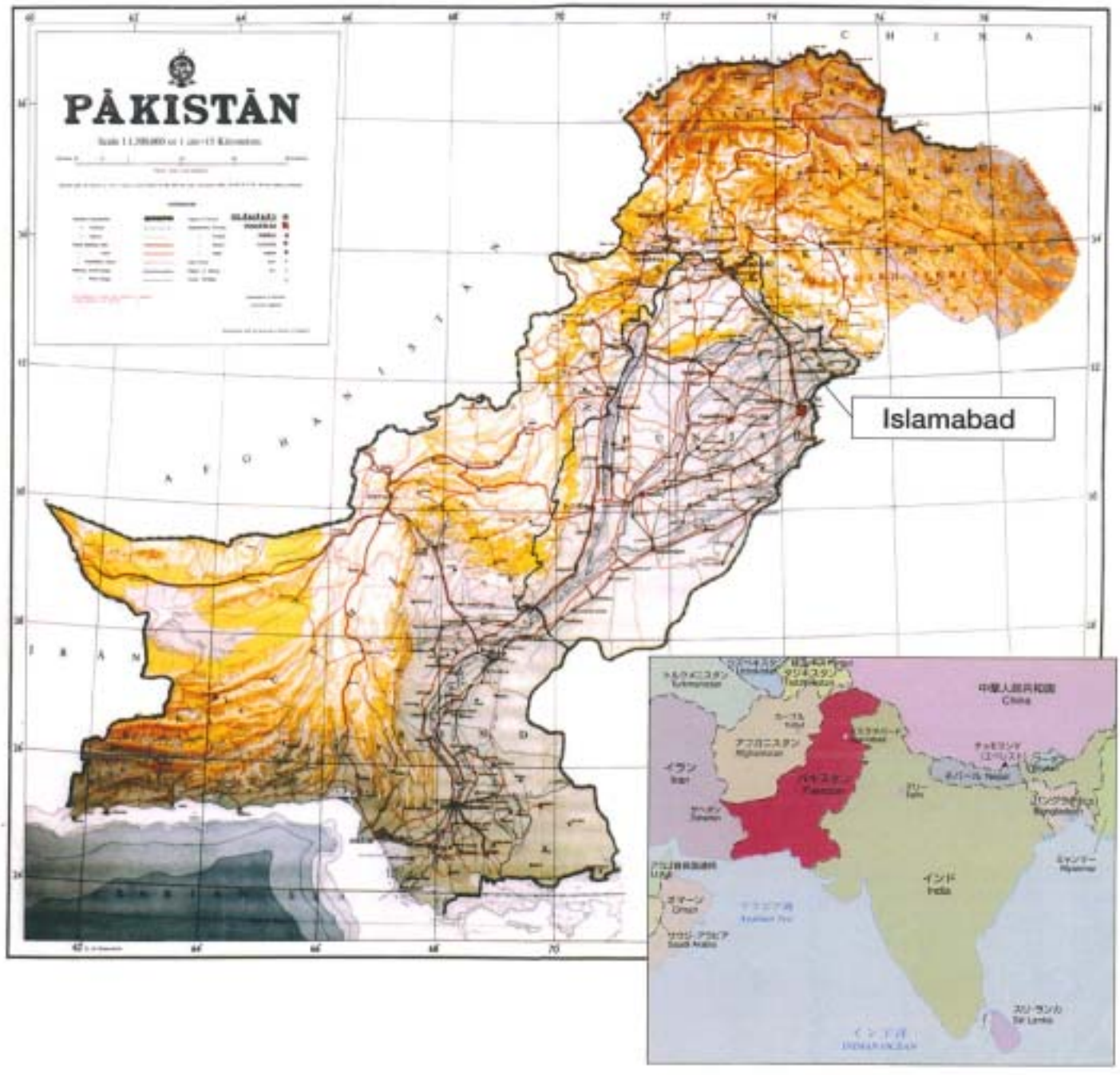
We are pleased to submit to you the basic design study report on The Project for Rehabilitation of The Children Hospital Islamabad

This study was conducted by K. Ito Architect & Engineers Inc., under a contract to JICA, during the period from December 2002 to March 2003. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Pakistan and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

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

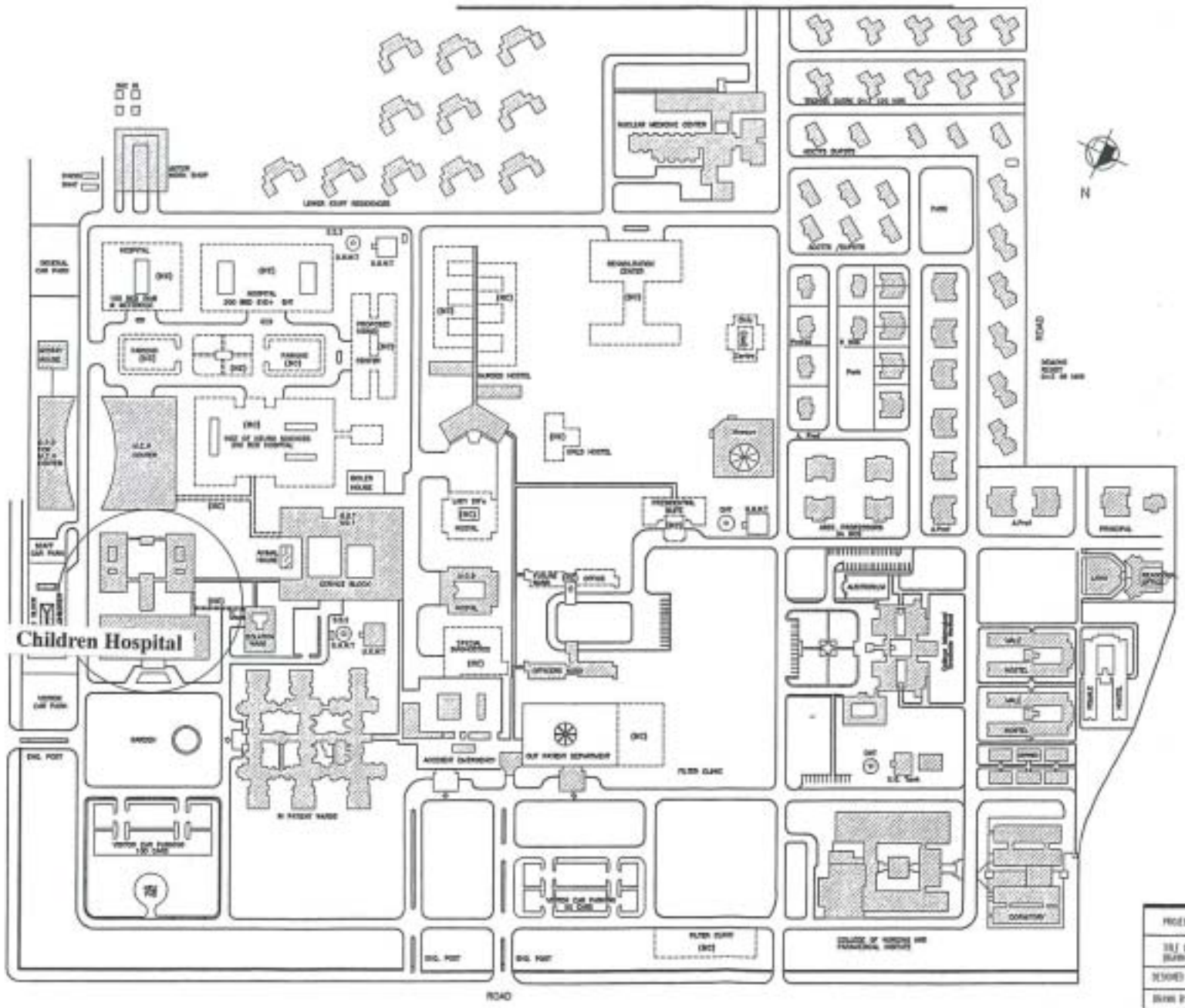
Very truly yours,

Kenji Miyazaki
Project manager,
Basic design study team on
The Project for Rehabilitation of
The Children Hospital Islamabad
K. Ito Architect & Engineers Inc.



The Islamic Republic of Pakistan

Islamabad Street Map



PIMS Site Plan

PROJECT	PAKISTAN INSTITUTE OF MEDICAL SCIENCES ISLAMABAD		
TITLE OF DRAWING	MASTER PLAN		
DESIGNED BY:		DATE:	SCALE:
DRAWN BY:	CHK CHECK		
		DRG NO:	
APPROVED BY:			

Children Hospital

overview north

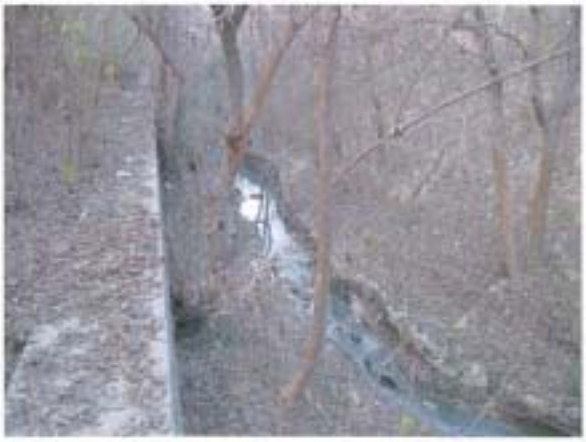
overview west

overview south

overview east

outside road

brook



service yard

parking space at basement floor

Damage after flood

service yard

mechanical room

The project of follow-up cooperaiton

air conditioning units at balcony

replacement of ACB on incoming panel

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ABBREVIATIONS

ACB	Air Circuit Breaker
AHU	Air Handling Units
ATS	Auto Transfer Switch
AP	Authorization to Pay
AVR	Auto Voltage Regulator
Aus AID	Australian Agency for International Development
B/A	Banking Arrangement
BHU	Basic Health Unit
CDA	Capital Development Authority
EAD	Economic Affairs Division
E/N	Exchange of Notes
GDP	Gross Domestic Product
GOJ	Government of Japan
JICA	Japan International Cooperation Agency
MCH	Maternal and Child Health Center
M/D	Minutes of Discussions
MDB	Main Distribution Boards
MOH	The Ministry of Health
NGO	Non-Governmental Organization
NWFP	North West Frontier Province
PC	Personal Computer
pH	Hydrogen-ion Concentration
PIMS	Pakistan Institute of Medical Sciences
PTTC	Project Type Technical Cooperation
RC	Reinforced Concrete
RHC	Regional Health Center
SAP	Social Action Program
SUI	Sui Northern Gas Pipe Ltd.
UNDP	United Nations Development Program
UNESCO	United Nations Education, Scientific and Cultural Organization
UNFPA	United Nations Population Fund
UNICEF	United Nations Children’s Fund
UPS	Uninterrupted Power Supply
WAPDA	Water and Power Development Authority
WB	World Bank
WHO	World Health Organization

SUMMARY

SUMMARY

In the Islamic Republic of Pakistan (hereinafter referred to as Pakistan), the health standard is lower than in other Southeast and Southwest Asian countries. For example, life expectancy in Pakistan was 63.0 in 2000, while that in adjacent countries was 66.5 on average; infant mortality rate per 1,000 childbirths in Pakistan was 83.3 (in 2000), compared to 41.5 on average in adjacent countries; and mortality rate per 1,000 children under 5 years of age in Pakistan was 110.3, in contrast to 51.9 on average in adjacent countries. In order to promote the on-going economic development plan (the Ninth 5-year program 1998-2003)more effectively, it is crucial to improve the health standard. Based on this concept, the Government of Pakistan has taken several measures to improve the health sector, including the expansion of medical facilities for children, the enhancement of the rate of immunization, and the improvement of children's nutrition.

With a view to improving the health standard, the Government of Pakistan planned to establish a general medical institution, Pakistan Institute of Medical Sciences (PIMS), in its capital Islamabad, soon after the relocation of the capital in 1961. Since 1978, PIMS has continuously provided comprehensive medical services, including tertiary medical services, to residents and government employees in the surrounding areas, as well as opportunities of medical education and research for the training of medical staff.

Children's Hospital Islamabad, aimed at the provision of substantial medical services exclusively for children and the training of medical staff engaged in the Hospital, was completed in March 1985 as the fiscal 1982-1983 grant-aid 'The Construction Project of the Children's Hospital' by the Government of Japan. During the period from 1986 to 1993, a project-type technical aid 'Children's Hospital Islamabad' was also provided. By dispatching medical specialists including doctors, and receiving trainees in Japan, this project-type technical aid aimed at the training of human resources in charge of medical services for children and the establishment of core educational facility after graduation with substantial functions. As a result of these cooperation projects, the Hospital with 230 beds became one of the largest tertiary medical care children's hospitals in Pakistan. At present, it consists of the General Outpatient Department, the Specialty Outpatient Department (internal medicine, surgery, orthopedics, ophthalmology, otolaryngology), the Accident and Emergency Department, and the Central Medical Examination Department (radiology room, inspection room, operating room, pharmacy), with general wards as well as isolation wards for patients of contagious diseases. There are 520 staff members in total: 69 doctors including the Director, 105 nursing staff members, 120 technical staff members for medical facilities, and 226 supporting staff members, such as janitors, drivers, carpenters, and typists.

Due to the torrential rain in Islamabad in July 2001, the electrical and mechanical rooms of the

Hospital were flooded by muddy water, causing insulation failure of instruments. Accordingly, as all the functions were paralyzed, all the hospitalized patients were forced to move to other facilities temporally, and outpatient services had to stop. After the disaster, the Hospital made every effort to recover its functions, by draining water, and cleaning and drying machines. A few days later, main power supply was switched on and some doctors resumed medical consultation; however, there was a possibility of a large accident caused by an inadequate stopgap measure. In particular, there was a possibility of a serious secondary accident, such as disasters caused by electric leakage and insulation failure as well as physical injuries caused by a sudden shutdown of the medical equipment.

To avoid the stagnation of the Hospital, the Government of Pakistan made a request to the Government of Japan for rehabilitation works of flood damages as a grant-aided project.

When the Government of Japan sent a follow-up cooperation mission from 27 August to 7 September 2001 to confirm the degree of damages and discuss the measures to be taken, extensive damages were confirmed. Among these damages, those that required urgent rehabilitation measures, for example, a main power supply switch panel and heat source equipment of the Children's Hospital, were included in the follow-up cooperation plan, together with the installation of a cable connecting a generator of the Maternal and Child Health Center (MCH) with a power supply machine in case of the blackout of electricity. As other rehabilitation works required a lot of time and money, they were included in the full-scale rehabilitation plan.

Due to the worsened situations in adjacent countries, the implementation of the project of follow-up cooperation was delayed. When the situations were calmed down at the end of 2001, the working drawing and tendering procedure were resumed. However, due to the delay of the implementation of the project, it was impossible to install the air conditioning system by the summer season. Therefore, the scope of works for the project of follow-up cooperation was changed to introduce package-type air conditioning equipment expeditiously to important facilities of the Children's Hospital, such as operating rooms, ICU, NICU, and pharmacies. Construction works in the project of follow-up cooperation project started in April 2002 and completed in October 2002.

Following the above project, the Government of Pakistan made a request to the Government of Japan for grant-aid project, such as full-scale rehabilitation works arranged by the follow-up cooperation mission and the preparation of disaster prevention measures.

Table A shows the degree of damages, details of the project of follow-up cooperation, and the requested items for full-scale rehabilitation works.

Table-A Outline of the project of follow-up cooperation and request for full-scale rehabilitation works

Degree of damages	The project of follow-up cooperation	Requested item
[Architectural work] Though the building was flooded, there was no damage because the floors were finished with terrazzo.		a. External work • Installation of concrete embankment at the boundary of access road • Change leveling of entrance driveway and installation of catch drain b. Replacement of sealing of windows and expand joints c. Replacement of waterproofing on the roof（2,600m^2） d. Exchange of drainage pipes e. Relocation of electrical room and generator room
[Electrical services] Electrical room and generator room were flooded up to 1.2m to 1.5 m from the floor level. As a result, power receiving panel, distribution board, automatic voltage controller, generator, and supplementary equipment became out of order.	A. Power receiving facilities a. Replacement of air insulation breaker b. Replacement of main part of air insulation breaker accompanied by the installation of air insulation breaker B. Generator a. Construction of bypass from MCH to Children Hospital b. Power supply work to cross board from existing generator c. Installation of cross board d. Installation of underground bypass cable C. Power supply work accompanied by the installation of air conditioning unit a. Installation of new distribution board b. Power supply work from electrical room c. Power supply work from new distribution board to switch panel for the installation of air conditioning unit d. Power supply work from distribution board to switch panel using cable work on ceiling	a. Replacement of power receiving facilities (power receiving panel and distribution board) and removal of old equipment b. Replacement of generators and removal of old ones c. Installation of a new uninterruptible power supply (UPS) system and removal of the old AVR equipment d. Cable work accompanied by the relocation of power receiving facilities e. Installation of a new drainage pump board with accompanying cable work f. Installation of a power control board with accompanying secondary wiring work

[Mechanical services] Freezing room and boiler room were flooded up to 1.2m to 1.5m from the floor level. As a result, chiller, boiler, air conditioning pump, hot water supply pump, air conditioning unit, and automatic controller became out of order. Monitor room and medical gas equipment room were flooded up to 30cm to 50cm from the floor level, and machines and equipment in these rooms became out of order.	A. Air conditioning facilities a. Installation of package-type air conditioning unit b. Installation of humidifier B. Sanitary facilities a. Medical gas facilities • Exchange of parts of air compressor • Exchange of parts of suction unit	a. Replacement of chillers b. Replacement of boilers c. Replacement of pumps • Replacement of air conditioning pump • Replacement of drainage pump • Replacement of hot water supply pump d. Replacement of parts of air conditioning unit（fan, filter, and motor） e. Replacement of a cooling tower f. Replacement of pipes and valves g. Replacement of automatic control system h. Replacement of medical gas facilities（suction unit and air compressor）
[Other repairs/renewals]		a. Architectural work • Replacement of ceiling board（2,500m^2） • Repainting of interior wall • Replacement of wooden door and door hardware b. Electrical services • Exchange of lighting apparatus c. Mechanical services • Exchange of lavatory apparatus d. Repair and renewal of medical equipment including computer network

At the request of Pakistan for a grant-aided project, Japan International Cooperation Agency (JICA) conducted the Basic Design Study from 8 to 21 January 2003. The Survey Team discussed and confirmed the content of the request with the Pakistan side, investigated the project site and the target facility, and collected relevant data. After explaining and discussing the content of rehabilitation project, the Survey Team reached a basic agreement with the Government of Pakistan.

Although the Pakistan side requested the replacement of medical equipment and a computer network, the Survey Team decided to exclude these requests from the Project for the following reasons: (1) the functions of such equipment were damaged by deterioration over time, not by the flood; and, (2) the computer network failed to function when the server stopped due to a sudden blackout during the heavy rain, and the computer itself was not damaged by the flood.

After returning to Japan, the Survey Team arranged plans for construction works and equipment works based on the analysis, and prepared the Report on Basic Design Study.

The basic design of grant-aided project was based on the following principles, taking into account the results of field survey and discussions.

[Design principle]

(1) The future flood control measures should be formulated to prevent another case of damage by torrential rain with a similar scale to July 2001 (400 mm rainfall in three hours with the maximum hourly rainfall of 180 mm and the maximum daily rainfall of 620 mm).
(2) As construction works will be carried out during the operating hours of the Children's Hospital, the priority must be given to maintaining and securing the functions of the Hospital, based on a plan to shorten the construction period while taking into account safety measures.
(3) The size and specifications of electrical as well as mechanical equipment to be rehabilitated should be basically similar to the former ones before the disaster.
(4) As for the rehabilitation of electrical and mechanical equipment, the priority should be given to the replacement of parts that had failed or deteriorated due to the disaster; however, in the case when the number of parts to be replaced is large, or when it is desirable to replace for the safety, the whole equipment should be replaced.
(5) When the rehabilitation of damaged equipment alone is not enough for the recovery of the whole system due to the deterioration with time, the rehabilitation of other equipment not damaged by the flood should be included in the Project.
(6) When designing the facility installation plan, the rain drainage route should be taken into account.

The Pakistan side also requested the installation of a new UPS system, which was included in the Minutes of Discussion as well. However, as a result of analysis, the Survey Team decided to replace only the existing AVR system in the Project. Although the necessity of a new UPS system is acceptable under these social situations where more sophisticated medical services are required compared to 18 years ago when the existing UPS system was installed, a tremendous amount of budget for repairs and renewal of a new UPS system would become necessary for the Pakistani side about ten years after the provision.

Similarly, the installation of a stand-by small generator for pumps to drain out the rainwater, which was one of the items in the mechanical plan, was also included in Minutes of Discussion. However, the Survey Team decided not to include this in the Project, either. The reason is that it will become possible to take future disaster prevention measures through the installation of concrete walls to act as water-stoppers, the improvement of the rainwater drainage system around the

Hospital, and the construction of a bypass from the MCH generator in the project of follow-up cooperation project.

Table B shows the outline of architectural plans, electrical plans, and mechanical plans.

Table-B Outline of Plans

Architectural plan	Electrical plan	Mechanical plan
• Improvement of rain drainage system around Children Hospital • Installation of a concrete water-stopper wall at the boundary of the access road around the Clinical Ward of the Children Hospital • Change in the floor level of the entrance driveway • Relocation of the electrical room and generator room to the floor above the parking lots • Exchange of joint fillers of penthouse doors, windows, and expand joints on the roof • Exchange of the vinyl floor sheet in the Operating Rooms (GF and 1F) • Change of the existing door to a window at a west corridor	• Replacement of power receiving facilities (power receiving panel and distribution board) and removal of old ones • Replacement of generator and removal of old one • Replacement of AVR and removal of old one • Cable work accompanied by the relocation of power receiving system • Installation of a new drainage pump board with accompanying cable work • Installation of a power control board with accompanying secondary wiring work	• Repairing and replacement of air conditioning system • Repairing of medical gas supply system • Replacement of sanitary equipment • Conversion of the existing oil tank into a storm adjustment tank with rainwater pump • Installation of air conditioning unit in the Accident Emergency Department (nurse station, doctors' room, waiting room) and in the Radiology Department (control room, dark room, staff viewing room) • Provision of high performance filters (operating room, ICU, NICU) • Repairing of external yard rainwater drainage system

When this Project is implemented as Japan's Grant Aid Project, the whole construction period, including detailed designing and tendering procedure, will be about 15 months. Total costs required for the Project are estimated to be 629 million yen, among which the Japanese side bears 625 million yen and the Pakistani side bears 4 million yen.

Through the implementation of the Project, the following effects are expected.

(1) Direct effect

1) Recovery of functions

(a) Damaged or malfunctioning electrical and mechanical equipment due to the disaster will be restored.

Table -C Current conditions of equipment and recovery of functions

Equipment	Number of sets	Current condition	Recovery of functions
Stand-by generator	1	Failed	Voltage to be restored to the design value; generating capacity to be improved to 500kva
Boiler	2	1 failed; 1 with 25% output	Steam pressure and steam volume to be restored to the design value
Chiller	2	Failed	Temperature difference and volume of cool water to be restored to the design value
Pump			
Chilled water, hot water, and condenser water	10	Failed	Pressure and water volume to be restored to the design value
Boiler feed water and return water	5	Failed	Pressure and water volume will be restored to the design value
Domestic hot water supply	2	Failed	Pressure and water volume to be restored to the design value
Rainwater drainage	4	Failed	Pressure and water volume to be restored to the design value
	2	(to be newly installed)	Pressure 22m; Water volume 1,700L/m
Foul water drainage	9	Failed	Pressure and water volume to be restored to the design value
Soil water drainage	2	Failed	Pressure and water volume will be restored to the design value
Air conditioning units	5	Failed	Wind pressure and wind volume to be restored to the design value
	20	Failed	Wind pressure and wind volume to be restored to the design value

(b) As a result of (a), the functions of medical equipment such as X ray, respirator, and infant incubator operating on electricity, water, and gas and those of aspiration and compressed air supply will also be restored to the former state before the disaster.

(c) With the function of the stand-by generator, electricity can be supplied to important facilities during power failure. In addition, with the recovery of functions such as boilers, chillers, and air conditioning units, functions of the Children's Hospital, such as the central heating and cooling system, hot water supply, and sterilization that had

to be restored in other facilities due to the flood damage, will be restored.

(d) The cleanliness of air in the sanitary areas will be restored through the replacement of floors in the Operating Room as well as the replacement of high performance filters of air conditioning units in the Operating Room, ICU, and NICU. Accordingly, the function of preventing infection within the Hospital will also be restored.

2) Restoration of safety

Serious secondary accidents and physical injuries, such as electric shock caused by electric leakage, fire caused by heat generation, and failure of medical equipment (such as respirator and infant incubator), can be prevented.

3) Prevention of another disaster

Through the implementation of flood control measures, such as the installation of water stopper walls, the improvement of rain drainage system around the Children's Hospital, the change in leveling of entrance driveway, and the relocation of an electrical room and a generator room, damages to facilities and equipment by another disaster caused by a heavy rain with a similar scale in 2001 (400 mm rainfall in three hours with the maximum hourly rainfall of 180mm and the maximum daily rainfall of 620 mm) can be prevented.

(2) Indirect effect

1) Recovery of the environment of the Hospital

Currently, both outpatients and inpatients are suffering from inconvenience due to the absence of services, such as air conditioning and hot water supply. With the recovery of the functions of the Children's Hospital, such physical and mental burdens will be removed. Moreover, the working environment for medical staff at the Hospital will be improved, thus enhancing their working efficiency.

2) Recovery of medical services and educational function of the whole PIMS

With the recovery of the functions of the Children's Hospital, one of the medical service facilities of PIMS, medical services and educational function of general medical facilities, the whole PIMS, will also be restored, thus contributing to the convenience of local residents.

The Children's Hospital Islamabad was constructed as Japan's grant-aided project and handed over to Pakistan in 1985, with a view to improving not only the standard of children's health around the Islamabad area but also the standard of national health as a whole in Pakistan. Due to Pakistan's strenuous efforts toward the operation and maintenance of the Hospital together with Japan's technical assistance, the Hospital has been fully functioning, thus contributing significantly to the provision of efficient and effective medical services in the health standard improvement program in Pakistan.

There will be no major changes both in the current operational and maintenance systems and in costs due to the implementation of this Project, as the Hospital has its own revenues from medical treatment as well as national subsidies. PIMS is planning to take budgetary measures for the construction work assigned to the Pakistan side.

It is expected that this Project will have the above-mentioned effects. Moreover, for the following reasons, the validity of this Project can be confirmed:

1) PIMS has provided comprehensive medical services, including tertiary medical services, to residents and government employees in the surrounding areas in Islamabad, as well as opportunities of medical education and research for the training of medical staff, as a core medical institution. Due to the flood damage, electrical and mechanical facilities stopped functioning. Through strenuous rehabilitation efforts made by the Pakistan side as well as Japan's follow-up cooperation project, some functions have been restored. The implementation of this full-scale rehabilitation project surely contributes to restoring the functions of the Hospital to the former state before the disaster.

2) The implementation of flood control measures, such as the installation of water stopper walls, the improvement of the rainwater drainage system around the Hospital, and the relocation of electrical and generator rooms, can prevent damage from another flood and eliminate the possible failure of electrical and mechanical facilities. Consequently, medical services will be provided continuously. Thus, this Project will contribute to the stable operation of the Hospital, and the reestablishment of credibility in medical services.

Contents

APPENDICES

CHAPTER 1 BACKGROUND OF THE PROJECT

1-1 Background of the request

In the Islamic Republic of Pakistan (hereinafter referred to as Pakistan), the health standard is lower than in other Southeast and Southwest Asian countries. For example, life expectancy in Pakistan was 63.0 in 2000, while that in adjacent countries was 66.5 on average; infant mortality rate per 1,000 childbirths in Pakistan was 83.3 (in 2000), compared to 41.5 on average in adjacent countries; and mortality rate per 1,000 children under 5 years of age in Pakistan was 110.3, in contrast to 51.9 on average in adjacent countries. In order to more effectively promote the on-going economic development plan (the Ninth 5-year program 1998-2003), it is crucial to improve the health standard. Based on this concept, the Government of Pakistan has taken several measures to improve the health sector, including the expansion of medical facilities for children, the enhancement of the rate of immunization, and the improvement of children's nutrition.

With a view to improving the health standard, the Government of Pakistan planned to establish a general medical institution, Pakistan Institute of Medical Sciences (PIMS), in its capital Islamabad, soon after the relocation of the capital in 1961. Since 1978, PIMS has continuously provided comprehensive medical services, including tertiary medical services, to residents and government employees in the surrounding areas, as well as opportunities of medical education and research for the training of medical staff.

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Due to the torrential rain in Islamabad in July 2001, the electrical and mechanical rooms of the Hospital were flooded by muddy water, causing insulation failure of instruments. Accordingly, as all the functions were paralyzed, all the patients hospitalized were forced to move to other facilities temporally, and outpatient services had to stop. After the disaster, the Hospital made every effort to recover its functions, by draining water, and cleaning and drying machines. A few days later, main power supply was switched on and some doctors resumed medical consultation; however, there was a possibility of a large accident caused by an inadequate stopgap measure. In particular, there was a possibility of a serious secondary accident, such as disasters caused by electric leakage and insulation failure as well as physical injuries caused by a sudden shutdown of the medical equipment.

To avoid the stagnation of the Hospital, the Government of Pakistan made a request to the Government of Japan for rehabilitation works of flood damages as a grant-aid project.

More specifically, the Government of Pakistan made a request for the following rehabilitation work:

(1) Architectural work

a. External work
   - Installation of concrete embankment at the boundary of access road
   - Change leveling of the entrance driveway and installation of catch drain

b. Replacement of joint fillers of windows and expansion joints
c. Replacement of waterproofing on the roof (2,600m^2)
d. Replacement of drainage pipes
e. Relocation of the electrical room and the generator room

(2) Electrical services

a. Replacement of power receiving facilities (power receiving panel and distribution board) and removal of old facilities
b. Replacement of generators and removal of old ones
c. Installation of a new UPS system and removal of the old AVR system
d. Cable work accompanied by the relocation of power receiving facilities
e. Installation of a new drainage pump board with accompanying cable work
f. Installation of a power control board with accompanying secondary wiring work

(3) Mechanical services

a. Replacement of chillers
b. Replacement of boilers
c. Replacement of pumps
   - Air conditioning pump
   - Drainage pump
   - Hot-water supply pump
d. Replacement of parts for air conditioning equipment (fan, filter, and motor)
e. Replacement of a cooling tower
f. Replacement of pipes and valves
g. Replacement of automatic control system
h. Replacement of medical gas facilities (vacuum system and air compressor)

(4) Other renovation work

a. Architectural work
   - Replacement of ceiling boards (2,500m^2)
   - Repainting of interior walls
   - Replacement of wooden doors and door hardware
b. Electrical service
   - Replacement of lighting apparatus
c. Mechanical service
   - Replacement of lavatory apparatus
d. Repair and renewal of medical equipment including computer network

1-2 Existing facilities and equipment

The facilities and equipment, which were available at the Children's Hospital prior to the disaster, are described below.

(1) Outline

1) Structure: Two-storied reinforced concrete construction with one basement

2) Floor area: 12,942.60 m^2

3) Wards: Clinic Ward, General Ward, Mother's Ward, Isolation Ward, connecting corridor, and Ancillary Ward

4) Electrical service

Power receiving equipment:	1,500 KVA in total (3-phase 400 V, single-phase 230 V, with a frequency of 50 Hz)
Generator:	400 KVA (important loads for lighting the Emergency Department, Operating Room, ICU, NICU, and examination rooms, and those for medical equipment)
Main feeders:	400 V for low-tension power feeders, single-phase 230 V for lighting and service outlets
Others:	Lighting, telephone system, public address system, communal television sets, nurse call system, doctor paging system, automatic fire alarm system, equipotential patient reference system, two lifts for beds

5) Mechanical service

Heat source system:	Two boilers (for a refrigerating machine, heating system, hot water supply, laundry, and medical equipment sterilization)
Cooling power system:	Two absorption refrigerating machines
Medical gas:	Oxygen, nitrous oxide, compressed air, vacuum pump
Others:	Water supply, hot water supply, drainage system (storm water, sewage, wastewater from examination rooms and Isolation Ward), city gas, fire fighting system (indoor hydrants)

(2) Electrical equipment

1) Power receiving system

The supply voltage is 3-phase 400 V, single-phase 230 V, with a frequency of 50 Hz. The system design loads for the whole facilities were planned as 1,500 KVA.

2) Generator

A generator with a capacity of 400 KVA is provided to supply power in the event of power failure. The loads supplied by the generator are for lighting the Emergency Department, Operating Room, ICU, NICU, examination room, nurse stations, and other important loads such as those of medical equipment.

3) Main feeders

Low-tension feeders are laid from the distribution board in the power room to each lighting distribution board, power control board, and distribution board for medical equipment. The supply voltage is 3-phase 400 V for low-tension power feeders, and

single-phase 230 V for lighting and service outlets. As the voltage drop is high (10%), the power supply for main medical equipment is effected through an automatic voltage adjustment system.

4) Power supply system

Electric power is supplied to the power loads of chillers, boilers, fans, pumps, and lifts. The required power loads are controlled centrally.

5) Lighting and service outlets

As for artificial lighting, fluorescent lamps are generally used, incandescent lamps being used in part. Escape guide lamps are installed in the corridors, stairwells, and at the main entrances and exits. Service outlets comprise medical equipment outlets and other general outlets. The outlets for medical equipment are equipped with earthing pins.

6) Equipotential patient reference system

An equipotential patient reference system is applied in the Operating Room, ICU, and NICU to prevent electric shocks (microshocks).

7) Telephone system

The lines carry about 10 circuits, and approximately 100 extension telephones are installed. The exchange equipment comprises an automatic cross bar system with a relay board. As an additional function, it is connected to the doctor paging system and calls between the extension telephones of the Children's Hospital and those of the General Hospital.

8) Public address system

Loudspeakers are installed in the halls and corridors in order to provide both the general and emergency public address services. Calling services are provided from the outpatient wards to the waiting hall, as well as from the dispensary to the waiting hall. The amplifier set for the public address to the whole hospital is installed in the office on the second floor, and a remote controller is installed in the telephone exchange room.

9) Nurse call system

Nurse call system is provided to call nurses from the patients' rooms and lavatories and also to facilitate communication between the nurses and patients.

10) Automatic fire alarm system

In each room smoke detectors or heat sensors are installed according to the function of the different rooms. Smoke detectors are installed in the corridors and stairwells.

When a fire is detected, bells will ring and an event of fire will be indicated on the receiver in the administration office. A sub-receiver is installed at the nurse stations.

11) Doctor paging system

A radio antenna system is connected to telephone exchange equipment. Maximum paging capacity by the receiver is 100 circuits.

12) Electric clock system

Electric clocks with time signals are provided in the halls, nurse stations, and other places where necessary. A clock for timing operations is installed in the Operating Room. The master clock is placed in the telephone exchange room.

13) Lift system

The specifications for the lift system are shown in Table 1-1.

Table 1-1 Lift System Specifications

Item / Use	Load Capacity		Speed (m/min)	Number of Stops	Quantity
	Load (kg)	Number of Passengers			
Lift for beds	1,000	15	45	3	2

(3) Air conditioning system

1) Heating and cooling power system

The heat source system comprises two steam boilers, a hot water tank, and a water softener, which are installed in a close proximity of each other. The load on the steam boiler consists of a power source for the refrigerating machines, a heating system, a hot water supply, a laundry, and medical equipment sterilizers. Natural gas, which is economical, is utilized. Two sets of absorption refrigerating machines, utilizing steam, are provided for the cooling power system.

2) Air conditioning zoning

Main systems are divided into the Emergency Dept., Outpatient Dept., Clinical Pathology Laboratory, Radiology Dept., Rehabilitation Dept., Operating Room, Burn Unit, ICU, NICU, and Administration Dept. As a precaution against cold shock in the summer and heat shock in the winter, the temperature in the waiting hall of the outpatient ward is controlled at an intermediate temperature between that of indoors and outdoors. The cool outside air is intercepted at the warm up stage, and is taken in at the intermediate

stage as well as during the night. Wards are included in the systems of patients' rooms, nurse stations, doctors' rooms, and nurses' rooms. Each room in the Isolation Ward takes in outside air independently and all the air is exhausted through the exhaust air treatment system.

3) Ventilation

The airing system is designed for rooms such as a boiler room and power room. The system for lavatories and disposal treatment room comprises only an air exhaust. Combustion gas containing grease from the kitchen is exhausted through the grease filter in the hood. Poisonous gas with odor generated in the examination rooms is extracted through the draught chamber to be dispersed and exhausted on the roof. It is designed to locally exhaust a small amount of exhaust on the spot, as it does not affect other factors.

(4) Water supply and plumbing system

1) Water supply

Water is supplied from PIMS overhead water tank with a capacity of 50,000 gallons installed at the height of 30 meters, utilizing the gravity system. The water for boilers and the cooling tower is stored in the storage tank installed in the double slab underground to be supplied after the water softening treatment.

2) Hot water supply

The systems comprise a central supply system with a storage tank in the machine room to distribute hot water to the necessary points, and the local supply system with small type boilers, mainly for drinking water.

3) Drainage system

The drainage system is systematized according to the water quality. For the drainage system of the pharmacy and examination rooms, a heavy metal treatment system is installed in the examination rooms to be connected through the treatment system for wastewater after washing the apparatus, to the drainage pipe within the site. Fixing solutions used for development are collected, and the diluted solution only is discharged into the treatment system. It is designed to discharge the wastewater from the kitchen after the grease and coarse garbage are caught in the grease stop.

4) City gas

Gas from the two systems, i.e., the medium pressure system (1,000 to 2,000 mm Aq, maximum supply: 600 Nm^3/H) as the energy source of the boilers, and the low pressure system (100 to 200 mm Aq) for the kitchen, examination rooms, and clinics, is extended and distributed from the General Hospital.

5) Fire fighting system

Diverging from the loop type feed pipes, outdoor fireplugs are installed in the Children's Hospital. Indoor hydrants, diverging from the same feed pipe, are installed in each ward.

6) Medical gas

From among the oxygen, nitrous oxide, and compressed air, the required gas is distributed by the central supply system to the operating room, ICU, emergency department, clinics, and inpatients' rooms. It has been planned to install vacuum pumps in the machine room to remove gas from each room.

1-3 Degree of damage

[Architectural work]

According to the follow-up cooperation survey conducted one month after the disaster, the entire machine room in the basement was flooded up to 1,300 mm from the floor level of the basement, because it was located at the deepest level from the ground surface. Therefore, electrical as well as mechanical equipment was damaged extensively. However, the building, consisting of a reinforced concrete structure finished with mortar, was restored to its former state after cleaning. The storm water flowed into the building from the main entrance, and the first floor was also flooded up to 300 mm from the floor level. Fortunately, as the floor was finished with terrazzo and the walls were covered with bricks or tiles or finished with paint, the first floor was practically restored to its former state after cleaning.

[Electrical service]

(1) Incoming & Main Distribution Board

Though Incoming & Main Distribution Boards (LC-1 to 5) were more than halfway flooded, they are now receiving & supplying electrical power. ACB (Air Circuit Breaker) for the main power receiving device in the Incoming panel was damaged, so the ACB should be dealt with urgently. Also other circuit breakers & relays were damaged by flood. Therefore, the above mentioned Boards should be changed completely.

- ACB should be changed urgently, because oil has leaked, so it is impossible to turn on.
- Earth leakage breakers & relays for over-voltage are working at present, but earth & sand have intermixed in those devices; therefore, there is the possibility of miss-working & non-working in the near future.

- Also the condition of the MCCB (Molded case circuit breaker) is the same as above, with earth and sand inside the device.

(2) Generator

The Generator & other auxiliary equipment (pumps, heater, compressor, and so on) were flooded completely. Panels & Engine were half flooded. Damage to the Engine is not so great, but the Engine itself is combined to the Generator (means cannot be separated), therefore the replacement is required. Also, as all electrical devices could not function and could not be reused, most parts of the Generator set should be changed.

- Damage to the Engine is not so great, but the Engine itself is combined to the Generator (means cannot be separated), therefore other auxiliary devices (pressure gages, solenoid valves, and so on) of the Engine should be changed.
- As insulation of other equipment for the Generator (oil pump, heater, cooling pump, cooling circulation water pump, compressor) is bad, these devices cannot be used.
- Panels (Generator panel, automatic start-up panel, battery panel) have rusted & circuit of control system has shorted. Therefore, these panels cannot be used.

(3) AVR (Automatic Voltage Regulator)

As control devices, Transformer for control power, Relays, & Main transformer were flooded, extensive damage was caused to the Insulation of the transformer & main circuit. Therefore AVR could not function, and could not be reused.

- As earth & sand had become intermixed in the inside of control devices, no devices could function.
- The Main transformer could not work due to earth and sand as well as rust, and the condition of insulation is bad (present value is less than 5MΩ, which is the normal minimum value).
- As wiring of inside of AVR was flooded, it could not function.

(4) Cable

The secondary cable from the Control panel, the socket outlets in the Mechanical room on basement floor and some of the main cable were flooded. Some of the cables with poor insulation need replacing.

- Main cable (The following lines have poor insulation)
  From the Main distribution board to the Isolation Ward, ELV-2, and Generator
- Secondary cable (The following lines have poor insulation)
  Secondary cable of the Control panel C-BM-1 & 2 in the Mechanical room
- Embedded conduit could not function because earth & sand is inside of it.

- As Insulation condition of socket outlets and cable in the Mechanical room is poor, they need replacing.

(5) Control Panel

Control panels C-BM-1 & 2 were more than half flooded and the control circuits in the panels have shorted. Therefore the above panels could not function. Control panel C-BM-3 can be used, because only the terminal block was flooded.

- Circuit of CT (current transformer) & capacitor have shorted due to the flood damage and could not be used.
- Transformer for control power & control circuit has shorted due to the flood damage; therefore, these devices including wiring could not be reused.
- Earth & sand have intermixed in MCCB & magnet contactor, so there is the possibility of miss-working.
- The connecting parts of terminal block & steel have rusted. The door handle is damaged, which was not caused by the flood, though.

[Mechanical service]

During the follow-up cooperation survey (after flood), the following checking was carried out:

1 - Overall visual appearance check for damaged equipment and system

2 - Insulation resistance test for motor, control panel and wiring

3 - Disassembly and internal check for boiler and chiller

During this Basic Design Survey, the condition of the damaged system and equipment was confirmed. Basically the condition remained unchanged in comparison to the one after flooding 1.5 years ago. The results of judgment are shown below.

(1) Absorption chiller

- After flood: Vacuum condition was kept as normal condition for main body and internal, however main component parts such as refrigerant pump, absorption pump, air purge pump and control panel need to be replaced. In addition to the above finding, calcium & magnesium accumulation, crystallization, was found inside of condensate water tube resulting in a reduction of the equipment performance.
- Current condition: No operation due to lack of spare parts.

Table 1-2　Condition of Absorption chiller after Flood

(Absorption chiller　2 sets)

Inspection Item	Judgment standard	Result	
		Acceptable	Unacceptable
Refrigerant pump	Insulation resistance: more than 10 M Ω		○
Absorption pump	Insulation resistance: more than 10 M Ω		○
Air purge pump	Insulation resistance: more than 10 M Ω	○	
Steam control valve	Any Damage & rust		○
Motorized Steam control valve	Insulation resistance: more than 10 M Ω		○
Control panel	Insulation resistance: more than 10 M Ω		○
Condenser tube	Any Damage		○
Insulation for Heat Exchanger	Any Damage		○

1) The following spare parts per unit shall be replaced for normal operation of Absorption chillers:
   - Absorption pump : 1 Set
   - Refrigerant pump : 1 Set
   - Purge pump (Incl. Motor) : 1 Set
   - Steam control valve and motorized control valve : 1 Lot
   - Control panel : 1 Lot
   - Mercury type vacuum gauge : 1 Set
   - Thermostat for dilution solution : 1 Set
   - Thermostat for concentrate solution : 1 Set
   - Chilled water flow switch : 1 Set
   - Chilled water temperature sensor : 1 Set
   - Chilled water anti-freeze thermostat : 1 Set
   - Pressure gauge for absorption pump : 1 Set
   - Electric pipe & wiring : 1 Lot

2) The following spare parts per unit shall be replaced due to deterioration (not due to flooding):
   - Spindle type service valve : 1 No (Damaged: Air Leak)
   - Purge trap : 1 No (Pipe fitting : Crack)
   - Gasket for Absorber header : 2 Sheets
   - Gasket for generator header : 2 Sheets
   - Gasket for Service valve : 4 Sheets
   - Gasket for Damper : 2 Sheets

- Diaphragm : 4 Sheets
- Absorber liquid : 200 Kg
- Corrosion protection inhibitor : 1000 cc
- Surfactant : 2 Liters

3) As a permanent measure, full replacement of the upper shell (Containing generator & condenser shell) is recommended for the following reasons:
   [1] Generator plug-off was carried out for generator tube section. Chiller may be suspect to damage because of this.
   [2] Formation of heavy scale inside condenser tube section was found. Removal of such scale for normal operation of Chillers is considered to be very difficult.
   [3] Absorber tube section needs to be washed.

(2) Smoke Tube Steam Boiler

- After flood: Rust observed in the Main body itself seems no serious problem. However the items below have to be replaced or repaired.
  a) The anti-heat internal material of Boiler needs repairing
  b) A part of the gas control valve at the burner position needs replacing
  c) Parts of the control equipment and control panel need replacing
- Current condition: Replacement of relay and breaker was done for control panel. One boiler out of two is operating by utilizing the parts of the other boiler (which is not operable). Performance of the boiler under operation is 25% of rated steam generation, from an observation of a non-stable operation at 3.7 kg/cm^2 G against design value of 4.0 kg/cm^2 G. Originally, the steam supply was intended to be for Heating, Domestic hot water supply, Humidifying and Sterilizing for medical services. However the steam supply was found to serve the domestic hot water system only.

Table 1-3 Condition of Smoke Tube Steam Boiler after Flood

(Steam Boiler 2 sets)

Inspection Item	Judgment standard	Result	
		Acceptable	Unacceptable
Boiler main body insulation	Any Damage		○
Inside of boiler	Any Damage	○	
Gas discharge nozzle for burner	Any Damage	○	
Gas burner casing	Any Damage		○
Water level gauge	Any Damage		○
Control equipment	Insulation resistance: more than 10 MΩ		○
Boiler control panel	Insulation resistance: more than 10 MΩ		○

1) The following spare parts per unit shall be replaced as they were damaged by the flood.
   - Anti-heat super brick : 1 Lot
   - Port ring adaptor : 1 Set
   - Universal coupling joint : 8 No
   - Bearing for pressure fan : 1 Set
   - V-belt : 3 No
   - Emergency gas shut-off valve : 1 Piece
   - Gas pressure gauge : 2 Pieces
   - Pilot gas solenoid valve : 2 Pieces
   - Pilot gas regulator : 1 No
   - Ignition transformer : 1 No
   - Control motor : 1 No
   - Interlock switch : 3 No
   - Pressure controller : 1 No
   - Pressure regulator : 1 No
   - Control panel : 2 Pieces

2) The following spare parts per unit shall be replaced due to deterioration (not due to flooding):
   - Water level gauge set : 1 Set
   - 3-way valve : 1 No
   - Electrode column : 2 Pairs
   - Peeping grass : 2 No
   - Anti-heat paint : 2 No
   - Manhole gasket : 2 No

3) Overall appearance

[1] Steam boiler

Insulation:	Hole was found in sheet metal cladding due to rust by water damage.
Boiler inside:	This was in normal condition with no findings of water scale & pitching.
Pre-smoke chamber room: Heat resistance material	Normal condition and no deterioration.

[2] Main burner

Gas nozzle:	Normal condition and no damage
Burner casing:	Air supply control bolt was broken but not caused by water damage. It needs to be replaced.

[3] Steam Boiler's accessories

Water level gauge:	Observation of steam leakage and missing glass tube & protection cover. Therefore this part needs to be replaced.
Valves:	One original Y-strainer is used for No. 1 Boiler. Others were replaced with those of another manufacturer.
Water supply pump:	Original pump (Maruyama) had been changed to one of another manufacturer (Grundfos), but was damaged by the flood.
Safety Valve:	Can be used if the setting pressure is adjusted.

(3) Pump

1) Pumps for Air-conditioning system: Condenser water pump, Chilled water pump & Hot water pump

- After flood: Rust was found inside motor, and insulation resistance valve was far below the standard value (0.4M). Scale such as calcium and magnesium formed from water as well as rust was observed and the bearing could not be rotated. Therefore, replacement was required.
- Current condition: Information was received from Hospital side M&E Engineer that they had taken the condenser water pump apart in an attempt to repair it, but failed. From the actual on-site check, the pumps for the Air-conditioning system do not function.

Table 1-4 Condition of Pump after Flood

(Chilled water pump 6 sets)

Inspection Item	Judgment standard	Result	
		Acceptable	Unacceptable
Overall appearance	Any Damage & rust		○
Bearing	Rotation & Abnormal sound		○
Motor	Insulation resistance: more than 4 MΩ		○

Table 1-5 Condition of Pump after Flood

(Hot water pump 2 sets)

Inspection Item	Judgment standard	Result	
		Acceptable	Unacceptable
Overall appearance	Any Damage & rust		○
Bearing	Rotation & Abnormal sound		○
Motor	Insulation resistance: more than 4 MΩ		○

Table 1-6 Condition of Pump after Flood

(Condenser water pump 2 sets)

Inspection Item	Judgment standard	Result	
		Acceptable	Unacceptable
Overall appearance	Any Damage & rust		○
Bearing	Rotation & Abnormal sound		○
Motor	Insulation resistance: more than 4 M Ω		○

Table 1-7 Condition of Pump after Flood

(Condenser, Make-up water pump 5 sets)

Inspection Item	Judgment standard	Result	
		Acceptable	Unacceptable
Overall appearance	Any Damage & rust		○
Bearing	Rotation & Abnormal sound		○
Motor	Insulation resistance: more than 4 MΩ		○

Table 1-8 Condition of Pump after Flood

(Boiler Feed water pump 2 sets)

Inspection Item	Judgment standard	Result	
		Acceptable	Unacceptable
Overall appearance	Any Damage & rust		○
Bearing	Rotation & Abnormal sound		○
Motor	Insulation resistance: more than 4 MΩ		○

2) Domestic Hot water supply pump

- After flood: Pump was flooded and totally useless so needed to be replaced.
- Current condition: When actually checked on site, pump was not functioning.

Table 1-9 Condition of Pump after Flood

(Domestic Hot water supply pump 2 sets)

Inspection Item	Judgment standard	Result	
		Acceptable	Unacceptable
Overall appearance	Any Damage & rust		○
Bearing	Rotation & Abnormal sound		○
Motor	Insulation resistance: more than 4 M Ω		○

3) Foul water & Rainwater drainage Pump

- After flood: Insulation resistance measurement showed no trouble, however result of performance test was 80% that of original condition.
- Current condition: In the original design, 2 sets were provided for automatic alternative running for each of the Foul water pump, and Spring water pump, but at this moment only one pump is running for each service. One Soil water pump out of two is operable.

Table 1-10 Condition of Pump after Flood

(Rainwater drain pump 4 sets)

Inspection Item	Judgment standard	Result	
		Acceptable	Unacceptable
Overall appearance	Any Damage & rust	○	
Bearing	Rotation & Abnormal sound	○	
Motor	Insulation resistance: more than 4 M Ω	○	
Pump head	10 m		○

Table 1-11 Condition of Pump after Flood

(Foul water drain pump 9 sets)

Inspection Item	Judgment standard	Result	
		Acceptable	Unacceptable
Overall appearance	Any Damage & rust	○	
Bearing	Rotation & Abnormal sound	○	
Motor	Insulation resistance: more than 4 M Ω	○	
Pump head	10 m		○

Table 1-12 Condition of Pump after Flood

(Soil water drain pump 2 sets)

Inspection Item	Judgment standard	Result	
		Acceptable	Unacceptable
Overall appearance	Any Damage & rust	○	
Bearing	Rotation & Abnormal sound	○	
Motor	Insulation resistance: more than 4 M Ω	○	
Pump head	10 m		○

(4) Air Handling Unit

- After flood: Fan motor & Automatic Cleaner motor insulation resistance drastically reduced from the standard value (0.4 M). And also, the drain pan had corroded & the internal insulation materials had dropped out from the AHU (Air Handling Units) Panel board, therefore full repair was required.
- Current condition: Of the 5 damaged AHU sets, 3 of them were working, however, the Fan & Motor bearing may wear out within a few years. AHU for Service building was totally useless due to water damage. In addition to the above, continuous inspection was carried out to other than the water damaged AHU. It was found that pre-filter clog, central vacuum hose crack and worn out gear motor reduced AHU performance. Also the medium filter was clogged, and is totally useless.

Table 1-13 Condition of Air Handling Unit after Flood

(AHU 5 sets)

Inspection Item	Judgment standard	Result	
		Acceptable	Unacceptable
Overall appearance	Any Damage & rust		○
Fan motor	Insulation resistance: more than 4 M Ω		○
Fan bearing	Rotation & Abnormal sound	○ partial	○
V-Belt	Any Damage		○
Coil	Any Damage & rust		○
Internal insulation	Any Damage		○
Drain pan	Any Damage & rust		○
Medium filter	Any Damage		○
Auto roll filter	Any Damage		○
Control panel for Auto roll filter	Any Damage		○
Gear motor	Function test		○
Hose	Any Damage		○

Note: ‘O partial’ means approximately 20% of normal condition

Table 1-14 Condition of AHU after Flood

(AHU 20 sets)

Inspection Item	Judgment standard	Result	
		Acceptable	Unacceptable
Overall appearance	Any Damage & rust	○	○ partial
Fan motor	Insulation resistance: more than 4 M Ω	○	
Fan bearing	Rotation & Abnormal sound	○	○ partial
V-Belt	Any Damage		○
Coil	Any Damage & rust		○
Internal insulation	Any Damage	○	○ partial
Drain pan	Any Damage & rust		○
Medium filter	Any Damage		○
Auto roll filter	Any Damage		○
Control panel for Auto roll filter	Any Damage	○	
Gear motor	Function test		○
Hose	Any Damage	○ partial	○

Note: 'O partial' means approximately 20% of normal condition

(5) Cooling tower

- After flood: This equipment was located on the roof, and no flood damage was found. However the survey was carried out as deterioration was observed. According to continuous checks done inside the Cooling tower, the filter gap position had accumulated scale which was blocking airflow. Also some filter had dropped out, reducing performance. This item required cleaning of the bottom water section, too.
- Current condition: Raw water analysis showed hard constituent (Scale) in raw water to be sticking on filter surface to a great extent. At first, replacement of filter was considered but it was not possible to procure the materials in Pakistan. The materials are not available in Japan either because there is no stock available as this product is no longer manufactured. In addition, the Axial type Fan was rotating without proper alignment and could malfunction at any time.

Table 1-15 Condition of Cooling Tower after Flood

(Cooling tower 2 sets)

Inspection Item	Judgment standard	Result	
		Acceptable	Unacceptable
Overall appearance	Any Damage		○
Fan motor	Insulation resistance: more than 4 MΩ	○	
Fan bearing	Rotation & Abnormal sound	○	
V-Belt	Any Damage		○
Pulley	Damaged & rust or not		○
Filter	Any Damage		○
Float valve	Any Damage		○

(6) Valve & Piping system

- After flood: Some of the piping system valves are difficult to operate; some valves do not function at all. Flood damaged parts of the piping system absorbed moisture, so insulation materials do not exhibit insulation performance.
- Current condition: The results of the on-site check show basically no change since 1.5 years ago at the time of the flood disaster. The Steam condensate pipe had a leak which had occurred due to pipe corrosion. As a tentative measure, the Pakistan side repaired it by themselves. However the Steam supply & Steam condensate pipes should be replaced in the plant room, in order to avoid leakage due to corrosion because 18 years have passed since the completion of this project.

(7) Automatic control system

- After flood: Insulation resistance measures for the Central Monitoring Control Panel, Automatic Control Panel, Automatic control valve & Motorized control damper were carried out, but the results were far below the standard.
- Current condition: The results of the on-site check showed the Control equipment of the Main plant room and Local control panel did not function due to water damage. Renewal of the Center Monitoring Control Panel was planned but power supply had already been recovered and it was running at approximately 20% of normal remote control operation condition. However, the Control panel display was malfunctioning.

Table 1-16 Condition of Automatic Control System after Flood

(Center Monitoring Control Panel 1 set)

Inspection Item	Judgment standard	Result	
		Acceptable	Unacceptable
Overall appearance	Any Damage	○	
Selection switch for input	Any Damage		○
Display Panel Device	Any Damage		○
Relay	Any Damage		○

Table 1-17 Condition of Automatic Control System after Flood

(Automatic Control Panel 2 sets)

Inspection Item	Judgment standard	Result	
		Acceptable	Unacceptable
Overall appearance	Any Damage		○
Insulation resistance measurement	Insulation resistance: more than 4 MΩ		○

(8) Medical gas service (Air Compressor & Vacuum Pump)

- After flood: Insulation resistance measures were carried out with satisfying results, but the solenoid valve malfunctioned and needs to be replaced.
- Current condition: Tentative measures were carried out by the project of follow-up cooperation. However, due to the deterioration by age, the main equipment could fail at any time.

Table 1-18 Condition of Medical Gas Service after Flood

(Medical Gas Main Equipment)

Inspection Item	Judgment standard	Result	
		Acceptable	Unacceptable
Air-compressor (oil free type)	Abnormal sound	○	
Control Panel	Automatic alternative operation		○
Air Dryer	Abnormal sound	○	
Auto water supply system	Any Damage		○
Pressure switch	Any Damage	○	
Pressure regulator	Any Damage	○	
Suction pump	Abnormal sound		○
Receiver tank	Any Damage	○	
Suction pump Control panel	Automatic alternative operation		○
Vacuum switch	Any Damage	○	

(9) Fans

- After flood: The Fan motor was flooded and malfunctioning.
- Current condition: The results of the on-site checks of current condition show no change since 1.5 years ago at the time of the flood disaster.

Table 1-19 Condition of Fans after Flood

(Fans 4 sets)

Inspection Item	Judgment standard	Result	
		Acceptable	Unacceptable
Overall appearance	Any Damage & rust		○
Fan motor	Insulation resistance: more than 4 MΩ		○
Fan bearing	Rotation & Abnormal sound		○
V-Belt	Any Damage	○	

(10) Auto filter Dust Vacuum Collection system

- After flood: Main equipment such as Control panel, Blower, Bag-filter, etc., and Control panel for AHU, Gear motor, Pre-filter, Suction nozzle & Vacuum hose were entirely malfunctioning due to water damage.
- Current condition: The status of the above-mentioned Equipment & materials was basically unchanged. Components in AHU, such as pre-filter, central vacuum hose and gear motor, have deteriorated by age. Electric 2-way valve is in usable condition.

Table 1-20 Condition of Auto filter Dust Vacuum Collection System after Flood

(Auto filter & dust vacuum collection system 1 set)

Inspection Item	Judgment standard	Result	
		Acceptable	Unacceptable
Overall appearance	Any Damage		○
Motor	Insulation resistance: more than 4 MΩ		○
Bearing	Rotation & Abnormal sound		○
Control panel	Any Damage		○

(11) Water quality Analysis Report

The life of the boiler, chiller and cooling tower heavily depends on the quality of make-up water. Therefore, a pH meter and conductivity measuring meter were brought onto the premises and measurement was carried out. Raw water and treated water after softener were sampled and analyzed in Japan. The results of analysis are described below:

1) Raw water supply for Cooling tower

Assessment of raw water quality analysis is conducted based on the Japan Refrigeration Association Standard (1994, JRA-GL02). Analytical results of raw water used in the Children's Hospital are as follows:

- Electric conductivity, Acid consumption quantity (M-Alkaline), and Total Hardness value are high. If used as Cooling water, scale will form in chillers and piping system. Therefore a Water Treatment system for the removal of total hardness, calcium hardness, is required to be installed.
- Raw water supply quality is low grade, so water scale will form easily inside the Absorption type chiller. Therefore this system requires chemical cleaning every year.

2) Raw water supply for Steam Boiler

The standard of the water quality for Steam Boiler is established by Japan Industrial Standard (JIS). Actually water treatment methods are different for each type of Boiler. Quality of raw water and treated water used in the Children's Hospital was assessed based on the JIS Water supply quality for Boilers:

- Current boiler feed water is supplied by branch-off from laboratory & operation room supply line, but neither water supply volume nor water quality is satisfactory.
- Total hardness and Electricity conductivity is too high and there are problems concerning treatment time & resin volume. An independent water treatment system for Steam boiler water supply is required as soon as possible.

1-4 Outline of the project of follow up cooperation

Based on the Survey conducted one month after the disaster, the plan for the urgent rehabilitation works was prepared. However, due to the worsened situations in adjacent countries, the implementation of these works was postponed. Accordingly, the urgent rehabilitation works were planned again as the project of follow-up cooperation. The project was started in April 2002 and completed in October.

(1) Electrical Service

Power-supply and heating source equipment for important facilities (Operation room, ICU, NICU) for the administration of the Hospital were considered for the safety of the patients.

As for back-up for power outage, Cabling work to connect to existing Generator in MCH (Maternal & Child Health Center) was included.

1) Incoming Panel

- ACB (Air Circuit Breaker) in Incoming Panel (LC-1) was changed.
- Copper bar is replaced and installation panel of ACB is modified, because present ACB is smaller than existing type.

2) Generator

- While new Generator is being installed, the power is supplied to the Children's Hospital by utilizing existing Generator in MCH as emergency power. For this purpose, installation of exchange panel & cabling work between MCH and the Children's Hospital was done.
- When all buildings have a power outage, MCH building has priority to be given electrical power. Electrical circuit system was considered for the above purpose.

(2) Mechanical service

1) Installation of Packaged type Air-conditioners

A total of 30 sets of Heat pump type & separate type small air-conditioner units were installed for the following rooms:

- Emergency section treatment room, 6 bedrooms, operation room, and pharmacy (ground floor)
- Operation section operation room, hall, I.C.U., and ICU section (first floor)
- Bedrooms beside the nurse station of East & West Wards on ground and first floor

Operation of this equipment does not overlap after the central air conditioning equipment is resumed, as the equipment is used for non operation hours and night duty.

2) Humidifier installation

The humidifiers were installed for the areas covered by small type Air-conditioner units.

3) Medical gas supply system

Oxygen, Nitrous oxide, Compressed air and Suction air is provided as medical gas service. The air compressor and air vacuum function has deteriorated by age. In view of safety for patients, as an emergency measure, replacement of V-belt & solenoid valve was done and refrigerant gas charge for air dryer was carried out

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