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Disaster Risk Information <Special Edition>

"Floods in Thailand"

Introduction

Major flooding occurred in Thailand, Vietnam, Cambodia, Philippine, and Laos due to heavy precipitation during the monsoon season since July. Among all, serious flooding damages are reported in Thailand. Major dams in the northern area exceeded their capacity and water was force to be released to compensate for incoming flow. As a result, significant damages were caused in the downstream areas.

It is said that the damage of the flooding is the worst in the past 50 years, and the situation is still unpredictable.

Damages are extremely serious in industrial estates where there are many Japanese companies and factories. Flooding occurred first in Saha Rattana Nakorn Industrial Estate in Ayutthaya which locates in the north of Bangkok followed by other industrial estates, and many companies in the area are forced to suspend operation.

In addition, factories which are not directly affected by floods also need to suspend operation due to disruption of parts supply and transportation system.

Many companies face the situation where they need to urgently review their supply chain not only in Thailand but in entire Asia. According to the Emergency Operation Center for Flood, Storms and Landslide (EOC), as of October 17, 27 out of 77 provinces are flooded and approximately 2.32 million people in 779,522 households are affected with 307 deaths and 3 missing persons. This is worse than flooding during the last year's monsoon season from August to November, which had been considered to be the worst in the past 10 years.

(Photo: Department of information in Thailand)

Transportation

75 highways and 192 local roads are interrupted and 18 train services heading north are fully-suspended.

Followings are water levels of the major dams in the northern area as of October 17. It is expected that water will be released if the water levels do not drop.

- Bhumibol dam 99% of the capacity
- Sirikit dam 99% of the capacity
- Kwae Noi dam 100% of the capacity
- Pasak dam 136% of the capacity
- Ubonrat dam 120% of the capacity
- Lampao dam 100% of the capacity

Flooding in Industrial Estates

As of October 17, a total of 6 industrial estates; all 5 industrial estates in Ayutthaya Province (North of Bangkok) and 1 in Pathum Thani Province are flooded, and about 730 companies including about 420 Japanese companies are affected.

Saha Rattana Nakorn Industrial Estate was flooded on October 6 inundating Rojana and High-Tech Industrial Estate in downstream areas. Bangpa-in Industrial Estate was flooded in October 14 followed by flooding in Factory Land Industrial Estate on October 16 and Nava Nakorn Industrial Zone which is the largest industrial estate in Bangkok located 50km north of the capital on October 17. It is reported an explosion accident (due to chemical reaction involving water) occurred in a plastic factory in Bangpa-in Industrial Estate and resulted in injuries. Factories in the affected industrial estates were forced to fully suspend operation. Flood depth ranges from 2-3m in heavily flooded areas up to 5m in Rojana Industrial Park. Many factories and companies in non-affected industrial estates are also suspending operation due to disruption of manufacturing supply chains and interruptions of transportation system.

The following tables released by Japan External Trade Organization (JETRO) show the lists of affected industrial estates and industrial estates where Industrial Estate Authority of Thailand issued alarm.

Flooded Industrial Estates

Date	Industrial Estates	Number of Japanese Companies	Total number of companies
10/6	Saha Rattana Nakorn Industrial Estate	35	42
10/8	Rojana Industrial Park	147	218
10/13	High-tech Industrial Estate	About 70% of the total	143
10/14	Bangpa-in Industrial Estate	30	84
10/16	Factory Land Industrial Estate	4	15
10/17	Nava Nakorn Industrial Zone	104	230

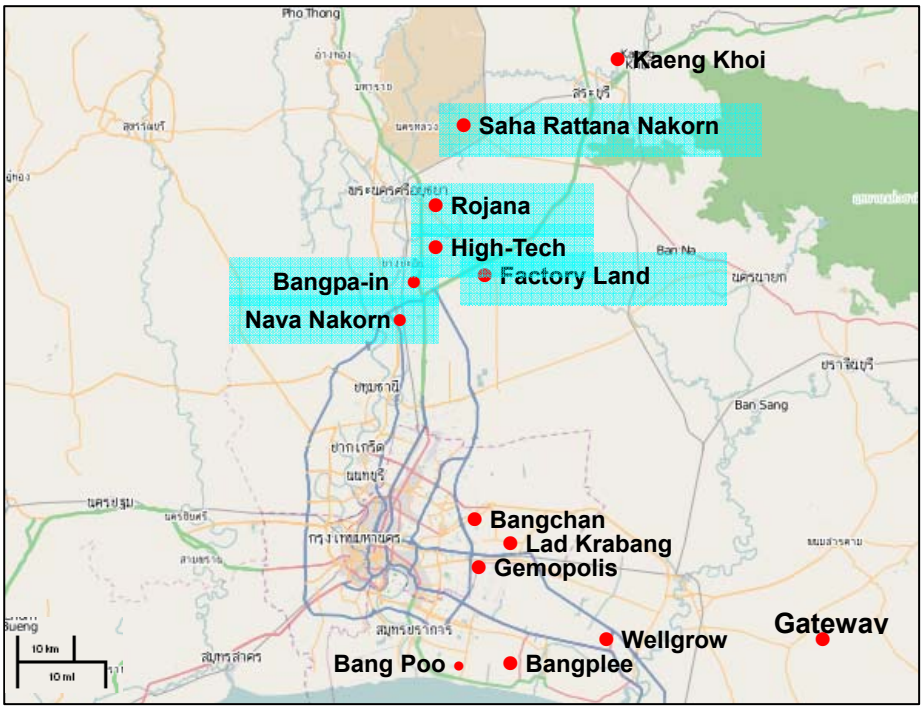
Industrial Estates on full alert for flooding

Industrial Estates	Number of Japanese Companies	Total number of companies
Lad Krabang Industrial Estate	49	283
Bangchan Industrial Estate	20	83

Industrial Estates with potential flood risk

Industrial Estates	Number of Japanese Companies	Total number of companies
Kaeng Khoi IIndustrial Estate	0	1
Gemopolis Industrial Estate（Jewelry Processing）	6	130
Wellgrow Industrial Estate	No data	No data
Bangplee Industrial Estate	48	120
Bang Poo Industrial Estate	72	287

Researched by JETRO



Map of Industrial Estates in Thailand

（Recreated OpenStreetMap by InterRisk Research Institute & Consulting, Inc.）

: Flooded Industrial Estates

Future prospect

In the medium forecast, although continuous rainfall is still expected, there will be a gradual decrease in precipitation toward the end of the monsoon season. Major dams in upstream areas are near-capacity and if water levels in the dams do not drop, further discharge of water will be implemented. Thus, it is expected to take considerable time (maximum 3-5 months in badly affected areas) for the water levels to drop and situation gets better to embark on recovery works.

Sea level in Gulf of Thailand, near the nation's capital Bangkok, rose to and stayed at its highest level and due to flood tide until 18th. The Thai Government and government agencies had swiftly raised banks and dredged sand to prevent rivers from overflowing into Bangkok. Although the government said that the peak period had passed, water level of Chaophraya River reached 2.11m (as of October 17) against embankments which are 2.5m higher than the sea level and built along the river to protect Bangkok city. It is also necessary to stay vigilant during the flood tide period from 27-31 October.

Meantime, more information about the water levels of canals in Bangkok and the height of embankments can be found at JETRO official website.

Potential Flood Risk in Thailand

Thailand, which is a fertile granary lying in the basin where many large and small rivers flow into, is prone to flooding due to heavy precipitations by seasonal monsoon from May through November, and flooding damages have been reported every time when rainy seasons arrived.

According to Department of Disaster Prevention and Mitigation Thailand (DDPM), flooding during Year 2002-2010 claimed more than 1,000 lives and caused economic loss of more than 40 billion baht (about 100 billion yen).

Year	Province	Death toll	Economic Loss	
			THB(million)	JPY (THB=JPY 2.5) (billion)
1983.10-11	Bangkok, Ayutthaya etc.	55	7,000	17.5
1988.11	Nakhon Sithammarat	700	1,000	2.5
1997.8	Chumphon	49	2,900	7.25
2000.11	Songkhla	26	2,000	5
2001.5-8	Phrae, Petchabun	170	No data	
2005.12	Songkhl, Nakhon Sithammarat etc.	25	600	1.5
2006.5	Uttaradit	75	2,000	5

Flood damages in Thailand in recent years (Source: Bangkok Post/ DDPM/Axco)

With the rapid urbanization of the city, drainage capacity has been decreased in Thailand since 1950' due to reclamation of canals in city areas for urban development and in the effort to tackle hygiene issues involving canals. Also, large amount of groundwater has been pumped up to cause ground subsidence. It is said that Thailand is currently experiencing land subsidence of 10cm a year.

Flood Control Measures

It is important to analyze risks, implement loss prevention/mitigation measures and discuss emergency responses and recovery plans against flooding in advance in order to prevent company offices from being flooded.

Followings are the important items to be included in the flood control measures.

(1) Identification of Potential Floods

It is crucial to collect the following relevant information, such as geographical condition of the premises, flood control measures in the neighboring rivers, countermeasures by the public authorities, past flood records in the neighboring areas, as well as the past weather information, in order to ascertain the potential flood risks.

As is often the case in this region, it is presumably more difficult to gather accurate information and data on the topography and the countermeasures by the public authorities, as well as the past floods records. If the company site or neighboring areas have past flood records, it is important to store and manage the information on their damages and countermeasures taken, so as to apply them for future preventive measures.

① Past Floods Information

If the company site or neighboring areas have past flood records, it is important to collect and consolidate the information on their damages and countermeasures taken, in order to check the potential risk and consider the necessary countermeasures against them.

② Rainy & Dry Seasons

Except for the area near the equator, most of the Southeast Asian countries have 2 distinct seasons – Rainy season with a great deal of precipitation and dry season with little precipitation. It is therefore possible to make a certain prediction on the occurrence of floods.

So called “rainy season”, in Southeast Asia is characterized by a brief and concentrated heavy downpour, and will rarely have incessant rain for a whole day like the rainy season in Japan. Therefore, it is very important to arrange for flood countermeasures prior to the flood (rainy) season.

Sample of the checklist for past flood records

◇Date: Year Month

◇Maximum Depth of Flooding

☐ Below 30cm ☐Below 50cm ☐50cm～１m ☐ １m～２m ☐ ２m above

◇Flooded Area

☐Factory ☐Warehouse ☐Office ☐Others ( )

◇Flooded Property

☐Building ☐Machinery Equipment ☐Utility Facilities
☐ Products / Work-in-Process / Raw Materials ☐Outdoor Facilities
☐ Computer / Communication System ☐Confidential Documents
☐Boundary Fences ☐Others( )

◇ Property Damage / Business Interruption

◇ Loss Prevention Measures at the time of flood

☐Implemented ☐Not Implemented

☐Placement of sandbags / Installation of flood barriers to the openings of boundary fences and gates
☐Placement of sandbags / Installation of flood barriers to the openings of buildings
☐Relocation of important facilities to a higher location
☐Placement of sandbags / Installation of flood barriers to important manufacturing equipment and utility facilities
☐Relocation of products, works-in-process, and raw materials to a higher location
☐Relocation of computer data and confidential documents to a higher location
☐Drainage by flood pumps
☐Others （

◇ Damage Details / Effects of Countermeasures / Problems, etc.

:
:
:

Monthly Average Precipitation of the Major Cities in the Southeast Asia (mm)

City	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Bangkok	9.4	16.6	31.5	76.3	207.3	149.6	157.0	207.8	345.3	269.5	53.7	5.6
Jakarta	402.8	279.5	226.2	125.8	128.1	100.6	54.4	69.2	61.9	111.1	126.4	217.2
Kuala Lumpur	163.9	166.3	230.6	242.7	210.0	125.3	127.2	144.5	195.3	253.0	286.6	244.3
Ha Noi	23.6	33.4	47.4	112.9	202.3	239.0	252.4	322.0	251.0	163.7	45.6	10.9
Singapore	184.8	120.2	138.1	122.9	170.4	137.0	159.8	156.3	191.4	134.1	272.5	299.8
Manila	14.3	4.1	6.2	12.8	112.8	192.9	263.2	409.3	247.6	261.7	134.8	55.2

Reference: Science Chronology (2011)

③ **Areas with Potential Floods**

§ Areas that are likely to have collapse of embankments or overflow
- ◇ Where the current of a river is inflected
- ◇ Where tributaries merge with main stream
- ◇ Where the width of a river becomes narrow rapidly
- ◇ Where the gradient of a river becomes rapidly decrease
- ◇ Where sluiceway is installed by penetrating embankment
- ◇ Near the structures, such as bridges, which are crossing the river
- ◇ Where an old river is shut off
- ◇ Where there is a pond adjacent an embankment

§ Areas that are likely to have inland floods
- ◇ Depression contour in low-lying plain, such as the areas where there used to be a river
- ◇ Urbanized hilly inland areas, low-lying area at valley floor of plateau
- ◇ Areas with land depression, zero-meter area, and reclaimed lands
- ◇ Depression contour in plateau and shallow valley

§ Buildings and facilities that are likely to have flood damages
- ◇ Buildings whose ground level or floor level are lower than the flood level
- ◇ Old and deteriorated buildings with loose joints
- ◇ Buildings with many openings, such as shutters, on the external walls
- ◇ Buildings with basement (especially those with utility facilities, such as electric equipment, in the basement)
- ◇ Wooden buildings

(2) Loss Prevention against flood damages

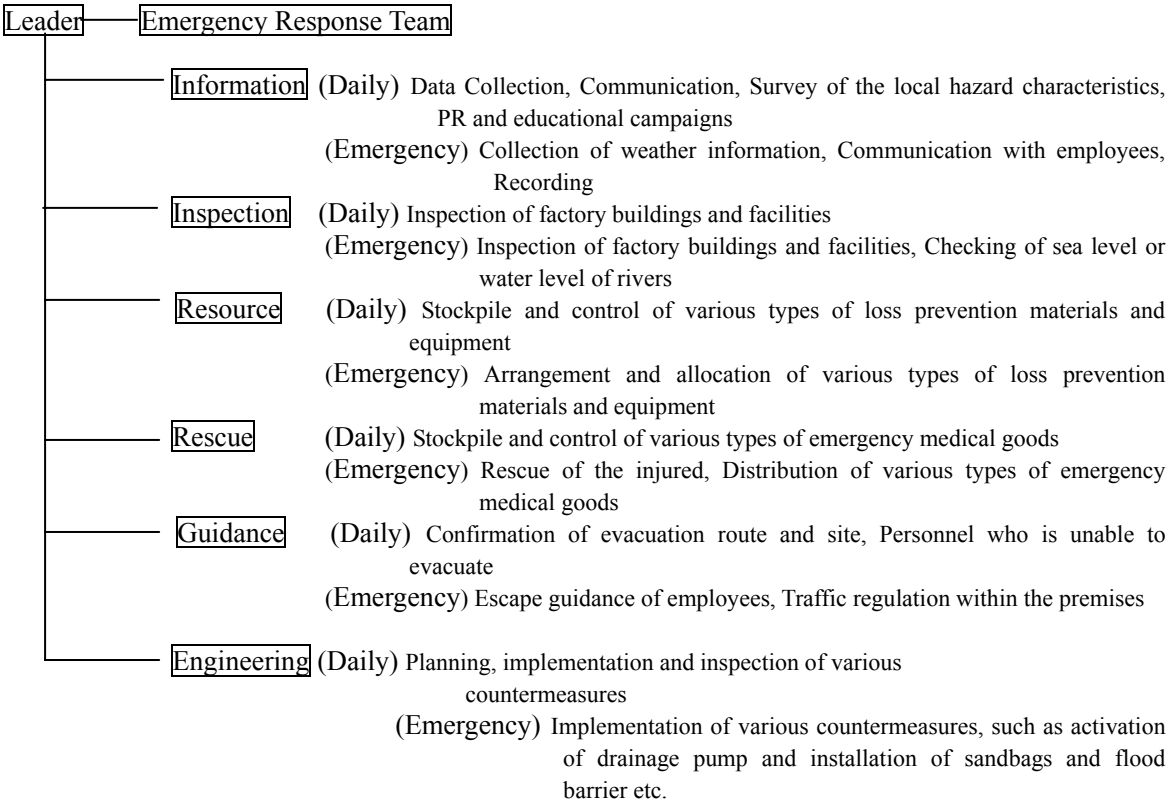
If certain flood damages are expected as a result of risk identification, it is important to consider and implement both software and hardware measures for daily and emergency cases.

①Organization/Planing/Training

a) Organization of Emergency Response Team

Since the flood season may be predicted to a certain extent, it will make a great difference with the actual flood damages if prompt countermeasures were implemented before the flood occurs.
Therefore it is important to organize an Emergency Response Team with clearly-defined roles, in order to implement flood countermeasures promptly. It is also crucial to consider that many employees may be unable to come to the affected site at the time of actual flood.

Example of Emergency Response Team



§ Decisions and Instruction by Headquarter of Emergency Response Team

◇Allocation of each group / Communication in between groups
◇Whether operation should be stopped or not
◇Timing, method and level of emergency countermeasures
◇Leaving time of employees
◇Priority sequence : "What should be given the priority in case of emergency?"
◇Establishment of precise and reliable emergency contact system between the headquarter, branch offices and factory etc.
◇Methods and procedure of restoration work after floods
◇How to have emergency summon when the factory was unmanned during weekend or holidays

b) Emergency Drills against Floods

In case of emergency, on-site operations by each employee, such as placement and installation of sandbags and flood barriers, as well as relocation of storage goods to a higher location will become very crucial.

It is therefore recommended to conduct regular drills upon the clarification of its method. Temporary remedies at the time of flood will not be very effective as countermeasures. It is important to have a comprehensive countermeasure, with all the necessary means, in order to have successful hazard prevention. It is therefore advised to implement the following 2 types of fire drills.

1)Individual Training : Communication Training, Evacuation Training, Proactive Training to the buildings and facilities
2)Comprehensive Training : Comprehensive training that will enable each group of emergency response team to implement their respective countermeasures based on the knowledge and skills learned from individual training.

A review meeting should be conducted after the training, in order to check and improve the content of training.

As for the implementation of training plan, the following details should be made clear.

◇Training Item ◇Date ◇Location
◇Person-in-charge of Training ◇Participants ◇Purpose of Training
◇Content of Training

c) Drawing up Emergency Response Manual

It is important to consolidate all the important information about an emergency case, which should be notified to all the employees, and draw up "Emergency Response Manual". Emergency Response Manual should be utilized at the time of regular emergency drills, so as to get it across all the employees.

＜Example of Emergency Response Manual Details＞

Item	Main Content
Ⅰ Disaster Prevention Policy of Corporation	Organization, Constitution and Assignment of each group, etc.
Ⅱ Emergency Response Team	
Ⅲ Disaster Prevention Drills	Training Plan and Training Details, etc.
Ⅳ Emergency Response	
（1） Headquarter Emergency Response Team	How to set up, Role of Headquarter, Member, and Role of a group, etc.
（2） Emergency Communication Method	Instruction Method and Standard for Emergency broadcasting, etc.
（3） Method of reinforcing the buildings and facilities, and its standard	Priority, Reinforcement Method, and Reinforcement Standard, etc.
（4） Loss Prevention Materials and Equipment	
（5） Protective Goods	Installed Location and Distribution Method, etc.
（6） How to operate emergency facilities	Installed Location and Distribution Method, etc.
（7） Evacuation method	Issuance Standard of Evacuation Order, Evacuation Site, and Precaution on Evacuation, etc.
Ⅴ Precautions after Hazard	
Ⅵ Business Recovery Plan	What to do for the main facilities after flooding

d) Preparation of Various Types of loss Prevention Materials and Equipment

Since flood damages will extend to a wide area, the need for necessary materials and equipment, as well as protective goods will inevitably increase rapidly. At the time of the last flood in Indonesia, such situation was observed that sandbags could not be obtained from any retailers, as they were sold out earlier due to a very heavy downpour.

There were also some past flood cases, in which the demand for fuels of electric generators (light oil / heavy oil), electric generator, sandbags, and emergency lighting fixtures was very high. It is therefore recommended to stock up a sufficient volume of various types of loss prevention materials and equipment on a routine basis. Since it is important to install these materials and equipment at appropriate locations, so as to ensure prompt countermeasures against potential floods, it is

recommended to pre-determine the loading height and location of sandbags (such as openings), the position of drainage pump, and the machinery equipment to be protected.

<Examples of Fire Prevention Materials and Equipment>

Flood Prevention Measures	Communication, Headquarter, Evacuation Measures	First-Aid & Waterproof Measures
☐Sandbags ☐Flood barriers ☐Waterproof sheets ☐Flood pump (engine) ☐Sufficient pump fuel ☐Flood pump (electric) ☐Electric generator ☐Sufficient fuel (electric generator) ☐Cloth tapes ☐Various Tools. ☐Work gloves ☐Wires, wireropes ☐Buckets, mops ☐Wheelbarrow (for carrying materials and equipment)	☐Flashlights, emergency lights ☐Megaphone ☐Portable walkie-talkie ☐Cellphones (for emergency use) ☐Radio transceivers ☐Radios ☐Batteries for the above-mentioned appliances ☐Candles, lighters ☐Employee lists, network ☐Helmets ☐Small-sized boats	☐Stretchers ☐Blankets ☐First-Aid kits ☐Emergency food provisions ☐Drinking water ☐Lifesavers

e) Business Recovery

After flooding, business recovery will require a considerable amount of time for cleaning and repairing of the buildings and machinery equipment, purchase of their replacements, as well as arrangement for spare parts, which likely result in a long-term business interruption.
It is therefore important to clarify the business recovery plan during the peacetime, so as to minimize a shorter business interruption period.

◇Clarify the priorities and importance level of each machinery equipment, parts, and raw material.
* Influence on the production * If replacement can be made easily
* If vulnerable to water damages
◇Store the spare parts of important machinery to somewhere else with no flood risk (such as 2F of a building).
◇Create a list of machinery equipment suppliers, parts & raw material suppliers, construction company, rental company as well as loss prevention material & equipment suppliers etc.
◇Clarify the cleaning and drying procedures of machinery equipment, as well as the persons-in-charge.

② Physical Protection Against Floods

In some past flood cases, the fences around the factory premises, which were originally intended as flood countermeasure, collapsed and resulted in large-scale damages. It is therefore important to implement various types of countermeasures, in order to prepare for unforeseeable events.

§ Perimeter and Boundary

◇Check if raising of the main gate is required.
◇The perimeter fencing should be made of concrete up to the estimated flood level.
◇Check the perimeter fencing if there are any traces of damages or deterioration that require for proper reinforcement and/or repair.
◇Check at regular interval if any part of the drainage canal in around premises have any blockage or unauthorized reclamation.

§ Building Foundation, Floor, and External Walls

◇Raise the foundation level as well as floor level, where the ground level can be raised.

◇Check the bottom part of building's external wall up to the estimated flood level to see if there are any windows or vents. Backfill them if any.

◇Repair cracks and damaged portions, if any.

§ Openings such as Entrances and Loading Bays

◇Install flood doors and shutters to the openings.

◇Install guide railing for flood barrier to the openings, and deploy flood barrier.

◇Install a flood pump near the openings. In addition, secure a suction pipe & water supply port of the flood pump.

◇Stock up more sandbags than the volume required for the pre-determined loading height at all openings (they may be partially piled up).

* It is necessary to arrange for a sufficient volume of sandbags. The actual volume should be estimated based on the fact that these sandbags will be piled more than two-tier. It is also important to uniform their height if they were to protect a building.

Machinery & Equipment (Inside Building)

◇Install a machinery equipment to 1-2-m high (or, alternatively higher than the previous flood level) from the ground.

◇Provide protection walls around machinery

◇Install a lifting equipment (such as overhead crane).

◇Make the machinery equipment movable, and pre-determine the higher location towhich the equipment can be moved in case of emergency.

◇Make the machinery equipment water-proofed.

◇Protect the equipment with sandbags.

* It is important to implement the above-mentioned countermeasures after identifying the vital machinery equipment, checking the installed height of motors, control panels, switchboards, and controls inside the equipment, which are prone to damages, and listing up the critical equipment that are installed lower than 1-m from the floor or the past flood level.

§ Machinery Equipment & Other structures (Outside Building)

◇Relocate them to a higher position.

◇Install protection walls in the surrounding area.

◇Stock up more sandbags than the volume required for the pre-determined loading height in the surrounding area (they may be partially piled up).

§ Transformers, Main Switchboards (within Electric Room), Electric Generators

As for the electric equipment such as transformers, switchboards and electric generators which are considered as plant's lifeline, it is important to give them top priority in installing necessary measures.

◇If it was an transformer provided outside building, install it at 2-m from the ground level or higher

◇If transformers were installed on the ground level, install protection walls at the surrou nding and deploy flood pump.

◇Provide the primary electric room into a independent building with floor elevation.

◇Install a guild railing for flood barrier to the opening of the electric room / generator room, and deploy flood barriers in the surrounding area.

◇Stock up more sandbags than the volume required for the pre-determined loading height at the opening of the electric room / generator room(they may be partially piled up).
◇Make electric room / Generator room a watertight structure (highly waterproofed structure made of concrete with no openings on the external walls, and with entrances installed with flood doors and shutters).
◇Repair any fracture or cracks on the rooftop or external walls of the Electric Room and Electric Generator Room.

§ Products, Material in Process, Parts & Raw Materials

According to the past flood cases, damages to the above-mentioned goods in most cases could have been avoided if they were shifted to a higher location.
It is therefore recommended to relocate these movable storage goods to a higher location prior to a flood so as to effectively minimize the potential flood damages.
◇Install free-standing racks in a warehouse. (in case of emergency, goods on the lower shelf of the rack should be shifted to the higher shelf or the 2nd story of the building) It is advised to control the storage amount and keep them all on the upper stands of the rack during the season with higher flood risk.
◇Storage area should be located at a higher location, such as the 2nd story of a building.

§ Computer / Confidential Documents / Plans, etc.

Once computer, software and data, as well as confidential documents and plans were damaged by water, it will take a considerable amount of time for their restoration.
◇Install a computer room at a safe location, such as the 2nd story of a building.
◇Back up the data and store them at a safe location without flood risk.
◇Store confidential documents, plans, safes, and loss prevention materials and equipment at a safe location without flood risk.

§ Drainage

◇Check if any parts of a drainage is clogged up.
◇Clean the drainage regularly.
◇Floodgate is being installed to prevent the back current.

§ Internal Water Pipe

There are cases in which, sewage water flows back into a building via water pipes, due to the flood outside the building. It is necessary to block these water pipes for flood prevention. However, if industrial water is being used at the production lines, such arrangement will cause an inevitable disruption with the factory's production. Their closing methods will also vary according to the volume of water usage. It is therefore recommended to clarify on the closing methods and locations in advance, and to determine whether water pipe should be closed or not by headquarter of Emergency Response Team.

§ Flood Pump

◇There are designated locations for the installation of drainage pumps.
◇There are sufficient drainage capacity for the site area.
◇The above-mentioned locations are all equipped with suction pits.
＜Engine Pump＞
◇All pumps are equipped with fuel sufficient for a whole-day operation.
＜Electric Pump＞
◇Besides purchasing electricity, there is an electric generator for emergency use.
◇All pumps of electric generator are equipped with fuel sufficient for a whole-day operation.
◇Control panels and cables of the pumps are all installed at a safe higher location without flooding.
◇The drainage pumps have dedicated circuits from electric room and electric generator .

§ Basement

Basement could be entirely submerged at the time of a flood, it is therefore important that necessary flood prevention measures should be implemented.

◇Do not install important facilities or store any crucial goods in the basement.

◇Make necessary arrangements so that facilities and goods on the basement floor could be shifted to a higher location in case of a flood.

Checklist for Loss Prevention Measures against Flood

◎Emergency Response Team

☐Organized ☐Not organized

◎Emergency Drills for Flooding

☐Implemented ☐Not implemented

◎Emergency Response Manual

☐Drafted ☐Not drafted

○Manual Contents

☐Emergency Response Team ☐Emergency Communication Method

☐Reinforcement Standard for Buildings and Machinery Facilities (Locations, Priority, and Reinforcement Method)

☐ Installed Location and Distribution Method of Loss Prevention Materials and Equipment

☐ Installed Location and Distribution Method of First Aid Goods

☐ Operation Method of Emergency Facilities ☐Evacuation Employees

☐ What to do with the Main Facilities in case of Emergency ☐Business Recovery Plan

◎Loss Prevention Materials and Equipment

☐Provided ☐Not provided

(Put a tick in those already provided.)

Flood Prevention Measures	Communication, Headquarter, Evacuation Measures	First-Aid & Waterproof Measures
☐Sandbag ☐Flood Barrier ☐Waterproof sheets ☐Flood pump (engine) ☐Sufficient pump fuel ☐Flood pump (electric) ☐Electric generator ☐Sufficient fuel (electric generator) ☐Cloth tapes ☐Various tools, etc. ☐Work gloves ☐Wires, wireropes ☐Buckets, mops ☐Wheelbarrow (for carrying materials and equipment)	☐Flashlights, emergency lights ☐Megaphone ☐Portable walkie-talkie ☐Cellphones (for emergency use) ☐Radio transceivers ☐Radios ☐Batteries for the above-mentioned appliances ☐Candles, lighters ☐Employee lists, network ☐Helmets ☐Small-sized boats	☐Stretchers ☐Blankets ☐First-Aid kits ☐Emergency food provisions ☐Drinking water ☐Lifesavers

◎Business Recovery

☐Spare parts of major machinery equipment are stored somewhere safe with no flood risk

☐The parts and raw materials, which are not easily obtainable, are stored somewhere safe with no flood risk

☐There is a list of machinery equipment suppliers, parts & raw material suppliers, construction company, rental company as well as loss prevention material & equipment suppliers.

☐The cleaning and drying procedures of machinery equipment, as well as the person-in-charge of such operation, have been made clear.

◎**Countermeasures for inundation and drainage**

○**Sandbags**

☐Provided ☐Not provided

- ☐The locations and height of piled sandbags are already determined. ☐No
- ☐The above-mentioned locations have sufficient numbers of sandbags. ☐No

○**Flood Pump**

☐Installed ☐Not installed.

- Engine-pump
  - ☐All pumps have fuel sufficient for at least a whole-day operation.
- Electric Motor-type
  - ☐There is an electric generator for the pump, and all pumps have fuel sufficient for at least a whole-day operation.
  - ☐Control panels and cables of the pump are located at a higher location, where there is no flood risk.
  - ☐There is a dedicated circuit from electric room and electric generator.

☐The installation location of flood pumps has already been determined. (suction pits are already installed)

☐No

◎**Flood Countermeasures for Perimeter Fences and Buildings**

○**Perimeter Fences (mainly from the ground to the estimated flood level)**

- Structure
  - ☐Concrete ☐Others ( )
- Cracks, Fracture, Damages
  - ☐Not at all ☐Partially (Location:)
  - ☐Many (Location:)
- Openings (Entrance gates, etc.)

＊Flood Measures

☐Installed

☐Providing Flood Barrier

☐Deployment of Sandbags ☐Providing Flood Pumps

☐Raising of Entrance Gates ☐Others

( )

☐Not installed

○**External Walls of Buildings (mainly from the ground to the estimated flood level)**

- Cracks, Fracture, Damages
  - ☐Not at all ☐Partially (Location:)
  - ☐Many (Location:)
- Openings (Doors, Shutters, Vents, and Windows, etc.)

＊Flood Measures

☐Installed to all locations

☐Partially installed (Location:)

☐Installation of Flood Doors and Shutters

☐Installation of Flood Walls ☐Providing Flood Barrier

☐Deployment of Sandbags ☐Providing Drainage Pumps

☐Backfilling with Concrete, etc.

☐Others ( )

☐Not installed

◎**Flood Countermeasures for Machinery Equipment (focus mainly on vital ones)**

○**Electric Equipment (Transformer, Main Switchboard)**

☐Implemented

☐Installed in an individual building with floor elevation

☐Installed in a designated watertight room (concrete structure, whose openings are installed with flood doors and shutters)

☐Raising of ground level (in case of external-type)

☐Installation of Flood Walls ☐Placement of Flood Barrier

☐Deployment of Sandbags ☐Providing Flood Pump

☐Others ( )

☐Not implemented

○**Electric Generator**

☐Implemented

☐Installed in an individual building with floor elevation

☐Installed in a designated watertight room (concrete structure, whose openings are installed with flood doors and shutters)

☐Raising of ground level (in case of external-type)

☐Installation of Flood Walls ☐Placement of Flood Barrier

☐Deployment of Sandbags ☐Providing Flood Pump

☐Others ( )

☐Not implemented

○**Machinery Equipment (Inside Buildings)**

☐Implemented (Name of the machinery equipment:)

☐Raising of Floor Level ☐Installation of Water Walls to the surrounding

☐Deployment of Sandbags

☐Installation of Lifting (e.g. cranes) Facilities

☐Installation of Movable Facilities

☐Installation of Waterproof Facilities

☐Others ( )

☐Not implemented

○**Outdoor Facilities**

☐Implemented (Name of the machinery equipment:)

☐Raising of Ground Level ☐Deployment of Sandbags

☐Installation of Water Walls ☐Others ( )

☐Not implemented

◎**Products, Work in process, Parts & Raw Materials**

☐Racks have been installed within a warehouse, so that it is possible to relocate storage goods to an upper level in case of flood.

☐Sandbags or flood barriers are deployed at the openings of a warehouse (e.g. doors and shutters)

◎**Drainage**

☐There are no parts of drainage clogged with dirt or mud.

☐There are parts of drainage clogged with dirt or mud.
(Locations:)

☐There is a floodgate to prevent a back current from outside of premises.

◎**Internal Water Pipes**

☐The closing method and standard of the internal water pipes are clear.

◎**Computers**

☐A Computer Room is located on the 2nd story, where there is no flood risk.

☐Data are backed up and stored somewhere safe without flood risk.

◎**Basement**

☐There are no important machinery equipment or storage goods in the basement.

☐Necessary arrangements have been made that the facilities and goods may be shifted to a higher location in case of a flood.

◎**Others**

☐Confidential documents, safes, and loss prevention materials and equipment are all stored somewhere safe with no flood risk.

☐Headquarter of Emergency Response Team is planned to be located on the 2nd story, where there are no flood risk.

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