

INTEGRATION FACTORY DISASTER MANAGEMENT PLAN IN FLOOD CRISIS.

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ABSTRACT

In 2011, Thailand suffered the most severe flooding. During the period of 25 July 2011 to 16 January 2012, a total of 175 days. The flood situation in 7 industrial estates in Ayutthaya and Pathum Thani provinces affecting industrial factories. Many places were damaged or it is necessary to suspend the production line. The Federation of Thai Industries (FTI) has assessed the damage that there are 838 factories located in 7 industrial estates, 9,021 factories outside the industrial estates, 285,000 small and medium-sized enterprises (SMEs), and at least 1.8 million workers affected by the flooding. Therefore, from the above problems to see the importance of preparing and reducing damage caused by floods. It is important to have an integration management planning to prepare for emergency situations and unexpected events in industrial plants. To help reduce the damage caused by flood disasters including the participation of personnel in industrial plants. From the result, the researchers found that those involved with industrial factories in the risk areas are lack of understanding in flood management plan in their factory. The conclusion of this study is the integration factory disaster management in flood crisis is divided into 4 steps which are 1. Preparation plan 2. Establish an emergency situation management center 3. Evacuation plan 4. Recovery and Rehabilitation plan

Keywords: Integration factory disaster management plan, Flood crisis

INTRODUCTION

At the end of 2011, Thailand suffered a major flood in 70 years. This great flood was caused by heavy rainfall is wide area and continuously accumulates throughout the rainy season due to the influence of monsoon and 5 storms.

As a result, from 1 January to 31 October 2011, Thailand has accumulated rainfall of 1,822.4 millimeters higher than normal (30 years in average) to 28 percent and if counting only the northern region, would be higher than normal by 42 percent.

Therefore accumulating an enormous amount of water resulting in the flow of water, the river capacity cannot support it. The water enter to agricultural and industrial areas and the highest intensity during the months of October to November through created a huge loss to the people ,the economy, the house, property, farmhouse machinery and equipment. [1]

This flood began on the 25th July 2011 in the northern and expansion areas. In October, from the flooding event, The 7 Industrial areas in Ayutthaya and Pathum Thani in the beginning assess the damage of factories inside and around these areas will be in accumulate 4.8 billion baht. [2]

Dr. Somchai Jitsuchon, Director of Thailand Development Research Institute, TDRI as the head of the research team of this project reveals study results that what is found is 1. Factories in industrial estates have not received a good warning by "Saharatana Nakorn" and "Bangkadi" being 2 industrial estates with the resonance from the operator that didn't receive

an alarm to 100 percent. While "Nava Nakorn", more than 80 percent of respondents said they did not receive the alarm. "Factory Land" operators responded that did not receive more than 70 percent of the alarm. "Rojana" said no receive alarms at more than 60 percent and "Hi-Tech" and "Bang Pa-in", about 55 percent of entrepreneurs in both estates responded that they did not receive an alarm. [3]

In the past, Thailand had limited experience in disaster management such as flooding, rainstorms, and seasonal droughts which is not high damage. Many preparations based on the assumptions of the extent of the violence level only. Preparation system management in an emergency disaster is not effective enough to handle large dangers.

From the above problems to see the importance of preparing and reducing damage caused by floods. It is important to have an integration management planning to prepare for emergency situations and unexpected events in industrial plants. To help reduce the damage caused by flood disasters including the participation of personnel in industrial plants.

METHODOLOGY

The objective of this research are 1. To be a pattern and practice in the event of a flood for industrial plants 2. To prepare for flood prevention 3. To prevent loss of life and property

The methodology is divided into 4 steps as follows

Step 1: Interview the data providers

The researcher surveys the overview data in 3 industrial estate areas that highly affect flood damage in 2011 are

1. Saha Rattana Nakorn Industrial Estate
2. Bang Wa Industrial Estate (Hi-Tech)
3. Bang Pa-in Industrial Estate



Fig. 1. All Industrial Estates in Thailand (www.firstly.co.th)

Step 2: Analyze the questionnaire about knowledge in flood management plans.

The researcher make 300 questionnaires for each industrial estate to prove the people's knowledge in flood management plans by using the group of people who involved with the industrial estate areas. The respondents for each estate are divided in 3 groups.

1. Owner or Manager 50 respondents
2. Supervisor or Chief of work 100 respondents
3. Labour 150 respondents

Step 3. Analyze data of related researches and disaster management plans.

The researcher reviews the related research results and disaster management plans to lead to the integration flood disaster management plans.

The related researches and disaster management plans that use in this research to apply the integration plan are

1. 2011 Great Flood, Impacts and Recovery trends from the survey of entrepreneurs [1]
2. Disaster management and rehabilitation after a disaster: a case study of Thailand and other countries [2]
3. Flood risk management of industrial estates in the lower Chao Phraya River Basin [3]
4. ISO 14001-Clause 4.4.7 Emergency Preparedness and Response [4]

Step 4: Establish integration operational and prevention plans for flood disaster in factory

The researcher establish the integration flood disaster management plans and get feedback by owners and managers in 3 industrial estate areas.

RESULTS AND DISCUSSION

The overview data

From Table 1 is shown about overview data of 3 industrial estates. Ban Wa Industrial Estate (Hi-Tech) is the most overall area and number of factories. Bang Pa-in Industrial Estate has the most percent of factories area per overall area.

Table 1. Overview data of industrial estates (source: Industrial estate authority of Thailand, 2019)

Overview data of industrial estates			
Name	Area (m^2)	Number of factories	Percent of factories area per overall area
Saha Rattana Nakorn Industrial Estate	3,280,000	55	42.29
Ban Wa Industrial Estate (Hi-Tech)	3,806,400	201	43.46
Bang Pa-in Industrial Estate	3,139,200	150	59.73

From the study found that each industrial estate has a flood protection. Saha Rattana Nakorn Industrial Estate constructs a mixed embankment consists of a soil embankment filled with Precast Concrete Panel. The ridge is a U-shaped reinforced concrete wall. The level of the embankment is +7.50 meters above sea level (MSL). The maximum level of the dam is +8.50 meters. Above the sea level (MSL) (highest flooding level in 2011 is +7.2 meters above sea level (MSL), the total length of the dam is 7 kilometers. Ban Wa Industrial Estate (Hi-Tech) construct a compacted soil ridge, reinforced with Double Concrete Sheet Pile. The soil level is +3.80 meters - +5.40 meters above sea level. (MSL) the highest level of

the dam is +5.40 meters above sea level (MSL) (the highest flooding level in 2011 is +4.90 meters above sea level (MSL)), total dam length is 11,050 meters by the flood prevention system. The design was based on the 70-year Design return period. Bang Pa-in Industrial Estate construct a combined embankment consists of a soil embankment filled with Precast Concrete Panel. The dam ridge is a U-shaped reinforced concrete wall. The embankment level is +4.40 meters above sea level (MSL). The highest level of the dam is +6.00 meters. Above the sea level (MSL) (highest flooding level in 2011 is +4.28 meters above sea level. The total length of the dam is 9,885 meters.



Fig. 2. Flood Protection (source: Industrial estate authority of Thailand, 2019)

After 2011, each estate has a flood crisis management plan. Bang Pa-in Industrial Estate create Emergency plan in flood crisis Bang Pa-in Industrial Estate (2017). Ban Wa Industrial Estate (Hi-Tech) and Saha Rattana Nakorn Industrial Estate practice emergency plan to prepare flood prevention and build confidence for entrepreneurs.

Knowledge in exist flood crisis management

From data surveying with 300 questionnaires for each industrial estate in different level of work, we found that from the table 2, in each estate, above 90 percent of supervisor or chief of work has an experience in flood crisis. Bang Pa-in Industrial Estate, 74 percent of manager level has an experience in flood crisis and around 80 percent in Saha Rattana Nakorn Industrial Estate and Ban Wa Industrial Estate (Hi-Tech).

Table 2. Percent of respondents who has an experience in flood crisis

Percent of respondents who has an experience in flood crisis			
Name	Owner or Manager level	Supervisor or Chief of work level	Labour level
Saha Rattana Nakorn Industrial Estate	82	92.00	88.00
Ban Wa Industrial Estate (Hi-Tech)	80	94.00	85.33
Bang Pa-in Industrial Estate	74	92.00	90.67

From the table 3 found that the most of owner or manager and supervisor or chief of work level aware the estate's flood crisis management plan while only 68 to 78 percent of labour level aware the plan.

Table 3. Percent of respondents who aware the estate's flood crisis management plan

Percent of respondents who aware the estate's flood crisis management plan			
Name	Owner or Manager level	Supervisor or Chief of work level	Labour level
Saha Rattana Nakorn Industrial Estate	100.00	86.00	68.00
Ban Wa Industrial Estate (Hi-Tech)	100.00	85.00	71.33
Bang Pa-in Industrial Estate	100.00	92.00	78.66

From the table 4 found that the most of owner or manager and supervisor or chief of work level understand the estate's flood crisis management plan while only half of labour level aware the plan.

Table 4. Percent of respondents who understand the estate's flood crisis management plan

Percent of respondents who understand the estate's flood crisis management plan			
Name	Owner or Manager level	Supervisor or Chief of work level	Labour level
Saha Rattana Nakorn Industrial Estate	90.00	78.00	44.00
Ban Wa Industrial Estate (Hi-Tech)	92.00	79.00	53.00
Bang Pa-in Industrial Estate	100.00	84.00	55.00

The conclusion is most of manager or owner and supervisor or chief of work have an experience in flood crisis and understand how to manage who the event occurs but most of labour level doesn't. The lack of understanding in labour level will be a main problem in the future because this level is a main force in the flood crisis management plan.

Learning from related researches and disaster management plans

Bank of Thailand reported about flood crisis in 2011 said that in the period before the flood, entrepreneurs adjusted to protect factories and machines in a variety of ways. The movement of machinery, goods and raw materials to a safe place is also possible before lifting the machine and part for large machines, only the important parts are removed such as electronics are used to remove the important parts. Some factories that cannot move machinery on time. Entrepreneurs arrange a team of speakers take the machine parts that are important to repair to shorten the damage recovery period.

Factory protection in industrial estates has 3 levels of protection as follows:

1. Protection of the total area of industrial estate

2. Area protection of each factory
3. Water protection doing down on the machine

Disaster management and rehabilitation after a disaster: a case study of Thailand and other countries (2011) explain that the prevention of modern natural disasters is a plan to face the situation before the incident, during the incident and after the ongoing incident until the completion of the process is called the cycle of disaster management consists of:

1. Prevention is an action to avoid or prevent a disaster and loss occurs.
2. Mitigation is an activity intended to reduce impact and severity of disaster causing danger and loss to communities and the nation.
3. Preparation is a preparation in advance to increase capacity for the government, organizations, community operations and individuals in the face of a catastrophic event.
4. Emergency response is an immediate action when disaster occurs.
5. Recovery is a process that is performed when the event. The disaster has passed. In order to restore the affected area or community to a better condition.
6. Development after the disaster covers. Review and study the disaster management experience that occurred and then improve the system of various operations available to be more effective in order to reduce losses to a minimum.

From studying Flood risk management of industrial estates in the lower Chao Phraya River Basin (2015) found that companies in the industrial estate chose the method of organizing an observation team to watch for floods at the highest level, 53.6%, followed by 33.3% of them have pumping equipment, while 32.1% of the top 3 are moving machinery up high, 30.5% in additional flood insurance and 29.8% in preparing warehouse outside the area. Entrepreneurs have an understanding of flooding problems. And have more public mind 90% of the respondents agreed that land use is important for flood management, 97.6% agreed that making land use plans necessary to consider water management, 94% thought that there should be make land use plans at the watershed level Interestingly, 80 percent support measures requiring new factories to be built so that they do not obstruct waterways meanwhile, the participation of the settlement with the surrounding community found that most of the 68.7 percent focus on budget assistance, followed by 41.1 percent donating items needed, the third 38.6 percent, providing shelter if the community outside the estate meet flood, following 32.5 percent give knowledge in management Flooding for the villagers, and 25.3%, is the community leader to solve the flooding problem.

ISO 14001-Clause 4.4.7 explain that an organization's best efforts, the possibility of accidents and other emergency situations still exists. Effective planning and preparation can reduce injuries, protect employees and neighbors, reduce asset losses and minimize production downtime. An effective emergency preparedness and response program should include provisions for assessing the potential for accidents and emergencies, preventing incidents and their associated environmental impacts, plans / procedures for responding to incidents, periodic testing of emergency plans / procedures and, mitigating impacts associated with these incidents. Consistent with your organization's focus on continual improvement, it also is a good idea to review emergency response performance after an incident has occurred. This review can help determine if more training is needed or if emergency plans / procedures should be revised. The Standard requires that three components be addressed by the organization:

1. Establish and maintain procedures to identify the potential for, and the response to, accidents and emergency situations, in order to prevent and mitigate the environmental impacts that may be associated with them.

2. Review and revise the importance of learning from incidents. Obviously corrective actions will be taken and results of audits will be considered after the occurrence of accidents or emergencies or even 'near misses'.

3. Testing of emergency plans should be planned and the Standard indicates that periodic testing of such procedures should be carried out where practicable.

Establish integration operational and prevention plans for flood disaster in factory

The researcher establish the integration flood disaster management plans and get feedback by owners and managers in 3 industrial estate areas. The integration flood disaster management plans is following 4 steps:

1. Preparation plan

- Preparation for the dam system to prevent flooding.
- Preparation of materials used for building defenses such as sandbags, stones, sand, etc.
- Explore and prepare tools equipment and vehicles.
- Check for leaks at various points around the factory.
- Prepare the fiberglass barges, 3.75 m., for inspecting the water barrier around the factory.
- Provide necessary equipment for operations such as a fuel, flashlight, dynamo, etc.
- Manage man power.
- Liaise with provinces and nearby hospital.
- Preparation of radio communication tools, alarm devices, sirens.

2. Establish an emergency situation management center

The rally point consists of a medical service unit, provide shelter, food, drinking water, equipment for surveying, trucks for carrying essential items and evacuating people to safe areas.

3. Evacuation plan

Set criteria for communication by the emergency protection unit. The situation is divided as follows:

- Public relations allow those inside the factory to prepare for possible evacuation. Consider the suitability for the condition of flooding.
- In the event that you are unable to control the situation. Assess the situation there is a risk of notifying an immediate evacuation notice by migrating to rally point.

4. Recovery and Rehabilitation plan

- Establishing a medical service center.
- Coordination for repair and restoration.
- Damage survey.
- Damage report
- Cleaning
- Repair
- Remedy for employees

CONCLUSION

From the study including the result of the questionnaire revealed that the participation of the labour level within the estates is a low level and when considering the components in each side, the employees participate in order from highest to lowest in each side participation and understanding make you aware of the involvement of employees in the factory who do not have enough participation to receive news about floods that will be handled. The estates hasn't publicized the their plan yet. The researcher has therefore prepared integration flood disaster management plans which can be applied to the factory in the event of an emergency

or situation. The integration flood disaster management plans is following 4 steps 1. Preparation plan 2. Establish an emergency situation management center 3. Evacuation plan 4. Recovery and Rehabilitation plan

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