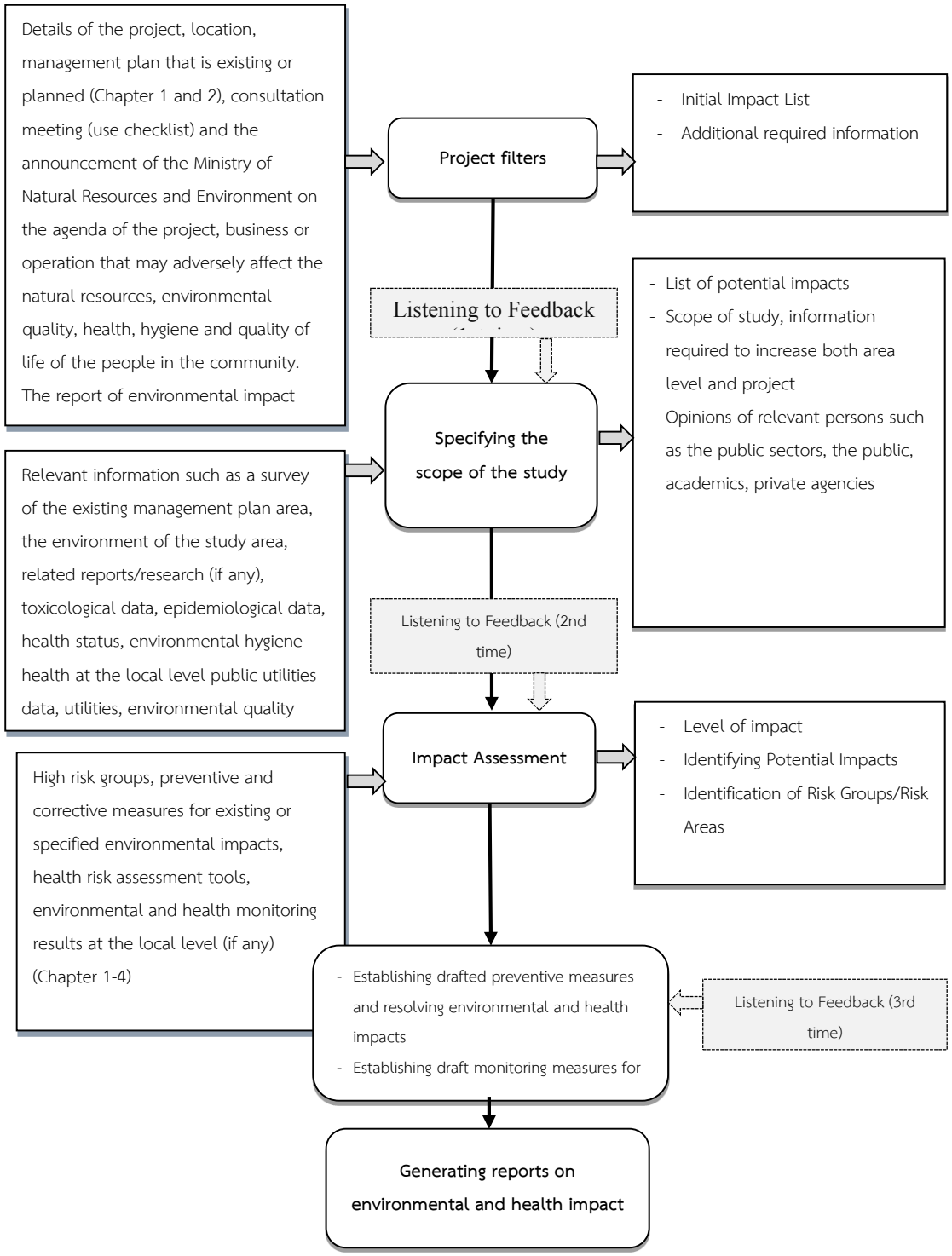
Chapter 6
Health Impact Assessment

6.1 Introduction

The health impact assessment in this project focuses on predicting the impact on the health status of the project due to implementation. The health impact analysis was considered linked to the project details, activities both during the construction phase and in operation. Current environmental information of the project site and environmental assessment results, in this regard, the scope of health impact assessment was taken into account the factors of health in order to comply with the definition of "**health**" stated in Section 3 of the National Health Act, 2007 which is defined as "The state of physical, mental, intellectual and social integrity is fully interconnected." In other words, the assessment is co-processed in many environmental dimensions. Socio-economic and public health, the projection scope considers that development activities may have an effect on changing the health status of people in the communities in the study area surrounding the project. The scope of the study on occupational health and safety impacts covers construction workers and employees working within U-Tapao International Airport.

Considering the impacts of project operations on the health of people in the community, construction workers and employees working within U-Tapao International Airport, according to the guideline on assessing the health impacts of ONEP in the Environmental Impact Analysis Report of 2013, beginning with screening of the project and scope of study (Scoping) within the scope of various secondary data and basic data that existed before this project. Then, the Health Risk Assessment principle is used to estimate the level of impact, which is an analysis that considers both the likelihood and severity of impact. The results of the assessment of the impact level lead to the determination of preventive measures and correction of health impacts as much as practically possible which can be summarize the scope of the health impact assessment, as shown in **Figure 6.1-1**



Source: Applied from the documentation/calculations on the set of systems and tools for industrial management of the environment, Sukothai Thammasat University, Unit 8: Assessment of Environmental and Health Impact, Nantika Suntornchaikul, B.E. 2018

Figure 6.1 1 Scope of Health Impact Assessment

6.2 Purpose of Health Impact Assessment

1. To show connection changes of environmental resources between the 4 aspects and health factorsconsistent with project operations.

2. To process health status data and other relevant health factors in the environmental impact assessment report for projects, businesses or operations that may severely affect the natural resources, environmental quality, health, hygiene and quality of life in the community under the elements of quality of life on public health and occupational health and safety issues.

3. To evaluate the impacts related to project development activities, which will have the potential to cause hygiene health impacts of the public in the area of the project including health impacts of construction workers and employees.

4. To provide a preliminary assessment of the vulnerability of local communities in the study area (vulnerability), Exposure which considers both (exposure), sensitivity (sensitivity) and the ability to adapt (adaptive capacity).

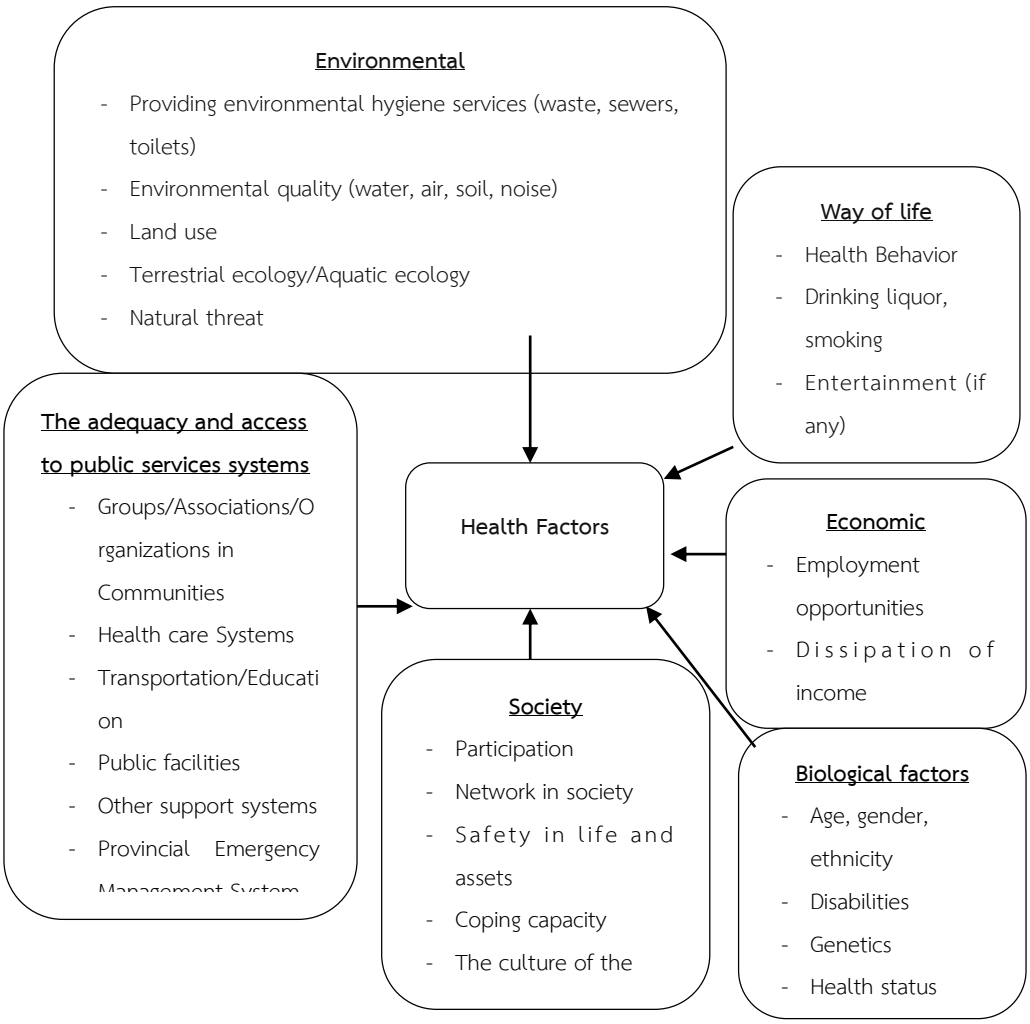
5. Integrate engagement into every step of the impact assessment.

6. To specify measures to prevent and resolve environmental impacts and measures to monitor environmental impacts of the project.

6.3 Health Impact Assessment Procedure

6.3.1 Project screening (Screening)

Project screening is both a review of the type of project that requires EHIA report according to the announcement of the Ministry of Natural Resources and the Environment and is the first step in the initial identification of the project operations, creating a threat that may affect the change in the determinant of health of the local population in the at-risk area and project workers because the change in the body from exposure to a health threat is a complex process. It may take longer to show symptoms of illness. This is to consider both positive and negative impacts on the health of people in the community, construction workers and staff working inside U-Tapao International Airport. A description of the determinants of health is shown in **Figure 6.3-**1. These factors are also indicators for determining the vulnerability of the study population.



Source: Applied from the guideline on health assessment in the case of steel industry, Department of Health, Ministry of Public Health, 2013

Figure 6.3□1 Scope of Health Factors for Health Impact Assessment

6.3.1.1 Procedures

How to conduct the screening process consists of:

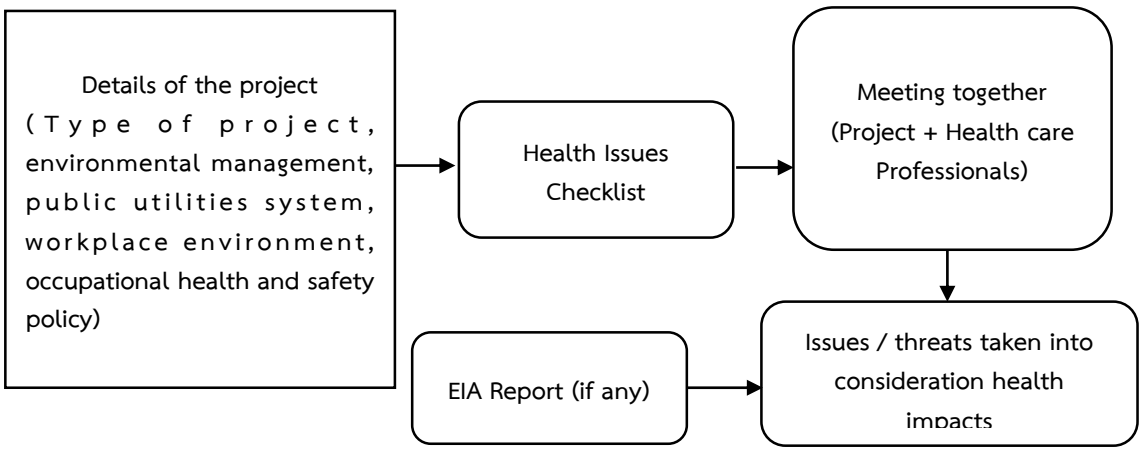
1. Joint meetings between project owners and project advisory team

2. Review of project details (details shown in **Chapter 2 Project details**)

3. Initial collection of spatial data / surveying the area

4. Using the Screening Checklist for preliminary evaluation to obtain health concerns or threats that may be expected to cause health effects and to further study in the scope of the study.

By performing a project filter, see **Figure 6.3-**2



Source: Applied from the guideline on health impact assessment in the case of steel industry, Department of Health, Ministry of Public Health, 2013

Figure 6.3 2 A Screening process in the impact of health studies

Results from the research project screening are issues or health threats that are expected to causeadverse health effects. Further study must be conducted in the scope of the study (Scoping).

6.3.1.2 Project Screening Results

The results of the preliminary project screening revealed that the groups who are expected to be affected due to project operations are classified according to the project phases as follows:

- Construction phase includes residents of the surrounding communities of the project area, communities on the path of transportation channel of materials and equipment used in construction, and construction workers operating in the project area.
- Implementation phase includes residents in the community in the area around the project area, communities that may be impacted by the noise of the aircraft according to the expected noise level in the form of Noise Exposure Forecast (NEF), and employees who are on duty in the project area.

For details of the negative health impacts and positive impacts expected to result from the development of the project are shown in **Table 6.3-** Expected negative health1 and **Table 6.3-**2 Expected positive

Table 6.3 Expected negative health1 effects from project development

Affected Parties	Health determining factor/health threatening factor	
	Construction Phase	Operation Phase
People in the community	1. Loud noises 2. Vibrations 3. Dust 4. Adequacy of public utility systems (drinking water) 5. Travel convenience (agility) 6. Community social network/ safety of life and assets 7. Sanitation (waste management, waste) 8. Common communicable diseases (main causative illness group, aquatic illness / food-borne illness; respiratory illness including the occurrence of viral epidemics such as COVID-19 outbreaks) 9. Public safety (road traffic accident) 10. The adequacy and access to health services systems, including personnel and medical supplies	1. Noise pollution 2. Vibrations 3. Dust and air pollution 4. Adequacy of public utilities (drinking water) 5. Travel convenience (agility) 6. Common communicable diseases (main disease group that causes illness in the area/respiratory diseases including the occurrence of viral epidemics such as the COVID-19 outbreak) 7. Public safety (accidents from road and air traffic) 8. Sanitation (waste management, waste) 9. The adequacy and access to health services systems, including personnel and medical supplies
Construction workers and employees operating within U-Tapao International Airport	Health effects of construction workers 1. Sanitation housing of construction workers 2. Work environment (loud noises) 3. Work accidents	Health effects of employees working within U-Tapao International Airport 1. Work environment (loud noises) 2. Chemical substances in the work environment 3. Accidents and Incidents

Table 6.3□2 Expected positiveimpact from project development

Effects on health	Health Factors (both construction and operational stages)
People in the community	1. Employment and an increase of income 2. Receiving support for community activities from sustainable development projects 3. Local government agencies receive taxes on the project, such as property taxes, sign taxes, etc. 4. The community receives benefits from other businesses related to tourism. 5. Community social network / community relations
Construction workers and employees operating within U-Tapao International Airport	1. Employment 2. Building Labor Relations

6.3.2 Scope of Study (Scoping)

The process of defining the scope of study is the processing of various information related to indicate that the results of the activities obtained from the project screening process has the potential to cause health effects. Thus by considering the health determinants of people in the community, construction workers and staff working inside U-Tapao International Airport for the project. As a result of this step, the scope of the study is clear and the direction of the study is determined both spatially and timely. The scope of participation is also broadly expanded to enable community people and public health workers in at-risk areas get more involved, which at times may receive information that leads to consequences that the consultants did not anticipate. This gives consultants more confidence that the study is going in the right direction. To identify potential environmental impacts helps predict the likelihood of causing both positive and negative impacts on a factor, determine the health of people in communities located in the project study area.

6.3.2.1 Objectives

1. State the health factors/health threatening factors that must be evaluated, which must be related to changes in health status.

2. Identify at-risk population and risk areas based on exposure, sensitivity, and adaptive capacity.

3. Specify risk assessment method.

4. Specify additional required data (Data Gap Analysis).

6.3.2.2 Procedures

The study scope calculation procedure (Scoping) consists of:

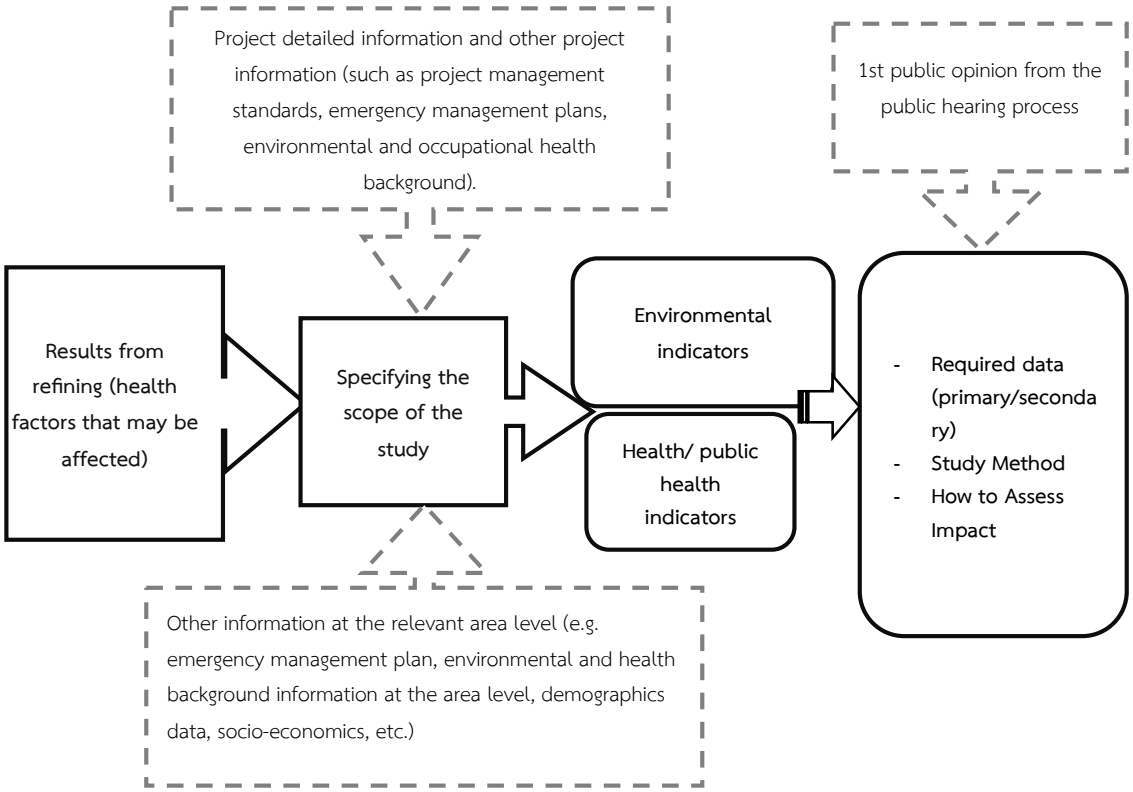
1. Review of project details, current environment, evaluation outcomes, environmental impact level, preventive measures and correction of environmental impact.

2. Secondary data review for various aspects, including demographic data, physical environment, health statistics, environmental hygiene, public utilities and public facilities, adequacy and system access to state, economic, socio-economic, public health personnel readiness, support systems available in the study area, and research reports.

3. Using the Scoping Checklist to break down the impact forecast.

4. Arrange for stakeholders to jointly specify the scope of the study through participation process, which includes (1) joint meetings between project owners, (2) meeting with key informants, and (3) receiving feedback on the scope and guidelines for environmental and health impact assessment (1st public discussion).

The process of defining the scope of this study covers the area of the study. The overview of the study procedure is shown in **Figure 6.3-3** Procedures for Determining the Scope



Source: Applied from the guideline on health impact assessment in the case of steel industry, Department of Health, Ministry of Public Health, 2013

Figure 6.3-3 Procedures for Determining the Scopeof the Study (Scoping)

6.3.2.3 Results of determining the study scope

1) Potentially affected boundary area

This project has identified study areas according to the area expected to be affected by the period of project development activities (Project Influence Area), especially impacts on the characteristics of aircraft routes measured from the boundary area scope of the project, to the east and west, 6 kilometers each side, and to the north and south side 10 kilometers each way. The area covers Rayong (including 2 districts, Ban Chang district and Mueang Rayong district) and Chonburi (including 2 districts, Bang Lamung district and Sattahip district).

2) Negative impacts expected to occur

The results of the screening of the project (Screening) and the scope of the study (Scoping) which are related to the information in Chapters 3, 4 and 5 can be summarized in detail the scope of the assessment of the negative health effects expected to have potential to people in the community, workers, and employees of the project, shown in **Table 6.3-3** Potential negative health impact assessment and **Table 6.3-4**

Table 6.3-3 Potential negative health impact assessmentscope for people in the community

Health Factors	Activities that cause Health threats	Risk group	Information used in evaluation
Construction Phase			
1) Loud noises	Construction activities	- Residents near the construction area - Airport service users	- Results of projections on the impact of sound from construction activities - The rate of illness of the body system that may be related to the effects of the noise. - Public Opinion Survey
2) Vibrations	Construction activities	- Residents near the construction area - Airport service users	- The expected impacts of vibrations from construction activities - Public Opinion Survey
3) Dust	Construction activities	- Residents near the construction area	- Predicted dust concentrations (Chapter 5) - Statistics: rate of respiratory illness from public health agencies - Public Opinion Survey
4) Adequacy of public utility systems (drinking water)	Construction/setting/ construction activities for workers	- Residents nearby the construction areas and accommodation of construction workers	- Predicting water consumption - Water sourcing practices for consumer goods - consumption, waste management, and wastewater in construction worker accommodation areas - Water production capacity of water supply to the project - Raw water source of public water supply - Public Opinion Survey

Table 6.3-3 Potential negative health impact assessmentscope for people in the community

Health Factors	Activities that cause Health threats	Risk group	Information used in evaluation
5) Travel convenience (agility)	Transportation of construction equipment and transportation of workers	- Those living around the airport and close to the transportation channel - Residents nearby accommodation for construction workers	- Project Transport Volume - The current state of traffic of the route used in the shipment. - Public Opinion Survey - Traffic index of local population routes
6) Community social networks/safety of life and assets	Entering the community of foreign workers	- Residents nearby the accommodation for construction workers and residents around the airport.	- Regulations in the accommodation of construction workers - Local Criminal Statistics - Public relations plans and project involvement - Public Opinion Survey
7) Sanitation (waste management, waste)	Construction/Building Accommodation for Construction Workers	- Residents nearby the accommodation for construction workers and around the airport.	- Measures to Supervise the Construction Contracting Company - Specify water procurement practices for use - consumption, waste management, and wastewater in the housing area of construction workers. - Public Opinion Survey
8) Common communicable diseases (main disease group that is the cause of water and food-borne illnesses/diseases, respiratory illness including the occurrence of viral epidemics such as the COVID-19 outbreak)	Construction/Building Accommodation for Construction Workers	- Residents nearby the accommodation for construction workers and around the airport.	- Measures to Supervise the Construction Contracting Company - Specify water procurement practices for use - consumption, waste management, and wastewater in the housing area of construction workers. - Statistics on patient rate and mortality in the area from public health agencies. - The capacity of public health facilities, personnel, and medical supplies in the area. - Public Opinion Survey
9) Public safety (road traffic accident)	Unexpected events/emergency events during the transportation of construction equipment materials and construction activities of the project and	- Residents living around the airport and are close to the transportation channel.	- Measures to supervise contractors on the transportation of construction equipment materials and workers. - Local Agency Transportation Accident Statistics - Public Opinion Survey - The capacity of public health facilities, personnel, and medical supplies in the area.

Table 6.3-3 Potential negative health impact assessmentscope for people in the community

Health Factors	Activities that cause Health threats	Risk group	Information used in evaluation
	construction activities.		
10) The adequacy and access to health services systems, including personnel and medical supplies.	Work accidents, infectious diseases	- Residents living around the airport (children, pregnant women, and elderly)	- Statistics on the cause of illness rate and mortality in the area from public health agencies. - The capacity of public health facilities, personnel, and medical supplies in the area. - Public Opinion Survey
Operation Phase			
1) Noise pollution	Flight activities	- Residents living around the airport (sensitive groups will affect impacts such as children, pregnant women, elderly persons).	- The results of the projections of sound effects from the forecasts by mathematics models. - Rate of cardiovascular disease - Stress/anxiety statistics - Public Opinion Survey
2) Vibrations	Flying activities / items falling out due to airplanes and compressed air (Wake Vortex).	- Residents living around the airport, especially along the flying routes.	- Predicted aircraft vibrations along the flight path that could cause the community to be affected by winds that hit the end of the wing. - Public Opinion Survey
3) Dust and air pollution	Flight activities and activities within the airport	- Residents living around the airport (sensitive groups will affect impacts such as children, pregnant women, elderly persons).	- The concentration of the pollution causing the health effect as predicted by a mathematics model. - Reference concentration value for assessment of health effects - Affected area - Respiratory and cardiovascular disease rates - Public Opinion Survey
4) Adequacy of public utilities systems (drinking water)	Activities within the airport	- Residents living around the airport - Airport service users	- Predicting water consumption - Practices for the supply of water for consumption - at the airport - Water production capacity of water supply to the project - Raw water source of public water supply - Public Opinion Survey
5) Travel convenience (agility)	Getting to the airport	- Residents living around the airport - Airport service users	- The expected traffic conditions of the main roads surrounding the airport. - Public Opinion Survey - Traffic index on the local population route.
6) Common communicable diseases (main disease group that causes illness in	Getting to the airport	- Residents living around the airport - Airport service users	- Airport communicative disease control plan - Statistics on the cause of illness rate and mortality in the area from public health agencies. - The capacity of public health facilities,

Table 6.3-3 Potential negative health impact assessmentscope for people in the community

Health Factors	Activities that cause Health threats	Risk group	Information used in evaluation
the area/respiratory diseases including the occurrence of viral epidemics such as the COVID-19 outbreak).			personnel, and medical supplies in the area. - Public Opinion Survey
7) Public safety (road traffic and air accidents)	Traffic accidents Ground and Airway	- Residents living around the airport, airport service . - Support workers the airport	- Accident prevention and response plans for emergencies - Accident / Emergency Statistics - Public Opinion Survey
8) Sanitation (waste management, waste)	Waste water, waste generated from airport operations	- Residents living around the airport	- The expected impact of wastewater/waste from airport operations. - Airport's wastewater management and waste management systems - Public Opinion Survey
9) The adequacy and access to health services systems, including personnel and medical supplies.	Road and air traffic accidents, communicable diseases	- Residents living around the airport	- Statistics on the cause of illness rate and mortality in the area from public health agencies. - The capacity of public health facilities, personnel, and medical supplies in the area. - Public Opinion Survey

Table 6.3-4 Scope of potential negative health impact assessment on construction workers and employees working withinthe airport

Health Factors	Activities that cause Health threats	Risk group	Information used in evaluation
Construction Phase			
1) Sanitation of housing for construction workers	The worker's residence	- Construction workers and families living in the housing area of construction workers - Airport operations staff	- Guidelines for residential management of construction workers - Contractor sanitation control requirements - Public Opinion Survey
2) Work environment (loud noises)	Use of machinery and equipment in construction	- Construction workers - Airport operations staff	- The policy governing the contracting company must comply with occupational health and safety laws. - Occupational health regulations in the construction area - Providing Personal Safety Equipment

Table 6.3-4 Scope of potential negative health impact assessment on construction workers and employees working withinthe airport

Health Factors	Activities that cause Health threats	Risk group	Information used in evaluation
			- Level of dust and sound impacts during construction
3) Work accidents	Transportation of construction equipment / transportation of workers and construction activities	- Construction workers	- Work safety regulations - Training of construction workers on working in hazardous areas or using personal safety equipment, etc.
Operation Phase			
1) Work environment (loud noises)	Flight activities	- Dedicated employees who operate in the airside area.	- Occupational health regulations in the work area - Providing Personal Safety Equipment - Noise level test results in the work environment, risk-based health examination, and/or hearing loss prevention plan for vulnerable workers
2) Chemical substances in the work environment	Flight activities	- Dedicated employees who operate in the airside area.	- Statistics of Work Environment Measurement Results - Occupational health and safety plans - Health monitoring plan for vulnerable employees
3) Accidents and Incidents	Flight activities and airport activities	- Dedicated employees who operate in the airside area.	- Work safety regulations - Work risk assessment plan - Work Accident Statistics - Training of employees on working in risk areas or using personal safety equipment, etc. - Emergency Response Plan

In this regard, the types of impacts that occur to the community, construction workers, and employees working within the U-Tapao International Airport, both in the construction phase and in the operation phase, which must be further evaluated in detail for the impacts as per **Table 6.3-5** and **Table 6.3-6**

Table 6.3-5 Issue of potential negative impacts for people in the community and construction workers in the construction phase that must be evaluated in detail.

Sequence No.	Construction Phase
Potential negative health impacts on people in the community.	
1.	Loud noises
2.	Dust
3.	Adequacy of public utilities systems (drinking water)
4.	Travel convenience (agility)
5.	Community social network/ safety in life and assets
6.	Communicable diseases (main disease group that causes water-borne illness/ food-borne diseases)
7.	Public safety (road traffic accident)
8.	The adequacy and access to health services systems, including personnel and medical supplies.
Potential negative health impacts on employees / project workers	
1.	Sanitation of housing for construction workers
2.	Work environment (loud noises)
3.	Work accidents

Table 6.3-6 Issue of potential negative impact for people in the community and employees working within U-Tapao International Airport, operations phase that must be evaluated in detail.

Sequence No.	Operation Phase
Potential negative health impacts on people in the community.	
1.	Noise pollution
2.	Air pollution
3.	Adequacy of public utilities systems (drinking water)
4.	Travel convenience (agility)
5.	Common Communicable Diseases (Main Disease Group Caused by the Local Population)
6.	Public safety (road and air traffic accidents)
7.	Sanitation (waste management, waste)
8.	The adequacy and access to health services systems, including personnel and medical supplies
Potential negative health impacts on employees working within U-Tapao International Airport	
1.	Work environment (loud noises)
2.	Chemical substances in the work environment
3.	Accidents and Incidents

6.3.3 Impact Assessment

The impact assessment is a significant estimate of the impact of the project operations that have been considered in the screening process and defined the scope of the study on health factors. The significant impact is based on the risk level of impact that can be considered directly or indirectly, which is considered as a result of the change in health conditions. In addition to the environmental impact, exposure, sensitivity, and adaptability with aims to demonstrate the link of such impacts to changes in health determinants in accordance with risk assessment principles. This step describes the nature of both the likelihood and adverse effects on the health factors of both the inside population (construction workers and operators inside U-Tapao International Airport) and population outside the project (people in the community who live around the airport) divided according to the project's operations stage. The risk assessment methods used in this study were: Qualitative Risk Assessment and Quantitative Risk Assessment (Quantitative Risk Assessment)

6.3.3.1 Objectives

1) To identify the level of health impact and describe the nature of the risk (the likelihood of occurrence, severity, and risk group).

2) To serve as information to consider options of preventive measures and to correct environmental and health impacts and to monitor environmental and health impacts.

6.3.3.2 Procedures

Compile and process all data required for analysis.

1) Type of additional required information

- Environmental indicators and health status and public health indicators, community profile which reflect exposure, sensitivity, and adaptability.
- Secondary data, such as current environmental data, public health and health statistics, review from government reports, previous studies, etc. that relate to the way of exposure to health threats.
- Primary data such as environmental quality test results, public opinion survey results
- The use of arithmetic models to predict air pollution and sound emissions

2) How to collect additional information

- Field survey for the general population, with key points in the survey of current problem conditions and the ability to deal with problems, health, accidents and safety statistics, awareness and opinions on project development. The project and its main environmental and health impacts and measures to monitor environmental and health impacts were explained to respondents prior to answering the questionnaire.
- Review research reports and relevant government agency reports
- Individual interviews/group conversations/in-depth discussions among various stakeholders for assessing the adaptability and ability to deal with problems occurring in the area as well as the culture of the organizations in the community (as shown in**Chapter 4, Public Engagement and Project PR**)

3) Risk assessment, the results can explain the following points:

- Explanation of the level of risk from exposure to health threatening substances which may affect changes in health status.
- Determining preventive and mitigation measures to track and monitor potential impacts

6.3.3.3 Qualitative risk assessment tools

- **Risk Matrix**

The assessment of the negative impact level here has adapted the risk table from other related research to be an assessment tool, considering both likelihood and consequences. The likelihood of the incident and the opinion of health professionals. The severity level of the consequences is determined by health factors, and other factors related to risk populations including sensitive groups to being affected (due to factors of the immune system, the development of the physiological system), the adaptability of the various systems in the area (eg. public utilities systems, health service systems, competence of relevant agencies (eg. public health agencies, local government authorities), management plan of local government organization, economy and society, and social network systems) and the resulting loss (Loss and Damage) (considering the morbidity / mortality rate, number of injuries and severity of injuries, physical damage such as the amount and degree of damage to health utilities systems, emergency care needs, and environmental hygiene health impacts in the community) The details of the risk tables are shown in **Table 6.3-**7 Risk

Table 6.3 7 RiskTable for Health Impact Assessment (4 x 3)

Severity of consequences	Likelihood of occurrence			
	Very rare (1)	Low (2)	Moderate (3)	High (4)
Low (1)	Very rare (1)	Low (2)	Low (3)	Moderate (4)
Moderate (2)	Low (2)	Moderate (4)	Moderate (6)	Moderate (8)
High (3)	Low (3)	Moderate (6)	Moderate (9)	High (12)

Table 6.3-7 RiskTable for Health Impact Assessment (4 x 3)

Severity of consequences	Likelihood of occurrence			
	Very rare (1)	Low (2)	Moderate (3)	High (4)

Source: Applied from the documentation/calculations on the set of systems and tools for industrial management of the environment, Sukothai Thammathiraj University, Unit 8: Assessment of Environmental and Health Impact, Nantika Suntornchaikul (2018)

There are scoring criteria for the likelihood of occurrence and severity of the following consequences:

- **The chance of an incident occurring**

Categorization of the likelihood level of an event will be based on statistics of the occurrence of that event in the area or nearby areas or situations and use the data for at least 3 years, with the definition for the likelihood of occurrence, as detailed in **Table 6.3-8**

Table 6.3-8 Definition of the possibility of an event occurring

Score	Level	Likelihood of occurrence
1	Very rare	There is a very low possibility that there has never been a statistic of occurring in Thailand or abroad from the development of the same project. There are standard operating procedures (SOPs).
2	Slightly	It is less likely that data shown that it is likely to occur, but it lacks clear statistics from the data it supports, and there are standard operating procedures (SOPs).
3	Moderate	Moderate possibility or statistics from available data that supports predicting possibility, no standard operating procedures (SOPs), or existing procedures do not cover the occurrence of events or are a concern and care for stakeholders
4	Very much	Has had an incident, no standard operating procedures (SOPs) or insufficient procedures in place

Source: Applied from the documentation/calculations on the set of systems and tools for industrial management of the environment, Sukothai Thammathiraj University, Unit 8: Assessment of Environmental and Health Impact, Nantika Suntornchaikul (2018)

- **Severity level of consequence**

Grading of the severity of the consequences, especially the negative qualitative impact is carried out by assigning a rating scale to the sub-factors as detailed in **Table 6.3-9**

Table 6.3□9 Scoring factors for determining the severity of the following outcomes

Score	Level	Severity of consequences
1	Low	Mild illness, no physical disability, no effect on increased illness rate, no need to stop work, a system in place for high handling and adjustment, no impact to local budget.
2	Moderate	Increased patient rate, injury, minor physical disability, accumulation of susceptible group,readiness for moderate handling and adjustment, impact to budget, loss of work, impact to local community on a large scale.
3	High	Death, severe physical disability may result in loss of organs, cost of rehabilitation. There is a system ready for moderate to low levels of response and adjustment. There is a cumulative amount of susceptible groups, affecting local communities and nearby areas.

Source: Applied from the documentation/calculations on the set of systems and tools for industrial management of the environment, Sukothai Thammathiraj University, Unit 8: Assessment of Environmental and Health Impact, Nantika Suntornchaikul (2018)

- **Level of impact**

The definition of the level of impact of the sum of the score between likelihood of occurrence and severity is shown in **Table 6.3-10**

Table 6.3- 10 Determining the Level of Impact between the Likelihood and Severity of the Consequences When Using the Health Risk Matrix (4 x 3)

Score from Risk Matrix	Level of impact	Definitions
1	Very rare	Does not cause damage to health status, does not increase sick/death rates, does not affect budget, community is able to recover, no preventive measures are required and no impact to be taken.
2 – 3	Low	Does not cause any harm to health status. Does not increase sick/death rates. Does not affect budget. Community has the capacity to recover. No additional preventive measures and impact required. May consider modifying existing measures.
4 – 9	Moderate	Causes damage to health status, increases illness rates, injuries, may affect budget, community is vulnerable to change, monitoring is required that prevention measures and reducing existing impacts are adequate and appropriate. If necessary and practical, additional measures may be added or improved to reflect the existing impacts with practical feasibility considered.
10 – 12	High	Causes damage to the health status, deaths, increased budget, community is vulnerable to change. Preventive measures, corrections, and reductions of impact must be added. If it cannot be avoided, there may be a need to change in operations.

Source: Applied from the documentation/calculations on the set of systems and tools for industrial management of the environment, Sukothai Thammathiraj University, Unit 8: Assessment of Environmental and Health Impact, Nantika Suntornchaikul (2018)

6.3.3.4 Quantitative risk assessment tool

This assessment is used for air pollution by predicting or forecasting the risk of exposure to various pollutants based on the toxicity of the substance and the reference values for exposure throughout the life period. The assessment for this project is divided into 2 groups as follows:

(1) For the group that has the information of the Inhalation Reference Concentration (RfC) [1/] and Cancer Potency Factor (CPF) from the International Database (Integrated Risk Information System): http://www.epa.gov/IRIS/ and the International Agency for Research on Cancer: http://www.iarc.fr/)

(2) For groups that do not have a database according to (1), use the environmental/occupational health or other standard means for risk comparison assessment.

The quantitative risk assessment when the information of RfC and CPF is available has the following guidelines:

1) Non-cancer risk assessment

Evaluation of respiratory exposure to pollutants in the case of non-cancer diseases performed by calculating the hazard proportions: HQ of Single Chemical Exposure and Hazard Index (HI) for exposure to more than 1 type, which takes into account the characteristics of the combined risk exposure and cumulative risk. The assumption of risk assessment is made based on the conservative approach, which is considered in the worst case, with the following hierarchy in the calculation:

(1) Chronic Daily Exposure: CDI or Exposure Concentration: EC estimation is shown as **equation (1).**

$$\text{CDI หรือ EC } (\mu g/m^3) = \frac{C_{Air} \times ET \times 1day/24hours \times EF \times ED}{AT}$$

Equation (1) [2]

- CDI (Chronic Daily Intake) or EC (Exposure Concentration) is the concentration of the substance that is continuously exposed, in micrograms per cubic meter.
- C_{Air} (Concentration of Contaminant in Air) is the concentration of air pollutant calculated by using a mathematics model (AERMOD) as detailed in **Chapter 5, Environmental Impact Assessment, Section 5.2.2 Air** Quality, with the result

[1/]Reference Concentration – An estimate (with uncertainty spanning about an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely Reference concentrations listed here are to be compared with long-term (maximum annual average) ambient air concentrations.

[2] Using EPA's current methodology, it is unnecessary to calculate an inhaled dose when using dose-response factors from IRIS in a risk assessment. However, inhalation risk assessments may require that an adjusted air concentration be used to represent continuous exposure. For noncarcinogens, the air concentration is adjusted based on the time over which exposure occurs (i.e., the exposure duration). For carcinogens, the concentration is averaged over the lifetime of the exposed individual (often assumed to be 70 years). Retrieve from https://www.epa.gov/expobox/exposure-assessment-tools-routes-inhalation

from the 4th case of the highest expected flight in 1998 (2 runways) using an average concentration of 1 year from a maximum concentration line of 3 levels (Isopleth) at the community's area of μm/m in the calculation of cubic square.

- ET (Exposure Time) is the period of exposure to a substance, in the unit of hours/day, defined as 24 hours per day, which is exposure throughout the day.
- EF (Exposure Frequency) is the frequency of exposure. The unit is defined as 365 days/year per year as daily exposure.
- ED (Exposure Duration) is defined as 70 years of exposure to substances in the unit of years, which is exposure throughout the lifetime.
- AT (Averaging Time) is the period used in the average of units as days, which is usually defined as 2 cases, i.e. 1) average over the lifetime (70x365 days), which is used for the population in the study as the hypothesis that the population in the area is from birth to death, and 2) averaged over the exposure period such as 30 years of work (AT value is 30x365 days), which is used in the staff group. In this study, the study, the average population is set to be at 70 years[3/](based on Thailand's age of Thailand's age from the Ministry of Public Health's age of Thailand, 2017).

(2) The concentration of air pollutants from the mathematics model, the microgram unit per cubic meter, to calculate the pollution ratio or risk value of HQ shown as **equation (2)** for Single Chemical Exposure.

$$\text{Hazard Quotient (HQ)} = \frac{\text{CDI } (\mu g/m^3)}{\text{RfC* } (\mu g/m^3)} \qquad \textbf{Equation (2)}$$

*RfC, which is the value for chronic exposure (based on the methodology of the U.S.EPA Integrated Risk Information System, as of May 25, 2011 (www.epa.gov/IRIS) and California Office of Environmental Health Hazard Assessment (OEHA), "All OEHA Acute, 8 - hour and Chronic Reference Update Level of Answers 2014").

(3) The calculation of the total risk (HI) for the case of exposure to more than one type of pollution at the same time (Mixed Chemical Exposure). The cumulative risk is calculated based on the sum of the HQ values of each substance herein considering only the cumulative risk. That is, all impacts that occur on the same target organ are shown in **equation (3).**

Hazard Index (HI) = the sum of HQ of each substance **Equation (3)**

[3/]Report of Health Adjusted Life Expectancy (HALE), 2015-2030, strategic plan for the development of the disease burden and health index of the Thai population, International Health Policy Program, Ministry of Public Health Policy, September 2017

(4)The risk explanation from the HQ and HI assessment must not exceed 1, meaning that the health effects from receiving the substance have been sustained in breathing for a long time remain acceptable.

2) Cancer Risk Assessment (in case of carcinogenicity)

In case that pollutants are carcinogenic, calculations are made by using the concentration values of that substance and the unit risk factor (URF), which is an estimate of the number of people who have cancer, increased by inhalation exposure at a concentration unit (e.g. 1 microgram per cubic air) throughout their lives. The calculation is as follows:

(1) Consider the average 1 year air pollution concentration (C_{Air}) of the first 3 levels of the highest concentration line (Isopleth) in the community area, which can be determined by using a mathematics model (ARMOD) using the result of the 4th case of the highest expected flight in 1998 (2 runways) to calculate the units in micrograms per cubic meter.

(2) Search the Pollutant-Specific Inhalation Unit Risk Factor (URF) values of air pollutants studied from 2 agencies, namely Integrated Risk Information System (IRIS, 2012) and California Environmental Protection Agency (CalEPA)- Air Toxics Hot Spots Program Technical Support Document for Cancer Potency Factors, Appendix A (Updated 2011) (Cal11)).

3) Set the duration of the cumulative exposure over the life expectancy of 70 years.

4) Bring the concentration values of air pollutants from the mathematics model in the microgram unit per cubic meter, to be calculated as the risk of cancer occurrence per concentration unit or cancer risk of carcinogen with the formula calculation shown in **equation (4).**

$$\text{Cancer Risk} = C_{Air}\ (\mu g/m^3) \times \text{URF (per } \mu g/m^3) \qquad \textbf{Equation (4)}$$

5) The results from the calculation according to article 4) shows that the number of people with cancer increases from exposure to respiratory substances at the expected concentration level for approximately 70 years.

6.4 Basic characteristics of the local community in the project area and the occupational health and safety.

Analysis of the basic characteristics of the local communities in the area in which the project was established prior to the project, and current occupational health and safety are necessary for assessing the comparison of health impacts when there is a project. Study area and data used in the analysis consists of project details (Chapter 2), current environment (Chapter 3), public health service system, health status, accident and injury statistics, health risk behavior, and disaster management system.

6.4.1 Data type and source

The collection of health factors for describing the basic characteristics of the population in the study area are divided into 2 categories as follows:

1) Secondary data

Secondary data is used for this review, it is basic health information for the local population in the study area collected in the past 5 years. Based on basic statistics on basic health information of Thailand, Health Data Center (HDC) system, Ministry of Public Health.

2) Primary data

The primary information used for consideration can be obtained from the interview with the target group within and around the project area. Using a subgroup meeting method, in-depth interview, with a random questionnaire. This was done in conjunction with the study of economic and social conditions. The basic information presented in this topic will cover the health factors that are consistent with the expected outcomes from the project operations.

All data and sources of information are summarized in **Table 6.4-1** Health and **Table 6.4-2** respectively.

Table 6.4-1 Healthbackground information based on health factors and source of data

Basic health information	Secondary	Primary
1) Physical environmental resources	✓	✓
2) The social environment	✓	✓
3) Economic characteristics	✓	-
4) The adequacy and access to health services systems, including personnel and medical supplies	✓	✓
5) Health status	✓	-
6) Local accidents and community safety	✓	✓
7) Public utilities systems and public services	✓	✓
8) Prevention and mitigation of disasters	✓	-
9) Public health comments and suggestions	-	✓

Table 6.4□2 Health Factors and Secondary Data Sources Used to Assess the Project's Health Impact

Health Factors	Subvariant(s)	The source of information
Physical environment resources	- pollution related to the project, such as noise and vibration, air quality, surface water quality, etc. (more details are provided in **Chapter 3, Current** Environment**, Section 3.5.1 Voice , Section 3.5.2 Vibration, Section 3.5.3, Air Quality ,Section 3.4.8 Surface Water Quality**)	- Construction plan - Project details - Government agency report - Results of current environmental measurement (Baseline) of the study area
Demographic structure (details are shown in **Chapter 3, Current Environment, Section 3.7.1 Economic and Society**)	- Overviewof demographic characteristics, changes, and proportions by age and employment	- Civil registrationdatabase, Department of Administrative Affairs, Ministry of Interior - The Public Health Office of Rayong and Chonburi - Rayong and Chonburi Statistics Office
Economic and society	- General socio-economic conditions - Mass Product Information (GDP) - Unemployment rate - Household sanitation information - Occupation/income/household expenditures	- Local administrative organisations - Field survey
Basic health statistical data	- The cause of outpatient illness, according to the top 10 disease groups - The cause of the patient's illness in the top 10 disease groups - Important communicable illness statistics - Important non-communicable illness statistics - The cause of death	- Health Data Center (HDC) StorageSystem, Ministry of Public Health - The Public Health Office of Rayong and Chonburi - CommunityHospital (CMH) - Subdistrict Health PromotionHospital (Sub-district Health Promotion Hospital) - Public Health Care Center
The adequacy and access to health services systems, including personnel and medical supplies.	- Health care infrastructure (both public and private) - Public Health Care and Medical Personnel	- The Public Health Office of Rayong and Chonburi - Office of the Permanent Secretary of the Ministry of Public Health

Table 6.4-2 Health Factors and Secondary Data Sources Used to Assess the Project's Health Impact

Health Factors	Subvariant(s)	The source of information
Public utilities / Public facilities Environmental Hygiene	- Transportation routes - Water use - Waste management - Wastewater treatment system - Public drainage system	- Local administrative organisations - Department of Highways - Local administrative organisations - Department of Health Service Support - Basic necessityinformation (BMN) and basic information at village/community level (NRD 2C)
Accidents and safety	- Accident/disaster/crime statistics	- Disaster Prevention and Mitigation Division - Provincial Police Station
Readiness of disaster prevention and mitigation work	- Equipment powerrating and emergency response plan	- Disaster Prevention and Mitigation Division - Local administrative organisations - Basic necessityinformation (BMN) and basic information at village/community level (NRD 2C)

This chapter presents the following details of public health and occupational health and safety information:

6.4.2 Public Health

Community Profile in the area where the project is located is the source of basic information before the project takes place, which will reflect the sensitivity of the community, the flexibility of the community if there is a change in the environment of the residence. The basic details are as follows:

6.4.2.1 Physical environmental quality

This section of the physical environmental quality data is consistent with the project detailed information (Chapter 2) and the detailed physical environment resources are presented in **Chapter 3**, Current **Environment.**

6.4.2.2 Social environment

Social environment, governance, demographic characteristics, social conditions refer to Chapter 3, Current Environment, Section **3.8.1, Economic and Society** and **Chapter 4, Public Involvement and Public Relations**, as well as results of economic conditions and social health Results in Study Areas, such as living conditions, occupation, income, expenses, health information, public utilities systems, changes in the last 5 years, community issues, as well as expectations, anxiety about the implementation of the project.

6.4.2.3 Economic characteristics (Employment/Revenue)

Economic data, including income of the population and income and household expenditures, refer to **Chapter 3, Current Environment, Section 3.8.1 Economic and Society.**

6.4.2.4 The adequacy and access to health services systems, including personnel and medical supplies.

The adequacy and access to health service systems and the number of public health workers are a component for assessing the health adaptability of the community around the project, and have the following details:

1) Provincial medical and public health facilities information

1.1) Rayong

Rayong has 9 government hospitals, namely Rayong Hospital, Rayong Memorial Hospital Sirindhorn, Ban Chang Hospital, Klaeng Hospital, Wang Chan Hospital, Ban Khai Hospital, Pluak Daeng Hospital, Khao Chamao Hospital and Nikhom Pattana Hospital. As for the 5 private hospitals are Bangkok Rayong Hospital, Mongkut Rayong Hospital, Chularat Hospital, Sri Rayong Hospital and Piyavej Rayong Hospital and 95 subdistrict health promoting hospitals and 360 clinics, details shown in **Table 6.4-3**.

Table 6.4-3 Healthcare Organizations by type in district of Rayong, FY 2017

District	Government Hospital	Private hospital	Subdistrict Health Promotion Hospital*	All clinic types
Rayong City	2	4	20	208
Ban Chang	1	-	9	31
Klaeng	1	-	23	63
Wang Chan	1	-	7	5
Ban Khai	1	-	15	14
Pluak Daeng	1	1	10	55
Khao Chamao	1	-	6	4
Nikhom Pattana	1	-	5	13
Total	**9**	**5**	**95**	**360**

Note : * Including government hospital, state enterprises and independent organizations and municipalities (excluding specialized service hospitals)

Source: Rayong Provincial Public Health Office (Information as of 2019)

The details of the number of beds and proportion of beds per population of the health facilities in Rayong are shown in **Table 6.4-4** Bed to population**. It** is evident that the number of beds in the facility is insufficient to meet the needs of the public. However, consideration of adequacy must be given to the public health agencies' management system and the rate of inpatient bed occupancy.

Table 6.4-4 Bed to populationproportions of Rayong

District	Health service network	Bed	Demographics (people)	Bed/Population
Rayong City	Rayong Hospital	576	227,697	1:395
Ban Chang	Ban Chang Hospital	70	61,192	1:874
Klaeng	Klaeng Hospital	200	130,504	1:653
Wang Chan	Wang Chan Hospital	43	28,699	1:667
Ban Khai	Ban Khai Hospital	26	67,513	1:2,597
Pluak Daeng	Pluak Daeng Hospital	51	46,940	1:920
Khao Chamao	Khao Chamao Hospital	30	22,619	1:754
	Rayong Memorial Hospital Sirindhorn	162	22,619	1:140
Nikhom Pattana	Nikom Pattana Hospital	30	35,752	1:1,192
Total		**1,188**	**643,535**	**1:542**

Note: DB-POP 2018 Data (Searched on 23 September 2019)

Source: Rayong Provincial Public Health Office (http://insurerayong.com/web/index.php)

2.2) Chonburi

Chonburi has 12 government hospitals, including Chonburi Hospital, Bang Lamung Hospital, Wat Yansangwararam Hospital, Laem Chabang Hospital, Phanat Nikhom Hospital, Ban Bueng Hospital, Sattahip KM.10 Hospital, Phanthong Hospital, Bothong Hospital, Nong Yai Hospital, Koh Chan Hospital, and Koh Sichang Hospital. As for the 14 private hospitals and 120 subdistrict health promotion hospitals and 994 clinics, the details are shown in **Table 6.4-**5

Table 6.4-5 Medical facilities by type in district of Chonburi, FY 2017

District	Government Hospital	Private hospital	Subdistrict Health Promotion Hospital*	All clinic types
Chonburi City	4	5	17	314
Ban Bueng	1	-	14	36
Nong Yai	1	-	9	-
Bang Lamung	1	3	14	299
Phanthong	1	-	10	27
Phanat Nikhom	1	-	21	38
Sriracha	1	6	12	229
Koh Sichang	1	-	-	-
Sattahip	1	-	6	44
Bothong	1	-	13	2
Koh Chan	1	-	4	5
Total	**12**	**14**	**120**	**994**

Note : * Including government hospital under the Ministry of Public Health and those outside (not including hospitals in the specialist service category).

Source: Summary of performance according to the Ministry of Public Health's inspection plan, FY2017, Chonburi Provincial Public Health Office.

The details of the number of beds and proportion of beds per population of the health care facility in Rayong are shown in **Table 6.4-6**Bed to population**. It** is evident that the

number of beds in the facility is insufficient to meet the needs of the public. However, consideration of adequacy must be given to the public health agencies' management system and the rate of inpatient bed occupancy.

Table 6.4-6 Bed to populationproportion of Chonburi

District	Health service network	Bed	Demographics (people)	Bed/Population
Chonburi City	Chonburi Hospital	850	335,063	1:394
Bang Lamung	Bang Lamung Hospital	260	301,607	1:1,160
Sriracha	Wat Yansangwararam Hospital	30	315,629	1:10,521
	Laem Chabang Hospital	161	315,629	1:1,960
Phanat Nikhom	Phanat Nikhom Hospital	138	124,637	1:903
Ban Bueng	Ban Bueng Hospital	138	107,415	1:778
Sattahip	Sattahip Hospital KM.10	56	165,492	1:2,955
Phanthong	Phanthong Hospital	57	69,429	1:1,218
Bothong	Bothong Hospital	60	50,318	1:839
Nong Yai	Nong Yai Hospital	30	23,625	1:788
Koh Chan	Koh Chan Hospital	30	37,670	1:1,256
Koh Sichang	Koh Sichang Hospital	30	4,560	1:152
Total		**1,840**	**1 ,851,074**	**1:1,006**

Source: Chonburi Provincial Public Health Office, Data as of June 12, 2019

2) Information on medical facilities and the number of health care professionals and public health in the study area.

The number of health care professionals and public health in accordance with the health facilities in Rayong and Chonburi are shown in the table (**Table 6.4-7** Public Health Facility and **Table 6.4-8** **Facility**Hospitals only have doctors, dentists, pharmacists, registered nurses, and public health academics. Meanwhile, hospitals for subdistrict health promotion have only registered nurses and public health academics.

Table 6.4□7 Public Health FacilityInformation in the Study Area

Subdistrict	Hospital	Subdistrict Health Promotion Hospital (Sub-district Health Promotion Hospital)	Public Health Care Center	Community Health Services Unit
Rayong				
Phala	- Ban Chang Hospital	Phala Subdistrict Health Promotion Hospital	- Public Health Community Service Center Eastern-Nong Muang	-
Samnugton	-	- Ban Khao Khrok Subdistrict Health Promotion Hospital - Ban Sa Kaeo Subdistrict Health Promotion Hospital - Samnugton Subdistrict Health Promotion Hospital - Ban Chak Mak Subdistrict Health Promotion Hospital - Ban Khlong Bang Phai Health Promotion Hospital - Ban Yai Ra Subdistrict Health Promotion Hospital	- Public Health Care Center 2 Ban Chang Municipality (Tassanee Center)	- Community Health Services Phudon-Huay Mahad
Ban Chang	-	- Ban Phayun Subdistrict Health Promotion Hospital	-	-
Chonburi				
Huay Yai	- Wat Yansangwararam Hospital - Somdej Phra Yanasangwon Hospital For the elderly, Chonburi	-	-	-
Bangsarae	-	- Ban Khlong Wan Phen Subdistrict Health Promotion Hospital	-	-
Phlu Ta Luang	- Queen Sirikit Hospital Royal Thai Navy Medical Department - Sattahip Hospital (KM.10)	-	-	-

Table 6.4□7 Public Health FacilityInformation in the Study Area

Subdistrict	Hospital	Subdistrict Health Promotion Hospital (Sub-district Health Promotion Hospital)	Public Health Care Center	Community Health Services Unit
Samaesarn	-	Ban Chong Subdistrict Health Promotion Hospital Samaesarn		-

Table 6.4□8 FacilityInformation and Number of Public Health Personnel in the Study Area, 2018

List of public health facilities	Subdistrict	Number of beds	The rate of occupancy*	Physician (Personnel)	Dentist (Person)	Pharmacist (Person)	Registered Nurse (people)	Public Health Academic Officer (Person)
Rayong								
1. Ban Chang Hospital	Ban Chang	70	35.36	13	5	8	62	2
2. Phala Subdistrict Health Promotion Hospital	Phala	-		-	-	-	2	2
3. Ban Khao Khrok Subdistrict Health Promotion Hospital	Samnugton	-		-	-	-	1	1
4. Ban Sa Kaeo Subdistrict Health Promotion Hospital	Samnugton	-		-	-	-	1	2
5. Samnugton Subdistrict Health Promotion Hospital	Samnugton	-		-	-	-	1	1
6. Ban Chak Mak Subdistrict Health Promotion Hospital	Samnugton	-		-	-	-	2	1
7. Ban Khlong Bang Phai Health Promotion Hospital	Samnugton	-		-	-	-	1	1
8. Ban Yai Ra Subdistrict Health Promotion Hospital	Samnugton	-		-	-	-	2	1

Table 6.4□8 FacilityInformation and Number of Public Health Personnel in the Study Area, 2018

List of public health facilities	Subdistrict	Number of beds	The rate of occupancy*	Physician (Personnel)	Dentist (Person)	Pharmacist (Person)	Registered Nurse (people)	Public Health Academic Officer (Person)
9. Ban Phayun Subdistrict Health Promotion Hospital	Ban Chang	-		-	-	-	1	2
Chonburi								
1. Wat Yansangwararam Hospital	Huay Yai	30	66.26	4	2	3	32	3
2. Somdej Phra Yanasangwon Hospital for the elderly, Chonburi	Huay Yai	10	-	3	-	1	7	2
3. Queen Sirikit Hospital	Phlu Ta Luang	441	-	118	11	16	710	6
4. Sattahip Hospital KM.10	Phlu Ta Luang	56	72.94	12	6	8	58	-
5. Ban Khlong Wan Phen Subdistrict Health Promotion Hospital	Bangsarae	-	-	-	-	-	1	-
6. Ban Chong Samaesarn Subdistrict Health Promotion Hospital	Samaesarn	-	-	-	-	-	1	3

Note : The occupancy rate refers to the monthly in-patient service rate information for every right (day-to-day and bed rate) from the Health Data Center (HDC) Health Information System. The Public Health Office of Rayong and Chonburi.

Source: Health Resources Geographic Information System Searched on 20 September 2019

When considering the occupancy rate of the provincial service area of the community hospital (CMH) in 2019, as per **Table 6.4-9** found that Rayong had a bed occupancy rate of 77 percent, higher than that of Chonburi at 67 percent, which was in the range of 60-80 percent, considered not a problem with insufficient beds or overcrowding.

Table 6.4-9 Bed occupancy rate, in the service network of Rayong and Chonburi, 2019

Province	Number of beds	Population per bed	Per physician bed	Number of new outpatients (persons)	Total number of outpatients (times)	Number of patients in (subjects)	Number of Inpatient Sleep Days	Rate of occupancy (percentage)
Provincial Service Network Area List								
Rayong	1,593	453	4	684,168	2,366,748	117,124	540,291	93
Chonburi	4,663	327	3	1,496,446	7,299,948	287,917	1,115,412	66
List of Provincial Service Network Areas of								
Rayong	604	1,195	5	140,489	508,676	39,692	209,118	95
Chonburi	850	1,796	3	52,450	1,054,246	58,895	281,536	91
List of Provincial Service Network of the General Hospital								
Rayong	362	1,994	5	105,344	370,272	23,772	87,093	66
Chonburi	290	5,265	5	150,267	538,085	25,309	92,220	87
List of Provincial Service Network of the Community Hospital								
Rayong	808	1,889	4	498,271	1,372,957	56,956	227,523	77
Chonburi	254	2,842	3	183,592	708,338	18,027	62,263	67

Source: Public Health Resources Report 2019, Strategic and Planning Division, Office of the Permanent Secretary of the Ministry of Public Health (found on 20 July 2020 from https://bps.moph.go.th/new_bps/healthdata)

Note : Calculated bed occupancy = $\frac{\text{number of days spent in 1 year x 100}}{\text{Number of beds x number of days in 1 year (365)}}$

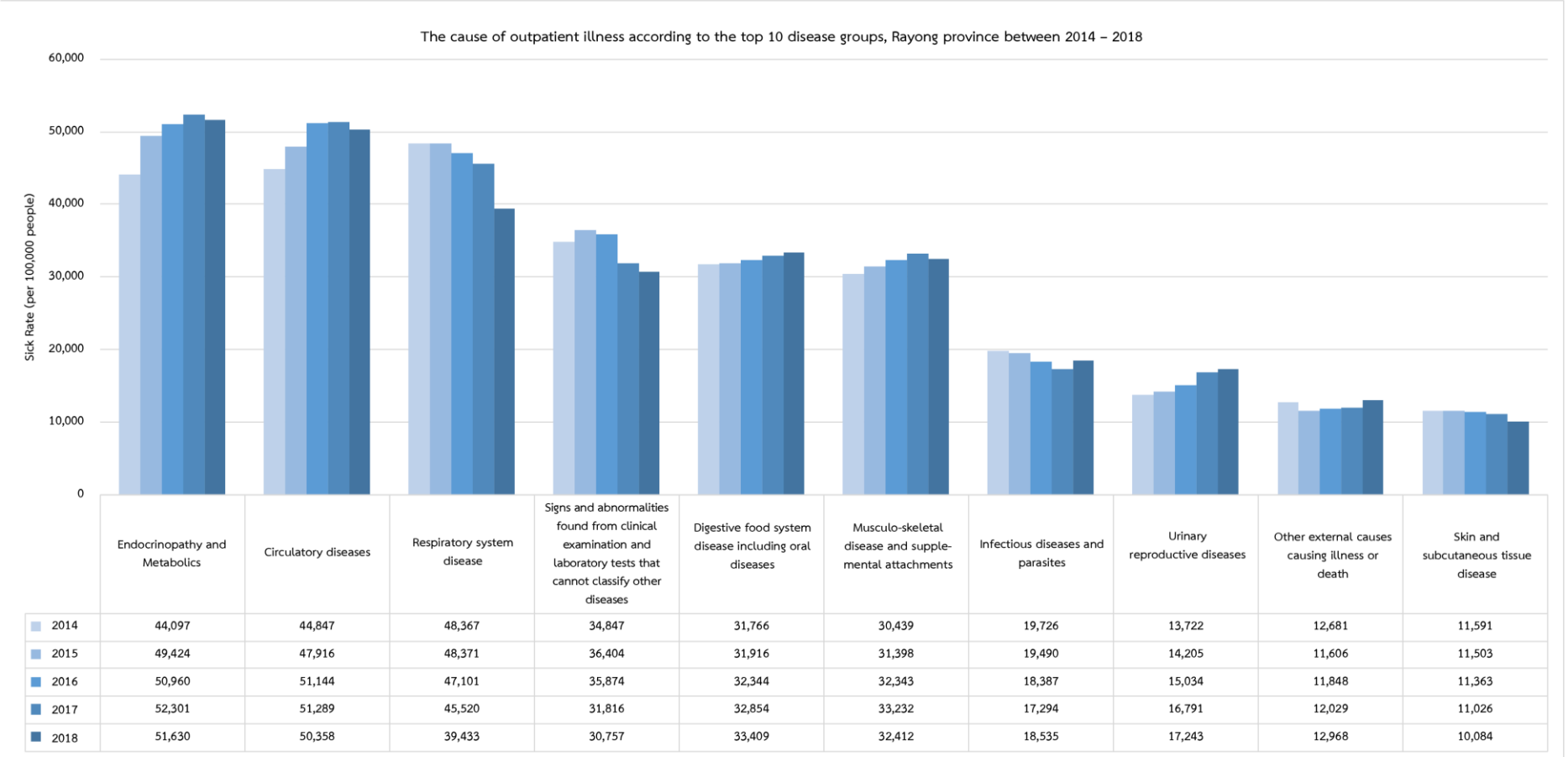
6.4.2.5 Health status

Demographic health status information in the study area is collected from the Health Data Center (HDC) Health Information System, Rayong Provincial Public Health Office, Chonburi Provincial Public Health Office, District Public Health Office, Subdistrict Health Promotion Hospital and local hospitals. Additional details are shown in **Appendix 6-1**. Overview of population health status is as follows:

1) Causes of Outpatient Illness by Top 10 Disease Groups

According to the statistical data collection of outpatient illness causes according to the top 10 disease groups in the population in Rayong province study area, between 2014-2018, it was found that the main causes of the illness were endocrinology and metabolism and circulatory system diseases, which is likely to increase every year, followed by respiratory illnesses which is likely to decrease. Other diseases tend to increase and decrease in each year, as shown in **Figure**

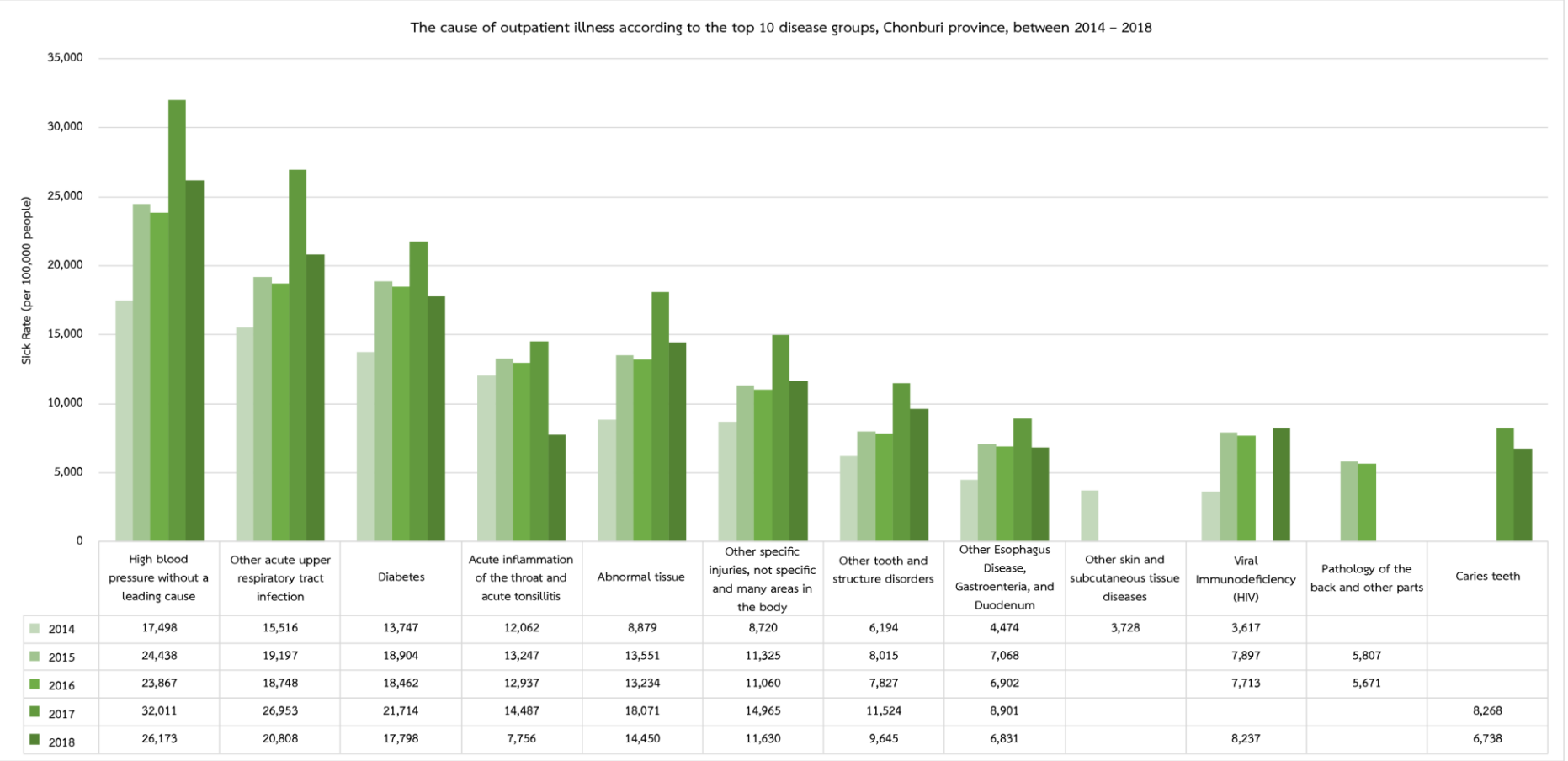
6.4-1 Patient Rate While Chonburi is found to have the most common causes of illness every year is high blood pressure without cause, leading to other acute upper respiratory tract infection and diabetes, followed by acute neck pain and tonsillitis, abnormal tissues, other specified injuries at unspecified and multiple areas in the body, etc. From the pathogenesis of each year, there was no clear trend or direction of change in each disease as shown in **Figure Figure 6.4-**1 Patient Rate and **Figure 6.4-2** Patient Rate



	Endocrinopathy and Metabolics	Circulatory diseases	Respiratory system disease	Signs and abnormalities found from clinical examination and laboratory tests that cannot classify other diseases	Digestive food system disease including oral diseases	Musculo-skeletal disease and supple-mental attachments	Infectious diseases and parasites	Urinary reproductive diseases	Other external causes causing illness or death	Skin and subcutaneous tissue disease
2014	44,097	44,847	48,367	34,847	31,766	30,439	19,726	13,722	12,681	11,591
2015	49,424	47,916	48,371	36,404	31,916	31,398	19,490	14,205	11,606	11,503
2016	50,960	51,144	47,101	35,874	32,344	32,343	18,387	15,034	11,848	11,363
2017	52,301	51,289	45,520	31,816	32,854	33,232	17,294	16,791	12,029	11,026
2018	51,630	50,358	39,433	30,757	33,409	32,412	18,535	17,243	12,968	10,084

Source: Health Data Center (HDC) Health Data Center Data Warehouse System, Rayong Provincial Public Health Office, searched at https://ryg.hdc.moph.go.th/hdc/main/index.php on 12 July 2020.

Figure 6.4□1 Patient RateChart by Outpatient Illness Causes by Top 10 Disease Groups, Rayong, between 2014 – 2018



	High blood pressure without a leading cause	Other acute upper respiratory tract infection	Diabetes	Acute inflammation of the throat and acute tonsillitis	Abnormal tissue	Other specific injuries, not specific and many areas in the body	Other tooth and structure disorders	Other Esophagus Disease, Gastroenteria, and Duodenum	Other skin and subcutaneous tissue diseases	Viral Immunodeficiency (HIV)	Pathology of the back and other parts	Caries teeth
2014	17,498	15,516	13,747	12,062	8,879	8,720	6,194	4,474	3,728	3,617		
2015	24,438	19,197	18,904	13,247	13,551	11,325	8,015	7,068		7,897	5,807	
2016	23,867	18,748	18,462	12,937	13,234	11,060	7,827	6,902		7,713	5,671	
2017	32,011	26,953	21,714	14,487	18,071	14,965	11,524	8,901				8,268
2018	26,173	20,808	17,798	7,756	14,450	11,630	9,645	6,831		8,237		6,738

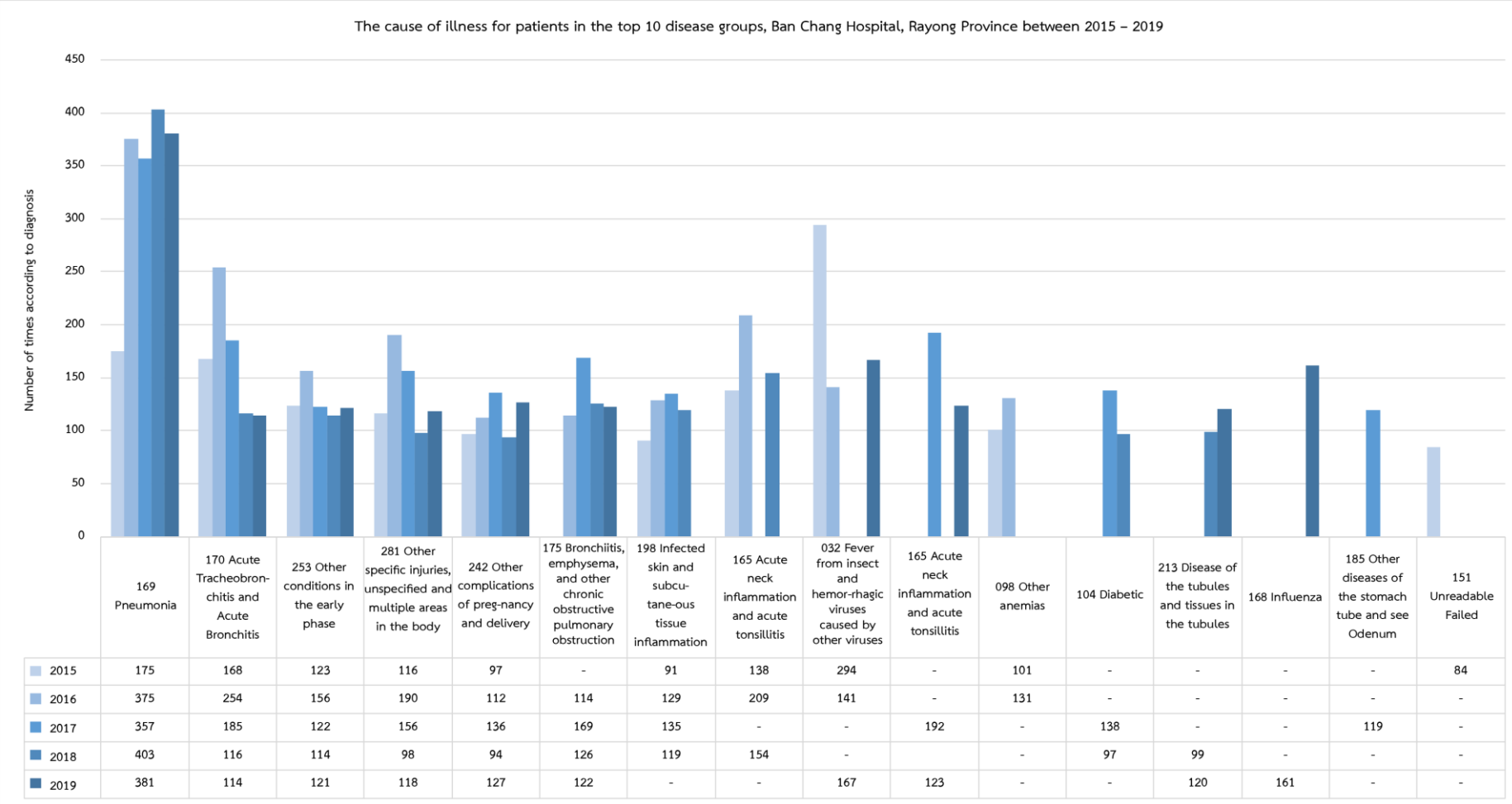
Source: Health Data Center (HDC) Health Data Center Data Warehouse System, Chonburi Provincial Public Health Office, search http://hdc2.cbo.moph.go.th/hdc/main/index.php on 12 July 2020.

Figure 6.4-2 Patient RateChart by Outpatient Illness Causes by Top 10 Disease Groups, Chonburi between 2014 – 2018

2) Causes of illness of the patients in the top 10 disease groups.

The cause of the patient's illness in the top 10 disease groups between 2015-2019, found that the most common cause of patient's illness at the hospitalizations at Ban Chang Hospital, Ban Chang District, Rayong, is pneumonia, followed by acute bronchitis and acute bronchitis. Other conditions in the period of perinatal, other specified injuries, not specific and many areas in the body. Other complications of pregnancy and delivery are found in the top 10 diseases of every year. Other chronic bronchitis, emphysema, and obstructive pulmonary disease is likely to increase in years. In addition, the incidence of insect and hemorrhagic fever caused by other viruses occurs again in 2019 after the trend of decreasing and not being in the top 10 in 2016-2017. Details shown in **Figure 6.4-3**.

The most common reason for patient's illness at the Hospital of Sattahip KM.10, Sattahip District, Chonburi is pneumonia, followed by other diseases of the urinary tract, insect and hemorrhagic virus caused by other viruses, bronchitis, emphysema, and other chronic obstructive lung disease, immunodeficiency virus (HIV), endocrinopathy, nutrition and other metabolic disorders, which are diseases found in the top 10 of every year and are more likely to develop. Other anemias are likely to rise continuously, with high disease groups, as shown in **Figure 6.4-**4.

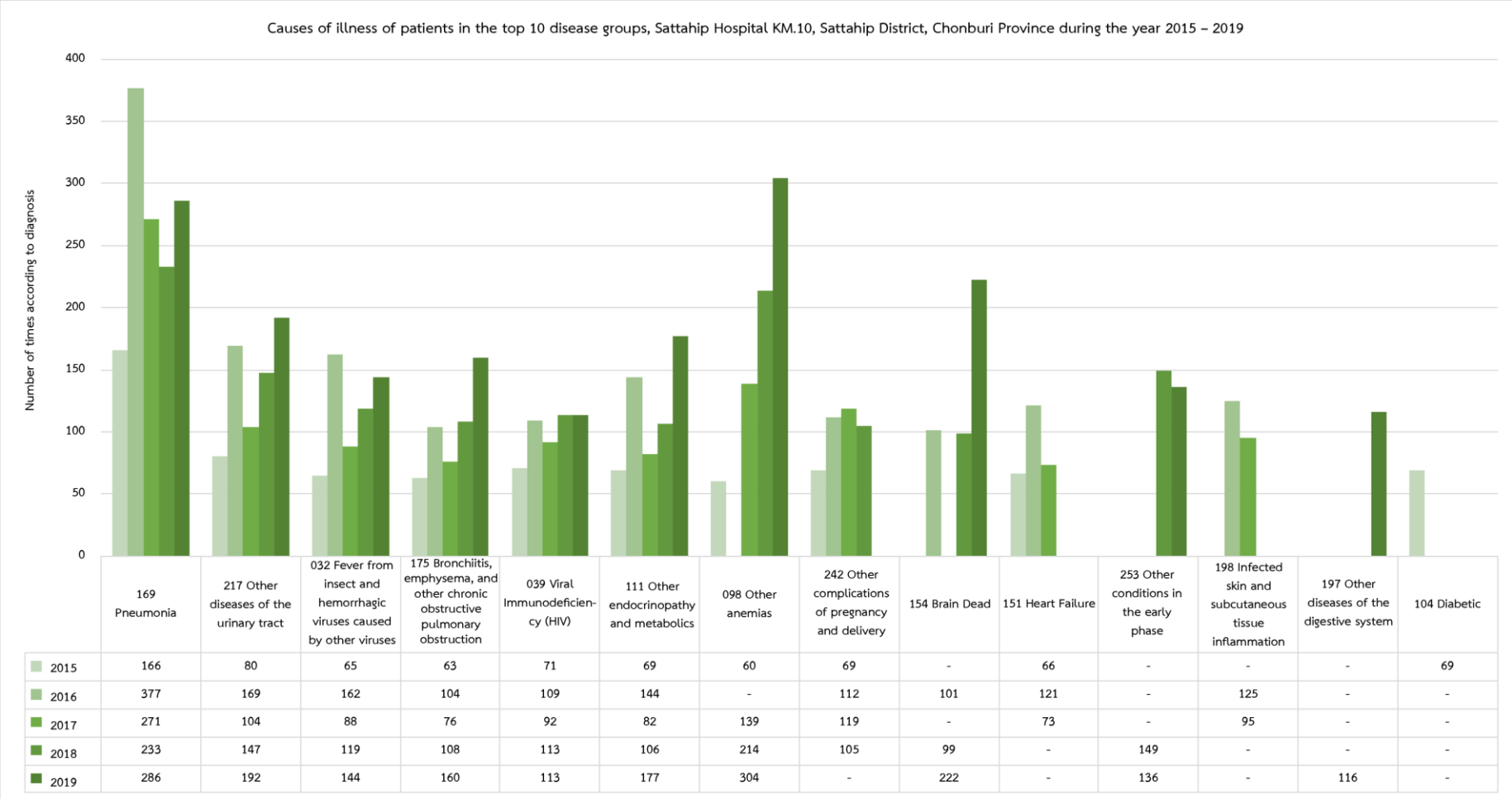


	169 Pneumonia	170 Acute Tracheobron-chitis and Acute Bronchitis	253 Other conditions in the early phase	281 Other specific injuries, unspecified and multiple areas in the body	242 Other complications of preg-nancy and delivery	175 Bronchiitis, emphysema, and other chronic obstructive pulmonary obstruction	198 Infected skin and subcu-tane-ous tissue inflammation	165 Acute neck inflammation and acute tonsillitis	032 Fever from insect and hemor-rhagic viruses caused by other viruses	165 Acute neck inflammation and acute tonsillitis	098 Other anemias	104 Diabetic	213 Disease of the tubules and tissues in the tubules	168 Influenza	185 Other diseases of the stomach tube and see Odenum	151 Unreadable Failed
2015	175	168	123	116	97	-	91	138	294	-	101	-	-	-	-	84
2016	375	254	156	190	112	114	129	209	141	-	131	-	-	-	-	-
2017	357	185	122	156	136	169	135	-	-	192	-	138	-	-	119	-
2018	403	116	114	98	94	126	119	154	-		-	97	99	-	-	-
2019	381	114	121	118	127	122	-	-	167	123	-	-	120	161	-	-

Note : - means No Data

Source: Health Data Center (HDC) Health Data Center Data Warehouse System, Rayong Provincial Public Health Office, searched at https://ryg.hdc.moph.go.th/hdc/main/index.php on 12 July 2020.

Figure 6.4-3 The graph shows the causes of illness among the top 10 patients in the Ban Chang Hospital, Ban Chang District, Rayong, between 2015 – 2019



	169 Pneumonia	217 Other diseases of the urinary tract	032 Fever from insect and hemorrhagic viruses caused by other viruses	175 Bronchiitis, emphysema, and other chronic obstructive pulmonary obstruction	039 Viral Immunodeficien-cy (HIV)	111 Other endocrinopathy and metabolics	098 Other anemias	242 Other complications of pregnancy and delivery	154 Brain Dead	151 Heart Failure	253 Other conditions in the early phase	198 Infected skin and subcutaneous tissue inflammation	197 Other diseases of the digestive system	104 Diabetic
2015	166	80	65	63	71	69	60	69	-	66	-	-	-	69
2016	377	169	162	104	109	144	-	112	101	121	-	125	-	-
2017	271	104	88	76	92	82	139	119	-	73	-	95	-	-
2018	233	147	119	108	113	106	214	105	99	-	149	-	-	-
2019	286	192	144	160	113	177	304	-	222	-	136	-	116	-

Note : - means No Data

Source: Health Data Center (HDC) Health Data Center Data Warehouse System, Chonburi Provincial Public Health Office, search http://hdc2.cbo.moph.go.th/hdc/main/index.php on 12 July 2020.

Figure 6.4 4 The graph showing the causes of illness among patients in the top 10 disease groups of Sattahip Hospital KM.10, Sattahip District, Chonburi during the year 2015 – 2019

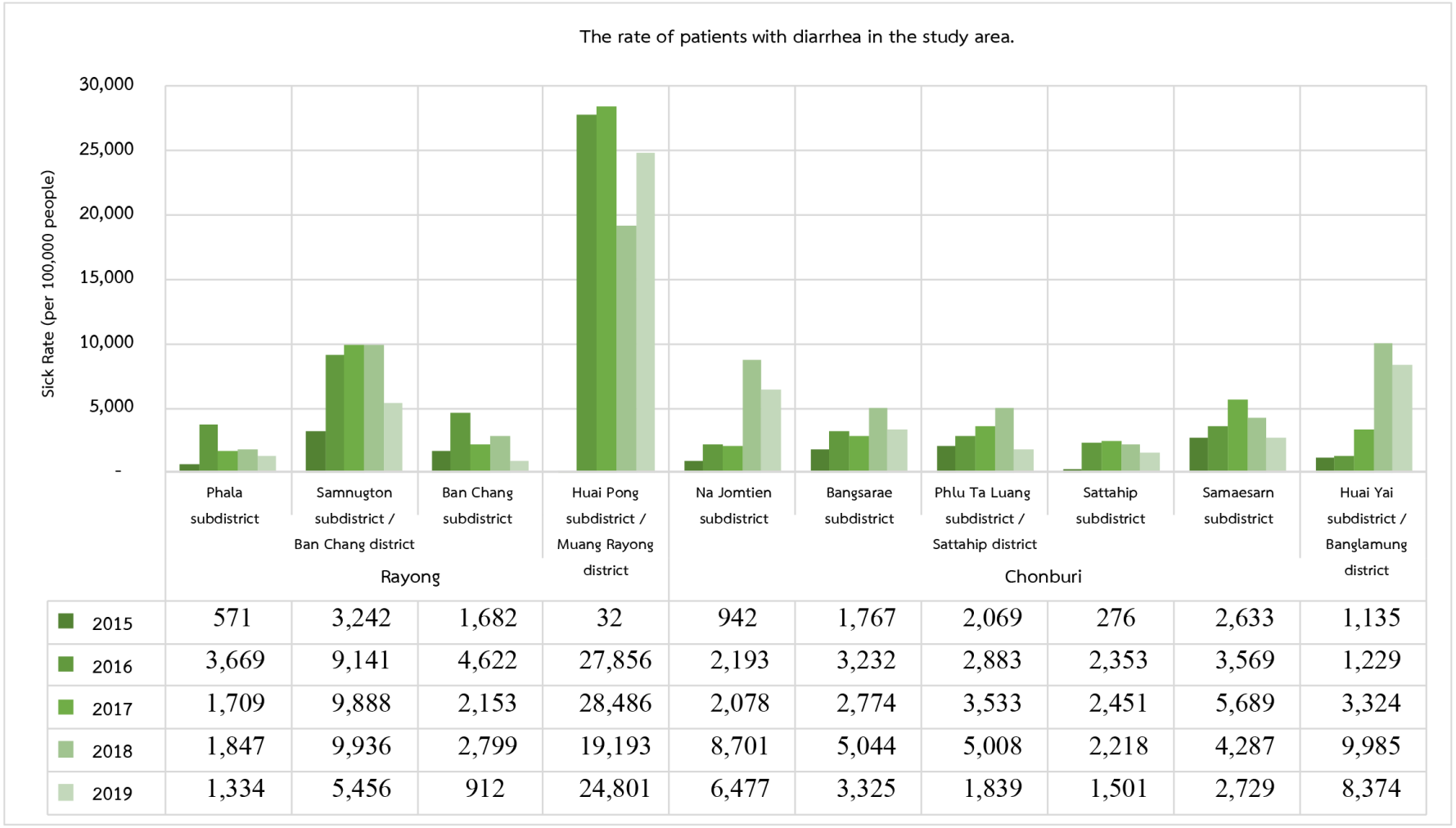
3) Key Infectious Disease Illness Statistics

In 2015-2019, it was found statistically found that diarrhea had the highest rate (maximum of approximately 28,486 patients per hundred thousand people), most commonly found in the Huaypong subdistrict, Mueang Rayong District, and Samnugton Subdistrict, Ban Chang District, Rayong, which tends to increase and decrease alternately each year. While the morbidity rate of the local population in Na Jomtien subdistrict, Sattahip district and Huay Yai subdistrict, Bang Lamung district, Chonburi was found that the incidence of diarrhea was approximately 3-4 times higher than in the year 2017, details as shown in **Figure 6.4-**5

In 2015-2019, the rate of encephalopathy were found to occur at approximately 79 cases per hundred thousand people. In 2017, it was found that the area of Huay Pong subdistrict, Mueang Rayong district, had an outbreak since 2016-2019 and in Samaesarn subdistrict, Sattahip district, Chonburi, there was a high rate of morbidity in 2017, just that one year. When considering the rate of illnesses in the Ban Chang subdistrict, Ban Chang district, Rayong was found that the trend was about 9 times higher in 2018, and no cases were found in 2019, details as shown in **Figure 6.4-**6

The rate of pneumonia between 2015-2019 were found to occur at approximately 5,356 cases per hundred thousand people. In 2017, it was mostly found in the Huaypong subdistrict, Mueang Rayong district, but with a downward trend in 2018-2019 respectively. Followed by cases in the Samaesarn subdistrict, Sattahip district, Chonburi with pneumonia, which is likely to which tends to increase and decrease alternately each year while in the Na Jomtien, Bangsarae, Phlu Ta Luang, Sattahip and Huay Yai subdistricts also has similar amount of cases as can be seen in **Figure 6.4-**7

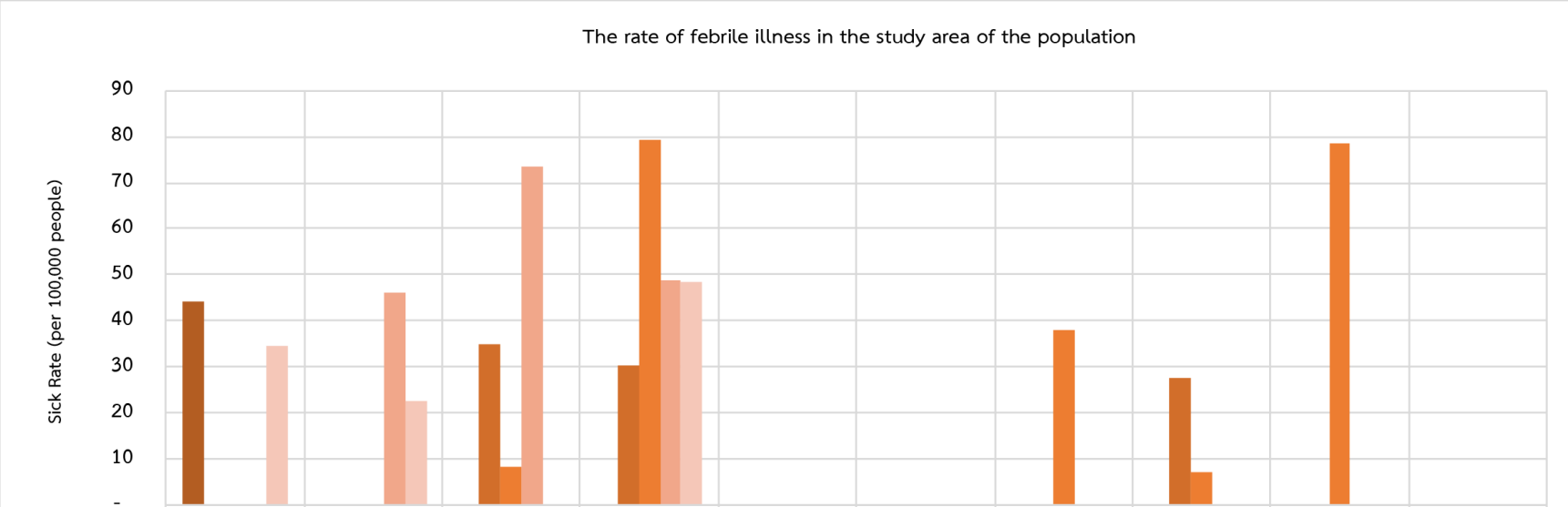
Hemorrhagic fever morbidity rates between 2015 and 2019 were found to occur at approximately 5,108 cases per hundred thousand population in 2017, most commonly found in Samaesarn subdistrict, Sattahip district, Chonburi, but with a downward trend and found that in Na Jomtien Subdistrict, Phlu Ta Luang subdistrict, Bangsarae subdistrict and Sattahip subdistrict have tendencies to increase and decrease incidence rates alternately each year. in Huay Yai subdistrict, Bang Lamung district tends to decline continuously. In addition, the morbidity rate of hemorrhagic fever was found in the area of Phala subdistrict, Samnugton subdistrict, Ban Chang subdistrict, Mueang Rayong district are relatively low. While in 2019, Huay Pong Subdistrict, Mueang Rayong district has a tendency to increase to approximately 3 times from the year 2018, details are shown in **Figure 6.4-**8



	Phala subdistrict	Samnugton subdistrict / Ban Chang district	Ban Chang subdistrict	Huai Pong subdistrict / Muang Rayong district	Na Jomtien subdistrict	Bangsarae subdistrict	Phlu Ta Luang subdistrict / Sattahip district	Sattahip subdistrict	Samaesarn subdistrict	Huai Yai subdistrict / Banglamung district
	Rayong				Chonburi					
2015	571	3,242	1,682	32	942	1,767	2,069	276	2,633	1,135
2016	3,669	9,141	4,622	27,856	2,193	3,232	2,883	2,353	3,569	1,229
2017	1,709	9,888	2,153	28,486	2,078	2,774	3,533	2,451	5,689	3,324
2018	1,847	9,936	2,799	19,193	8,701	5,044	5,008	2,218	4,287	9,985
2019	1,334	5,456	912	24,801	6,477	3,325	1,839	1,501	2,729	8,374

Source: Health Data Center (HDC) Health Data Center Data Warehouse System, Rayong Provincial Public Health Office, searched at https://ryg.hdc.moph.go.th/hdc/main/index.php on 12 July 2020 and Chonburi Provincial Public Health Office. Search http://hdc2.cbo.moph.go.th/hdc/main/index.php on 12 July 2020.

Figure 6.4 5 Diagram showing the rate of patients with diarrhea in the study area between 2015-2019

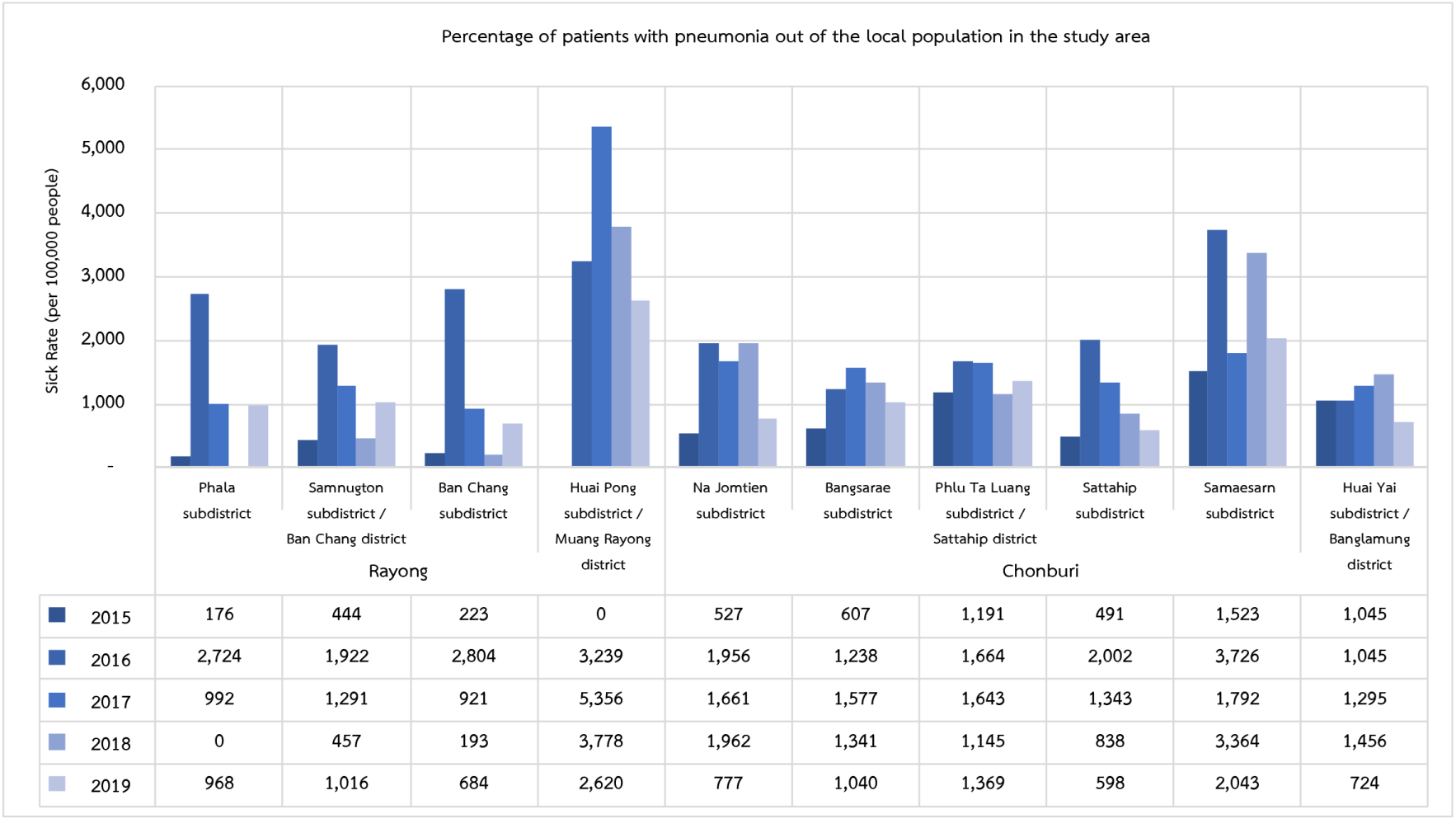


	Phala subdistrict	Samnugton subdistrict / Ban Chang district	Ban Chang subdistrict	Huai Pong subdistrict / Muang Rayong district	Na Jomtien subdistrict	Bangsarae subdistrict	Phlu Ta Luang subdistrict / Sattahip district	Sattahip subdistrict	Samaesarn subdistrict	Huai Yai subdistrict / Banglamung district
	Rayong				Chonburi					
2015	44	0	0	0	0	0	0	0	0	0
2016	0	0	35	30	0	0	0	28	0	0
2017	0	0	8	79	0	0	38	7	79	0
2018	0	46	74	49	0	0	0	0	0	0
2019	35	23	0	48	0	0	0	0	0	0

Note : 0 means no patient

Source: Health Data Center (HDC) Health Data Center Data Warehouse System, Rayong Provincial Public Health Office, searched at https://ryg.hdc.moph.go.th/hdc/main/index.php on 12 July 2020 and Chonburi Provincial Public Health Office. Search http://hdc2.cbo.moph.go.th/hdc/main/index.php on 12 July 2020.

Figure 6.4 6 Diagram showing the rate of cerebral Encephalitis in the study area population between 2015-2019

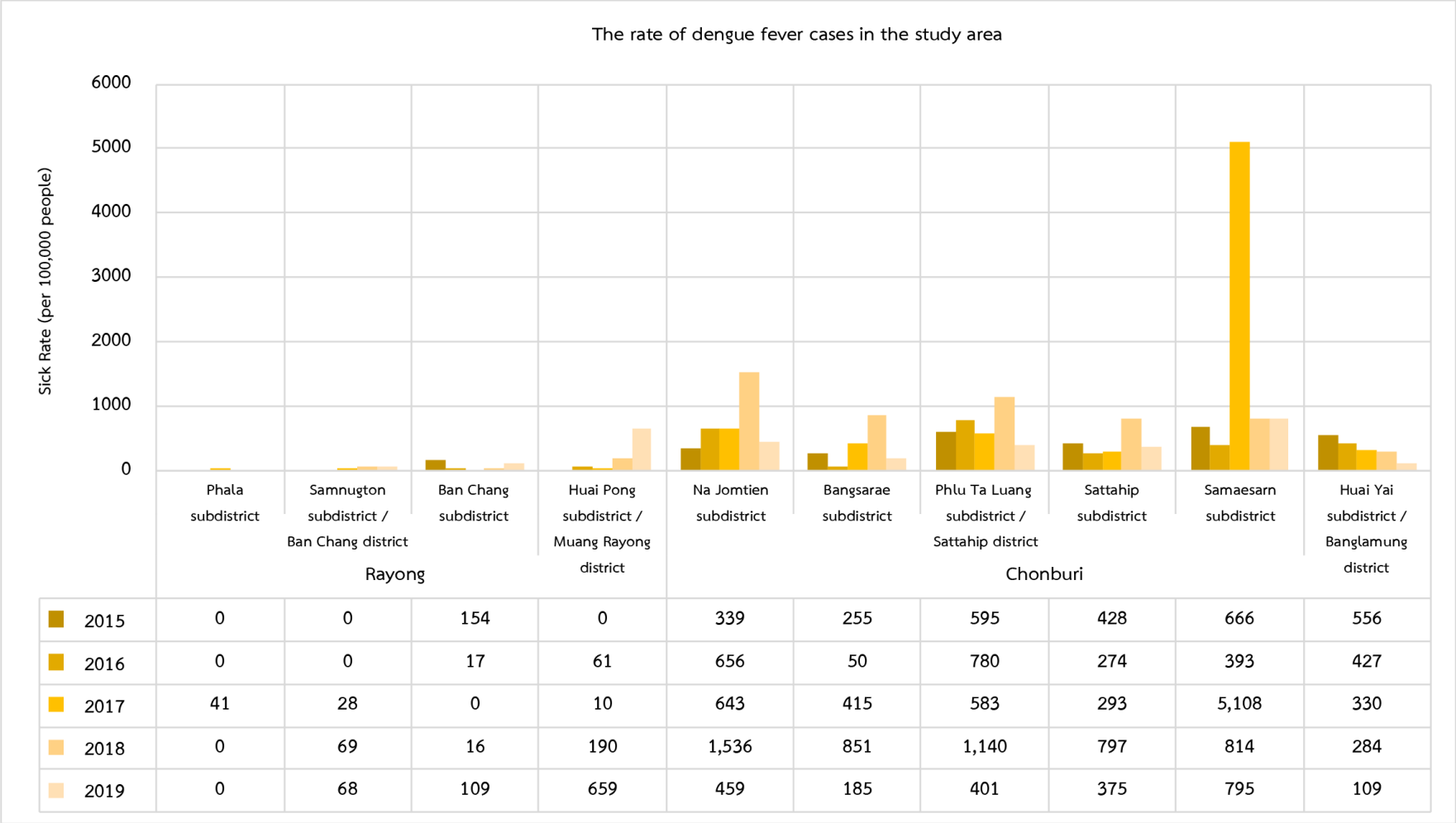


	Phala subdistrict	Samnugton subdistrict / Ban Chang district	Ban Chang subdistrict	Huai Pong subdistrict / Muang Rayong district	Na Jomtien subdistrict	Bangsarae subdistrict	Phlu Ta Luang subdistrict / Sattahip district	Sattahip subdistrict	Samaesarn subdistrict	Huai Yai subdistrict / Banglamung district
	Rayong				Chonburi					
2015	176	444	223	0	527	607	1,191	491	1,523	1,045
2016	2,724	1,922	2,804	3,239	1,956	1,238	1,664	2,002	3,726	1,045
2017	992	1,291	921	5,356	1,661	1,577	1,643	1,343	1,792	1,295
2018	0	457	193	3,778	1,962	1,341	1,145	838	3,364	1,456
2019	968	1,016	684	2,620	777	1,040	1,369	598	2,043	724

Note : 0 means no patient

Source: Health Data Center (HDC) Health Data Center Data Warehouse System, Rayong Provincial Public Health Office, searched at https://ryg.hdc.moph.go.th/hdc/main/index.php on 12 July 2020 and Chonburi Provincial Public Health Office. Search http://hdc2.cbo.moph.go.th/hdc/main/index.php on 12 July 2020.

Figure 6.4 7 Diagram showing the population rate of pneumonia in the study area between 2015-2019



	Phala subdistrict	Samnugton subdistrict / Ban Chang district	Ban Chang subdistrict	Huai Pong subdistrict / Muang Rayong district	Na Jomtien subdistrict	Bangsarae subdistrict	Phlu Ta Luang subdistrict / Sattahip district	Sattahip subdistrict	Samaesarn subdistrict	Huai Yai subdistrict / Banglamung district
	Rayong				Chonburi					
2015	0	0	154	0	339	255	595	428	666	556
2016	0	0	17	61	656	50	780	274	393	427
2017	41	28	0	10	643	415	583	293	5,108	330
2018	0	69	16	190	1,536	851	1,140	797	814	284
2019	0	68	109	659	459	185	401	375	795	109

Note : 0 means no patient

Source: Health Data Center (HDC) Health Data Center Data Warehouse System, Rayong Provincial Public Health Office, searched at https://ryg.hdc.moph.go.th/hdc/main/index.php on 12 July 2020 and Chonburi Provincial Public Health Office. Search http://hdc2.cbo.moph.go.th/hdc/main/index.php on 12 July 2020.

Figure 6.4 8 Diagram showing the rate of hemorrhagic fever cases in the study area population between 2015-2019

4) Important Uncommunicable Disease Statistics

The rates of patients with significant non-communicable diseases, including respiratory tract disease, cardiovascular disease, hypertension (I10-I15), stroke (I60-I69), chronic obstructive pulmonary disease (J44), and diabetes (E10-E14) among the local population in the study area during 2015-2019, where the trend of morbidity with these diseases increased and decreased alternately each year. An overview look found that Samnugton subdistrict, Ban Chang district, Rayong had the highest rate of illness, while in Sattahip subdistrict, Sattahip district, Chonburi were less likely to suffer from chronic disease than other areas. Details are as follows:

Respiratory illness rate (ICD 10 code is J00-J39,J60-J99) between 2015-2019 and it was found that in the Samnugton Subdistrict, Ban Chang Subdistrict and Huay Yai Subdistrict had decreased since 2017. In Sattahip Subdistrict the patient rate tend to increase, while other districts In the study area, there was an alternating trend of increasing and decreasing morbidity rates each year, as shown in **Figure 6.4-**9

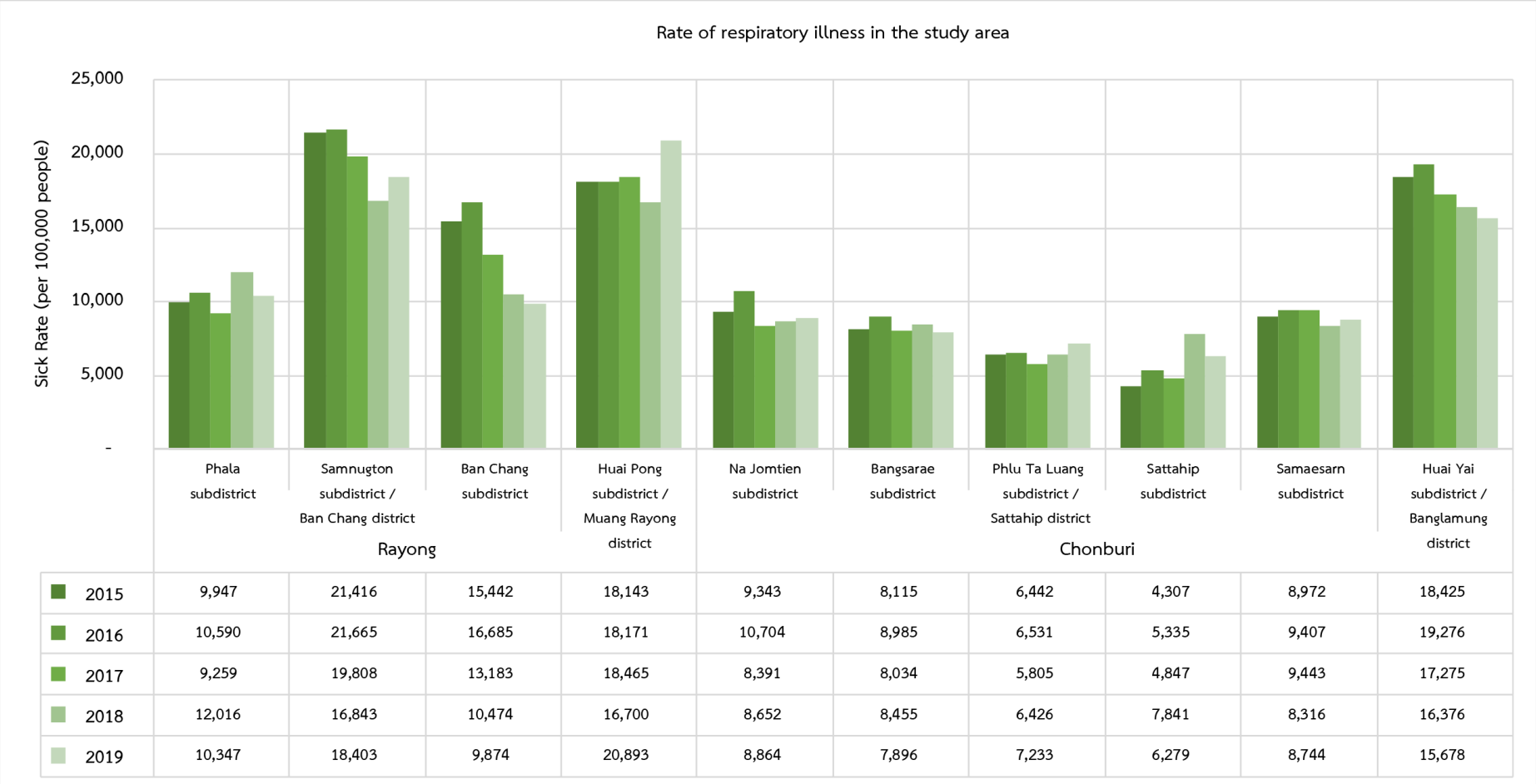
The cardiovascular disease rate (ICD 10 code is I00-I09 or I20-I28 or I30-I52) between 2015-2019 and found that in Samnugton Subdistrict, Ban Chang Subdistrict and Huay Yai Subdistrict, the patient rate has decreased since 2017. The Sattahip Subdistrict the patient rate is likely to increase. Other subdistricts in the study areas, there was an alternating trend of increasing and decreasing morbidity rates each year, as shown in **Figure 6.4-**10

High blood pressure sick rate (ICD 10 to I10-I15) between 2015-2019 and found that in Samnugton Subdistrict, Ban Chang Subdistrict and Huay Yai Subdistrict the patient rate had decreased since 2017. In Sattahip Subdistrict the patient rate tends to increase, while other subdistricts in the study area there was an alternating trend of increasing and decreasing morbidity rates each year, with details shown in **Figure 6.4-**11

Stroke sick rate (ICD 10 code to I60-I69) between 2015-2019 found that in the Samnugton Subdistrict, Ban Chang Subdistrict and Huay Yai Subdistrict the patient rate has decreased since 2017. In Sattahip Subdistrict the patient rate tends to increase, while other subdistricts in the study area there was an alternating trend of increasing and decreasing morbidity rates each year, with details shown in, as shown in **Figure 6.4-**12

The patient rate with Chronic Obstructive Pulmonary Disease (ICD 10 to J44) between 2015-2019 found that in the Samnugton Subdistrict, Ban Chang Subdistrict and Huay Yai Subdistrict the patient rate has decreased since 2017. In Sattahip Subdistrict the patient rate tends to increase, while other subdistricts in the study area there was an alternating trend of increasing and decreasing morbidity rates each year, with details shown in, as shown in **Figure 6.4-**13

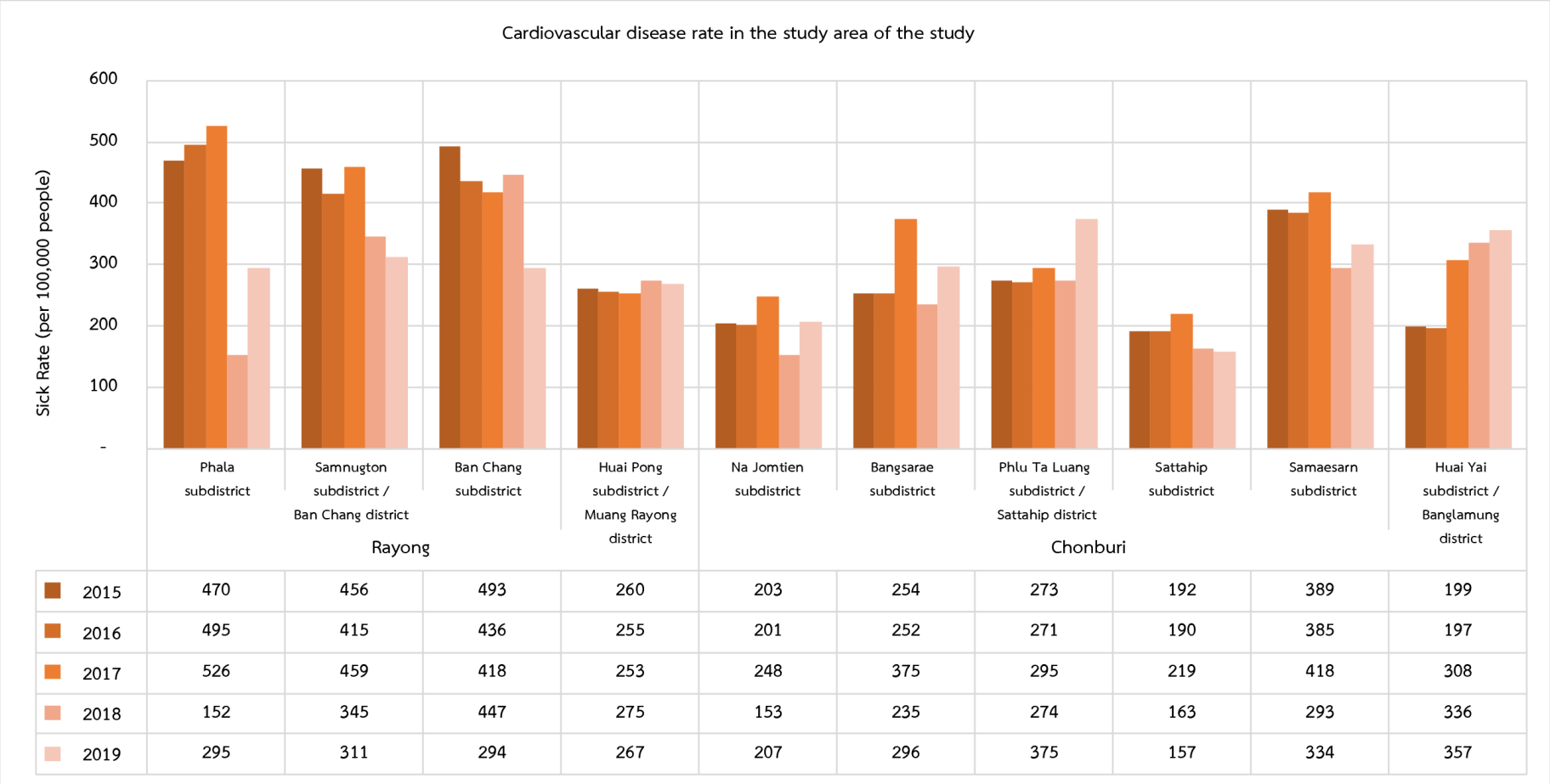
The patient rate with diabetes (ICD 10 code to E10-E14) between 2015-2019 was found that in Samnugton subdistrict, Ban Chang subdistrict and Huay Yai subdistrict, the patient rate has decreased since 2017. In addition, Sattahip subdistrict tends to increase and the other subdistricts in the study area tend to increase and decrease alternately between the years. Details are shown in **Figure 6.4-**14



	Phala subdistrict	Samnugton subdistrict / Ban Chang district	Ban Chang subdistrict	Huai Pong subdistrict / Muang Rayong district	Na Jomtien subdistrict	Bangsarae subdistrict	Phlu Ta Luang subdistrict / Sattahip district	Sattahip subdistrict	Samaesarn subdistrict	Huai Yai subdistrict / Banglamung district
	Rayong				Chonburi					
2015	9,947	21,416	15,442	18,143	9,343	8,115	6,442	4,307	8,972	18,425
2016	10,590	21,665	16,685	18,171	10,704	8,985	6,531	5,335	9,407	19,276
2017	9,259	19,808	13,183	18,465	8,391	8,034	5,805	4,847	9,443	17,275
2018	12,016	16,843	10,474	16,700	8,652	8,455	6,426	7,841	8,316	16,376
2019	10,347	18,403	9,874	20,893	8,864	7,896	7,233	6,279	8,744	15,678

Source: Health Data Center (HDC) Health Data Center Data Warehouse System, Rayong Provincial Public Health Office, searched at https://ryg.hdc.moph.go.th/hdc/main/index.php on 12 July 2020 and Chonburi Provincial Public Health Office. Search http://hdc2.cbo.moph.go.th/hdc/main/index.php on 12 July 2020.

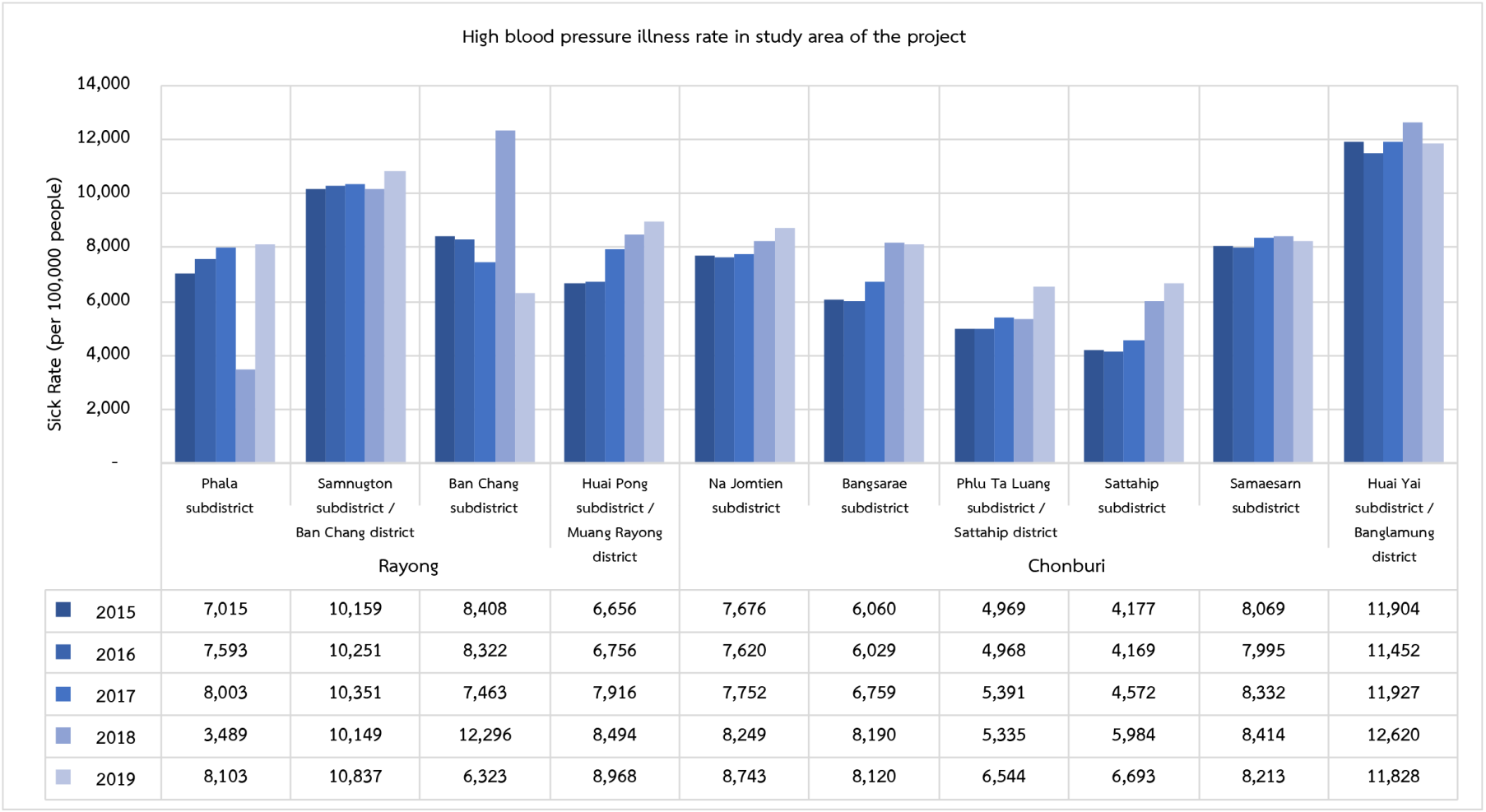
Figure 6.4 9 Diagram showing the rate of respiratory illness of the study area population between 2015-2019



	Phala subdistrict	Samnugton subdistrict / Ban Chang district	Ban Chang subdistrict	Huai Pong subdistrict / Muang Rayong district	Na Jomtien subdistrict	Bangsarae subdistrict	Phlu Ta Luang subdistrict / Sattahip district	Sattahip subdistrict	Samaesarn subdistrict	Huai Yai subdistrict / Banglamung district
	Rayong				Chonburi					
2015	470	456	493	260	203	254	273	192	389	199
2016	495	415	436	255	201	252	271	190	385	197
2017	526	459	418	253	248	375	295	219	418	308
2018	152	345	447	275	153	235	274	163	293	336
2019	295	311	294	267	207	296	375	157	334	357

Source: Health Data Center (HDC) Health Data Center Data Warehouse System, Rayong Provincial Public Health Office, searched at https://ryg.hdc.moph.go.th/hdc/main/index.php on 12 July 2020 and Chonburi Provincial Public Health Office. Search http://hdc2.cbo.moph.go.th/hdc/main/index.php on 12 July 2020.

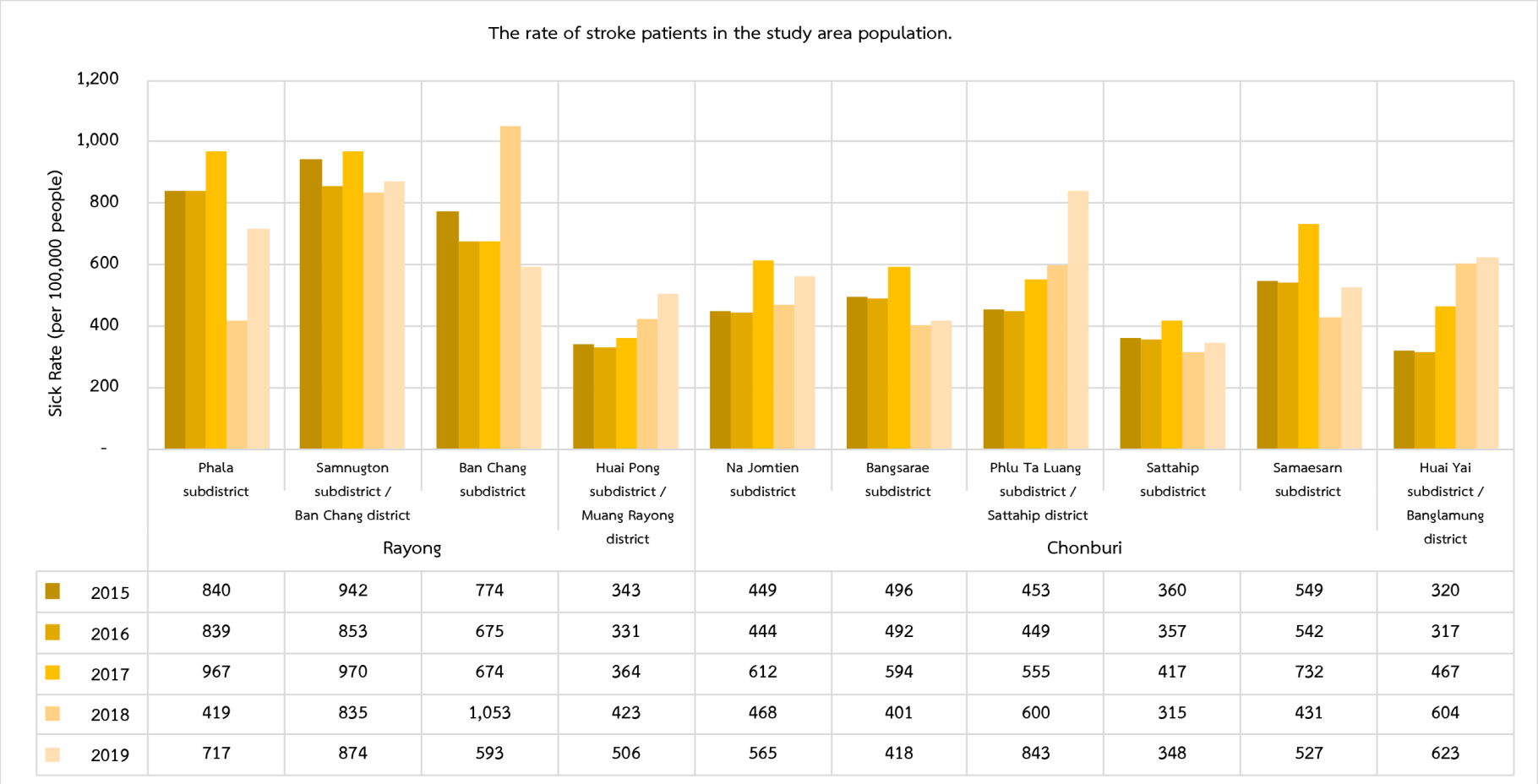
Figure 6.4 10 Diagram showing the rate of cardiovascular disease in the study area between 2015-2019



	Phala subdistrict	Samnugton subdistrict / Ban Chang district	Ban Chang subdistrict	Huai Pong subdistrict / Muang Rayong district	Na Jomtien subdistrict	Bangsarae subdistrict	Phlu Ta Luang subdistrict / Sattahip district	Sattahip subdistrict	Samaesarn subdistrict	Huai Yai subdistrict / Banglamung district
	Rayong				Chonburi					
2015	7,015	10,159	8,408	6,656	7,676	6,060	4,969	4,177	8,069	11,904
2016	7,593	10,251	8,322	6,756	7,620	6,029	4,968	4,169	7,995	11,452
2017	8,003	10,351	7,463	7,916	7,752	6,759	5,391	4,572	8,332	11,927
2018	3,489	10,149	12,296	8,494	8,249	8,190	5,335	5,984	8,414	12,620
2019	8,103	10,837	6,323	8,968	8,743	8,120	6,544	6,693	8,213	11,828

Source: Health Data Center (HDC) Health Data Center Data Warehouse System, Rayong Provincial Public Health Office, searched at https://ryg.hdc.moph.go.th/hdc/main/index.php on 12 July 2020 and Chonburi Provincial Public Health Office. Search http://hdc2.cbo.moph.go.th/hdc/main/index.php on 12 July 2020.

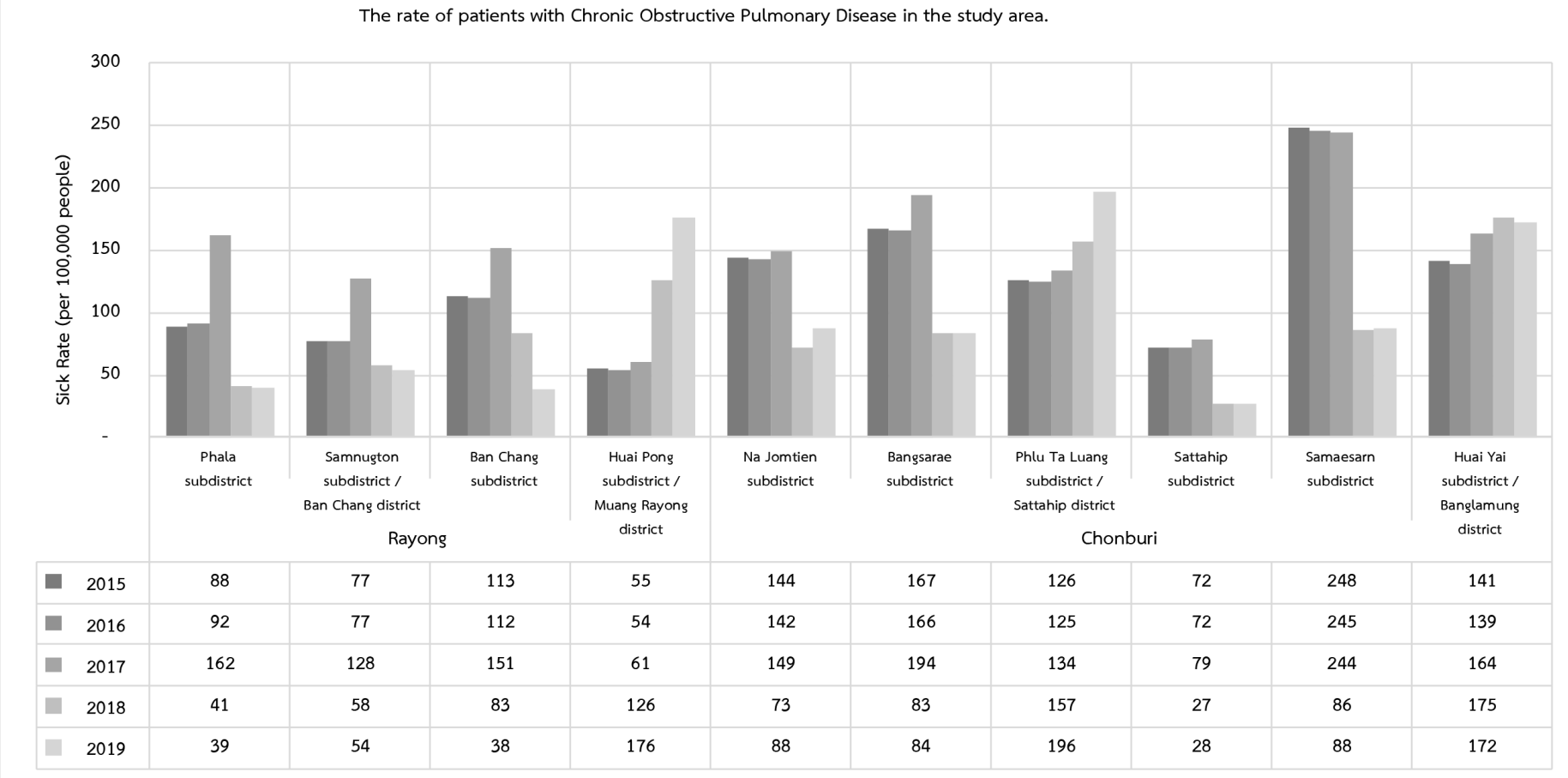
Figure 6.4□11 Diagram showing the rate of patients with high blood pressure in the study area between 2015-2019



	Phala subdistrict	Samnugton subdistrict / Ban Chang district	Ban Chang subdistrict	Huai Pong subdistrict / Muang Rayong district	Na Jomtien subdistrict	Bangsarae subdistrict	Phlu Ta Luang subdistrict / Sattahip district	Sattahip subdistrict	Samaesarn subdistrict	Huai Yai subdistrict / Banglamung district
2015	840	942	774	343	449	496	453	360	549	320
2016	839	853	675	331	444	492	449	357	542	317
2017	967	970	674	364	612	594	555	417	732	467
2018	419	835	1,053	423	468	401	600	315	431	604
2019	717	874	593	506	565	418	843	348	527	623

Source: Health Data Center (HDC) Health Data Center Data Warehouse System, Rayong Provincial Public Health Office, searched at https://ryg.hdc.moph.go.th/hdc/main/index.php on 12 July 2020 and Chonburi Provincial Public Health Office. Search http://hdc2.cbo.moph.go.th/hdc/main/index.php on 12 July 2020.

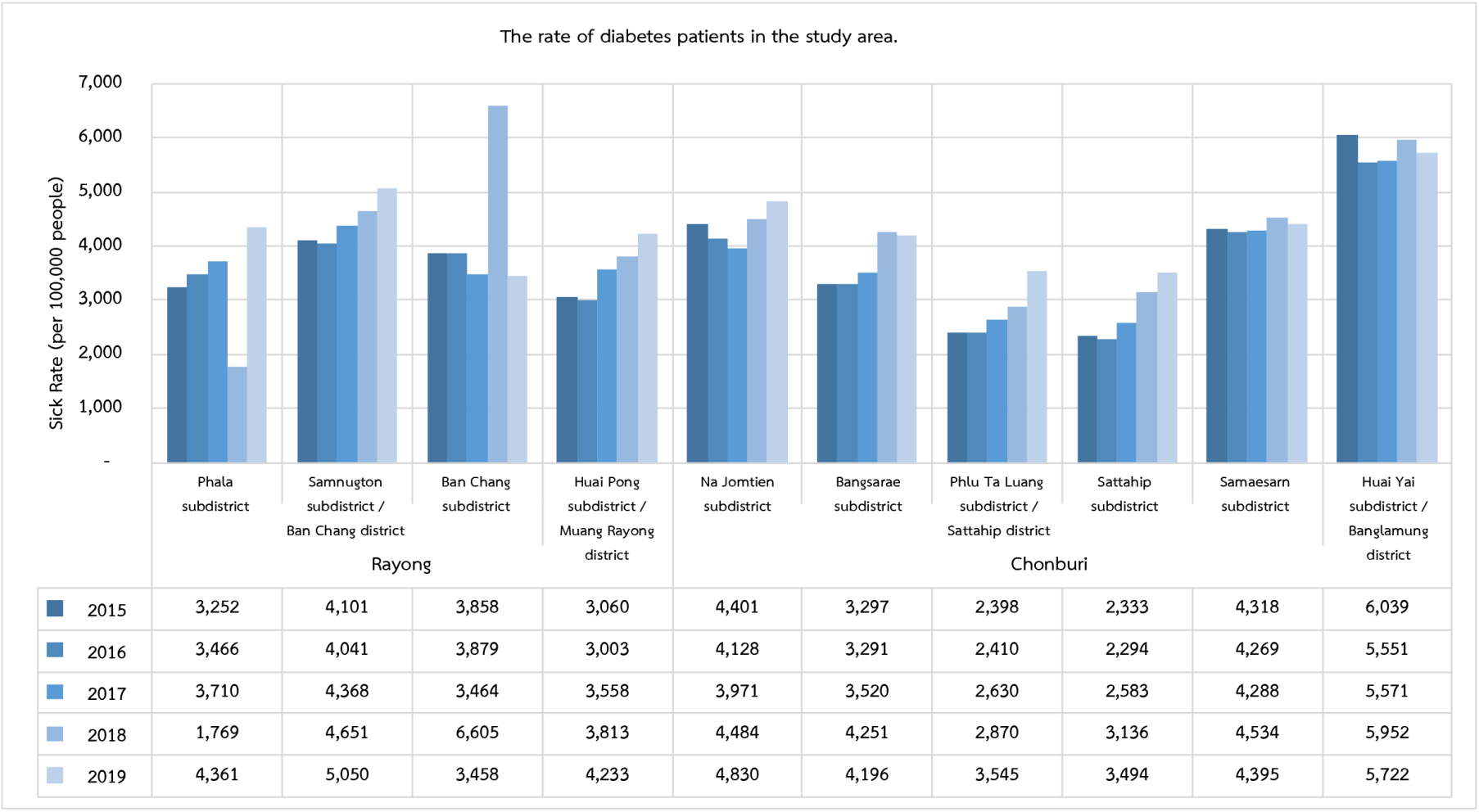
Figure 6.4 12 Diagram showing the rate of stroke patients in the study area between 2015-2019



	Phala subdistrict	Samnugton subdistrict / Ban Chang district	Ban Chang subdistrict	Huai Pong subdistrict / Muang Rayong district	Na Jomtien subdistrict	Bangsarae subdistrict	Phlu Ta Luang subdistrict / Sattahip district	Sattahip subdistrict	Samaesarn subdistrict	Huai Yai subdistrict / Banglamung district
2015	88	77	113	55	144	167	126	72	248	141
2016	92	77	112	54	142	166	125	72	245	139
2017	162	128	151	61	149	194	134	79	244	164
2018	41	58	83	126	73	83	157	27	86	175
2019	39	54	38	176	88	84	196	28	88	172

Source: Health Data Center (HDC) Health Data Center Data Warehouse System, Rayong Provincial Public Health Office, searched at https://ryg.hdc.moph.go.th/hdc/main/index.php on 12 July 2020 and Chonburi Provincial Public Health Office. Search http://hdc2.cbo.moph.go.th/hdc/main/index.php on 12 July 2020.

Figure 6.4 13 Diagram showing the rate of patients with COPD in the study area between 2015-2019



	Phala subdistrict	Samnugton subdistrict / Ban Chang district	Ban Chang subdistrict	Huai Pong subdistrict / Muang Rayong district	Na Jomtien subdistrict	Bangsarae subdistrict	Phlu Ta Luang subdistrict / Sattahip district	Sattahip subdistrict	Samaesarn subdistrict	Huai Yai subdistrict / Banglamung district
	Rayong				Chonburi					
2015	3,252	4,101	3,858	3,060	4,401	3,297	2,398	2,333	4,318	6,039
2016	3,466	4,041	3,879	3,003	4,128	3,291	2,410	2,294	4,269	5,551
2017	3,710	4,368	3,464	3,558	3,971	3,520	2,630	2,583	4,288	5,571
2018	1,769	4,651	6,605	3,813	4,484	4,251	2,870	3,136	4,534	5,952
2019	4,361	5,050	3,458	4,233	4,830	4,196	3,545	3,494	4,395	5,722

Source: Health Data Center (HDC) Health Data Center Data Warehouse System, Rayong Provincial Public Health Office, searched at https://ryg.hdc.moph.go.th/hdc/main/index.php on 12 July 2020 and Chonburi Provincial Public Health Office. Search http://hdc2.cbo.moph.go.th/hdc/main/index.php on 12 July 2020.

Figure 6.4 14 Diagram showing the population's diabetes sick rate in the study area between 2015-2019

5) Cause of death

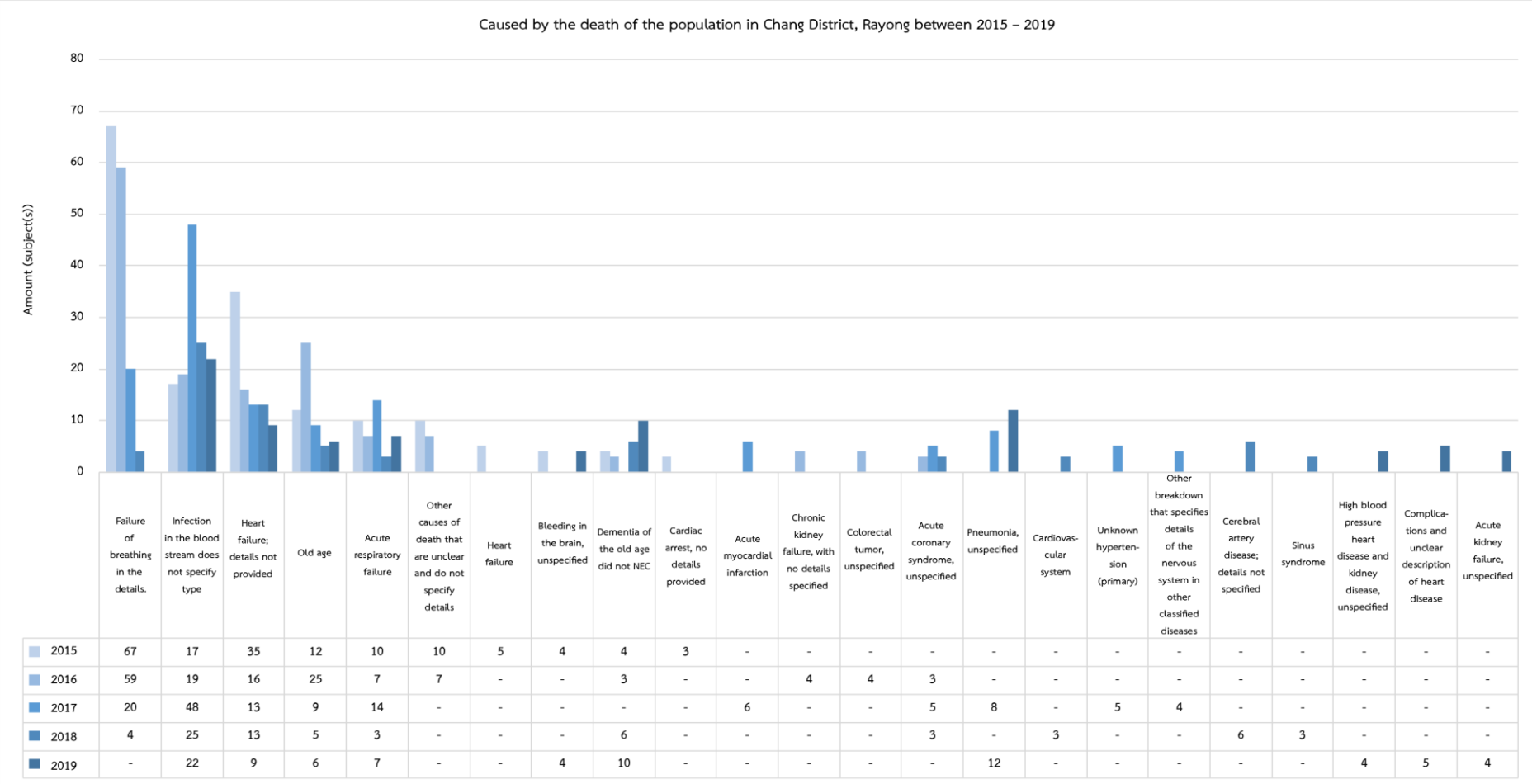
The cause of death from Ban Chang district during the year 2015-2019 was respiratory failure, with no details as high as 67 persons in 2015 and continuously decreased. Second, the infection in the blood stream with no identification at the highest of 48 persons in 2017, heart failure with no details of up to 35 persons in 2015, Old age highest up to 25 persons in 2016 and acute respiratory failure at highest of 14 persons in 2017 respectively, details are as follows **Figure 6.4-**15

The cause of death in the population in the Sattahip district is mostly caused by unknown sepsis with 90 people, the highest of infection in 2016 with the trend decreasing in the next year. Followed by the elderly, up to 58 cases in 2015, which tends to increase and decrease alternating, as well as heart failure, not specifying details, and heart failure with details shown in **Figure 6.4-**16

6) Mental health status

Psychiatric outpatients that came to the nursing home in Ban Chang District, Rayong during 2017-2019 were mainly due to psychosis and behavior caused by the usage of neuropsychiatric actives. The number of patients is likely to steadily increase from 313 in 2017 to 663 patients in 2019. Followed by neurosis, a disorder related to stress and somatoform disorder. The trend was relatively high, about 534 cases, followed by schizophrenia, schizophrenia behaviors and delusions, which tended to increase and decrease in number of cases alternately. The details are shown as follows **Figure 6.4-17** Graph

For Sattahip district, Chonburi with psychiatric outpatients services during 2017-2019, was due to mental and behavioral disorders caused by the use of psychotropic substances, as was the case with Ban Chang District, while Schizophrenia, Schizophrenic behavior and delusions, schizophrenia group mood disorders and depression had a tendency for roughly the same amount of patients. Every disease group has a tendency of increased number of patients receiving treatment every year, as per details shown in **Figure 6.4-**18 Graph

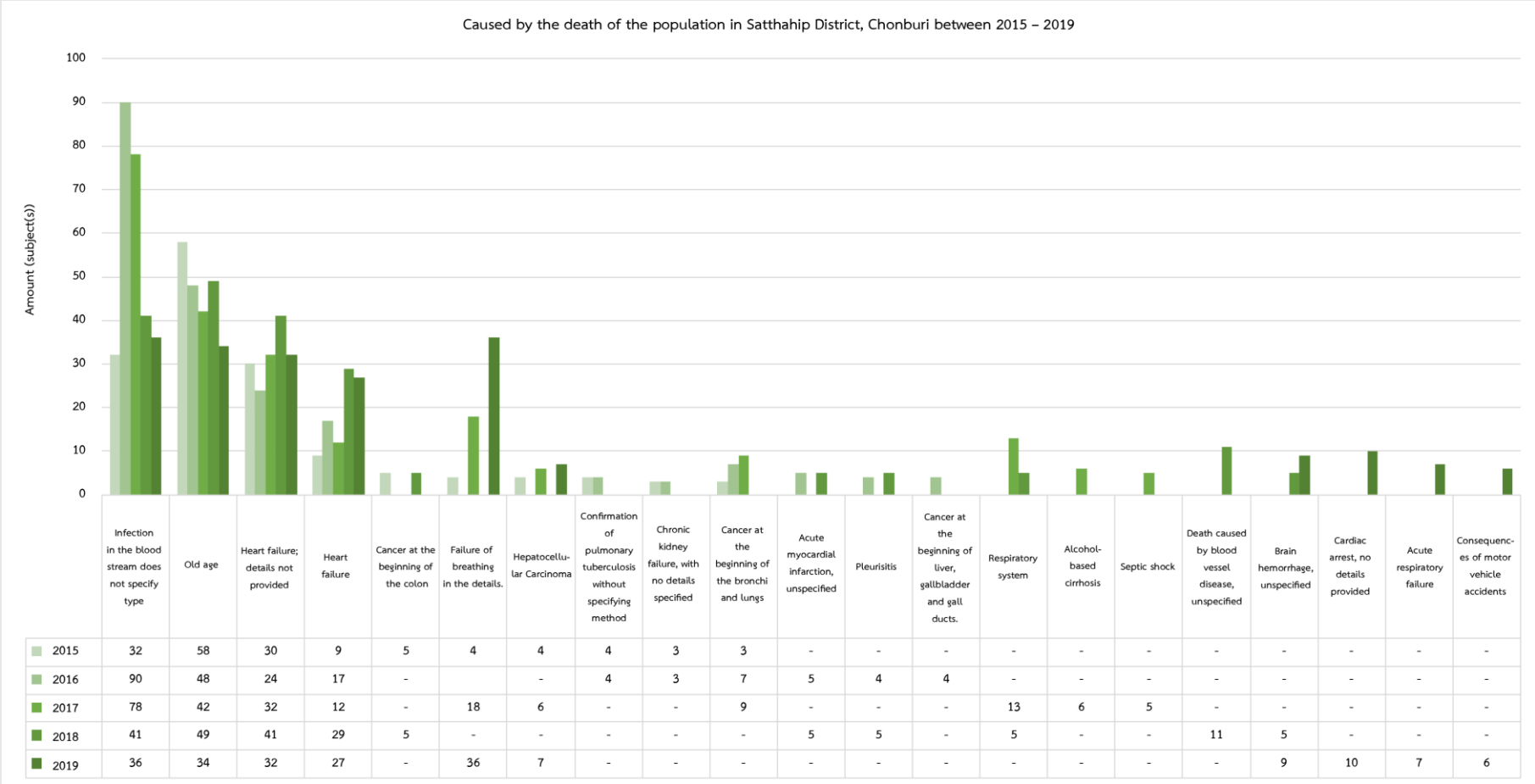


	Failure of breathing in the details.	Infection in the blood stream does not specify type	Heart failure; details not provided	Old age	Acute respiratory failure	Other causes of death that are unclear and do not specify details	Heart failure	Bleeding in the brain, unspecified	Dementia of the old age did not NEC	Cardiac arrest, no details provided	Acute myocardial infarction	Chronic kidney failure, with no details specified	Colorectal tumor, unspecified	Acute coronary syndrome, unspecified	Pneumonia, unspecified	Cardiovas-cular system	Unknown hyperten-sion (primary)	Other breakdown that specifies details of the nervous system in other classified diseases	Cerebral artery disease; details not specified	Sinus syndrome	High blood pressure heart disease and kidney disease, unspecified	Complica-tions and unclear description of heart disease	Acute kidney failure, unspecified
2015	67	17	35	12	10	10	5	4	4	3	-	-	-	-	-	-	-	-	-	-	-	-	-
2016	59	19	16	25	7	7	-	-	3	-	-	4	4	3	-	-	-	-	-	-	-	-	-
2017	20	48	13	9	14	-	-	-	-	-	6	-	-	5	8	-	5	4	-	-	-	-	-
2018	4	25	13	5	3	-	-	-	6	-	-	-	-	3	-	3	-	-	6	3	-	-	-
2019	-	22	9	6	7	-	-	4	10	-	-	-	-	-	12	-	-	-	-	-	4	5	4

Note : - means No Data

Source: Health Data Center (HDC) Health Data Center Data Warehouse System, Rayong Provincial Public Health Office, searched at https://ryg.hdc.moph.go.th/hdc/main/index.php on 12 July 2020 and Chonburi Provincial Public Health Office. Search http://hdc2.cbo.moph.go.th/hdc/main/index.php on 12 July 2020.

Figure 6.4 15 Diagram showing the cause of death among the population in the Ban Chang district, Rayong between 2015-2019

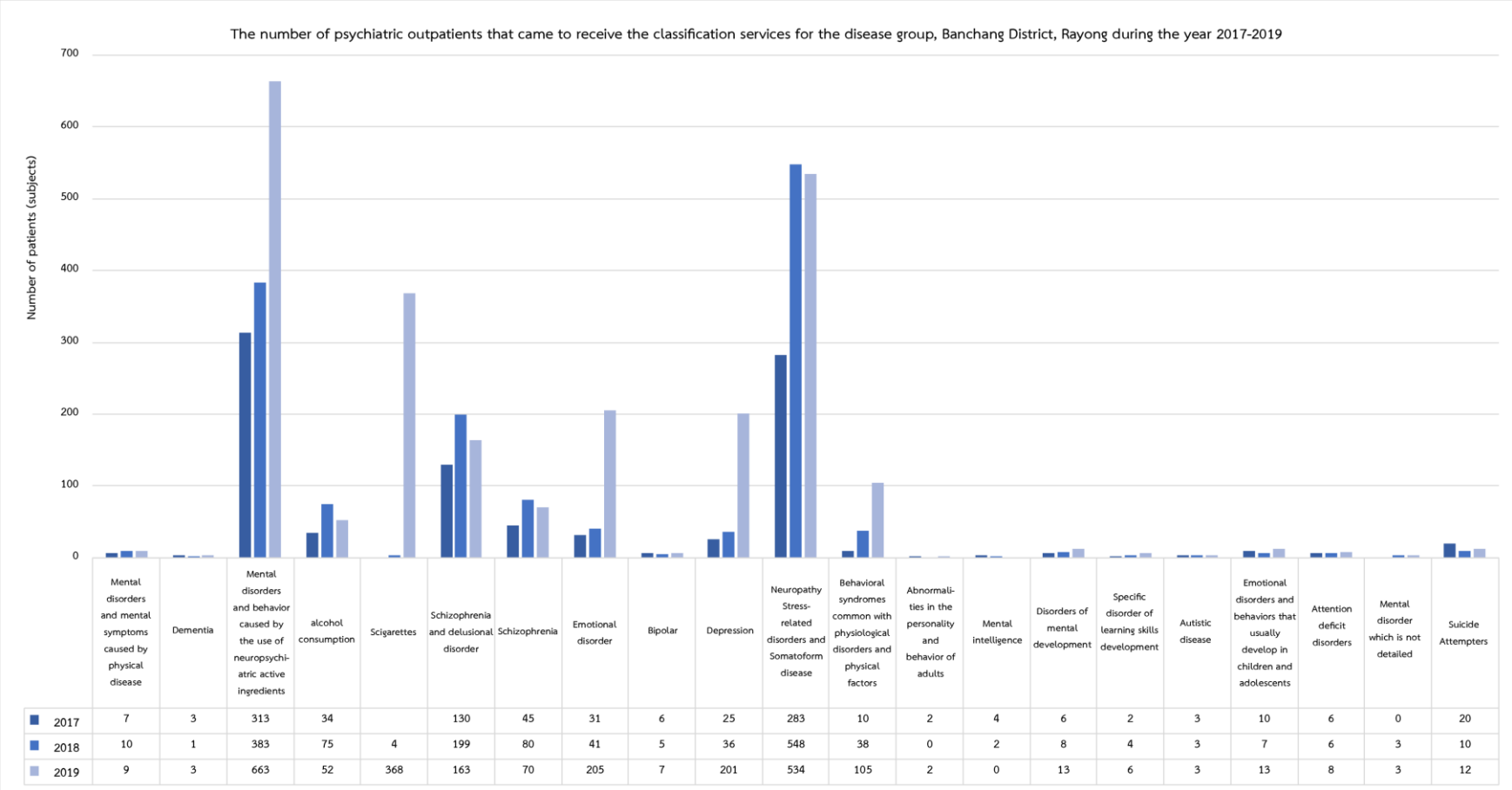


	Infection in the blood stream does not specify type	Old age	Heart failure; details not provided	Heart failure	Cancer at the beginning of the colon	Failure of breathing in the details.	Hepatocellu-lar Carcinoma	Confirmation of pulmonary tuberculosis without specifying method	Chronic kidney failure, with no details specified	Cancer at the beginning of the bronchi and lungs	Acute myocardial infarction, unspecified	Pleurisitis	Cancer at the beginning of liver, gallbladder and gall ducts.	Respiratory system	Alcohol-based cirrhosis	Septic shock	Death caused by blood vessel disease, unspecified	Brain hemorrhage, unspecified	Cardiac arrest, no details provided	Acute respiratory failure	Consequenc-es of motor vehicle accidents
2015	32	58	30	9	5	4	4	4	3	3	-	-	-	-	-	-	-	-	-	-	-
2016	90	48	24	17	-		-	4	3	7	5	4	4	-	-	-	-	-	-	-	-
2017	78	42	32	12	-	18	6	-	-	9	-	-	-	13	6	5	-	-	-	-	-
2018	41	49	41	29	5	-	-	-	-	-	5	5	-	5	-	-	11	5	-	-	-
2019	36	34	32	27	-	36	7	-	-	-	-	-	-	-	-	-	-	9	10	7	6

Note : - means No Data

Source: Health Data Center (HDC) Health Data Center Data Warehouse System, Chonburi Provincial Public Health Office, search http://hdc2.cbo.moph.go.th/hdc/main/index.php on 12 July 2020.

Figure 6.4 16 Diagram showing the causes of death among the population in Sattahip District, Chonburi between 2015-2019

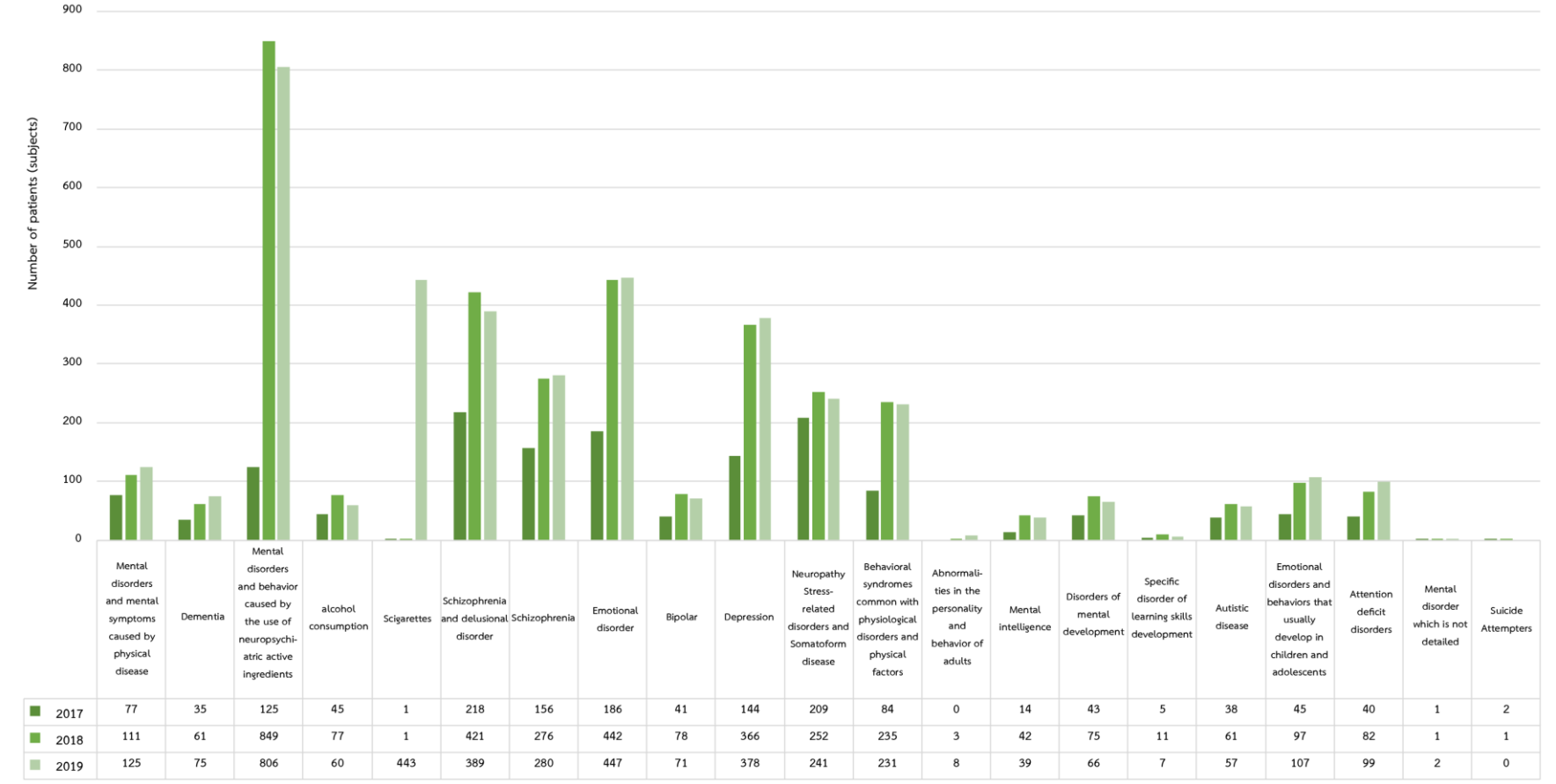


	Mental disorders and mental symptoms caused by physical disease	Dementia	Mental disorders and behavior caused by the use of neuropsychi-atric active ingredients	alcohol consumption	Scigarettes	Schizophrenia and delusional disorder	Schizophrenia	Emotional disorder	Bipolar	Depression	Neuropathy Stress-related disorders and Somatoform disease	Behavioral syndromes common with physiological disorders and physical factors	Abnormali-ties in the personality and behavior of adults	Mental intelligence	Disorders of mental development	Specific disorder of learning skills development	Autistic disease	Emotional disorders and behaviors that usually develop in children and adolescents	Attention deficit disorders	Mental disorder which is not detailed	Suicide Attempters
2017	7	3	313	34		130	45	31	6	25	283	10	2	4	6	2	3	10	6	0	20
2018	10	1	383	75	4	199	80	41	5	36	548	38	0	2	8	4	3	7	6	3	10
2019	9	3	663	52	368	163	70	205	7	201	534	105	2	0	13	6	3	13	8	3	12

Note : - means No Data

Source: Health Data Center (HDC) Health Data Center Data Warehouse System, Rayong Provincial Public Health Office, searched at https://ryg.hdc.moph.go.th/hdc/main/index.php on 12 July 2020.

Figure 6.4-17 Graphs howing the number of psychiatric outpatients that came to receive classification services for the disease group, Ban Chang district, Rayong between 2015-2019



	Mental disorders and mental symptoms caused by physical disease	Dementia	Mental disorders and behavior caused by the use of neuropsychi-atric active ingredients	alcohol consumption	Scigarettes	Schizophrenia and delusional disorder	Schizophrenia	Emotional disorder	Bipolar	Depression	Neuropathy Stress-related disorders and Somatoform disease	Behavioral syndromes common with physiological disorders and physical factors	Abnormali-ties in the personality and behavior of adults	Mental intelligence	Disorders of mental development	Specific disorder of learning skills development	Autistic disease	Emotional disorders and behaviors that usually develop in children and adolescents	Attention deficit disorders	Mental disorder which is not detailed	Suicide Attempters
2017	77	35	125	45	1	218	156	186	41	144	209	84	0	14	43	5	38	45	40	1	2
2018	111	61	849	77	1	421	276	442	78	366	252	235	3	42	75	11	61	97	82	1	1
2019	125	75	806	60	443	389	280	447	71	378	241	231	8	39	66	7	57	107	99	2	0

Note : - means No Data

Source: Health Data Center (HDC) Health Data Center Data Warehouse System, Chonburi Provincial Public Health Office, search http://hdc2.cbo.moph.go.th/hdc/main/index.php on 12 July 2020.

Figure 6.4-18 Graphshowing the number of psychiatric outpatients that came to receive the classification service for the disease group, Sattahip District, Chonburi during the year 2015-2019

6.4.2.6 Accidents and community safety

1) Accidental Injury Statistics

According to the 2014-2018 accident and other accidents statistics in Rayong, the highest cause of injury were the transportation accidents, followed by exposure to object mechanical forces and contact with animal mechanical forces, respectively. Details are shown in **Table 6.4-**10 Number

Table 6.4-10 Numberof statistics of injuries from accidents and other incidents in Rayong 2014-2018

[unintelligible]	Number of injuries caused by accident (person)				
	2014	2015	2016	2017	2018
1. Transportation Accident	34,912	37,192	38,283	38,934	37,217
2. Other accidents					
2.1 Falls, Falls	13,607	13,795	14,804	16,343	16,955
2.2 Contact with mechanical forces, objects, things	31,114	28,990	29,267	30,628	29,370
2.3 Contact with animal force	23,010	20,990	22,841	21,894	31,256
2.4 Falling into the water, drowning	99	60	101	61	87
2.5 Threatens breathing	66	54	55	53	110
2.6 Contact with electricity, radiation and temperature	859	908	707	732	377
2.7 Exposure to smoke, fire and flame	396	242	340	346	213
2.8 Contact with heat	1,073	1,012	1,227	1,207	957
2.9 Contact with poison from animals or plants	2,641	2,653	2,749	2,783	2,368
2.10 Exposed to natural energy	122	128	83	55	67
2.11 Contact with toxic and other substances	428	515	639	502	509
2.12 Over exertion	213	240	239	334	316
2.13 Exposure to unknown material	132	111	78	78	713
3. Attacks by various methods.	743	770	751	678	676
4. Has been attacked by various methods	5,449	5,151	4,760	4,613	4,194
5. Unintentional injury	2,164	1,975	2,265	1,795	1,748
6. Proceeding legally or through war.	3	1	2	1	2
7. Don't know the cause or intent	49	31	48	31	13
Total	**117,080**	**114,568**	**119,239**	**121,068**	**127,148**

Source: Rayong Provincial Public Health Office

According to the 2014-2018 accident and other accidents statistics in the Chonburi, the highest cause of accident was due to transportation, followed by exposure to mechanical forces, objects, and mechanical contact with animals respectively. Details are shown in **Table 6.4-**11 Number

Table 6.4-11 Numberof statistics of injuries from accidents and other incidents in Chonburi 2014-2018

[unintelligible]	Number of injuries caused by accident (person)				
	2014	**2015**	**2016**	**2017**	**2018**
1. Transportation Accident	36,505	46,385	50,509	48,077	46,530
2. Other accidents					
2.1 Falls, Falls	16,721	22,044	24,775	24,906	25,267
2.2 Contact with mechanical forces, objects, things	32,019	38,007	38,806	38,666	36,881
2.3 Contact with animal force	22,287	28,480	30,098	31,752	44,275
2.4 Falling into the water, drowning	103	153	167	151	187
2.5 Threatens breathing	44	77	162	129	161
2.6 Contact with electricity, radiation and temperature	935	1,035	1,202	1,245	1,247
2.7 Exposure to smoke, fire and flame	184	199	225	266	275
2.8 Contact with heat	1,027	1,303	1,350	1,455	1,463
2.9 Contact with poison from animals or plants	3,616	4,381	4,417	4,680	5,204
2.10 Exposed to natural energy	60	63	44	24	34
2.11 Contact with toxic and other substances	794	1,107	1,103	1,203	1,465
2.12 Over exertion	337	371	561	537	593
2.13 Exposure to unknown material	1,503	1,510	1,515	1,115	1,470
3. Attacks by various methods.	686	891	886	826	854
4. Has been attacked by various methods	7,040	8,461	7,315	6,969	6,993
5. Unintentional injury	1,713	2,245	2,559	3,710	5,037
6. Proceeding legally or through war.	0	0	67	287	229
7. Don't know the cause or intent	458	1,468	1,840	2,212	2,293
Total	**126,032**	**158,180**	**167,601**	**168,210**	**180,458**

Source: Chonburi Provincial Public Health Office

2) Crash Case Statistics

Carrying out of project operations increases the chance of accidents from construction phase activities such as transportation of materials and equipment, transportation of construction workers and activities in the operational phase, such as travel and land transport which may cause accidents to commuters using the route, serious injury leading to death is considered another health impact. The project considers using statistical data for land accident notification classified by vehicle type, damage and suspects, collected from the Central Information Technology Center, The Royal Thai Police during the year 2015-2019 which found that both Rayong and Chonburi with the type of vehicle with the highest number of accidents was other types of vehicles, followed by passenger cars and motorcycles, respectively, in which the damage caused by the majority of people resulted in death, serious injuries and minor injuries. In 2019 it was found that the number of reported accidents was higher than that of the previous year.

3) Social Security Information

Development of the project, especially during the construction phase, the use of foreign laborers in the project area may result in increased crime cases. Statistical data from social safety information on notification and arrest of all 5 types of crimes in the past 4 years (2015-2018), the Central Information Technology Center of the National Police Office (NCOI) collected the summary as follows:

According to the Criminal Statistics of Rayong, 2015 – 2016, details are shown in **Table 6.4-**13 Criminal from all reported cases 22,064 lawsuits found that the most proportioned case group was the group of cases in which the state was the party who suffered the damages (82.474 percent), followed by the property crime case groups (8.897 percent) and the criminal case groups related to body and gender (3.997 percent), respectively. In 2017 – 2018 there were four newly grouped criminal cases, consisting of: life, body, and gender-related lawsuit groups, property-related offenses, special offences, and state-damaged offenses. Details are shown in **Table 6.4-15**

Criminal It was found that, based on the total reported case, 23,334 cases, most proportion of case groups is the group of lawsuits that were state-damaged offence (85.870 percent) followed by property-related offence (10.320 percent), special offenses group (3.273 percent) and sex life, body, and gender case group (2.241 percent) respectively.

According to the Criminal Statistics of Chonburi Province 2015 – 2016, the details are shown in **Table 6.4-**14 Criminal from all reported cases 49,514 lawsuits found that the most proportioned case group was the group of cases in which the state was the subject of damages (86.541 percent), followed by property crime case groups (6.693 percent) and cases of interest group (3.706 percent), respectively. In 2017 – 2018, there were 4 newly grouped criminal cases, namely those related to life, body and gender, offences related to property, special offences, and offenses that were state-damaged cases, as detailed in **Table 6.4-**16 Criminal, it was found that, based on the reported case, 43,875 lawsuits, most proportion group of cases was the group of lawsuits in which the state was damaged (85.821 percent), followed by the group of offences

related to property (9.053 percent) and sex, body, and life scenario group cases (2.694 percent), respectively.

Table 6.4-12 Crash casestatistics are classified by type of damage and suspects between 2015 - 2019

	Notified (subject (s))	pedestrian	Bicycle	Tri-cycle	Motor cycle	The three-wheeled Bike	Cars	a small passenger car (van)	Small Truck (Pick Up)	E-Tan car.	Large bus	6-wheeled Truck	10-wheeled Truck	Taxis	Other cars	Value of damaged property (baht)	Damage to a person						Suspect				
																	Death		Seriously injured		Slightly injured		Arrests		Escape		Unknown
																	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	
Rayong																											
2015	402	10	4	-	270	-	198	10	177	1	8	15	-	-	16	23,688,797	74	24	40	25	77	44	277	57	17	-	1
2016	280	13	4	-	142	-	105	8	69	1	3	8	-	-	9	14,228,600	69	35	22	9	28	27	163	29	9	1	1
2017	259	12	5	-	96	-	105	7	87	1	6	2	-	-	-	7,756,600	67	28	11	9	19	15	167	31	8	2	-
2018	242	15	5	-	89	-	104	5	63	-	3	3	13	1	287	8,287,500	75	30	60	26	97	59	111	21	9	1	14
2019	748	21	10	-	386	-	397	25	267	-	8	13	60	2	1,173	13,609,100	86	33	53	26	280	160	418	119	10	3	52
Chonburi																											
2015	571	11	1	-	56	2	48	5	32	1	2	3	-	-	6	127,00	29	13	8	4	25	8	181	33	10	3	2
2016	1,604	22	31	1	378	2	392	21	235	10	12	29	-	4	31	352,692	74	27	8	7	6	6	484	137	20	2	5
2017	1,861	26	26	-	387	2	295	13	302	7	26	34	-	2	38	-	96	47	23	25	10	13	191	41	7	1	-
2018	2,190	20	57	2	441	1	469	23	348	-	4	24	98	-	1,478	-	102	35	61	41	409	240	297	59	8	1	63
2019	3,905	38	163	1	723	1	1,227	29	627	-	23	35	83	13	2,941	-	99	39	82	42	596	328	429	151	13	4	65

Source: Central Information Technology Center, Information and Communications Technology Office, National Police Office, searched at http://pitc.police.go.th/2014/ on 18 July 2020.

Note : (-) indicates that there is no record in the database.

Table 6.4-13 CriminalStatistics of Rayong between 2015-2016

Criminal case	Rayong							
	2015		2016		Total		Percentage	
	Notified	Arrested	Notified	Arrested	Notified	Arrested	Notified	Arrested
1. Serious & Violent Crimes	**45**	**42**	**41**	**35**	**86**	**77**	**0.390**	**0.278**
1.1 Homicide	27	25	21	17	48	42	0.218	0.190
1.2 Robbery	4	4	5	4	9	8	0.041	0.036
1.3 Robbery	13	12	13	12	26	24	0.118	0.109
1.4 Ransom	-	-	-	-	-	-	-	-
1.5 Arson	1	1	2	2	3	3	0.014	0.014
2. Life, body and gender case	**491**	**450**	**391**	**358**	**882**	**808**	**3.997**	**2.920**
2.1 Homicide	27	25	21	17	48	42	0.218	0.190
2.2 Manslaughter	19	14	12	8	31	22	0.141	0.100
2.3 Death due to negligence	1	1	1	1	2	2	0.009	0.009
2.4 Attempted murder	39	31	25	20	64	51	0.290	0.231
2.5 Physical Assault	353	336	280	264	633	600	2.869	2.719
2.6 Sexual Assault	52	43	52	48	104	91	0.471	0.412
3. Property Offence Case	**1,014**	**740**	**949**	**731**	**1,963**	**1,471**	**8.897**	**5.315**
3.1 Theft	702	440	573	371	1,275	811	5.779	3.676
3.2 Snatching	37	36	23	21	60	57	0.272	0.258
3.3 Blackmail	-	-	-	-	-	-	-	-
3.4 Extortion	4	4	6	5	10	9	0.045	0.041
3.5 Robbery	13	12	13	12	26	24	0.118	0.109
3.6 Robbery	4	4	5	4	9	8	0.041	0.036
3.7 Receiving stolen goods	3	2	2	2	5	4	0.023	0.018
3.8 Loss of Property	251	242	327	316	578	558	2.620	2.529
4. Interesting case	**455**	**185**	**481**	**251**	**936**	**436**	**4.242**	**1.575**
4.1 Motorcycle theft	224	90	110	31	334	121	1.514	0.548
4.2 Motor Vehicle Theft	47	9	81	36	128	45	0.580	0.204
4.3 Cattle Theft	-	-	-	-	-	-	-	-
4.4 Agricultural tool theft	1	1	-	-	1	1	0.005	0.005
4.5 Robbery - Hijacking A Bus	-	-	-	-	-	-	-	-
4.6 Robbery - Hijacking A Taxi	-	-	-	-	-	-	-	-

Table 6.4-13 CriminalStatistics of Rayong between 2015-2016

Criminal case	Rayong							
	2015		2016		Total		Percentage	
	Notified	Arrested	Notified	Arrested	Notified	Arrested	Notified	Arrested
4.7 Rape & Murder	-	-	-	-	-	-	-	-
4.8 Ransom	-	-	-	-	-	-	-	-
4.9 Fraud	74	37	111	59	185	96	0.838	0.435
4.10 Embezzlement	109	48	179	125	288	173	1.305	0.784
5. The lawsuit in which the state is the victim	**9,050**	**13,036**	**9,147**	**11,847**	**18,197**	**24,883**	**82.474**	**89.911**
5.1 Firearms	509	541	477	497	986	1,038	4.469	3.751
5.2 Gambling	1,699	5,460	1,241	3,774	2,940	9,234	13.325	33.366
5.3 Narcotics	5,195	5,388	6,176	6,323	11,371	11,711	51.536	42.316
5.4 Anti-Sex Trafficking	1,645	1,645	1,253	1,253	2,898	2,898	13.135	10.472
5.5 Have and published pornographic material	2	2	-	-	2	2	0.009	0.007
Total amount					**22,064**	**27,675**	**100**	**100**

Source: National Statistical Office of Thailand (Searched from http://statbbi.nso.go.th/staticreport/page/sector/th/09.aspx) on 18 July 2020.

Note : (-) indicates that there is no record in the database.

Table 6.4-14 CriminalStatistics of Chonburi Province between 2015-2016

Criminal case	Chonburi							
	2015		2016		Total		Percentage	
	Notified	Arrested	Notified	Arrested	Notified	Arrested	Notified	Arrested
1. Serious & Violent Crimes	**120**	**98**	**97**	**77**	**217**	**175**	**0.438**	**0.317**
1.1 Homicide	48	40	52	45	100	85	0.202	0.172
1.2 Robbery	14	12	11	8	25	20	0.050	0.040
1.3 Robbery	55	43	29	22	84	65	0.170	0.131
1.4 Ransom	1	1	-	-	1	1	0.002	0.002
1.5 Arson	2	2	5	2	7	4	0.014	0.008
2. Life, body and gender case	**723**	**535**	**575**	**412**	**1,298**	**947**	**2.621**	**1.718**
2.1 Homicide	48	40	52	45	100	85	0.202	0.172
2.2 Manslaughter	33	23	21	15	54	38	0.109	0.077
2.3 Death due to negligence	5	3	1	-	6	3	0.012	0.006
2.4 Attempted Murder	110	76	67	44	177	120	0.357	0.242
2.5 Physical Assault	418	319	367	273	785	592	1.585	1.196
2.6 Sexual Assault	109	74	67	35	176	109	0.355	0.220
3. Property Offence Case	**1,806**	**1,165**	**1,508**	**937**	**3,314**	**2,102**	**6.693**	**3.813**
3.1 Theft	1,484	913	1,237	739	2,721	1,652	5.495	3.336
3.2 Snatching	149	114	72	45	221	159	0.446	0.321
3.3 Blackmail	1	1	3	3	4	4	0.008	0.008
3.4 Extortion	9	6	9	6	18	12	0.036	0.024
3.5 Robbery	55	43	29	22	84	65	0.170	0.131
3.6 Robbery	14	12	11	8	25	20	0.050	0.040
3.7 Receiving stolen goods	10	9	14	13	24	22	0.048	0.044
3.8 Loss of Property	84	67	133	101	217	168	0.438	0.339
4. Interesting case	**1,036**	**378**	**799**	**317**	**1,835**	**695**	**3.706**	**1.261**
4.1 Motorcycle theft	439	210	188	65	627	275	1.266	0.555
4.2 Motor Vehicle Theft	76	9	150	73	226	82	0.456	0.166
4.3 Cattle Theft	-	-	-	-	-	-	-	-
4.4 Agricultural tool theft	-	-	-	-	-	-	-	-
4.5 Robbery - Hijacking a Bus	-	-	-	-	-	-	-	-
4.6 Robbery - Hijacking a Taxi	-	-	-	-	-	-	-	-

Table 6.4-14 CriminalStatistics of Chonburi Province between 2015-2016

Criminal case	Chonburi							
	2015		2016		Total		Percentage	
	Notified	Arrested	Notified	Arrested	Notified	Arrested	Notified	Arrested
4.7 Rape & Murder	-	-	-	-	-	-	-	-
4.8 Ransom	1	1	0	0	1	1	0.002	0.002
4.9 Fraud	293	91	266	105	559	196	1.129	0.396
4.10 Embezzlement	227	67	195	74	422	141	0.852	0.285
5. The lawsuit in which the state is the victim	**24,567**	**29,791**	**18,283**	**21,420**	**42,850**	**51,211**	**86.541**	**92.891**
5.1 Firearms	745	786	783	824	1,528	1,610	3.086	2.920
5.2 Gambling	4,942	9,854	2,264	5,090	7,206	14,944	14.553	27.107
5.3 Narcotics	6,952	7,221	9,854	10,123	16,806	17,344	33.942	31.460
5.4 Anti-Sex Trafficking	11,900	11,902	5,354	5,355	17,254	17,257	34.847	31.302
5.5 Have and published pornographic material	28	28	28	28	56	56	0.113	0.102
Total amount					**49,514**	**55,130**	**100**	**100**

Source: National Statistical Office of Thailand (Searched from http://statbbi.nso.go.th/staticreport/page/sector/th/09.aspx) on 18 July 2020.

Note : (-) indicates that there is no record in the database.

Table 6.4-15 CriminalStatistics of Rayong, 2017-2018

Criminal case	Rayong							
	2017		2018		Total		Percentage	
	Notified	Arrested	Notified	Arrested	Notified	Total Arrested	Notified	Total Arrested
1. Life, body and gender case	**281**	**267**	**242**	**244**	**523**	**511**	**2.241**	**2.104**
1.1 Murder	11	11	10	10	21	21	0.090	0.086
1.2 Assaulting others to death	8	6	7	4	15	10	0.064	0.041
1.3 Attempted Murder	17	11	20	17	37	28	0.159	0.115
1.4 Physical Assault	154	163	138	152	292	315	1.251	1.297
1.5 Sexual Assault	52	38	33	29	85	67	0.364	0.276
1.6 Others	39	38	34	32	73	70	0.313	0.288
2. Property Offences	**1,235**	**948**	**1,173**	**1,041**	**2,408**	**1,989**	**10.320**	**8.190**
2.1 Robbery	-	-	1	3	1	3	0.004	0.012
2.2 Robbery	3	3	11	12	14	15	0.060	0.062
2.3 Snatching	25	25	17	15	42	40	0.180	0.165
2.4 Theft	426	290	484	437	910	727	3.900	2.993
2.5 Extortion	0	0	4	4	4	4	0.017	0.016
2.6 Fraud	125	77	156	112	281	189	1.204	0.778
2.7 Embezzlement	150	122	118	88	268	210	1.149	0.865
2.8 Loss of Property	335	342	326	322	661	664	2.833	2.734
2.9 Receiving stolen goods	8	7	2	4	10	11	0.043	0.045
2.10 Ransom	-	-	-	-	-	-	-	-
2.11 Arson	6	9	7	6	13	15	0.056	0.062
2.12 Others	70	55	47	38	117	93	0.501	0.383
2.13 Theft of cars	15	1	14	2	29	3	0.124	0.012
2.14 Motorcycle theft	72	17	65	34	137	51	0.587	0.210
3. Special offences	**133**	**99**	**233**	**209**	**366**	**308**	**1.569**	**1.268**
3.1 Prevention and Suppression of Human Trafficking Act	2	2	1	-	3	2	0.013	0.008
3.2 Child Protection Act	1	1	-	-	1	1	0.004	0.004
3.3 Copyright Act	29	27	47	47	76	74	0.326	0.305
3.4 Patent Act	0	0	-	-	-	-	0.000	0.000
3.5 Trademark Act	24	27	24	24	48	51	0.206	0.210

Table 6.4-15 CriminalStatistics of Rayong, 2017-2018

Criminal case	Rayong							
	2017		2018		Total		Percentage	
	Notified	Arrested	Notified	Arrested	Notified	Total Arrested	Notified	Total Arrested
3.6 Computer-Related Crime Act	3	1	1	1	4	2	0.017	0.008
3.7 Offences Concerning Electronic Cards (Penal No. Mor.269/1-269/7)	1	2	-	-	1	2	0.004	0.008
3.8 Forests Act	19	6	34	6	53	12	0.227	0.049
3.9 National Reserved Forests Act	20	1	3	-	23	1	0.099	0.004
3.10 National Park Act	-	-	19	20	19	20	0.081	0.082
3.11 Wild Animal Conservation And Protection Act	4	1	3	2	7	3	0.030	0.012
3.12 Enhancement And Conservation Of Environmental Quality Act	-	-	-	-	-	-	0.000	0.000
3.13 Elephant Ivory Tusks Act	-	-	1	1	1	1	0.004	0.004
3.14 Excavation and Land Filling Act	1	1	4	4	5	5	0.021	0.021
3.15 Customs Act	8	8	11	11	19	19	0.081	0.078
3.16 The Anti-Money Laundering Act	-	-	-	-	-	-	0.000	0.000
3.17 Prohibit Calling Interest In Excess Of Rates Act	21	22	85	93	106	115	0.454	0.474
4. Offenses that the state is the victim	**10,461**	**10,547**	**9,576**	**10,931**	**20,037**	**21,478**	**85.870**	**88.438**
4.1 Narcotics	7,596	7,709	7,428	7,566	15,024	15,275	64.387	62.896
4.2 Firearms and Explosives	470	480	293	290	763	770	3.270	3.171
4.3 Gambling	925	946	817	2,038	1,742	2,984	7.466	12.287
4.4 Offences Regarding Materials, Media and Indecent Publications	2	2	1	1	3	3	0.013	0.012
4.5 Offences Relating to the Immigration Act	399	409	141	143	540	552	2.314	2.273
4.6 Offences Concerning the Prevention and Suppression of Sex-Trafficking	937	860	759	756	1,696	1,616	7.268	6.654
4.7 Facility Infringement Offenses	31	37	26	26	57	63	0.244	0.259
4.8 Alcohol Beverage Control Offenses	101	104	111	111	212	215	0.909	0.885
Total amount					**23,334**	**24,286**	**100**	**100**

Source: National Statistical Office of Thailand (Searched from http://statbbi.nso.go.th/staticreport/page/sector/th/09.aspx) on 18 July 2020.

Note : (-) indicates that there is no record in the database.

Table 6.4-16 CriminalStatistics of Chonburi Province 2017-2018

Criminal case	Chonburi							
	2017		2018		Total		Percentage	
	Notified	Arrested	Notified	Arrested	Notified	Total Arrested	Notified	Total Arrested
1. Life, body and gender case	**589**	**371**	**593**	**598**	**1,182**	**969**	**2.694**	**2.239**
1.1 Murder	44	28	37	49	81	77	0.185	0.178
1.2 Assaulting others to death	18	12	19	17	37	29	0.084	0.067
1.3 Attempted Murder	39	21	42	42	81	63	0.185	0.146
1.4 Physical Assault	340	230	373	394	713	624	1.625	1.442
1.5 Sexual Assault	85	45	84	66	169	111	0.385	0.257
1.6 Others	63	35	38	30	101	65	0.230	0.150
2. Property Offences	**2,122**	**1,162**	**1,850**	**1,507**	**3,972**	**2,669**	**9.053**	**6.168**
2.1 Robbery	9	6	1	4	10	10	0.023	0.023
2.2 Robbery	18	10	24	25	42	35	0.096	0.081
2.3 Snatching	82	42	50	44	132	86	0.301	0.199
2.4 Theft	1,117	658	1,018	899	2,135	1,557	4.866	3.598
2.5 Extortion	8	6	4	2	12	8	0.027	0.018
2.6 Fraud	295	134	305	184	600	318	1.368	0.735
2.7 Embezzlement	237	97	229	148	466	245	1.062	0.566
2.8 Loss of Property	56	35	51	46	107	81	0.244	0.187
2.9 Receiving stolen goods	33	27	26	27	59	54	0.134	0.125
2.10 Ransom	-	-	-	-	-	-	-	-
2.11 Arson	3	3	12	3	15	6	0.034	0.014
2.12 Others	196	131	130	125	326	256	0.743	0.592
2.13 Theft of cars	11	2	7	2	18	4	0.041	0.009
2.14 Motorcycle theft	57	11	45	39	102	50	0.232	0.116
3. Special Offences	**518**	**418**	**549**	**577**	**1,067**	**995**	**2.432**	**2.299**
3.1 Prevention and Suppression of Human Trafficking Act	21	16	13	22	34	38	0.077	0.088
3.2 Child Protection Act	36	19	2	2	38	21	0.087	0.049
3.3 Copyright Act	72	46	53	60	125	106	0.285	0.245
3.4 Patent Act	-	-	-	-	-	-	-	-
3.5 Trademark Act	119	124	68	68	187	192	0.426	0.444

Table 6.4-16 CriminalStatistics of Chonburi Province 2017-2018

Criminal case	Chonburi							
	2017		2018		Total		Percentage	
	Notified	Arrested	Notified	Arrested	Notified	Total Arrested	Notified	Total Arrested
3.6 Computer-Related Crime Act	13	7	19	14	32	21	0.073	0.049
3.7 Offences Concerning Electronic Cards (Penal No. Mor.269/1-269/7)	19	12	10	13	29	25	0.066	0.058
3.8 Forests Act	19	9	12	11	31	20	0.071	0.046
3.9 National Reserved Forests Act	10	5	7	8	17	13	0.039	0.030
3.10 National Park Act	8	8	6	6	14	14	0.032	0.032
3.11 Wild Animal Conservation And Protection Act	33	31	47	48	80	79	0.182	0.183
3.12 Enhancement And Conservation Of Environmental Quality Act	3	-	4	2	7	2	0.016	0.005
3.13 Elephant Ivory Tusks Act	-	-	-	-	-	-	-	-
3.14 Excavation and Land Filling Act	3	1	2	2	5	3	0.011	0.007
3.15 Customs Act	115	107	119	120	234	227	0.533	0.525
3.16 The Anti-Money Laundering Act	-	-	2	1	2	1	0.005	0.002
3.17 Prohibit Calling Interest In Excess Of Rates Act	47	33	185	200	232	233	0.529	0.538
4. Offences that the state is the victim	**17,910**	**17,404**	**19,744**	**21,235**	**37,654**	**38,639**	**85.821**	**89.293**
4.1 Narcotics	10,504	9,970	12,706	12,773	23,210	22,743	52.900	52.558
4.2 Firearms and Explosives	940	849	463	459	1,403	1,308	3.198	3.023
4.3 Gambling	1,325	1,282	1,492	2,919	2,817	4,201	6.421	9.708
4.4 Offences Regarding materials, media and Indecent Publications	62	64	21	20	83	84	0.189	0.194
4.5 Offences Relating to the Immigration Act	977	959	516	531	1,493	1,490	3.403	3.443
4.6 Offences Concerning the Prevention and Suppression of Sex-Trafficking	3,785	3,970	4,102	4,088	7,887	8,058	17.976	18.622
4.7 Facility infringement offenses	190	185	225	226	415	411	0.946	0.950
4.8 Alcohol beverage control offenses	127	125	219	219	346	344	0.789	0.795
Total amount					**43,875**	**43,272**	**100**	**100**

Source: National Statistical Office of Thailand (Searched from http://statbbi.nso.go.th/staticreport/page/sector/th/09.aspx) on 18 July 2020.

Note : (-) indicates that there is no record in the database.

6.4.2.7 Public utility systems and public services

Public utility systems and service system information, as shown in Chapter 3, Current Environment, Section 3.6.2 Public Utilities Systems, and Section 3.6.3 Transport

6.4.2.8 Prevention and mitigation of disasters

1) Rayong

Rayong has a disaster management system in order to enable warning, suspension, and set up an ad-hoc management center at the province and district level. By virtue of Section 16 of the Prevention and Mitigation Act, 2007, in order to prevent and control the situation quickly and with minimal danger and damage to people's lives and property. The Rayong Provincial emergency management plan is divided into 3 levels, namely:

Industrial/site-level emergencies are small disasters in the factory or along the transportation channel or pipeline in which the factory staff is at the scene or plant nearby the accident route from which the transportation accident or the operator was responsible can take control of the situation and stop the accident with the operating flow chart at the industrial/site level. When an accident occurs in the industrial factory or facility, the agencies in the area must be informed/prepared for such operations. The local administrative organization, local organization, local hospital, or private plant that is in agreement with the factory (in case of injury), the industrial plant/ adjacent site area, industrial estate or local adjacent area of incident whilst a team take out the emergency immediately (Details show**Figure 6.4-19** Industrial Plant/Site-Level Emergency Action)

Level 1 emergencies are situations that exceed the capacity of the plant in which the incident occurs or the root cause operator cannot control or suspend the incident. External assistance must be sought, such as the Department of Disaster Prevention and Mitigation, Local Administration, District's Department of Disaster and Mitigation or adjacent factories and can control the situation or suspend the incident, including evacuation. Help affected persons for the Level 1 emergency plan (see details in **Figure 6.4-20** Level 1 Emergency Action). In this case, the municipality/district administration organization of the area/local director will coordinate with the local hospital where the incident occurred/close by, local police, the community/people. In addition, there is coordination with the District's Department of Disaster Prevention and Mitigation in order to inform and request assistance from the Provincial's Department of Disaster Prevention and Mitigation.

For Level 2 emergencies, the Department of Disaster Prevention and Mitigation Administration, the local administrative organization of the area and towns cannot suspend and control the situation, assistance must be sought from the Division of Disaster Preventive and Mitigation in Rayong and nearby provinces, as well as other support units from other external agencies for 2nd level emergency action plans (details shown in **Figure 6.4-**21 Level 2 Emergency Action).

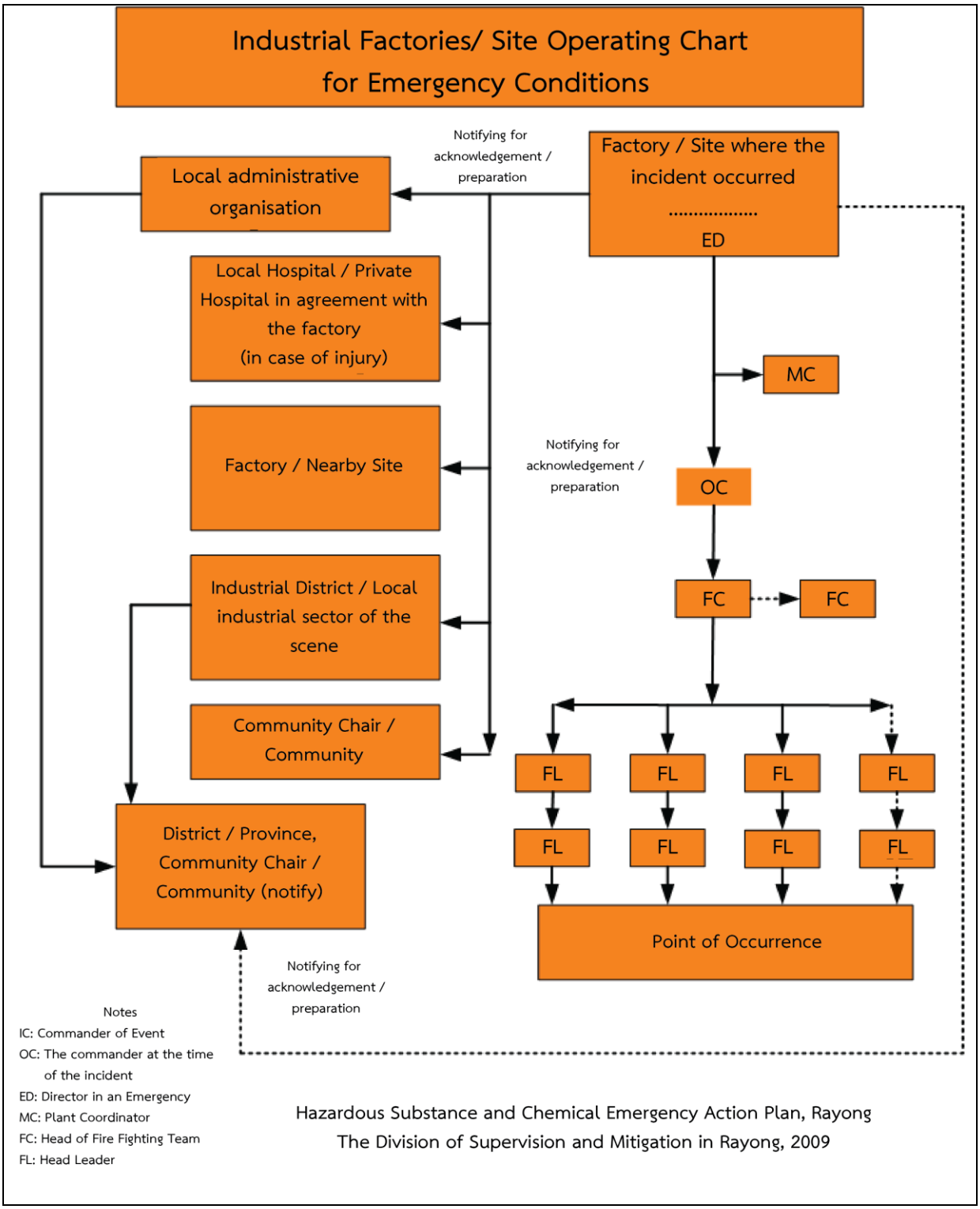


Figure 6.4-19 Industrial Plant/Site-Level Emergency ActionFlow

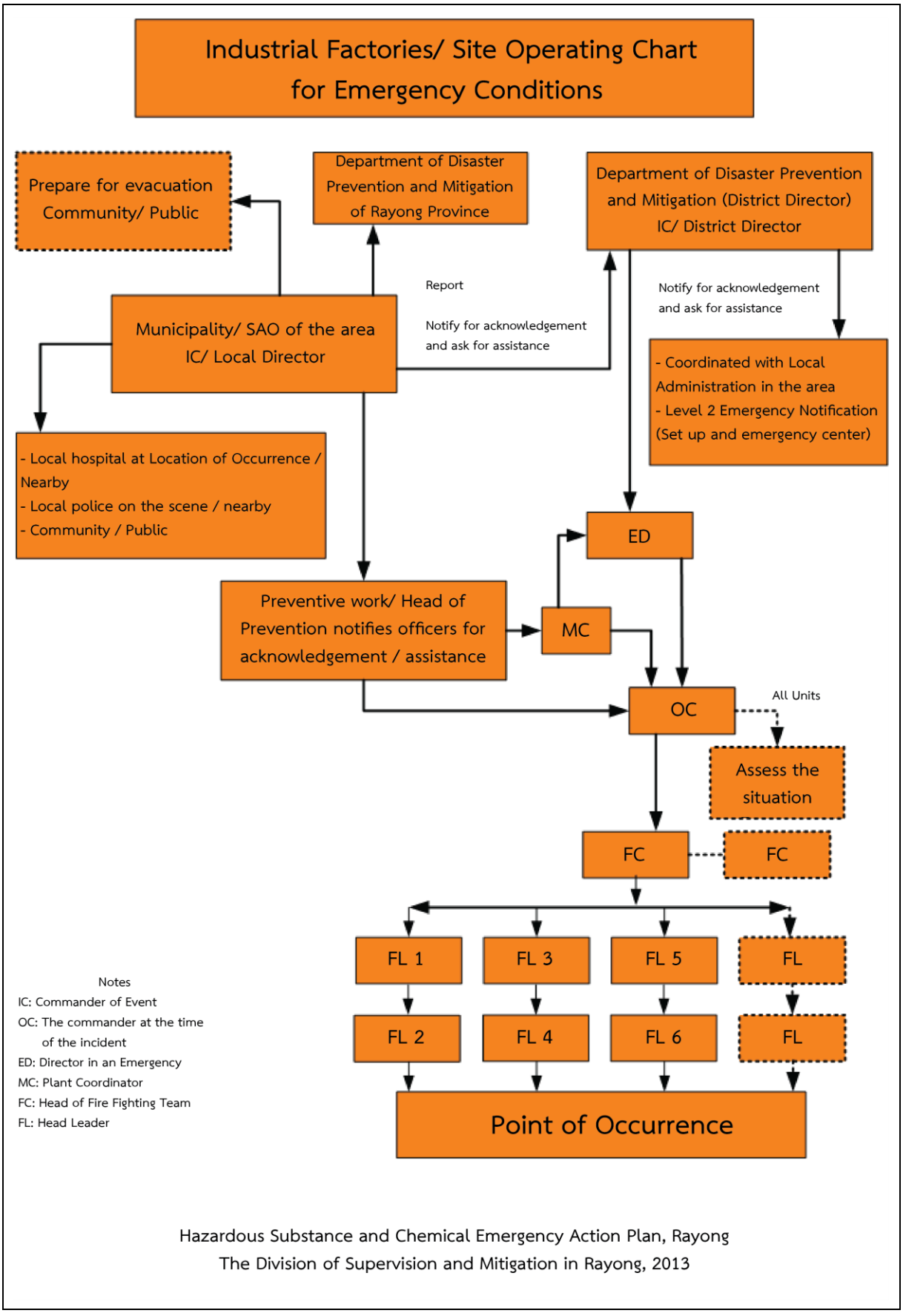
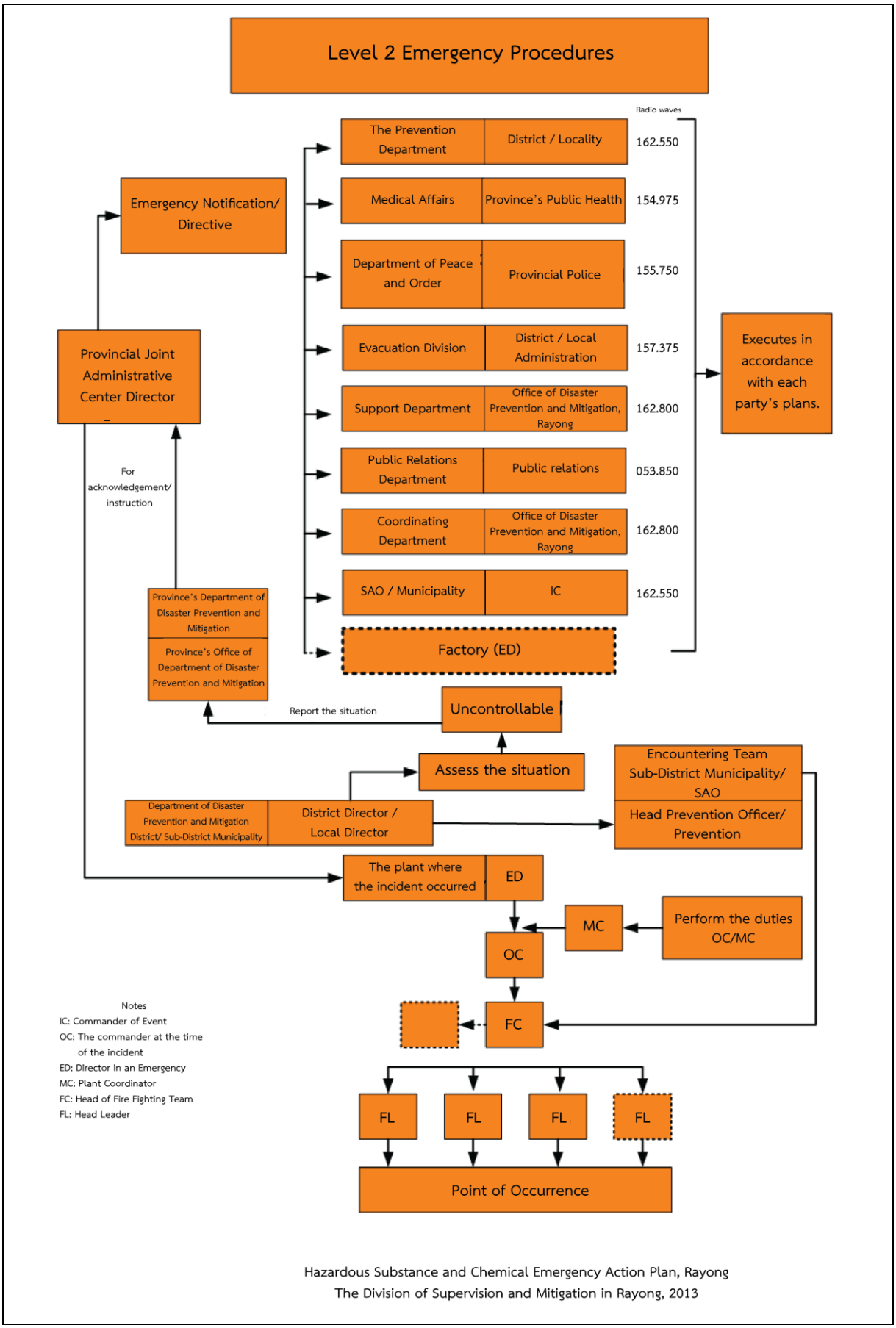


Figure 6.4-20 Level 1 Emergency ActionFlow Chart



Hazardous Substance and Chemical Emergency Action Plan, Rayong
The Division of Supervision and Mitigation in Rayong, 2013

Figure 6.4-21 Level 2 Emergency ActionFlow Chart

2) Subdistrict Municipality

The current natural disaster situation occurs in increasing frequency and severity, including fires, winds, floods, droughts, absence of rainfall and forest fire. Disaster assistance is to immediately inform the village head of the municipality, immediately writing a request for assistance at Phala's Subdistrict Municipality, Department of Labor and Preventive Action along with the Technical Division investigates the area for damage, Phala's Subdistrict consider assistance, as per the Public Health and Standard Safety and Standard Mitigation. The work standards consist of 7 areas, consisting of

1. Standards on the operational plan for prevention and mitigation of disasters of the local administration.

2. Standards for disaster prevention and mitigation action plan drills

3. Standards on public notification of disasters through various media and continuously spreading public knowledge about the disaster and prevention.

4. Standards on promotion of knowledge about disasters and prevention of harm to the public

5. Standards for fire prevention procedures for the public

6. Standards for road accident prevention for the public

7. Standards for the development of disaster prevention officers or civil protection volunteers

3) Chonburi

The plan for preventing and mitigating disasters in Chonburi 2018 divided the level of the alarm system to 5 levels from the highest dangerous situation to the normal, with the meaning of the color in the warning shown in **Table 6.4-17** Alarm level

Table 6.4-17 Alarm level symbols

Red color	The situation is in the highest hazardous condition, so live in a safe place and follow directions.
Orange color	The situation is at high risk. The official is controlling the situation, evacuate to a safe location and following the guidelines as required.
Yellow color	The situation is in a hazardous situation. It is likely that the situation will be more severe. Prepare for the situation and follow the instructions.
Blue color	Circumstances under surveillance should be closely monitored every 24 hours.
Green	The situation is under normal conditions. Check the information regularly.

Chonburi has managed each level of emergency by appointing persons with the authority to prevent and alleviate public disasters under the Prevention and Mitigation Act of Thailand. Under the Prevention and Mitigation Act of 2007, it is responsible for each level of public safety management. The guideline for establishing emergency management operations is represented by the Provincial Emergency Operations Center, which has the organizational structure of the Chonburi Incident Command Center shown in **Table 6.4-25** Health check.

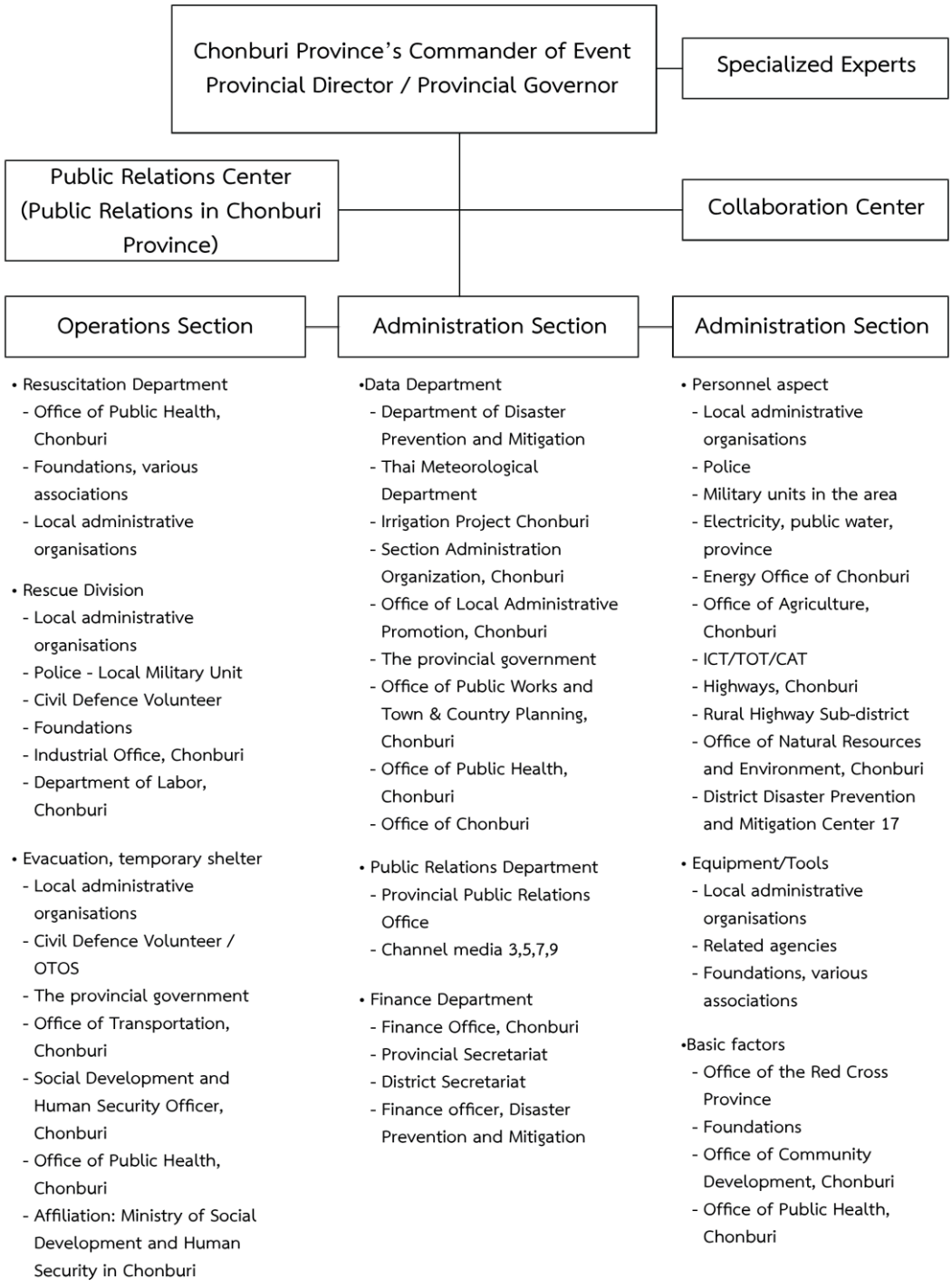


Figure 6.4-22 Organizational structure of the Center of the Event in Chonburi

In order to manage the public disasters in the area, a notification of the disaster area is issued at the discretion of the government, agency, local administrative agency and private sector which can assist victims in accordance with relevant regulations as shown in **Table 6.4-18** Issue

Table 6.4-18 Issueof the Disaster Land Area Announcement

Level	Management	The issuer of the disasters declaration area
1	Small disasters	Provincial Joint Administrative Center Director
2	Medium-sized disasters	Provincial Joint Administrative Center Director
3	Large disasters	National Disaster Prevention and Mitigation Commander
4	Extremely hazardous disasters	Prime Minister or Deputy Prime Minister as assigned by the Prime Minister

In this regard, the victims may request a certificate of risk, both as individuals and a legal entity to be assigned by the Department of Prevention and Mitigation to set a format, guidelines for the announcement of the disaster area and a certificate for persons and a legal entity in accordance with Section 30 of the Act on Prevention and Mitigation of Disaster, 2007.

Emergency communication

At all levels of the Department of Disaster Prevention and Mitigation acts as a communications center in their area of responsibility for 24 hours. Use communication routes in conjunction with telecommunication networks or other networks as appropriate to increase capacity and provide additional backup systems and systems. Also consider the use of radio clubs communications for volunteers as well as clubs or amateur radios in the local area by adhering to the principles of maintaining communication safety and speed of communication with the telecommunications systems of various agencies, as shown in **Figure 6.4-**23 Communication

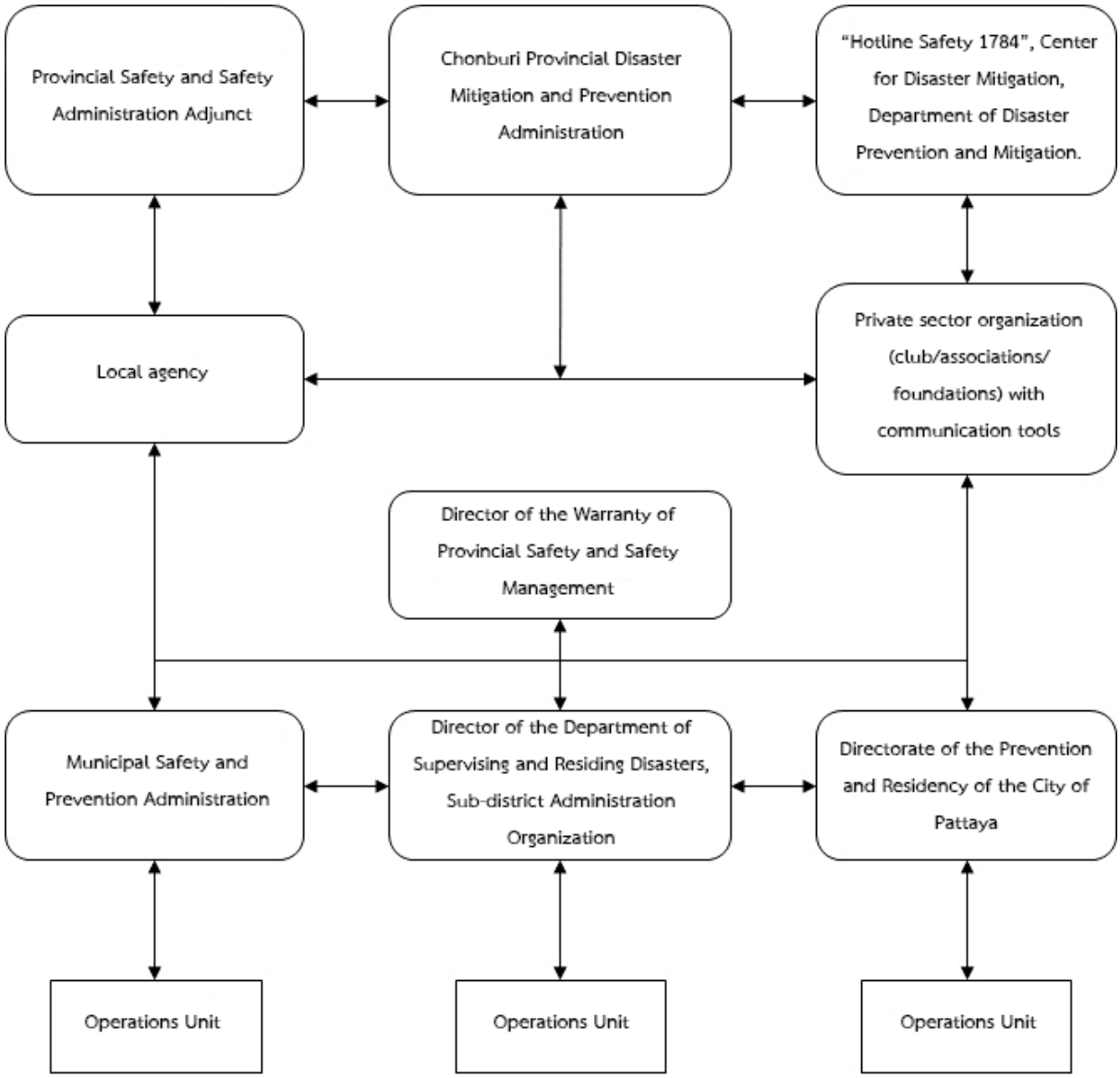


Figure 6.4-23 Communicationchart for the prevention and mitigation of the disasters in Chonburi

According to information from the Chonburi Provincial Disaster Prevention and Mitigation Division, the Office of Disaster Prevention and Mitigation in Chonburi is found that there are a number and types of machinery, vehicles and equipment of agencies such as municipalities, subdistrict administration organizations as shown in **Table 6.4-19**

Table 6.4-19 Information on the type of machinery, vehicles and equipment of agencies in Chonburi

Sequence No.	Agency	Type of machinery, vehicles and equipment	Quantity
1.	Huai Yai Subdistrict Municipality	Vehicle for inspection	1
		6" pump	3
		12,000 liters Fire truck	2
		10,000 liters Fire Truck	2

Table 6.4-19 Information on the type of machinery, vehicles and equipment of agencies in Chonburi

Sequence No.	Agency	Type of machinery, vehicles and equipment	Quantity
		6,000 liters Fire Truck	1
		4,000 liters Fire truck	1
2.	Phlu Ta Luang Subdistrict Administrative Organization	Vehicle for inspection	2
		Water trucks	3
		Vacuum Pumps	1
3.	Sattahip Subdistrict Municipality	Vehicle for inspection	1
		Multipurpose rescue car	1
		Large 8 inch pump	2
		Clam pumping machine	1
		Fire Trucks	1
		10,000 liters Fire Truck	1

Source: Disaster Prevention and Mitigation Plan, Chonburi 2018

6.4.2.9 Feedback and suggestions from receiving feedback

1) Opinions and suggestions from public health and safety agencies

From the target groups that conducted the in-depth interviews, the health authorities consisted of the Rayong Provincial Public Health Office, Mueang Rayong District Public Health Office, Ban Chang District Public Health Office, Ban Chang Hospital, Phudon - Huay Mahad Community Health Service Unit, Rayong Occupational Health and Environment Development Center, Public Health Service Center 1, Ban Chang Municipality, Ban Sa Kaeo Health Promoting Hospital, Chonburi Provincial Public Health Office, Bang Lamung District Public Health Office, Sattahip District Public Health Office, Wat Yansangwararam Hospital, Somdej Phra Sangkharat Yanasangvara Hospital for the Elderly Chonburi, Queen Sirikit Hospital and Sattahip Hospital (KM. 10), as well as public safety agencies, consisting of the Rayong's Provincial Disaster Prevention and Mitigation Office, Chonburi's Provincial Disaster Prevention and Mitigation Office have opinions and recommendations summarized as shown in **Table 6.4-**20.

Table 6.4 20 Summary of comments and suggestions from public health and safety agencies

From	Feedback and Feedback Issues
Environmental quality measurements	- Offer to measure the air quality in the airport to find ways to reduce the impact of respiratory illness. - Offer to install air quality and automatic sound monitors and have channels for public to acknowledge.
Monitoring health and enhancing the potential of areas in public health services	- Provide a project to monitor the hearing performance of people in the community who are affected by noise, as well as the impact of noise levels on mental health, as well as prevention methods. - Have a health check and a list with workers' history prior to working per local area and 1 audit per year. - Focus on preliminary prevention and administer the vaccine in the risk group. - Ensure that health measures are consistent with the impacts of project operations. - There should be a plan to prevent more disease from workers, tourists, and latent populations entering the area causing new/recurrent diseases in the area. - Concerns about the number of workers and hidden populations that enter the area due to public health service with people in the area - Have the workers move the house registration into the area so that the medical budget comes into the area. - Provide a management system for workers to maintain proper sanitation, have basic medical facilities, and have training in cleanliness care to reduce disease occurrence. - There are measures to care for the mental health of people in the area affected by the project. - Add health measures "coordinate with public health agencies to plan health operations." - Provide health checks and establish the health status of the local population in order to monitor impact, as a local awareness. - Agree on the measures of cooperation with public health agencies and the establishment of the fund to compensate affected persons and request compensation as sustainable compensation. - Provide the EEC with the promotion of public health services and increasing the number of health care professionals and supporting the local budget to support developments that will occur in the area. There are only public health facilities to support emergencies.

Table 6.4 20 Summary of comments and suggestions from public health and safety agencies

From	Feedback and Feedback Issues
Accidents and enhancing the potential of areas for disaster prevention and mitigation	- Worried about accidents caused by increasing traffic volume - Civil defence volunteers with in the area are to support with equipment materials and to prepare sufficient capacity for future support plans, as well as to rehearse joint plans to create cooperation between external agencies and airport areas. - Provide a complete, preventive measure, control, emergency response plan, and rehabilitation plan. - Develop the potential of water disaster mitigation by providing adequate education and support equipment. - Prepare security by rehearse emergency support plans according to the timeline specified. - Specify safety measures for transporting workers
Complaint Management and Fund Setting	- There are channels of complaints for those affected by projects that are easily accessible to the public and the responsible persons are identified to take action and respond to the complaints clearly. - Establish an airport development fund and surrounding communities from the beginning. How does the project have a concrete fund management approach? Elements should be clearly put in place and truly beneficial to the community. - There shall be representatives of the public and various local sectors as the Fund Management Board.

The details of opinions and other suggestions on important issues are classified by each target group that has been interviewed in-depth, group meeting/discussion groups, and questionnaire survey. The details are shown in **Chapter 4, Public Engagement and Public Relations.**

2) Public opinions

Results from the survey of economic and social conditions in the study area related to public health information (physical health, mental health, access to health services) and accident, incident and public safety information of the group of households in the NEF ≥40 area of 71 persons, group of households in the NEF 30 - 40 areas of 354 persons, group of households in the area of NEF <30 of 428 persons to the area boundary, group of community leaders in the noise contour zone, 25 persons and the sensitive areas surrounding the 14 projects are summarized as follows:

2.1) Public health information (physical health, mental health, access to health services systems)

In the past year, the family and households in the NEF group were ≥40 NEF 30 - 40 and NEF <30, and 52% and 69% and 27% of households in the family, respectively. The most

sick were cold and respiratory related diseases. Other diseases, such as high blood pressure, lung diseases, diabetes, and gastrointestinal disease, and found that the household group in the NEF <30 group was infected with dermatological illnesses and allergies more than other groups. Whenillnesses occured most were treated at the government hospitals (Ban Chang Hospital, Queen Sirikit Hospital, Sattahip Hospital and Bang Lamung Hospital), apart from that opted to buy medications, treatment at private hospitals and allowed themselves to recover on their own. 11.7 Mental health problems occurred in NEF ≥ 40 household groups, while all NEF 30 - 40 households indicated no problems. In the NEF < 30 group, they indicated 0.7 percent problem with mental health. The main cause of stress and anxiety is because the airport expansion program causes the family to worry about returning land from the workplace, work stress, and noise stress from the nearby factory, have over thinking symptoms. Most of them let it disappear on their own, and some visit psychiatrists and treatment staff.

In the past year to the present, it was found that the questionnaire household members of the NEF group respondents are ≥ 40 NEF 30 - 40 and < 30 have no hearing problems, 81.9%, 98.0% and 93.0% respectively. Those that have problems with hearing, due to health problems and the impacts of work. The public health service from the public sector in the area is adequate. The problem lays in the part of the service which is caused by a large number of people receiving service, insufficient staff, far away health care centers, high cost facilities, and expensive. In addition, the community has disease control activities and community health promotion activities, such as anti-hemorrhagic fever, anti-drug activities, rabies vaccination activities, cervical cancer prevention tests, and exercise activities within the community, etc. When asking about participants who participated in activities, the questionnaire participants stated that there are those that participated and those that did not in similar proportions.

2.2) Information on accidents and incidents and public safety

Most of the most common accidents in a community are vehicle accidents. Most of the accidents were unknown and there were some known causes of accidents due to negligence, fast driving, bad road conditions, and not following traffic rules. Most questionnaire respondents never experienced an accident. When they saw an accident or disaster happen in the community, the questionnaire respondents would not do anything as much as inform an emergency by the agency, which reported the 1669 hotline, informed the police 191 to the community leaders and self help.

For the joint emergency management training with local authorities, it was found that the questionnaire respondents never participated in the training and did not know how to notify of an emergency in the event of an aviation accident. In very small part, the information provided about how to report the incident was made by contacting the telephone number of U-Tapao International Airport and if it was affected by an aviation accident, the questionnaire respondent will seek assistance from the hospital and community leaders, respectively.

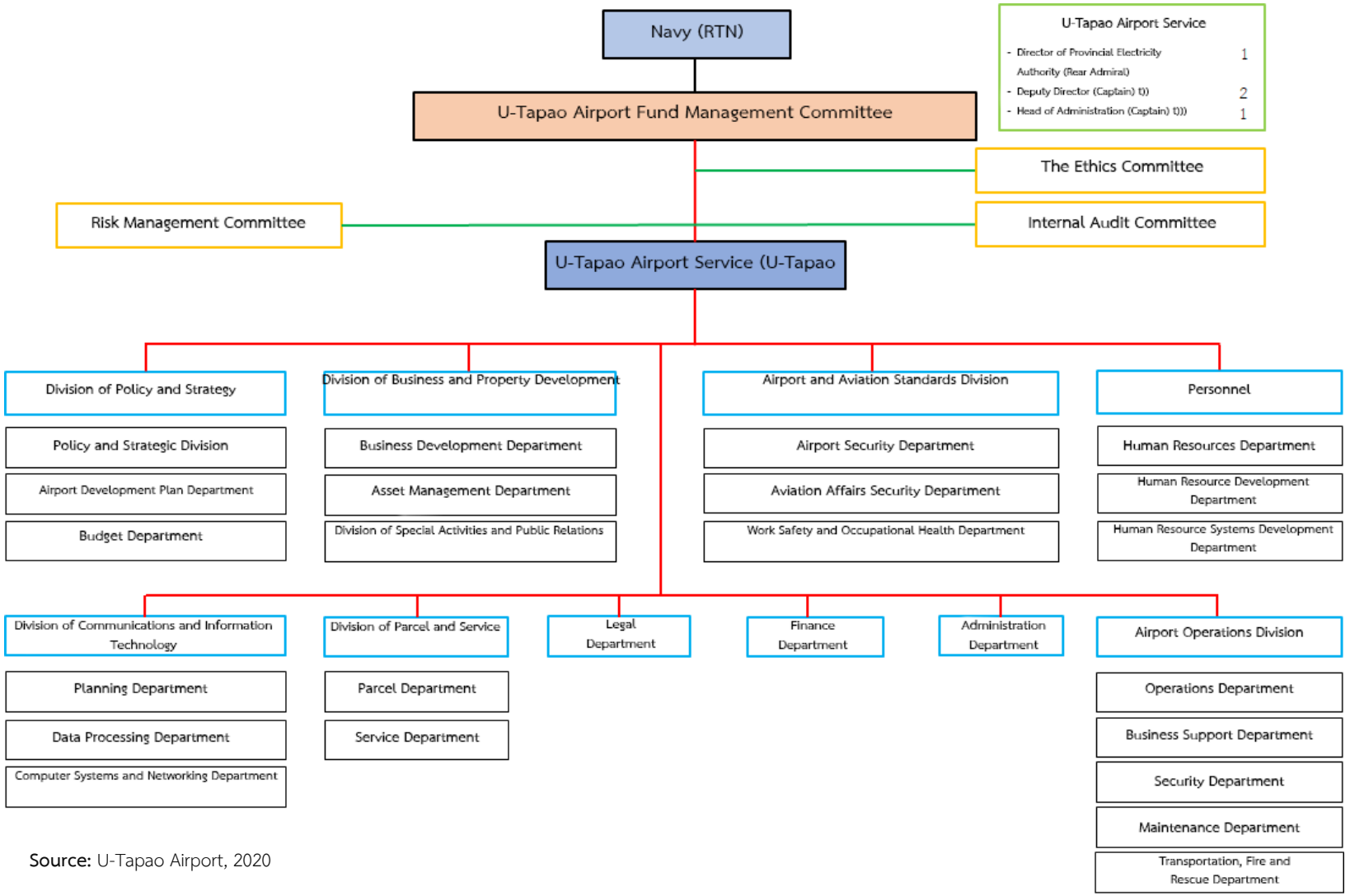
6.4.3 Occupational Health and Safety

U-Tapao International Airport currently has an occupational health agency, which reports to the Department of Occupational Safety and Occupational Health, which reports to the Department of Airports and Aviation Standards, U-Tapao Airport. **Figure 6.4-**24, shows who is responsible for the planning, directing, and carrying out operations related work on incident prevention, occupational health, and work environment, analysis, assessment, evaluation, measures, control, hazard prevention, working in conjunction with the agencies within the airport operations and other works involved.

In 2018, the airport directive was appointed by the Aerodome Safety Committee, with the director of U-Tapao Airport as the Head of the Committee and Head of Occupational Safety and Occupational Health Department. The Airport and Aviation Standards Division were the Committee, as shown Figure **6.4-25.** The airport safety reporting system (Integrate) has integrated the safety investigation system, incidents occurring in the airport's airside into the work health and safety investigation system. The airport safety and safety committee has appointed occupational health officers and occupational safety officers at the airport to join the airport safety committee of the airport to participate in investigations, analyze the causes and issue safety recommendations as well. Meetings are held to exchange information between the Airport Security Department and the Occupational Health Department and safety at work to improve the safety of operations in the airport's aviation zone, and in the year 2019, an announcement from U-Tapao Airport regarding the Aerodrome Safety Policy for the year 2019, with all executives, civil servants, employees and employees must be aware of the safety of working in the airport and systematic environmental management. U-Tapao Airport has prepared the "Aerodrome Safety Management System at U-Tapao, Rayong, Pattaya International Airport" with 5 elements: (1) Safety Policy and Objectives (2) Safety Risk Management (3) Safety Assurance (4) Safety Promotion and (5) Aerodrome Emergency Plan which will have objectives and goals for airport safety operations and will be publicized and distributed to the departments and people involved within the U-Tapao Airport to use for operations as well. The material will involve details of Safety Risk Management, Risk Assessment and Mitigation, Safety Communication, etc.

6.4.3.1 Occupational health and public health plans

In 2020, U-Tapao Airport established the Occupational Health and Public Health Plan, details as in **Table 6.4-**21 The Occupational Health and Public Health, for the 4 main projects, namely the measurement of work environment, promoting work safety, international health rules, and safety warning signs improvement in the passenger building.



Source: U-Tapao Airport, 2020

Figure 6.4 24 Organizational structures and agencies responsible for standards and airport safety of U-Tapao Airport

U-Tapao Airport Directive

(Only)

No. 311/2561

Subject Appointment of the Aerodrome Safety Committee

.....

To ensure that the management of aviation safety is complete and efficient and complies with the requirements of the International Civil Aviation Organization (ICAO), the following steps should be taken:

1. To have a board of members named "Aerodrome Safety Committee";
2. The following names are to be members to the Aerodrome Safety Committee, U-Tapao Airport:

2.1	Director of U-Tapao Airport,	Head of the Board
2.2	Deputy Director of U-Tapao Airport (1)	Deputy Head of the Board of Directors
2.3	Deputy Director of U-Tapao Airport (2)	Deputy Head of the Board of Directors
2.4	Representatives of the Navy Aviation Division,	Board Member
2.5	Representative of the Division of Science and Aviation Safety, the Marine Division,	Board Member
2.6	Director of the Airport and Aviation Standards Division,	Board Member
2.7	Airport Operations Representative,	Board Member
2.8	Representatives of the Division of Asset and Development,	Board Member
2.9	Airport Service Manager Representatives, Thai Airways U-Tapao,	Board Member
2.10	Representative of U-Tapao Station, Bangkok Airways International Co., Ltd.,	Board Member
2.11	Representative of U-Tapao Station, Thai AirAsia Company Limited,	Board Member
2.12	Representative of U-Tapao Station, Back Ground Service Company Limited,	Board Member
2.13	Representative of U-Tapao Station, Thai Lion Company Limited,	Board Member
2.16	Representative of SFS Aviation Co., Ltd.,	Board Member
2.17	Representative of Thai Aviation Service Company Limited,	Board Member
2.18	Representative of H.S. Company Aviation Limited,	Board Member
2.19	Representative of PTT Public Company Limited,	Board Member
2.20	Head of Aviation Security, Airport and Aviation Standards Division,	Board Member
2.21	Head of Occupational Safety and Health Department, Airport and Aviation Standards Division,	Board Member
2.22	Head of Airport Security, Airport and Aviation Standards Division, Board Member and Secretary	Board Member and Secretary
2.23	Safety management system officer, Airport and Aviation Standards Division,	Board Member and Secretary Assistant

3. The Board shall have the powers and responsibilities as follows:
   - 3.1 The Board must comply with aviation safety regulations, rules and regulations.
   - 3.2 Check flight safety once a month
   - 3.3 Hold airport safety consultation meetings every 3 months or when necessary
   - 3.4 Report and recommend safety measures or improvement guidelines
   - 3.5 Promote aviation safety activities
   - 3.6 Determining aviation safety rules and regulations
   - 3.7 Report operational results and evaluate flight safety
   - 3.8 The agencies at U-Tapao Airport shall cooperate with the Airport Safety Committee when requested.

From now on

Ordered on 18 October 2018

พล.ร.ท.
(ลือชัย ศรีเอี่ยมกูล)
ผอ.กทภ.

Figure 6.4 25 Organizational structure and agency responsible for standards and airport safety

Table 6.4-21 The Occupational Health and Public Health Action Plan of U-Tapao Airport of the Year 2020

Sequence	Project/Activity	FY2563																																								
		2019												2020																													
		Oct				Nov				Dec				Jan				Feb				Mar				Apr				May				Jun				Jul				Aug				Sep			
		W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
1	Measurement of the work environment																																														
	1.1 Measurement of the work environment																																														
2	Work safety promotion project																																														
	2.1 Activities 5Sor.																																														
	2.2 Safety notification activities																																														
	2.3 Fire drill evacuation																																														
3	International Health Compliance Operations																																														
	3.1 Hold a meeting of working groups to develop access to the country, U-Tapao Airport																																														
	3.2 Hold a meeting of airline operators and ground service operators																																														
	3.3 Arrange a meeting to receive an assessment of immigration performance																																														
	3.4 Providing information talks to restaurant merchants																																														
	3.5 Standard Inspection of Clean Food Good Taste and Public Toilets (HAS)																																														
	3.6 Training on Emergency Public Health Plan																																														
	3.7 Providing standard inspection equipment for shops and restaurants at the airport as required by the Ministry of Public Health																																														
4	Improve safety warning signs inside the building area																																														
	4.1 Provide safety warning signs inside the building																																														

U-Tapao Airport Service has health care measures for employees and workers, so that they are safe and healthy with no illnesses, with an annual health check program for employees and workers in U-Tapao Airport every year. This is to promote prevention of disease, not a medical treatment, which is conducted by the Queen Sirikit Hospital.

6.4.3.2 Employees and workers' health information

Currently, there are 184 employees and employees of U-Tapao Airport, with 162 workers and employees attending the 2019 annual health check-up, divided into 66 men and 96 women, with the health examination divided into 2 ages, namely employees and workers aged over 35 years and employees and workers aged over 35 years. Details are shown in **Table 6.4-**22

Table 6.4-22 Number of employees and employees of U-Tapao International Airport attend the annual health check-up 2019

Employees	Male (people)	Female (people)	Total (people)
1. Employees and workers aged 35 and under	59	76	**135**
2. Employees and workers over 35 years old	7	20	**27**
Total	**66**	**96**	**162**

Source: Annual Health Check Report (FY2019) U-Tapao International Airport

The health check list of employees and employees are divided by age range of 2 i.e. employees and workers aged 35 and under underwent 7 health check items in total and employees and workers aged over 35 underwent 12 health check items in total, details shown in **Table 6.4-**23 Employees' health check

Table 6.4-23 Employees' health check at U-Tapao Airport, B.E. 2019

List of tests	Aged 35 years or younger	Above 35 years old
1. Body mass index	/	/
2. Blood pressure measurement	/	/
3. Physical examination by a physician	/	/
4. Visual examination	/	/
5. Urine test	/	/
6. Complete blood count test	/	/
7. Blood sugar test	-	/
8. Blood lipid test	-	/
9. Kidney function test	-	/
10. Blood Euric Test	-	/
11. Liver function tests	-	/
12. Chest X-ray	/	/

Note : (-) Non-examinations

Source: Report of annual health check-up results, fiscal year 2019

1) General health examination information

1.1) Health check results for employees and workers aged 35 years or younger

For annual employee health check in FY19 of 135 employees and workers under 35 years of age, there were 7 health check items including body mass index, blood pressure, physical examination by physician, visual examination, urinalysis, complete blood count and chest X-ray. It was found that most of the health examination results were within the normal range, including blood pressure measurement, followed by chest x-ray, and eye examination. The most abnormal health test results were examined by physicians, body mass index, and urine test results. However, the physician had provided recommendations to employees and workers whose examination records were abnormal to get a diagnosis and treatment. Details are as follows **Table 6.4-24** Health check**.**

Table 6.4-24 Health checkresults of employees and workers of U-Tapao Airport not exceeding 35 years of age, fiscal year 2019

List of tests	Number of subject(s) (person(s))	Number of Non-Inspections (Persons)	Above 35 years old	
			Normal (people)	Unusual (people)
1. Body mass index result	135	-	53	82
2. Blood pressure test results	135	-	127	8
3. Physical examination results by a physician	135	-	40	95
4. Visual Acuity Results	133	2	110	23
5. Urine test results	135	-	91	44
6. Complete blood count test results	135	-	100	35
7. Chest x-ray result	134	1	129	5

Note : (-) No visit

Source: Annual Health Check Report (FY2019) U-Tapao International Airport

1.2) Health check results for employees and workers over 35 years of age

For the annual employee health check in FY19 for employees and workers over 35 years of age, there were 27 workers with a total of 12 health check items including body mass index, blood pressure, physical examination by doctor, visual examination of the eyes, examination of the urine, complete blood count, blood sugar test, blood fat test, kidney function test, uric blood test, liver function test and chest X-ray. It is found that the results of the health examination of most employees and workers are in good range for blood pressure, blood sugar levels, kidney function and chest X-Ray; followed by visual examination, urine examination, uric blood test, blood fat test and liver function test. The test results which are most abnormal are body mass index, physical examination by physician, complete blood count, however, doctors have given recommendations to employees and workers who have abnormal results to get a diagnosis and treatment. Details are as follows: **Table 6.4-25** Health check.

Table 6.4-25 Health checkresults of employees and workers of U-Tapao Airport, aged over 35 years, fiscal year 2019

List of tests	Number of subject(s) (person(s))	Number of Non-Inspections (Persons)	Above 35 years old	
			Normal (people)	Unusual (people)
1. Body mass index result	27	-	7	20
2. Blood pressure test results	27	-	25	2
3. Physical examination results by a physician	27	-	9	18
4. Visual Acuity Results	25	2	21	4
5. Urine test results	27	-	21	6
6. Complete blood count test results	27	-	18	9
7. Blood sugar test results	26	1	25	1
8. Blood lipid test results	26	1	19	7
9. Kidney function test results	26	1	25	1
10. Results of blood uric acid test	26	1	21	5
11. Liver function test results	26	1	19	7
12. Chest x-ray result	25	2	25	-

Note : (-) No visit

Source: Annual Health Check Report (FY2019) U-Tapao International Airport

2) Health monitoring information for employees and workers based on risk factors

Employees and workers working in the airside area were examined for 1 more item, which is the area of hearing performance. The risk and impact of hearing impairment is therefore necessary to add items to workers in some locations at risk. Presently (2019), 20 employees and workers are required to undergo hearing function testing are divided into 14 males and 6 females. Details are shown in **Table 6.4-**26

Table 6.4-26 Number of employees and employees of airports working in the airside area, 2019

Employees	Male (people)	Female (people)	Total (people)
1. Employees and workers aged 35 and under	12	6	**18**
2. Employees and workers over 35 years old	2	-	**2**
Total	**14**	**6**	**20**

Source: Annual Health Check Report (FY2019) U-Tapao International Airport

U-Tapao International Airport provides health monitoring for employees and workers based on risk factors, which is a test of hearing once a year. Measurements are conducted with 20 employees and workers. It is found that 16 employees and workers have a normal hearing result and 4 abnormal hearing results. Age and gender can be divided as shown in **Table 6.4-27** and summarized as follows:

- 18 employees and workers aged 35 and under with a normal hearing result of 15 people (9 males and 6 female) and 3 people with abnormal hearing (3 males).
- Employees and workers over 35 years old, 10 persons with normal hearing result, 1 person (1 male) and 1 employee who hears abnormally. (1 male).

Table 6.4-27 Summary of hearing test results for employees working in the Airside area of U-Tapao International Airport, 2019

Employees	Number of (people)	Results of hearing test (people)			
		Getting it normally		Irregular hearing	
		Male	Female	Male	Female
1. Employees and workers aged 35 and under	18	9	6	3	-
2. Employees and workers over 35 years old	2	1	-	1	-
Total	**20**	**10**	**6**	**4**	**-**

Source: Report on annual health check-up results for the fiscal year 2019, U-Tapao International Airport

6.5 Health Impact Assessment Results

Health Impact Assessment uses the risk matrix to consider both the likelihood and consequences of impacts which are factors of health in both construction and operation phase. The risk assessment is used for the assessment of the effects of air pollution in the operational stage. Consideration of the group of risk is based on people in the community who live around U-Tapao International Airport, especially the elderly, pregnant women and children. The factors used to determine the risk of air quality in this study, annual forecast results of the concentration of air pollution, statistics of related sickness such as respiratory diseases, anxieties and concerns of the stakeholders for example; which would be predicted or foretold of the risk of contact of various air pollutants according to the toxicity of the pollutants and safety reference values for lifetime exposure. This topic presents qualitative and quantitative assessment results with details are as follows:

6.5.1 Qualitative evaluation results

The assessment results of the health impact level are described by project operations, divided by construction phase and operation phase. The impact of each phase of the project is based on 2 target groups which are people in the communities surrounding U-Tapao International Airport and construction workers, or employees operating within U-Tapao International Airport. The negative impact on health related to the development of the project is expected to affect public hygiene around the project and its operators, as follows:

6.5.1.1 Impact and preventive measures and resolution of health and public health impacts

The negative health impacts related to the development of the project, which are estimated to affect the health of people in the communities living around U-Tapao International Airport. There are 8 issues in the construction phase and there are 7 issues in the operation phase, which are assessed using the risk matrix as detailed in **Table 6.5-1** Impact

Table 6.5-1 Impacton health of people in the community with potential and significance

Issues of Impact	Risk group	Common factors used in consideration	Level of impact
Construction Phase			
1) Loud noises	- People in communities living near construction areas and service to U-Tapao International Airport	- Noise level from construction activities - Noise levels in sensitive communities near the project - Anxieties and concerns of stakeholders	Moderate
2) Vibrations	- People in communities living near construction areas - Service users of U-Tapao International Airport	- Level of vibrations from construction activities - Level of vibrations in sensitive areas of the community near the project - Anxieties and concerns of stakeholders	Moderate
3) dust	- People in communities living near construction areas	- The concentration of dust from construction activities - Dust concentrations in sensitive communities near the project - Anxieties and concerns of stakeholders	Moderate
4) Adequacy of public utilities systems (drinking water)	- People in communities living near construction areas and accommodation of construction workers	- Amount of water demand - Water supply capacity of the agency providing the water - Anxieties and concerns of stakeholders	Moderate
5) Travel convenience (agility)	- People in the community who live around U-Tapao International Airport and close to the transportation channels surrounding U-Tapao International Airport. - People in communities living nearby building worker accommodation	- Road capacity - Road Complaint Statistics - Information on current situation of traffic - Anxieties and concerns of stakeholders	Moderate
6) Community social networks/safety of life and assets	- People in the community who live near construction workers' accommodation	- Increase in number of employees - Community Relations Activities - Information on the current social	Moderate

Table 6.5-1 Impacton health of people in the community with potential and significance

Issues of Impact	Risk group	Common factors used in consideration	Level of impact
	and around U-Tapao International Airport.	environment of the community - Anxieties and concerns of stakeholders	
7) Sanitation (waste management, waste)	- Villagers nearby accommodation for construction workers and around U-Tapao International Airport	- Results of assessment on the impact of wastewater and waste management on construction - Measures to Supervise the Construction Contracting Company - Specify water procurement practices for use- consumption, waste management, and wastewater in the housing area of construction workers. - Anxieties and concerns of stakeholders	Moderate
8) Common communicable diseases (main disease group that is the cause of water and food-borne illness/diseases, respiratory illness including the occurrence of viral epidemics such as the COVID-19 outbreak)	- People in the community who live near construction workers' accomodation and around U-Tapao International Airport.	- Number of construction workers - Procurement guidelines and requirements for sanitation management in construction areas and housing of construction workers - Local population illness statistics from the public health agencies - The capacity of public health facilities, personnel, and medical supplies in the area. - Anxieties and concerns of stakeholders	Moderate
9) Public safety (road traffic accident)	- People in the community who live around U-Tapao International Airport and close to the transportation channels surrounding U-Tapao International Airport.	- Accident statistics that occurred in the study area - Project prevention measures - The readiness and suitability of the plan Good communication with the community - Anxieties and cares of stakeholders	Moderate
10)The adequacy and access to health services systems, including personnel and medical supplies	- People in the community who live around U-Tapao International Airport	- Health statistical data and Public health in educational areas of the project - Information on the current state of public health services and opinions of relevant government officials - Anxieties and concerns of stakeholders	Moderate

Table 6.5-1 Impacton health of people in the community with potential and significance

Issues of Impact	Risk group	Common factors used in consideration	Level of impact
Operation Phase			
1) Noise pollution	- People in the community who live around U-Tapao International Airport - Especially the elderly, pregnant women, and children	- Number of flights - The result of the noise level - Measurement results of noise level in the study area - Related illness statistics, such as high blood pressure - Anxieties and concerns of stakeholders	Moderate
2) Vibrations	- Residents that live around the airport, especially along the flying routes.	- Predicted aircraft vibrations along the flight path that could cause the community to be affected by winds that hit the end of the wing. - Anxieties and concerns of stakeholders	Moderate
3) Dust and air pollution	- Residents living around the airport (sensitive groups will affect impacts such as children, pregnant women, elderly persons).	- The concentration of the pollution causing the health effects as predicted by a mathematics model. - Reference concentration value for assessment of health effects - Affected area - Respiratory and cardiovascular disease rates - Anxieties and concerns of stakeholders	Moderate
4) Adequacy of public utilities systems (drinking water)	- People in the community who live around U-Tapao International Airport	- Amount of water demand - Water supply capacity of the agency providing the water - Anxieties and concerns of stakeholders	Moderate
5) Travel convenience (agility)	- People in the community who live around U-Tapao International Airport and people using U-Tapao International Airport	- Road capacity - Complaint Statistics - Anxieties and concerns of stakeholders	Moderate
6) Common communicable diseases (main disease group that causes illness in the area/respiratory diseases including the occurrence of viral epidemics such as the COVID- 19 outbreak).	- People in the community who live around U-Tapao International Airport - Airport service users	- Airport communicative disease control plan - Study area population morbidity statistics - The capacity of public health facilities, personnel, and medical supplies in the area. - Anxieties and concerns of stakeholders	Moderate

Table 6.5-1 Impacton health of people in the community with potential and significance

Issues of Impact	Risk group	Common factors used in consideration	Level of impact
7) Public safety (road and air traffic accidents)	- People in the community who live around U-Tapao International Airport and close to the surrounding transportation routes. - Airport service users	- Number of flights - Accident statistics that occurred in the study area - Project prevention measures - Good communication and rehearsal plan Emergency plan with community - Anxieties and concerns of stakeholders	Moderate
8) Sanitation (waste management, waste)	- People in the community who live around U-Tapao International Airport	- Ability to manage wastewater and waste in U-Tapao International Airport - Results of assessment on wastewater and waste system adequacy - Anxieties and concerns of stakeholders	Moderate
9) The adequacy and access to health services systems, including personnel and medical supplies	- People in the community who live around U-Tapao International Airport	- Health statistical data and Public health in educational areas of the project - Information on current situation of Public health systems, including health care professionals and medical supplies - Anxieties and concerns of stakeholders	Moderate

The impacts and prevention measures and the resolution of the health impacts of people in the community can be summarized as detailed in **Table 6.5-**2 and **Table 6.5-**6

Table 6.5□2 Summary of impacts and preventive measures and resolution of community health impacts (construction phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
1) Noise	**Physically** Noise from construction activities, machinery and equipment used to free up space, construction, runways and 2nd driveway **Mentally** Stress and annoyance **Risk group** Residents nearby construction areas and airport service users	**Physically** The noise level from the construction will affect the hearing of nearby residents and operators of the aircraft. If exposed to noise for a long period of time, it may cause hearing loss. Hearing loss may be temporary or permanent depending on the volume and duration of exposure. It will also interfere with communication and rest. **Mentally** The noise level from the construction causes distraction, annoyance and can also result in chronic diseases.	**Moderate (3)** The project does not have operational standards that control the level of the machinery's noise level and there is no plan to select the maintenance of equipment used in construction as well as the anxieties and concerns of stakeholders.	**Moderate (2)** Machinery operations from construction activities, such as hammering, digging, drilling, impacts on sensitive areas and communities surrounding project areas at 178 sites, fall in the range of 59.7-65.2 decibel A, which is less than average of 24 hours of normal noise level standards.	**Moderate(3x2=6)**	• Follow measures to prevent and resolve the environmental impacts of noise during the construction phase (Chapter 7, Topic 7.3.1 Voice Action Plan) • Notify public health agencies of activities, number of workers and duration of work. • Open complaint channels, such as the U-Tapao International Airport public relations website, RTN and EEC or construction operators websites, online media, etc.
2) Vibration	**Physically**	**Physically** Vibrations from construction activities	**Moderate (3)** Construction activities take place inside the	**Moderate (2)** In the event that public buildings and	**Moderate (3x2=6)**	• Follow the measures to prevent and resolve environmental impacts of

Table 6.5□2 Summary of impacts and preventive measures and resolution of community health impacts (construction phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
	Vibrations from construction machinery **Mentally** Annoyance and anxieties **Risk group** - People in communities living near construction areas - Service users of U-Tapao International Airport	may cause damage to building structures and nearby houses in the construction area. **Mentally** It is an anxiety and annoyance to the sense of vibration.	airport. Vibration is caused by the use of the Bore Piling Machine equipment, which is not ongoing. The assessment of vibrations from such machinery will be made to the community and sensitive areas near the construction area stage 1,120 meters found that the impact on the local population was incapable of having any effect and no impact/ damage on all types of structures. However, it is a concern of the community to the risk of household collapse due to the large number of construction activities within the airport area. The project also has not yet set a clear schedule for controlling and monitoring construction companies operations.	households are affected by the construction activities of the project, it may cause property damage and safety, affecting the budget of local authorities to manage and restore.		vibration during the construction phase (ONEP.1 form, Section 2. Vibration) • Specify practices for construction contractors / sub-lease companies to monitor operations. • Open complaint channels, such as the U-Tapao International Airport public relations website, RTN and EEC websites, online media, etc.

Table 6.5□2 Summary of impacts and preventive measures and resolution of community health impacts (construction phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
3) Dust	**Physically** Dust from construction activities, area adjustment **Mentally** Annoyance and anxieties **Risk group** Residents near the construction area	**Physically** Dust arising from construction activities, localization will affect the health of people in the communities who live around the airport, causing irritation and inflammation of the respiratory tract system, increasing the risk of respiratory illness, interfering with vision, resulting in accidents. **Mentally** Dust generated from construction may cause disturbances in vision and dirtiness.	**Moderate (3)** Land opening activities, pitching and building runways and 2nd driveway may lead to dust dispersion. The project has no operating standards to control dust from construction as well as anxieties and concerns for stakeholders.	**Moderate (2)** Normally, construction dust will be a temporary impact. This is due to the average 24 hours of expected total particulate matter (TSP) during construction of the 2nd track and driveway combined with the baseline measurement value, which is in the range of 74.273-165.920 micrograms per cubic meter, which is not exceeding the standard value (330 micrograms per cubic meter), with the maximum concentration in the area of Village 3, Ban Sa Kaeo which is 1,870 meters away from the construction area, while the concentration of particulate matter	**Moderate (3x2=6)**	• Follow preventive measures and correct environmental impacts, air quality, during the construction phase (Chapter 7, Topic 7.3.3 Air Quality Action Plan). • Notify public health agencies of activities, number of workers and duration of work. • Open complaint channels, such as the U-Tapao International Airport public relations website, RTN and EEC or construction operators websites, online media, etc.

Table 6.5□2 Summary of impacts and preventive measures and resolution of community health impacts (construction phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
				does not exceed 10 micron (PM_{10}), the average of 24 hours is in the range of 42.568-68.148 micrograms per cubic meter, which does not exceed standard values (120 micrograms per cubic meter). The effects on disease incidence are low, but the effects on the mind is moderate due to causing irritation and irritability due to physically dirtiness.		
4) Adequacy of public utilities systems (drinking water)	**Physically** Adequacy of water for consumption **Mentally** Anxiety **Risk group** Residents living around the airport	**Physically** If water for usage and consumption is not sufficient to the need, shortages for people living in the surrounding area, water use between people in the community and workers may also result in gastrointestinal	**Moderate (3)** The amount of water used within the U-Tapao International Airport area is estimated to be around 300 construction workers and about 30 control staffs, total of 330 people. The usage of water is around 23.10 cubic meters per day.	**Moderate (2)** Water shortages may lead to the development of water-based diseases, but in accordance with the local private agency (East Water Company), there is a water management plan sufficient to supply to the service group thoroughly and	**Moderate (3x2=6)**	• Follow the measures to prevent and resolve the environmental impacts of water use during the construction phase (Chapter 7, Section 7.3.16 Public utilities and public facilities action plans). • Open complaint channels, such as the U-Tapao International Airport public relations website, RTN and EEC or construction operators websites, online media, etc.

Table 6.5□2 Summary of impacts and preventive measures and resolution of community health impacts (construction phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
		diseases containing water and food. **Mentally** The use of water by construction workers, including from construction activities, may cause anxiety to the community in terms of the adequacyof water for consumption.	The residential area where workers use water is around 45.00 cubic meters per day. However, the framework shall be specified in the contract of the construction contractor to provide a water storage tank in order to provide adequate water supply in the event that the public water does not flow.	adequately. Therefore, access and adequacy problems are not important issues. However, the cost of raw water source management and searching for raw water will increase. In addition, all groups have a chance of being affected.		
5) Travel convenience (mobility)	**Physically** Traffic, transportation and accidents **Mentally** Anxiety and Annoyance **Risk group** Those who live around the airport and are in the transportation	**Physically** Transportation activities of materials, equipment, machinery and workers may result in traffic congestion in some routes, delayed route traffic and increased risk of accidents to the public near project areas and route users, resulting in injuries and death.	**Low (2)** Construction of the project will use Highways 3, 331, 332 and 3126 to transport various equipment materials and transport construction workers from the accommodation, which will increase the V/C ratio very rarely (maximum of 0.53)	**Moderate (2)** There is no support data arising from the inconvenience of traveling to the patient rate. However, construction equipment materials transportation activities cause anxiety to the main risk groups of working adults and those in residences	**Moderate (2x2=4)**	• Follow the measures to prevent and resolve the environmental impacts of transportation during the construction phase (Chapter 7, Section 7.3.15 Transportation Action Plan). • Implement measures to protect and resolve environmental, economic and social impacts during the construction phase (Chapter 7, Topic 7.3.18, Economic and Social Action Plan) • Open complaint channels, such as the U-Tapao International Airport public relations website, RTN and EEC or

Table 6.5□2 Summary of impacts and preventive measures and resolution of community health impacts (construction phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
	channel and the people nearby who live close to workers' accommodation.	<u>Mentally</u> People on the road may be concerned and annoyed that they have to stay in the car for a long time and the transportation of construction materials and equipment/machinery of the project causes loud noises and vibrations, which may cause annoyance to those who live near the said transport channel.	while traffic conditions are still in level A with high flexibility.	around the transportation channel. According to the comments, there was a suggestion from the community to consider opening new airport access channels for transportation of construction equipment materials to reduce the impact of traffic congestion at current entrance areas, as well as offering to avoid transit through communities, temples, schools, and traffic routes. Moreover, project transport activities may affect local budgets in traffic management in case of the road damage caused by the project transportation.		construction operators websites, online media, etc.
6) Community social networking/life and property safety	<u>Physically</u> Routine and lifestyle of foreign workers	<u>Physically</u> When workers from different regions	**Moderate (3)** The construction period uses	**Moderate (2)** Information on the statistical data of the	**Moderate (3x2=6)**	• Implement measures to protect and resolve environmental, economic and social impacts during the construction

Table 6.5□2 Summary of impacts and preventive measures and resolution of community health impacts (construction phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
	Mentally Annoyance, anxiety and stress. **Risk group** Residents who live around the airport	entering the area, there may be different lifestyles or the use of public utilities may cause conflict and controversy. **Mentally** Anxiety, dissatisfaction, paranoia, fear of damage to life and property	approximately 330 workers and the construction period is around 30-36 months. Furthermore, construction workers are located in the community area and there is no clear practice in managing construction workers.	arguments, warning, or crimes in the study area do not change the plots. However, there is a concerns of the local population that foreign workers may cause damage to life and property, which may affect the local budget in social security management.		phase (Chapter 7, Topic 7.3.18, Economic and Social Action Plan) • It is required that the list be notified with the worker's history prior to joining the local authorities and monitored once a year.
7) Sanitation (waste management, waste)	**Physically** Pathogens and carriers may be caused by poor sanitation within the construction area and the accommodation of construction workers. **Mentally** Annoyance and Anxiety **Risk group** People in communities living near construction areas and	**Physically** Without good sanitation management, those areas could become breeding sites for pathogens and disease carriers, causing the spread of diseases to nearby areas. **Mentally** If waste and wastewater are not adequately managed, it may cause foul odors and irritate to those who live in the	**Moderate (3)** The project specified in the contract for the contractor to provide the contractor with a wastewater management system and waste management system arising from construction activities and the daily use of construction area workers in the airport and overnight accommodation outside the airport to support the volume of wastewater	**Moderate (2)** If gastrointestinal infections occur, they may increase the rate of illness, which may impact the health care system's expense budget. The budget may need to be adjusted to support public health problems and affect all groups of people.	**Moderate (3x2=6)**	• Follow the measures to prevent and resolve the environmental impacts of waste and wastewater management during the construction phase (ONEP.1 form, Section 13. Waste and wastewater management) • Implement measures to prevent and resolve environmental impacts on occupational health and safety, sanitation issues on workers' accommodation during the construction phase (ONEP.1 Form, Topic 21. Occupational Health and Safety) • Implement measures to protect and resolve the impacts of the economy and society during the construction phase. The issues regarding the provision of

Table 6.5□2 Summary of impacts and preventive measures and resolution of community health impacts (construction phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
	accommodation of construction workers	surrounding area and visitors to the airport. It also causes anxiety in the areas of the cleanliness of the U-Tapao International Airport.	and waste that will be increased from such activities. However, if the contractor is unable to manage, it will affect the local authorities outside that are responsible for environmental management.			suitable accommodation for construction workers and orderly care in the construction area and worker accommodation areas, including the establishment of a board to monitor impacts with the principles of community involvement in monitoring (ONEP.1 form, Topic 18. Economics and Society) • Notify public health agencies of activities, number of workers and duration of work. • Open complaint channels, such as the U-Tapao International Airport public relations website, RTN and EEC or construction operators websites, online media, etc.
8) General Communicable Diseases (Main causative illness group) Water and food borne illness/disease, respiratory illness, including viral epidemics such as outbreaks of COVID-19)	**Physically** Pathogenic organisms such as bacteria, viruses, especially those that cause severe outbreaks such as SARS,the COVID 19 virus, increase the need for public health service and medical supplies. **Mentally** Anxiety of infection of the pandemic	**Physically** The entry of workers. Locals may bring infectious diseases to the community. In addition, if there is no proper care of the worker's residential area, it may be a source of disease, especially water- and food-borne diseases, media, or acute viral respiratory diseases, such as SARS,the COVID	**Moderate (3)** According to the statistical data of illness with significant infectious diseases in the study area, between 2015-2019, it was found that diarrhea had the highest rate, followed by Encephalitis. Most commonly found in the Huaypong subdistrict, Mueang Rayong District, which has continued	**High (3)** In case of illness caused by infectious diseases to the body's system, it may increase both the rate of illness and the severity of the disease, which may affect the health care system's expenses, including medical supplies, may affect public health budgets and other plans and	**Moderate (3x3=9)**	• Follow the environmental impact prevention and correction measures for waste and wastewater management during the construction phase (ONEP.1 Form, Section 13. Waste and wastewater management) • Implement preventive measures and resolve environmental impacts on occupational health and safety, sanitation issues for construction workers during the construction phase (ONEP.1 form, section 21. Occupational Health and Safety)

Table 6.5□2 Summary of impacts and preventive measures and resolution of community health impacts (construction phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
	Risk group People in the community who live near construction workers' accommodation and around U-Tapao International Airport.	19 virus. In the event of a outbreak of the disease, it may result continued service in public health facilities. **Mentally** The number of construction workers who work in the area may cause anxiety to the nearby people in regards to the use of public health services, healthcare professionals and public health which is currently insufficient.	outbreaks since 2015-2019. Pneumonia was found in the Huaypong subdistrict area, Mueang Rayong District, and Samaesarn subdistrict, Sattahip District, Chonburi the most likely to have hemorrhagic fever but with a downward trend. In addition, the project has no clear guidelines for supervising construction companies to maintain sanitation and hygiene of their residences, so there is a moderate probability that there is a high likelihood of contracting infectious diseases from the entry of migrant workers.	affect the population of all groups. Moreover, it is also a community concerns, which listening to the feedback given to the project to have a prevention plan against workers, tourists, and latent populations that enter the area causing new/recurrent diseases in the area, as well as a project to emphasize preliminary prevention and to administer vaccines in risk groups to prevent the occurrence of infectious diseases.		• Implement measures to protect and resolve the impacts of the economy and society. During the construction phase, on the issues of providing suitable and orderly accommodation for the construction area and the housing area, including the establishment of a board to monitor impacts by involving the community in monitoring (ONEP.1 form, Topic 18. Economic and social) • There are procedures for care for residential hygiene, waste management and sewage, including prevention and disposal of disease carriers, and strict monitoring must be carried out. • Set up health checks and report the list along with the worker's health history before joining the public health agencies. • Direct the contractor to provide knowledge and advice to the workers regarding good hygiene practices, cleanliness and protection of contact diseases by requesting assistance from public health facilities in project areas, such as hospitals, public health services, and should begin at the beginning of construction. • Direct the contractor to strictly comply with laws, notices and regulations

Table 6.5□2 Summary of impacts and preventive measures and resolution of community health impacts (construction phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
						related to the control and prevention of communicable diseases, such as Public Health Act Communicable diseases, including compliance with public health measures to control the outbreak of infectious diseases with a public health urgency, such as coronavirus (SARS-CoV, Covid-19) Influenza 2009 by complying with national and international laws and regulations, such as (1) the Infectious Diseases Act, 2015 (2) Notification of the Department of Health regarding the Regulations, Procedures and Measures on the Prevention of Risk from Coronavirus Disease 2019 (COVID– 19) for Government Offices, Private Workplace and Business Offices 2020 (3) Notification of the Department of Health on Criteria, Methods and Measures to Prevent the Risk of Coronavirus Disease 2019 (COVID-19) for service provider Public Transport 2020 (4) Suspected communicable disease universal precaution Kit (IATA, 2017) (5) Communicable disease surveillance and response systems: Guide to monitoring and evaluating (WHO, 2006). • The Contractor is required to prepare a plan for the prevention of

Table 6.5□2 Summary of impacts and preventive measures and resolution of community health impacts (construction phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
						communicable diseases in the construction workers' accommodation areas proposed to RTN and EEC. • Set RTN and EEC to coordinate with local public health agencies to plan the implementation and prevention of environmental and health problems in the construction worker accommodation area of the project. • Notify public health agencies of activities, number of workers and duration of work. • Prepare media and promote communication channels with RTN and EEC to send information to public health agencies. Record of activities related to the support of public health agencies. • Open complaint channels, such as the U-Tapao International Airport public relations website, RTN and EEC websites, online media, etc.
9) Public safety (road traffic accident)	<u>Physically</u> Activities that can cause accidents <u>Mentally</u> Anxiety and Stress <u>Risk group</u>	<u>Physically</u> Accidents cause injuries, loss of life and property, which may increase medical and public health requirements, including medical supplies, and affect	**Moderate (3)** The transportation of construction materials of the project will increase the number of cars, together with the existing traffic density in the area around U-Tapao	**High (3)** The impacts that occur may cause loss of life and property, and accidents impact the patient rate, injuries, and budgets of relevant agencies in	**Moderate (3x3=9)**	• Follow the measures to prevent and resolve the environmental impacts of transportation during the construction phase (Chapter 7, Section 7.3.15 Transportation Action Plan). • Implement measures to protect and resolve environmental, economic and social impacts during the construction

Table 6.5□2 Summary of impacts and preventive measures and resolution of community health impacts (construction phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
	Residents living around the airport	the adequacy of health care and medical products personnel. Mentally Anxiety of the problems, injuries, absences, medical expenses, expenses and any damages arising from the accident, which may cause stress.	International Airport, which will increase the likelihood of accidents in transportation, as well as the trend of accidents in Rayong and Chonburi. The project has not yet set a clear schedule for controlling and monitoring construction companies operations and is concerned and cared by stakeholders.	the area. This impact can occur with local population of all age groups, therefore the severity of the impact is high.		phase (Chapter 7, Topic 7.3.18, Economic and Social Action Plan) • Specify guidelines for construction/sub-lease contractors to monitor operations • Open complaint channels, such as the U-Tapao International Airport public relations website, RTN and EEC or construction operators websites, online media, etc.
10) Sufficient and access to health services systems, including personnel and medical supplies	Physically Increasing the need for medical and public health services Mentally Anxiety and stress. Risk group Residents living around the airport (children, pregnant women, seniors)	Physically The ongoing and cumulative impact of other impacts, resulting in increased demand for public health services, medical supplies, and health care professionals in the area, may lead to insufficient readiness and adequacy of health facilities,	**Moderate (3)** There is a possibility that the local population and the sick construction workers will receive more services to public health agencies from the public sector, which may lead to the usurpation use of public health services. In particular, the project has no	**High (3)** As the impact on public health system adequacy is cumulative. If public health agencies are unable to provide support or provide services effectively, it may cause overall impact to the local community. According to the statistical data of the patient's illness	**Moderate (3x3=9)**	• Set RTN and EEC or construction operators to coordinate with local public health agencies to plan operations and protections against environmental and health issues in construction areas, projects, and construction workers' residences. • Set RTN and EEC or construction operators, provide or locate a medical facility or public health system for the service provision of services to the public, which shall not be burdened by the main medical facilities used by the local population.

Table 6.5□2 Summary of impacts and preventive measures and resolution of community health impacts (construction phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
		personnel and medical supplies, and public sector budget allocations. **Mentally** Anxiety of speed of service and the ability to maintain and access health services as there are increasing number of visitors.	guidelines toarrange for contractor health welfare and is a concerns and care from stakeholders about the number of workers and latent population that will enter the area to use the public health services and offer workers to move the house registration to the area to allow the medical budget to enter the area as well as well as propose to have a health examination and establish the health status of the local population to monitor the impact. This is to raise awareness in the area	during the hospital stay during 2015-2019, it was found that it was caused by pneumonia, bronchitis, other complications of pregnancy, and delivery, which is a group of diseases that require medical devices and equipment readily available. The entry of foreign workers during the construction phase could impact local budget in providing adequate equipment and medical supplies to patients.		• Have RTN and EEC or construction operators, provide a channel for public health agencies in the area to contact, as well as supporting local health authorities in the areas of the readiness of health facilities and the potential of personnel. • Conduct CSR (Corporate Social Responsibility) by supporting subdistrict health promotion hospitals in the area surrounding the project. • Create a list of health facilities/ public health agencies nearby the project area with the contact coordinator's name and telephone number for the coordination of the activity details. • Prepare media and promote communication channels with RTN and EEC or construction operator to send information to health authorities . Record details of activities related to the support of public health agencies.

Table 6.5□3 Summary of Impact and Preventive Measures and Resolution of Community Health Impact (Operating Phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
1) Noise pollution	**Physically** Voice from the business-sector **Mentally** Stress and Annoyance **Risk group** Airport service users and those who live around the airport (children, pregnant women, seniors)	**Physically** Noise from the aircraft may affect the hearing of people living around the airport and users of the airport. Long periods of noise exposure may cause hearing loss. Hearing loss may be temporary or permanent depending on the noise level and duration of exposure. In addition, it may interfere with rest, which may affect people with the underlying diseases such as high blood pressure, heart disease, etc. **Mentally** Causes annoyance, lack of concentration, and disturbance to rest, may cause stress.	**High (4)** According to the comparison of the area of the line (NEF line), in the case of running of runways and 2nd driveway (as shown in the heading of Noise and Vibration), it was found that in the opening year 1998 there was a NEF 30-40 and NEF ≥ 40 increase from the present date (2019), which would increase the number of people affected by the aircraft. However, the project has put preventive measures to resolve the impact on the noise from the aircraft.	**Moderate (2)** Noise from the airplane causes more annoyance than noise from motor vehicles. Noise in the environment may cause the sleep system of people to be unable to sleep continuously for a period of time. It can make you startle early in the morning while still not getting enough rest. The results of epidemiological studies show that long-term exposure to loud noises can cause high blood pressure and may end in cardiovascular disease. Sleep disturbances can affect hormonal and metabo lic changes permeate (including enzymes and cell functions). The long-term consequence is the occurrence of cardiovascular disease,	**Moderate (4x2=8)**	• Implement measures to prevent and resolve impacts on the environment of noise and vibration during the operational phase (Chapter 7, Topic 7.3.1 Voice Action Plan) • There is continuous monitoring of the noise level. • Set up an fund from the impact from U-Tapao International Airport to alleviate the impacts that the public may have on the operations of U-Tapao International Airport to alleviate overall environmental and public health impacts. • Coordinate and collaborate with public health agencies to plan the operation of hearing performance, monitoring of the people affected by the noises of the operations of U-Tapao International Airport. • Promote and support the potential to monitor the noise pollution of public health agencies and volunteer groups. • Open complaint channels, such as the U-Tapao International Airport public relations website, RTN and EEC or project management or maintenance websites, online media, etc.

Table 6.5□3 Summary of Impact and Preventive Measures and Resolution of Community Health Impact (Operating Phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
				the variation between day and night also affects the immune system, sensitization which can cause the sensitized heart muscle cells to thicken or become enlarge. Although the current sleep test results are polysomnography and not directly associated with cardiovascular disease. But this should be able to serve as an index for long-term risk monitoring for cases of high blood pressure. Loud noises can affect stress hormones such as epinephrine or norepinephrine where this group of substances may affect the function of the endothelial wall. This change can lead to the development of atherosclerosis. However, previous		

Table 6.5□3 Summary of Impact and Preventive Measures and Resolution of Community Health Impact (Operating Phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
				studies have not been able to conclude that noise is a direct cause of hypertension or cardiovascular diseases, that is, loud noises may be a contributing factor in the occurrence of chronic diseases mentioned above and affects only those who are at risk, such as age >35, those who are overweight, type 2 diabetic patients, occupation, physical inactivity drinking and smoking high-fat foods, etc.		
2) Vibration	**Physically** Items falling due to Aircraft and compressed air loss (Wake Vortex) **Mentally** Anxiety and stress **Risk group** People in the community who live around U-Tapao	**Physically** Vibrations caused by the aircraft along the flight path. **Mentally** Causes stress and anxiety in the event that it occurs.	**Moderate (3)** The main activities in the operational phase of U-Tapao International Airport when the 2nd runway is activated will increase. There may be some vibrations from the aircraft along the route that could be	**Moderate (2)** The damage caused by falling objects from the aircraft falling to the roof of the household in the community, including compressed air, causes stress and anxiety for the people who have households	**Moderate (3x2=6)**	• Implement preventive measures and resolve environmental impacts of vibration during the operational phase (ONEP.1 Form, Section 2. Vibration) • Implement measures to protect and resolve the impacts of the economic and social environment during the implementation phase (ONEP.1 Form, Section 18. Economic and social)

Table 6.5□3 Summary of Impact and Preventive Measures and Resolution of Community Health Impact (Operating Phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
	International Airport, especially along the flying route.		affected by winds at the end of the wing.	along the route. In the event that such an accident will damage property, it may cause damage to the local budget, and may cause life damage, injury, increase illness rate, and affect the management budget, which may increase medical and medical requirements, and medical supplies, and the adequacy of public health and medical personnel.		• Requires the airport operations certification recipient to coordinate with public health agencies to plan operations and prevention of environmental and health correction in the community areas surrounding U-Tapao International Airport. • Promote and support the emergency management of public health agencies and safety agencies and volunteer groups.
3) Dust and air pollution	**Physically** Dust exhaust from Aerospace and cars **Mentally** Annoyance and Anxiety **Risk group** People in the community who live around U-Tapao International Airport.	**Physically** Operating the engine of Aircraft and cars, including vehicles that pick up and transport passengers, cause fuel burn, cause exhaust gas, such as hydrocarbon compounds (PAHs), volatile organic compounds (VOCs), sulfur dioxide (SO2), nitrogen oxide (NO_x), and	**Moderate (3)** The increased number of flights resulting in increased aircraft volume and air pollution. The program to assess the quantitative risk of health from exposure to pollutants through respiratory tract, by explaining the risk compared to reference	**Moderate (2)** Air-borne pollutants have an effect on increasing the risk of respiratory illness in the public area. Respiratory illness is an important cause of illness. Although the risk of respiratory impacts is expected to be low and long-term, it may be a	**Moderate (3x2=6)**	• Follow preventive measures and correct the impact of the air quality environment during the operational phase (ONEP.1 Form, Section 3. air quality) • Regular monitoring of air pollution is conducted, especially in air pollution risk areas. • Coordinate with and cooperate with public health agencies in the health monitoring of vulnerable groups. The analysis and monitoring of environmental impact reports must be conducted

Table 6.5□3 Summary of Impact and Preventive Measures and Resolution of Community Health Impact (Operating Phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
		particulate matter (PM), which result in irritation and inflammation of the respiratory system, increase the risk of respiratory illness. Mentally Dust and air emissions from airplanes and vehicles, such as soot / smoke, may cause annoyance to the people around the project area.	values, namely (1) the risk level of non-cancer risk based on HQ HI and the risk of cancer risk from exposure to 4 expected organic volatile substances, including Acrolein, benzene. 1,3 Butadiene and Formaldehyde and (2) the risk level when compared to the environmental standard values for other airborne substances, namely nitrogen dioxide (NO2)gas sulfur dioxide (SO2)and particulate matter ($PM_{2.5}$ and PM_{10}) with the exposure risk assessment (HQ) of each substance being less than 1 except for Acrolin with an HQ of more than 1 about 1-5 times the community area around U-Tapao International Airport on the North and East side. However, this risk does not require an	common cause that affects the overview of the public's health status, especially in vulnerable groups such as the elderly, chronic patients, young children, and is also a concerns of people in the area, especially those with the same experience and do not fully understand.		continuously with the public health agencies to consider the potential health impact on the risk group after opening and to provide solutions for appropriate impacts consistent with the situation. • Promote and support the capability of monitoring the air pollution of public health agencies and volunteer groups. • Open complaint channels, such as the U-Tapao International Airport public relations website, the website of the EEC, Online media, etc.

Table 6.5□3 Summary of Impact and Preventive Measures and Resolution of Community Health Impact (Operating Phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
			emergency evacuation of the public. As the concentration of Acrolin in the area does not exceed the maximum concentration allowed at U-Tapao International Airport to be exposed in the short duration (IDLH). In addition to the cumulative risk was found that the hematologic and reproductive HI risk values were less than 1 except for the respiratory system with HI values greater than 1 due to Acroline. As for the cancer risk (Cancer Risk) from exposure to Benzene in the highest concentration scope ranges from 2-4 people in ten million exposures. 1,3-Butadiene, 3 people in one million exposure and Formaldehyde of 7 people in one million exposure. As for the risks in accordance with the			

Table 6.5□3 Summary of Impact and Preventive Measures and Resolution of Community Health Impact (Operating Phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
			environmental standards for pollution NO_2 SO_2 PM substance$_{2.5}$ and PM_{10} with the highest concentration level below the standard. However, the distance further away from U-Tapao International Airport will be increased. The risk will be reduced.			
4) Adequacy of public utilities (drinking water)	**Physically** Adequacy of water for consumption **Mentally** Anxiety **Risk group** Residents living around the airport	**Physically** If water for usage and consumption is insufficient to the demand, shortage for those living in the surrounding area may result in usurpation of water use between people in the community and the service of the airport which may also result in gastrointestinal diseases with water and food as the medium. **Mentally**	**Moderate (3)** The volume of water used within the U-Tapao International Airport in 1998 is expected to be 19,332.52 cubic meters per hour, with the airport receiving tap water from East Water's public water production system, the design with the highest capacity of 20,000 cubic meters per day. Planning for construction of 2 phases of public water reserve tank, i.e. Phase 1, with a	**Moderate (2)** Water shortages may lead to water-based disease, but in accordance with the local private agency (East Water Company), there is a water management plan sufficient to supply to the service group thoroughly and adequately. Therefore, access and adequacy problems are not important issues. However, the cost of raw water source	**Moderate (3x2=6)**	• Implement measures to prevent and resolve environmental impacts in the public utilities and public facilities in the operational phase (Chapter 7, Heading 7.3.16 Public utilities and public facilities service action plans) • Open complaint channels, such as the U-Tapao International Airport public relations website, RTN and EEC or project management or maintenance websites, online media, etc.

Table 6.5□3 Summary of Impact and Preventive Measures and Resolution of Community Health Impact (Operating Phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
		Using water at the airport may cause anxiety to the community in terms of the adequacyof water for consumption.	backup tank of 30,000 cubic meters of water can be reserved for use for at least 3 days and 2nd phase construction of a water supply tank with capacity of 30,000 cubic meters of water can be reserved for use for at least 3 days with a total capacity of 60,000 cubic meters from the potential of water supply to U-Tapao International Airport, which can accommodate up to 70 million passengers, without affecting the water use of those around U-Tapao International Airport	management and searching for raw water will increase. In addition, all groups have a chance of being affected.		
5) Travel convenience (mobility)	**Physically** Traffic volume inside and outside the airport and accidents **Mentally** Anxiety and annoyance	**Physically** Passenger traffic causes traffic congestion around the airport and may cause motor vehicle accidents	**Moderate (3)** The results of traffic condition assessment after the operations of the 2nd route and driveway in 1998. It is expected that the main	**Moderate (2)** The inconvenience of travel may cause stress for travelers on that route or result in accidents, injuries and	**Moderate (3x2=6)**	• Implement measures to prevent and resolve impacts on the transportation environment during the transit period (Chapter 7, Section 7.3.15 Transportation Action Plan) • Specify guidelines for all cars entering and exiting, and provide a system of

Table 6.5□3 Summary of Impact and Preventive Measures and Resolution of Community Health Impact (Operating Phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
	Risk group Residents living around the airport and those who use airport service.	resulting in loss of life and property. **Mentally** Anxiety about travel times for service users traveling to the airport and causing annoyance to road users and the public in the surrounding area.	road around U-Tapao International Airport area, namely Highway 331, 332, 3216, will be very busy, with the service level F being barely mobile (V/C Ratio more than 1) and there is a need to expand the traffic for all major channels.	may affect the budget of relevant agencies.		traffic routing that can be easily supported within the U-Tapao International Airport area. • Open complaint channels, such as the U-Tapao International Airport public relations website, RTN and EEC or project management or maintenance websites, online media, etc.
6) General communicable diseases (the main disease group causing illness of the local population / respiratory tract disease including the occurrence of viral disease such as the COVID 19 outbreak)	**Physically** Pathogenic organisms such as bacteria, viruses, especially those that cause severe outbreaks such as SARS, and COVID 19, increase the demand for public health services and medical supplies. **Mentally** Anxiety of infection of the pandemic **Risk group** - People in the community who live around U-Tapao International Airport - Service users of U-	**Physically** Passenger and visitor entrances may bring infectious diseases from foreign countries to the community. In addition, if there is no good screening of patients arriving at the airport, an infectious disease outbreak, especially pathogens causing severe acute respiratory syndrome, will result in continued access to public health care facilities. **Mentally**	**Moderate (3)** According to the statistical data of the study site, the most recent rate of 2015-2019 diarrhea was the highest, followed by Encephalitis which was mostly found in the Huaipong subdistrict, Mueang Rayong District, which has been continuously endemic since 2015-2019. Pneumonia was also mostly found in the Huaipong subdistrict, Mueang Rayong District,	**Moderate (2)** In case of illness from infectious diseases to the body system, both illness rate and mortality rate may be increased, which may affect the health care system budget and medical supplies. Other public health budgets and plans may affect the entire population. Moreover, it is a concerns of the community. From hearing, opinions are offered to the project. There is an increased prevention plan against	**Moderate (3x2=6)**	• Follow public health measures to control the outbreak of infectious diseases with public health urgency, such as coronavirus (SARS-CoV, Covid-19) Influenza 2009 by complying with national and international laws and regulations, such as (1) Infectious Diseases Act, B.E.2558 (2015) (2) Notification of the Department of Health on the Regulations, Procedures and Measures on the Prevention of Risk from Corona Virus Disease 2019 (COVID-19) for the Government Offices, Private Offices and Business Offices 2020 (3) Notification of the Department of Health on COVID-19 Criteria and Prevention of Corona Virus Disease 2019 (COVID-19) for public transporation users 2019 (4) Operational

Table 6.5□3 Summary of Impact and Preventive Measures and Resolution of Community Health Impact (Operating Phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
	Tapao International Airport	Passenger and tourist movement may cause anxiety to the nearby public in the matter of the loss of public health services, medical personnel, and public health, which is currently insufficient, as well as concerns about infectious diseases from overseas.	while hemorrhagic fever was also found in the Samaesarn subdistrict, Sattahip district, Chonburi but with a downward trend. In addition, the project has no clear way to cope with the communicable disease. Therefore, there is a moderate probability that there is a chance of contracting communicable diseases from the arrival of passengers and foreign tourists. In addition, the contraction of viral respiratory disease epidemic has increased.	workers, tourists, and latent population entering the area causing new/recurrent diseases in the area.		considerations for managing COVID-19 cases or outbreak in aviation (WHO, 2020) (5) Aircraft cleaning and disinfection during and post pandemic (IATA, 2020) (6) Preventing spread of disease on commercial aircraft: Guidance for cabin crew (CDC, 2020) (7) Suspected communicable disease universal precaution Kit (IATA, 2017); (8) ICAO Guidelines for managing communicable disease in aviation (9) Communicable disease surveillance and response systems: Guide to monitoring and evaluating (WHO, 2006) • Set the EEC to coordinate with local public health agencies to plan operations and environmental and health prevention in community areas around U-Tapao International Airport. • Requires airport operations certification recipients to provide communication channels to the local public health agencies, as well as to support the local public health agencies in the areas of health facilities readiness and the potential of personnel. • Have the local public health agencies acknowledge the management plan and participate in the activities of emergency

Table 6.5□3 Summary of Impact and Preventive Measures and Resolution of Community Health Impact (Operating Phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
						management, such as preparing a plan, conducting drills according to the emergency management plan, especially those related to infectious pathogens and quarantine. • Communicate to the community and have opportunities available to participate in emergency plan rehearsals, especially those related to infectious diseases and quarantine. • Promote and support the potential in emergency management of public health authorities and volunteer groups. • Keep a record of communication plans and emergency management plans, especially those related to infectious pathogens and quarantine. • Open complaint channels, such as the U-Tapao International Airport PR website, EEC website, online media, etc.
7) Public safety (accidents caused by road traffic and air traffic)	<u>Physically</u> Accidents related to traffic, road, travel, air traffic, aircraft accidents, such as in the case of a plane crash, the aircraft caught fire causing deaths, including aircrafts encountering a	<u>Physically</u> Accidents cause injuries, loss of life and property, which may increase medical and public health requirements, including medical supplies, and affect the adequacy of health care	**Moderate (3)** Statistical data on land traffic accidents in Rayong and Chonburi are likely to increase. The results from the expected traffic volume on the main roads surrounding the airport	**High (3)** The increasing volume of passengers used the airport service resulted in traffic congestion and may cause more accidents, causing stress for pedestrians in that route, or causing	**Moderate (3x3=9)**	• Follow measures to prevent and resolve impacts on the environment in voice, air quality, and transportation during the implementation period, with emphasis on management measures (Chapter 7, Section 7.3.1 Voice Action Plan, Section 7.3.3 Air Quality Action Plan, Section 7.3.15 Transportation Action Plan)

Table 6.5□3 Summary of Impact and Preventive Measures and Resolution of Community Health Impact (Operating Phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
	problem that causes damage, flights are to be canceled. **Mentally** Anxiety and stress **Risk group** Airport service users, persons supporting the airport, and those in residence around the airport	and medical products personnel. **Mentally** Anxiety of the problems, injuries, absences, medical expenses, expenses, and damages arising from the accident, which may cause stress.	after the launch of the 2nd taxi and driveway in 1998 will increase the volume of cars that need the channels to be increased. The chance of increased traffic accidents during the journey has resulted in loss of life and property. Even though the project has evaluated the risk and prepared a plan to prevent air traffic accidents, an unplanned event of the airport business can occur. There is no specific public health plan to support accidents from airport operations, and every sector has not participated in continuous and consistent emergency response plans.	continuous consequences for accidents, injuries, and may affect the budget of related agencies. If there is an accident caused by air traffic, it will have a wide range of impacts, which can increase the rate of illness, mortality, and affect the management budget, which may increase medical and public health care requirements including medical supplies, and the adequacy of healthcare personnel and medical supplies.		• Take the following measures to alleviate damage from the compressed air or dropped objects from the aircraft. o Provide a primary channel for receiving complaints. The public should report matters to the U-Tapao International Airport Environmental Impact Resolution Coordination Center located at U-Tapao International Airport, every day during business hours (8.00 am - 5.00 pm). o Submit the officer to inspect the condition of the damage and make a memorandum as evidence of all cases to assess, the expenses required for repair. Then, the building owner arranges for the contractor to perform the repair by themselves, with the cost charged to RTN and EEC or project management or maintenance within the amount evaluated by the working group to consider damages due to compressed air in all cases, or in the event that the building owner is unable to procure a contractor to perform repairs RTN and the person managing the project or maintenance of the project, will procure a contractor to perform the work.

Table 6.5□3 Summary of Impact and Preventive Measures and Resolution of Community Health Impact (Operating Phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
						o Set the RTN and EEC or project management or maintenance, in accordance with the objectives of the establishment of an impact fund from U-Tapao International Airport in the case of the resolution of the impact of the falling object from the aircraft and compressed air. • Have the public health agencies acknowledge the management plan and participate in various activities of emergency management, such as preparing a plan and rehearsals according to the emergency management plan. • Communicate to the community and have opportunities for participation in emergency plan rehearsals. • To establish measures for airlines and pilots to comply with the announcement of the Civil Aviation Authority of Thailand, which issued the Notice to Airman (NOTAM) that pilots must comply with International Procedure (General Procedure) according to ICAO standards in order to prevent accidents caused by the winds at the end of the aircraft (Wake Vortex Turbulence).

Table 6.5□3 Summary of Impact and Preventive Measures and Resolution of Community Health Impact (Operating Phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
						• Promote and support the emergency management of public health agencies and safety agencies and volunteer groups. • Document communications and emergency management plans. • Compile a plan for disaster prevention and mitigation from relevant agencies.
8) Sanitation (waste management, waste)	**Physically** Pathogens and carrier animals carrying the disease. **Mentally** Anxiety and annoyance. **Risk group** Airport service users and those who live around the airport	**Physically** Without good sanitation management, those areas could become breeding sites for pathogens and disease carriers, causing the spread of diseases to nearby areas. **Mentally** If there is no waste management and wastewater that is adequate, it may cause foul odors and cause irritation to those living in the surrounding area and visitors to the airport. It also causes	**Very rare (1)** The project has provided adequate wastewater management systems and waste management systems that occur within U-Tapao International Airport to support the increased wastewater and waste volume from passengers who visit and use the service. Therefore, chances that the airport cannot be managed and will affect third parties is very low.	**Moderate (2)** If gastrointestinal infections occur, they may increase the rate of illness, which may impact the health care system's expense budget. The budget may need to be adjusted to support public health problems and affect all groups of people.	Low (1x2=2)	• Follow the measures to prevent and resolve environmental impacts of waste and wastewater management in the operational phase (Chapter 7 Section 7.3.13 Waste and Wastewater Management Operations Plan). • Open complaint channels, such as the U-Tapao International Airport public relations website, RTN and EEC or construction operators websites, online media, etc.

Table 6.5□3 Summary of Impact and Preventive Measures and Resolution of Community Health Impact (Operating Phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of consequences	Level of impact	
		anxiety in the areas of airport cleanliness.				
9) Sufficient and access to health services systems, including personnel and medical supplies	**Physically** Increasing the need for health care, personnel, and medical supplies systems **Mentally** Anxiety and stress **Risk group** Surrounding residences Airports	**Physically** Increasing the number of airport service users and those who work in professional capacity to support the airport's operations, such as contracting and trading, may result in the use of health service systems, convenience and quality of care, resulting in public sector budget allocation. **Mentally** Anxiety about the quality of care provision and adequacy of personnel and medical supplies	**Moderate (3)** It is possible that passengers, as well as workers who are sick, will be served by public health agencies of public sector, which may cause usurpation from community public health systems, as well as projects that are concerned and cared for stakeholders.	**Moderate (2)** This effect is affected due to other impacts and the overall cumulative impact which may impact local budget in providing adequate equipment and medical supplies for public health care work leading to insufficiency, inconvenience and system access to services.	Moderate (3x2=6)	• To have the public health agencies acknowledge activities including results of the management of the environmental and health on a regular basis. • The RTN and EEC/ or project management or maintenance program have a channel for the public health agencies to communicate, as well as supporting the public health with regards to the readiness of health facilities and the potential of personnel. • Conduct CSR (Corporate Social Responsibility) by supporting subdistrict health promotion hospitals in the area of the project.

6.5.1.2 Impact and preventive measures and correction of occupational health and safety impacts

The impacts and prevention measures on the health impacts of construction workers and employees operating within U-Tapao International Airport are health impacts related to the development of the project. It is anticipated that there are 3 areas which may affect the health of the construction workers. There are employees working within U-Tapao International Airport during the 3 operational stages. Details are shown in **Table 6.5-**4

Table 6.5-4 Health effects of constructionworkers and employees operating within U-Tapao International Airport

Issues of Impact	Risk group	Common factors used in consideration	Level of impact
Construction Phase			
1) Sanitation in the housing of construction workers	- Construction workers, employees operating within U-Tapao International Airport	- Policy on oversight of project contractors - Guidelines for the management of contractor's housing sanitation	Moderate
2) Work environment (loud noise)	- Construction workers - Employees who operate within U-Tapao International Airport	- Construction phase activity characteristics - Work area noise level - Management systems and personal protective equipment	Moderate
3) Labor accidents	- Construction workers	- Construction phase activities - Management system and work practices for construction workers - Personal protective equipment	Moderate
Operation Phase			
1Work environment (loud noise))	- Employees, especially those who operate in the airside.	- Operations phase activities - Work area noise level - Hearing test results - Management systems and personal protective equipment	Moderate
2) Atmospheric chemicals Working	- Dedicated employees who operate in the airside area.	- Operations phase activities - Management system and plan - Health check results - Results of measurement of the working environment	Moderate
3) Accidents and incidents	- Employees who operate within U-Tapao International Airport	- Operations phase activities - Accident Statistics - Management system and plan	Moderate

In this regard, the impact and prevention measures and the health impacts of construction workers and employees working within U-Tapao International Airport can be summarized as detailed in Table **6.5-5** and **Table 6.5-6**

Table 6.5□5 Summary of impacts and preventive measures and correction of health impacts of workers and employees (construction phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of the impact	Level of impact	
1) Sanitation in the housing of construction workers	**Physically** Poor housing sanitation management may become a source of disease and breed disease carriers such as rodents, cockroaches, flies, mosquitoes. **Mentally** Anxiety and annoyance **Risk group** Construction workers and families residing in the housing areas of construction workers and airport workers.	**Physically** Illness with various diseases, pathogens associated with the worker or with other carriers. **Mentally** Waste and wastewater management of workers, which if handled badly, may cause foul odors. The breeding source of the disease carrier is both annoying and anxious for both the workers and existing employees.	**Moderate (3)** The worker accommodation is scheduled to be rested outside the airport project area. The project has no clear guidelines and governance for sanitation, including waste management and wastewater in the worker accommodation area for construction contractors.	**Moderate (2)** If the building worker's shelter does not manage sanitation well, it may result in illness caused by the disease carriers, including transmission within the accommodation and impact on health service issues.	**Moderate(3x2=6)**	• Determined in the Contractor Contract to construct accommodations for workers based on the Engineering Institute of Thailand 1010-34 • Require contractors to train workers on hygiene and prevention of disease, behavior, non-noise, narcotic substances every 6 months, as well as to provide safety documentation for all workers to increase knowledge and consciousness of work safety. • There are regulations for the prevention and disposal of disease carriers. For the housing of construction workers, it is used to prevent the breeding of disease carriers and the spread of infectious diseases and must be strictly monitored. • Schedule periodic sanitation inspections by working with public health officials, local administrative organizations. • Cooperation with prevention, vaccination, or eliminating carrier sources in the event of an outbreak

Table 6.5□5 Summary of impacts and preventive measures and correction of health impacts of workers and employees (construction phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of the impact	Level of impact	
						of the disease or when requested by public health authorities.
2) Work environment (loud noise)	<u>Physically</u> Noise from construction activities <u>Mentally</u> Stress and annoyance <u>Risk group</u> Construction workers and current employees operating at the airport	<u>Physically</u> Prolonged exposure to loud noise may cause hearing loss. This may be temporary or permanent loss. Furthermore, it can interfere with worker or employee communication that causes work damage, a mistake in communication. <u>Mentally</u> When exposed to loud noises it also interferes with communication, it can cause annoyance and stress.	**Moderate (3)** The construction of runways, driveways and tunnels under the runways takes about 36 months. The types of work used in the excavation and area adjustment, construction of the pavement structure, installation of a bracing system, construction of pile tunnel walls and construction of tunnel floors where workers are exposed to loud noises while working both from the machinery used in the operations and activities of the airport. This can cause hearing problems and because it is a construction company, construction worker illness is under the care of the contractor; which may not be rigorously overseen in compliance with occupational health and safety laws, including not being able to provide personal protective	**Moderate (2)** Noise exposure while working may cause hearing problems, illness and loss of hearing performance. From the work, impacts the management budget.	**Moderate(3x2=6)**	• Strictly follow the environmental measures and the existing occupational health and safety management plan. • Implement measures to prevent and resolve impacts of the sound environment during the construction phase, including: - Provide personal protective equipment such as ear plugs or ear muffs for all workers. - Limit the duration of work for construction workers in noisy areas to no more than 8 hours of work for areas with a noise level exceeding 90 decibel A. • Provide a place that can reduce noise produced by aircrafts for construction workers to rest during break hours.

Table 6.5 5 Summary of impacts and preventive measures and correction of health impacts of workers and employees (construction phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of the impact	Level of impact	
			equipment to reduce exposure to sound thoroughly.			
3) Labor accidents	**Physically** Unsafe act and unsafe condition **Mentally** Stress and anxiety **Risk group** Construction workers	**Physicaly** Work-related accidents cause injuries or could result in loss of life and property. They also result in work delays. **Mentally** Stress and anxiety caused by injury, loss including medical expenses, other expenses.	**Moderate (3)** Due to the construction of runways and underpass tunnels, it is the employment of the construction contractor. The illness of the construction workers is under the supervision of the contract company, which may not have strict supervision in compliance with occupational health and safety laws, including being unable to provide adequate personal protective equipment.	**Moderate (2)** Work accidents resulting from unsafe acts and conditions have an effect on increasing the rate of illness, taking leave of work, or affecting construction workers/employees working within U-Tapao International Airport. This could result in loss of life and property, and can impact the budget management.	**Moderate (3x2=6)**	• Strictly follow the environmental measures and the existing occupational health and safety management plan. • Requiring contractors to comply with occupational health safety and work environment laws, such as: - Occupational Safety, Health and Environment Act, 2011 - Announcement of the Department of Labor Protection and Welfare, Re: Standardizing Personal Safety Equipment, 2011 - Labor Protection Act, 1998 - The ministerial regulation sets the standards for the management and management of safety, occupational health, and the work environment (version 2), 2010 - The ministerial regulation sets the standards for managing the safety, occupational health and work environment related to construction, 2008 - Announcement of the

Table 6.5□5 Summary of impacts and preventive measures and correction of health impacts of workers and employees (construction phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of the impact	Level of impact	
						Department of Labor Protection and Welfare, Re: Type and Type of Machinery and Equipment used in Construction Work Requiring Annual Certification, 2011 - The ministerial regulation sets the standards for the management and management of safety, occupational health and the work environment in 2006 or the latest announcement. • Accident statistics must be reported and recorded. • The cause of the accident must be investigated and recommendations of preventive measures must be taken.

Table 6.5□6 Summary of Impact and Preventive Measures and Resolution of the Health Impact of Workers and Employees (Operating Phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of the impact	Level of impact	
1) Work environment (loud noise)	**Physically** Audio from flight activity **Mentally** Stress and annoyance **Risk group** Dedicated employees who operate in the airside area.	**Physically** Prolonged exposure to loud noises may cause hearing loss. It may be permanent or temporary. It can also interfere with employee communication and performance. **Mentally** When loud noise interferes with communication and work performance, causing employees to feel annoyed, and if the work performance goes wrong because communication can also cause stress.	**Moderate (3)** U-Tapao International Airport has no plans to monitor the noise level in the office building and passenger building. The results of the hearing test of employees working in the airside have found that there are employees with hearing-related disorders.	**Moderate (2)** Noise pollution has an effect on increasing the rate of illness, affecting daily life and may affect the auditory environment, resulting in continuous health impacts over the long term, and may have an impact on the operations of the airport management agency in the future.	**Moderate (3x2=6)**	• Increase the noise level measurement touch points by attaching to persons, especially employees operating in the airside or at risk groups. • Annual measurement of hearing performance • Analyze the link between the sound received and the hearing performance to see the likelihood of hearing loss. • In the event that abnormalities are found, there must be a management plan such as reducing exposure, reducing exposure time. • Create a hearing conservation project
2) Atmospheric chemicals Working	**Physically** Air pollution caused by aviation activities **Mentally** Anxiety **Risk group**	**Physically** Prolonged inhalation of certain types of air pollutants caused by air engine exhaust may cause irritation and inflammation of the respiratory system,	**Moderate (3)** U-Tapao International Airport has not yet measured the presence of chemicals in the working environment in the airside area and has not been found to	**Moderate (2)** Employees working in the airside area have exposure to chemicals from burning fuel, which affects the changes of the health facility both in the short-term and	**Moderate (3x2=6)**	• Increase the measurement of the amount of chemicals in the working environment on a person, especially employees working in the airside or at risk groups. • Measure health according to risk • Analyze the link between the levels of chemicals that have been

Table 6.5□6 Summary of Impact and Preventive Measures and Resolution of the Health Impact of Workers and Employees (Operating Phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of the impact	Level of impact	
	Employees, especially those working in the operational area	which is one of the causes of respiratory illness. **Mentally** Anxiety of operations that may be exposed to pollutants in the air while working.	monitor employee health according to risk. Thus, it is initially hypothesized that there is a moderate likelihood to consider increasingprevention measures and monitoring measures.	long-term, increasing the rate of illness, taking time off, or affecting operations.		exposed to health to see the likelihood of the impact on health from exposure to chemicals. • In the case of contracted employment, there must be oversight by the receiving company to report the health examination results of employees at least once a year.
2 Labor accidents	**Physically** Unsafe act and unsafe conditions **Mentally** Stress and anxiety **Risk group** Dedicated employees who operate in the airside area.	**Physically** An accident arising from work results in an injury or may cause loss of life and property, delays in work. **Mentally** Stress and anxiety caused by injury, loss including medical expenses, other expenses.	**Moderate (3)** U-Tapao International Airport has a plan to prevent accidents, but could not yet identify accident statistical data because there was no record of employee accidents.	**Moderate (2)** Work accidents affect illness and disability increase the rate of illness, injury, loss of work, or affect workers/employees at work within the airport.	**Moderate (3x2=6)**	• Analyze the causes of accidents, prepare accident statistical data and analyze accident trends to lead to providing appropriate guidelines for accident prevention. • Prepare a work accident prevention and reduction plan. • Must be organized in accordance with the Occupational Safety, Health and Environment Act. • Safety board must be established. • Security officers must be provided. • There must be a preparation of occupational health and safety plans, such as: - Risk assessment identify areas that are exposed to risk, such as confined spaces, hot work areas, areas with noise levels

Table 6.5□6 Summary of Impact and Preventive Measures and Resolution of the Health Impact of Workers and Employees (Operating Phase)

Health Factors	Health Effects		Health Risk Matrix			Environmental impact prevention and resolution measures
	Threats	Nature of impact	Likelihood of occurrence	Severity of the impact	Level of impact	
						inconsistent with standards, areas or work that are at risk of exposure to chemicals in the work environment. - Work environment surveillance plan - Physical examination and risk-based examination - Health Promotion Plan - Work accident prevention plan - Emergency response plan • In this regard, occupational health and safety plans, such as plans and performance, must be reported to the Safety Board to consider and review measures at least once a year.

6.5.2 Results of effects assessment from airborne pollution (quantitative)

Based on the predicted emissions of air pollution with a mathematics model (AERMOD), it was found that there were 11 significant volatile organic compounds that were expected to release from the exhaust of diesel fuel, aircraft engines and surface support equipment, divided into 8 types of non-cancerous substances, including Acetaldehyde, Acrolein, Isopropylbenzene or Cumene, Ethylbenzene, Naphthalene, Styrene, Touluene and Xylene and 3 others which are cancerous, Benzene, 1,3-Butadiene and Formaldehyde with details of the expected toxicity data of the substances from the study when received through the respiratory system, are shown in **Table 6.5-7** Exposure toxicities

The risk assessment from exposure via respiratory system is divided into 2 groups of non-cancerous substances and carcinogenic substances by explaining the risk versus reference values, namely (1) risk level when compared to the RfC value (which are explained by the HQ HI value) and URF (assay the Cancer Risk level) and (2) risk level when compared with the environmental standard values due to the absence of the RfC and URF value.

6.5.2.1 Risk levels based on HQ, HI, and Cancer Risk

Details of the air emissions model estimates (AERMOD) in the calculation of the concentration of pollutants are presented in **Chapter 5 Environmental Impact Assessment, Section 5.2.3, Air quality in** each case received the concentration line of the Isopleth at various levels, with level 1 covering the area having the highest concentration of the study substance.

For risk assessment, the only hypothesis that in case 4 the maximum flight expected in 1998 (2 routes) was determined by the Isopleth line of 11 volatile organic compounds, which is expected to have health impacts, is shown in **Figure 6.5-1** Average 1-year concentration expected to **Figure 6.5-**11 Average 1-year concentration predicted , then select the concentration value (in mcg per cubic meter) from the Isopleths line at the community area (incussion point of impact of pollution) outside of U-Tapao Airport by selecting the first 3 highest concentration level to calculate risk level and analyze the affected community scope. Using this to calculate risk level by setting the risk scenario in the most serious cases. The evaluation result can be a representative for explaining the risk level of other cases.

Table 6.5-7 Exposure toxicitiesinformation from breathing in pollutants for Project Quantitative Health Risk Calculations

Type of air pollutants (Air Toxic)	Non-cancer risk			In case of cancer risk			
	Reference Concentration (RfC)	RfC Source	(Chronic Inhalation Hazard Index) Target Organ System(s)*	Unit Risk Factor (URF)	Cancer Class		URF Source
	(µg/m$^{3)}$			(µg/m$^{3)-1}$	USEPA	IARC	
Acetaldehyde	9	IRIS	Respiratory System	2.20x10^{-06}	B2	2B	IRIS
Acrolein	0.02	IRIS	Respiratory System	-	-	3	-
Benzene	30	IRIS	Hematological System	2.2 to 7.80 x10^{-06}	A	1	IRIS
1,3-Butadiene	2	IRIS	Reproductive/ Development	3.0 x10^{-05}	B2	1	IRIS
Isopropylbenzene or Cumene	400	IRIS	Cardiovascular, Adrenal Gland, Kidney	-	-	2B	-
Ethylbenzene	1000	IRIS	Alimentary, Progressive/ Development, Endocrine, Kidney	2.5 x10^{-06}	-	2B	Cal11
Formaldehyde	9	Cal11	Respiratory System	1.3 x10^{-05}	A	1	IRIS
Naphthalene	3	IRIS	Respiratory System	3.4 x10^{-05}	C	2B	Cal11
Styrene	1000	IRIS	Nervous System	5.7 x10^{-07}	B2	2B	HEAST 91
Toluene	5000	IRIS	Reproductive/ Development, Nervous, Respiratory System	-	-	3	-
Xylene	100	IRIS	Eye, Nervous, Respiratory System	-	-	3	-

Note: Toxicity information is based on the New Jersey Department of Environmental Protection, Division of Air Quality, Bureau of Evaluation and Planning - Air Quality Evaluation Section TOXICITY VALUES FOR INHALATION EXPOSURE February 2016 and can be found at http://www.nj.gov/dep/aqpp/risk.html

The Chronic Infection Hazard Index Target Organ System(s) is referenced from Air Toxics Hot Spots Program Risk Assessment Guidelines, The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, February 2015, Air, Community, and Environmental Research

Branch, Office of Environmental Health Hazard Assessment California Environmental Protection Agency, Agency George V. Alexeeff, Ph.D., Director.

General Information on Health Effects of Air Toxics

Air toxics can be grouped into two categories, according to their health effects: carcinogens (cancer-causing) or noncarcinogens. Carcinogens are things that have been shown to cause cancer, either in people or animals. Non-carcinogens have other skins of health effects, affecting such things as development, reproduction, respiration, the liver, kidney or other organizations. Health effects of meals are distributed in a number of ways. Researchers can study groups of people that have been exposed to the chemicals in the past, usually at the workplace. They can also expose volunteers to specific amounts of a chemical and record the effects. Most health effects information comes from studies of animals that are exposed in the laboratory to specific doses of a chemical for specific periods of time.

Using Health Benchmarks

Groups of experts at government agencies, such as U.S.EPA and California EPA, look at all of the studies done on the health effects of a chemical, and recommend measures of toxicity, known as unit risk factors and reference concentrations, that can be used to evaluate public exposure to those chemicals.

Unit risk factors are measures used for carcinogens that estimate the increased risk of getting cancer associated with the concentration of the chemical in the air that you are breathing. A risk of less than one in a million is considered to be negligible.

Reference concentrations are measures developed for noncarcinogens. Exposure to a chemical below the reference concentration, even over a long period of time, is not expected to have any negative effect on health.

These unit risk factors and reference concentrations can be used as health benchmarks, to evaluate the potential health effects of air toxic concentrations. For carcinogens, the health benchmark is the air concentration that would result in a one in a million increase in the risk of getting cancer if a person inhaled that concentration over a whole lifetime. For noncarcinogens, health benchmarks are set at the reference concentration. Air concentrations that are below these health benchmarks are not expected to be harmful to human health. It is not always clear, however, how far above the health benchmark an air concentration has to be before it becomes harmful. Types of harmful health effects and actual harmful levels will vary substantially from pollutant to pollutant.

Unit Risk Factor - The unit risk factor (URF) is the estimated excess probability of contracting cancer as the result of continuous exposure over a 70-year lifetime to an ambient concentration of one.

Cancer Class - Two sources of carcinogenicity classifications are given here (U.S.EPA and IARC):

USEPA classification of carcinogenicity:

Group A Human carcinogen; sufficient evidence of carcinogenicity in humans.
Group B1 Probable human carcinogen; limited evidence of carcinogenicity in humans.
Group B2 Probable human carcinogen; sufficient evidence of carcinogenicity in animals with inadequate evidence in humans.
Group C Possible human carcinogen; limited evidence of carcinogenicity in animals and inadequate human data.
Group D Not classifiable as to human carcinogenicity; inadequate or no evidence.

IARC (International Agency for Research on Cancer) classification of carcinogenicity (www.iarc.fr)

Group 1 Carcinogenic to humans.
Group 2A Probably carcinogenic to humans.
Group 2B Possibly carcinogenic to humans.
Group 3 Not classifiable as to carcinogenicity in humans.
Group 4 Limited not carcinogenic to humans.

Reference Concentration – An estimate (with uncertainty spanning about an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely Reference concentrations listed here are to be compared with long-term (maximum annual average) ambient air concentrations.

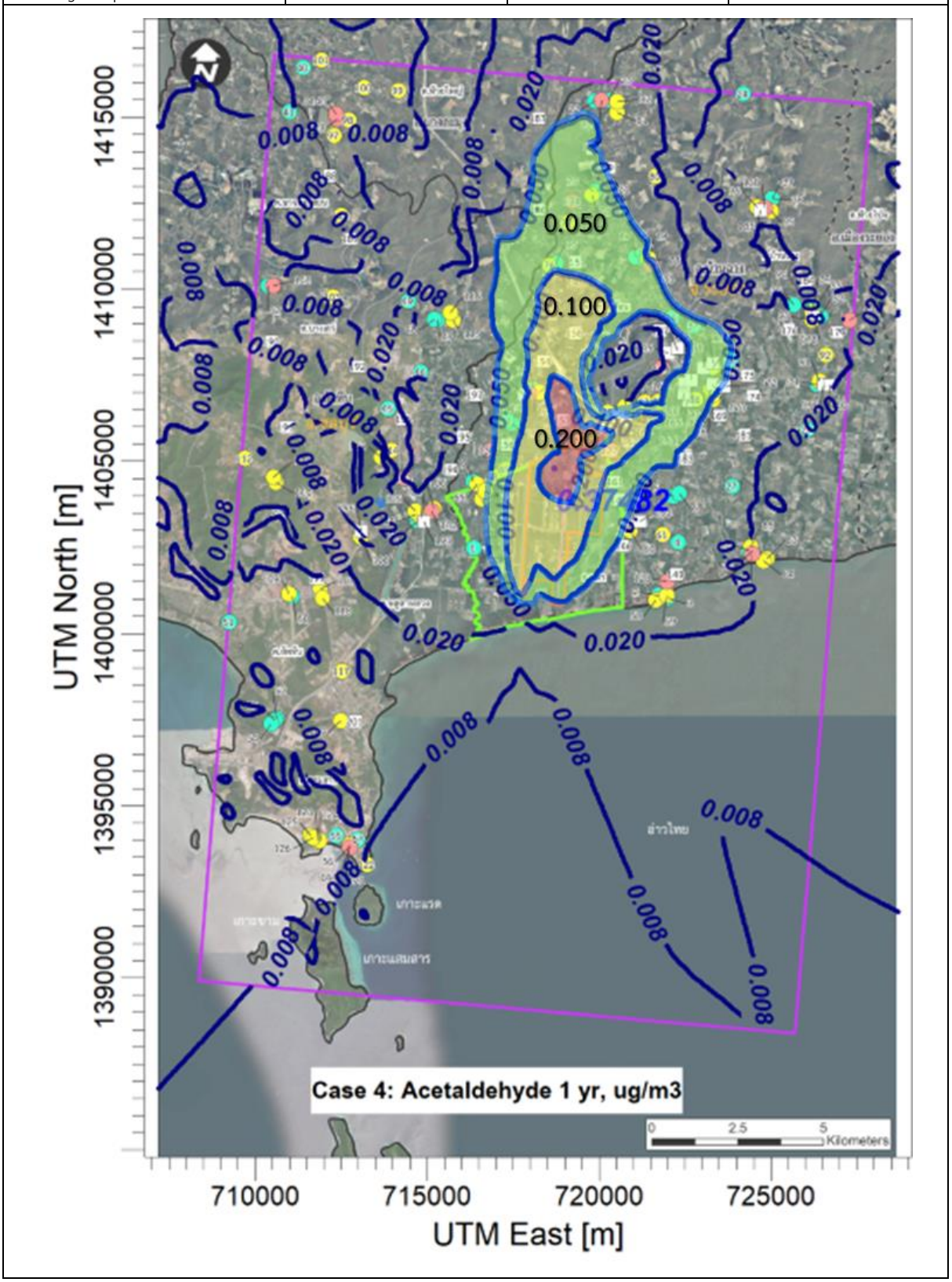
Short-Term Reference Concentration – An exposure that is not likely to cause adverse health effects in a human population, including sensitive subgroups, exposed to that concentration for the period Short-term reference concentrations are to be compared with maximum average ambient air concentrations averaged over the period given in the "RfC Averaging Time" column. 24-hour RfCs from IRIS are based on reproductive and/or developmental effects.

Sources of Toxicity Data

Cal 11 California Environmental Protection Agency (CalEPA), Air Toxics Hot Spots Program Technical Support Document for Cancer Potency Factors, Appendix A (upted 2011) (www.oehha.ca.gov/air/hot_spots/tsd052909.html).

IRIS USPA Integrated Risk Information System, as of May 25, 2011 (www.epa.gov/iris)

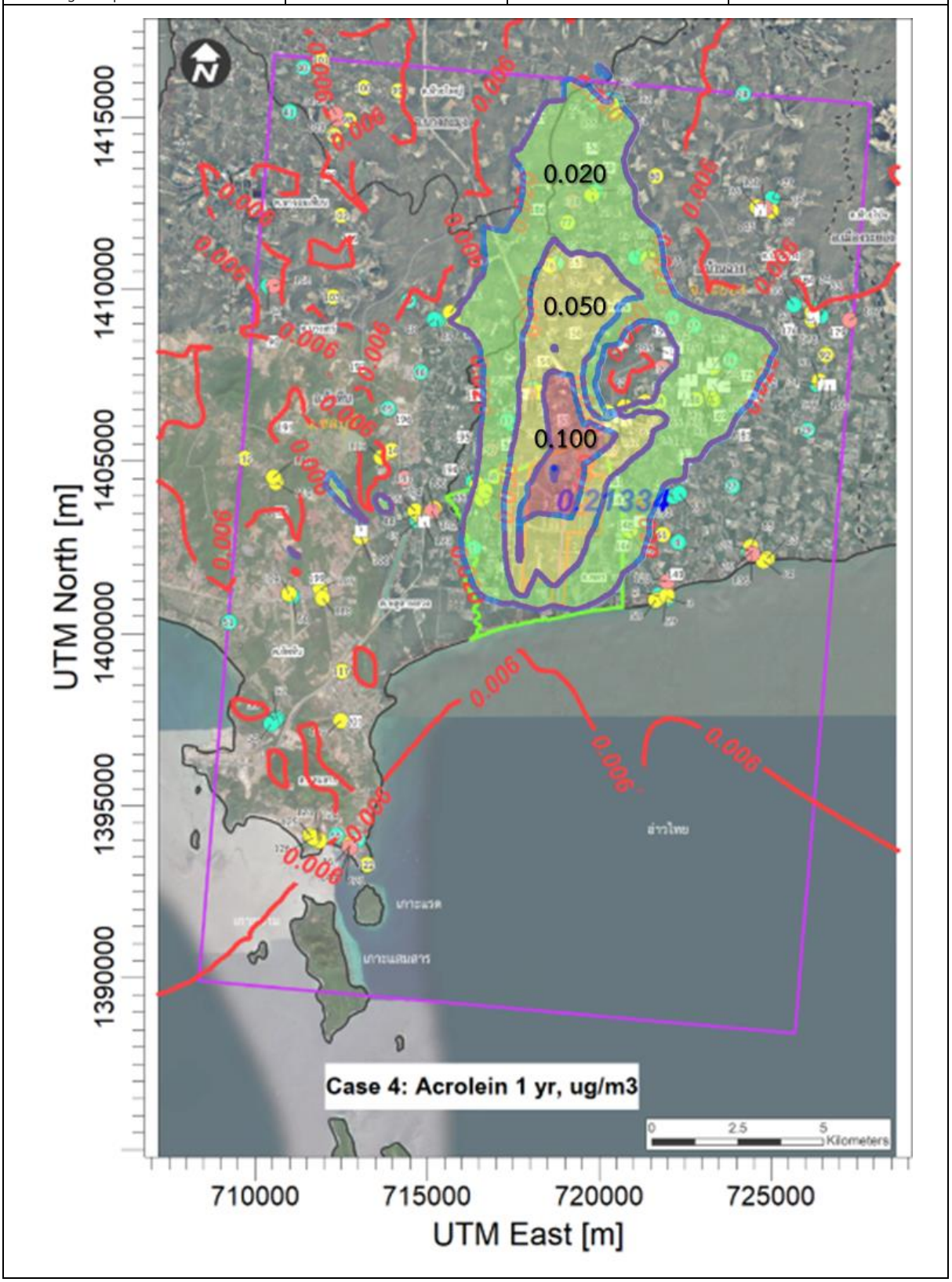
Concentration	Level 1 Peak	Level 2	Level 3
Units (gram per cubic meter)	0.200	0.100	0.050



Note : Assumptions Case 4 - Max expected flight in 1998 (2 routes)

Figure 6.5-1 Average 1-year concentration expectedline of Acetaldehyde

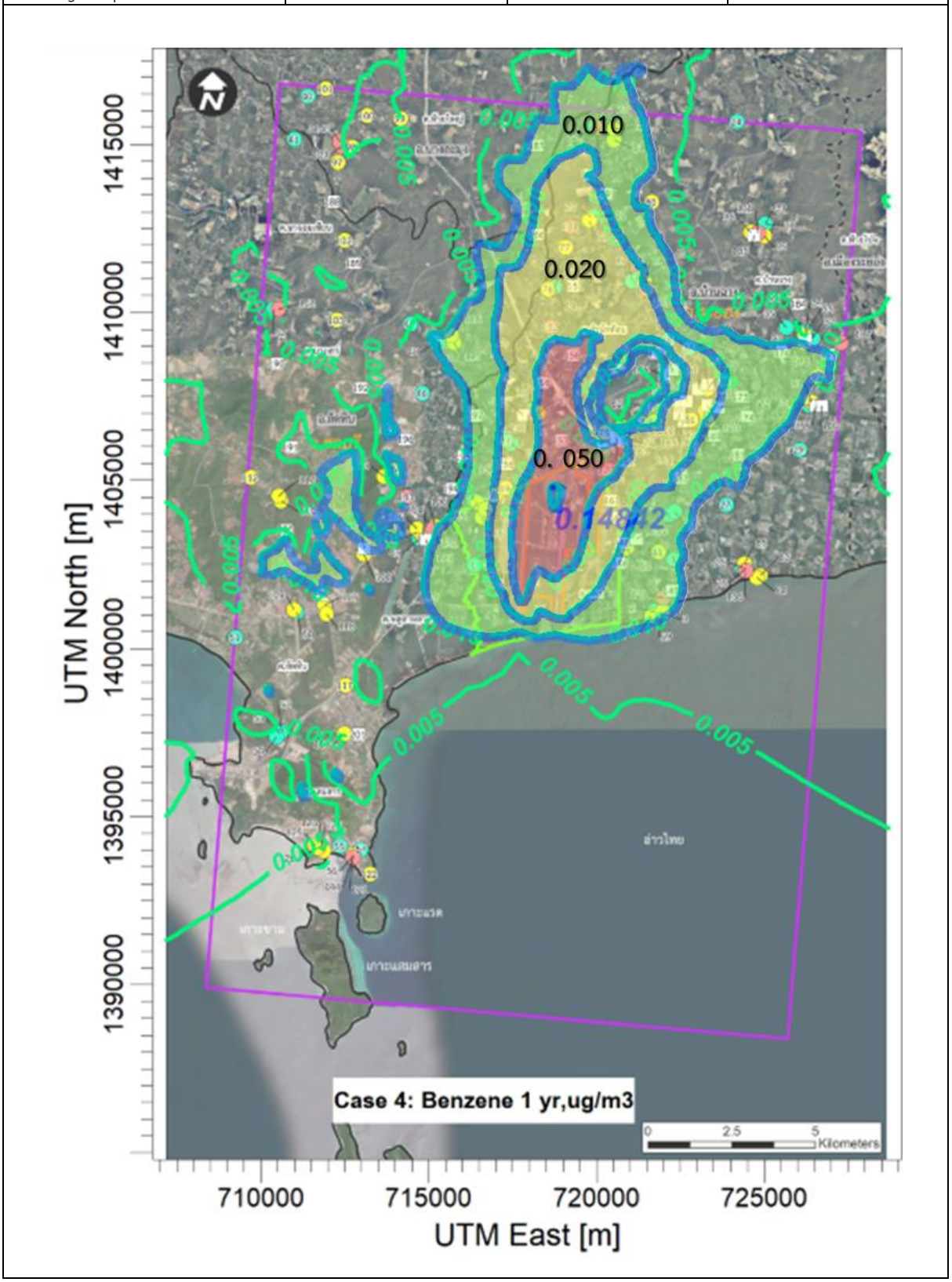
Concentration	Level 1 Peak	Level 2	Level 3
Units (gram per cubic meter)	0.100	0.050	0.020



Note : Assumptions Case 4 - Max expected flight in 1998 (2 routes)

Figure 6.5-2 Average 1-year concentration predictedline of Acrolein

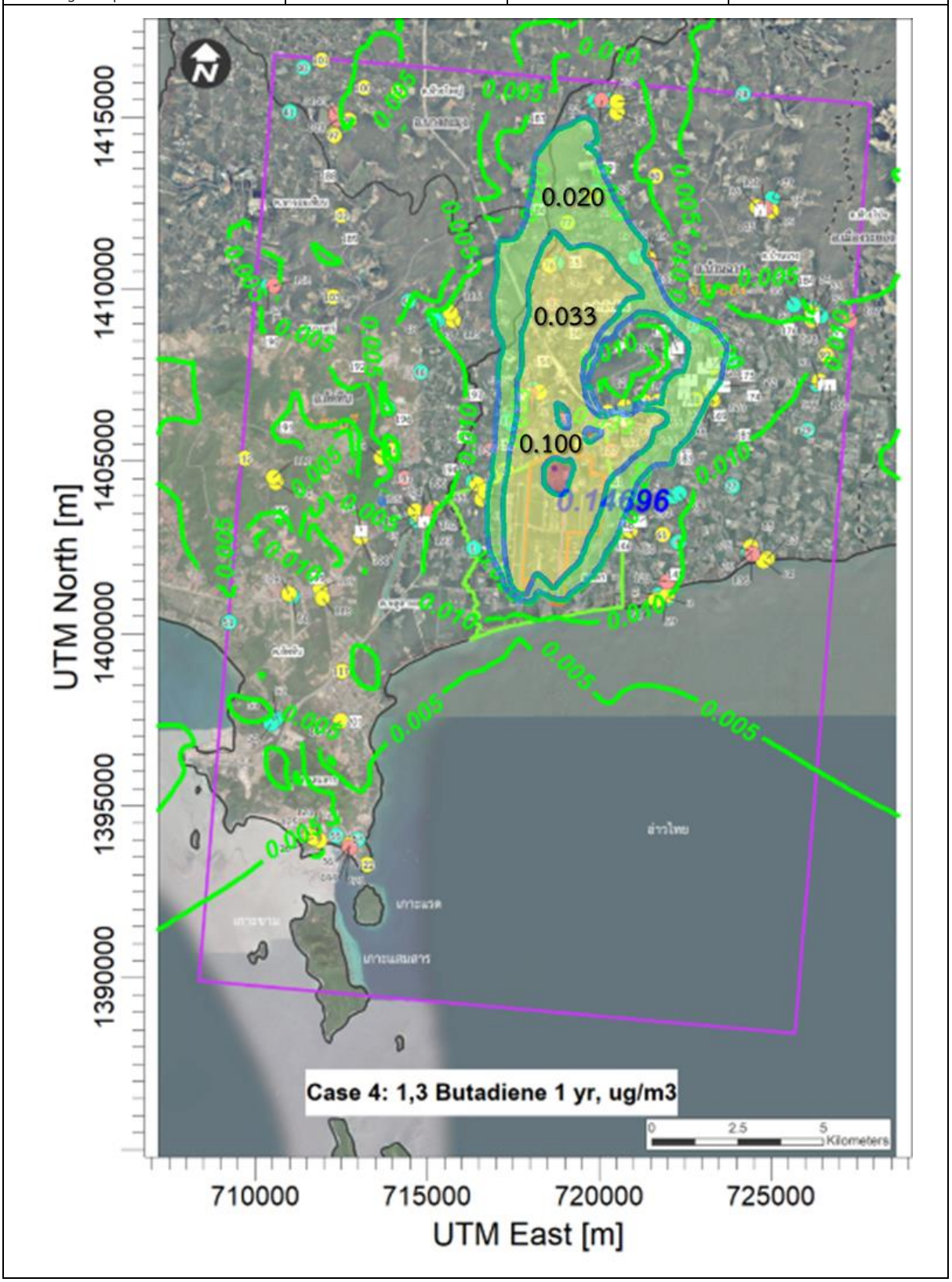
Concentration	Level 1 Peak	Level 2	Level 3
Units (gram per cubic meter)	0.050	0.020	0.010



Note : Assumptions Case 4 - Max expected flight in 1998 (2 routes)

Figure 6.5-3 Average 1-year concentration predictedline of benzene

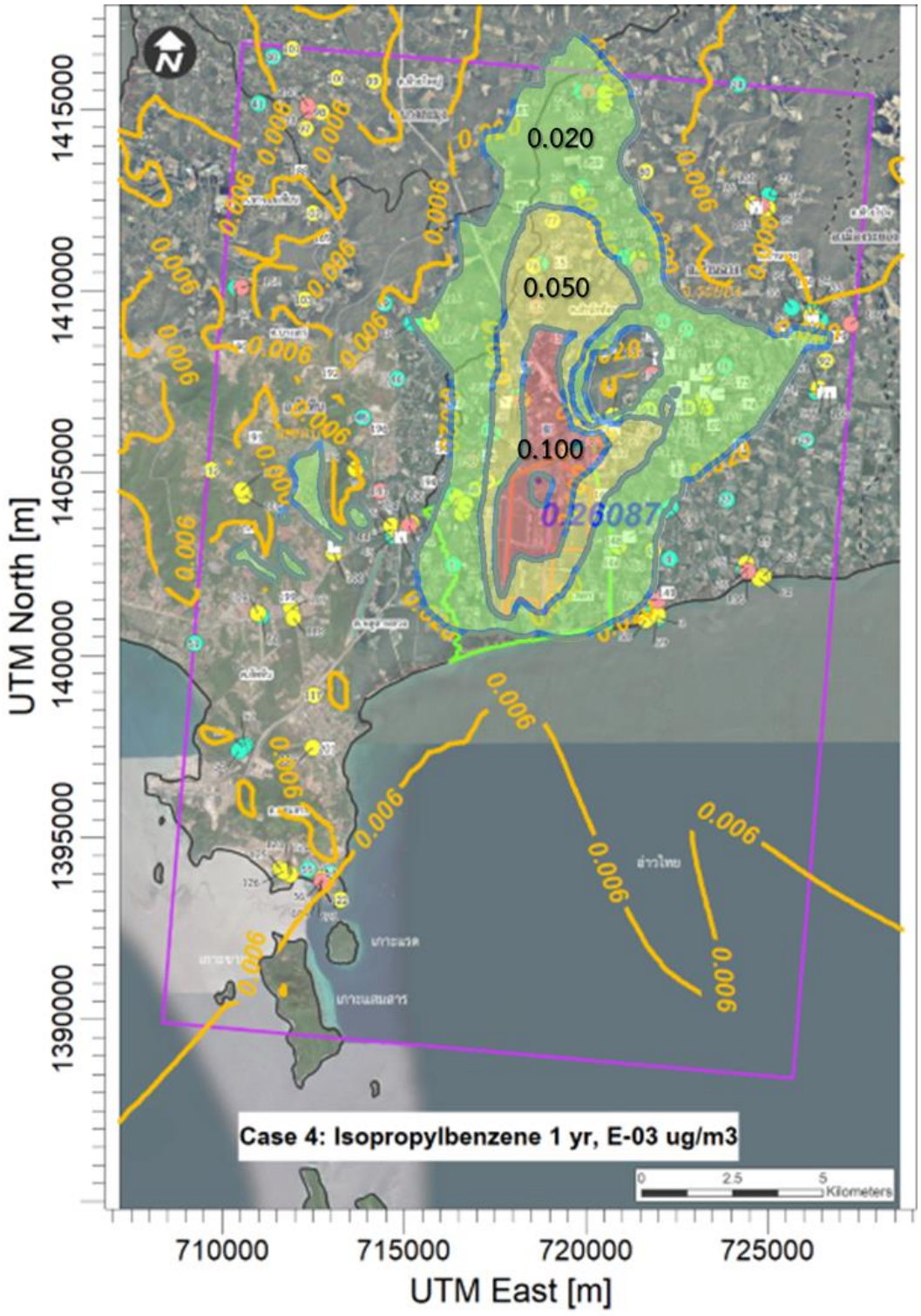
Concentration	Level 1 Peak	Level 2	Level 3
Units (gram per cubic meter)	0.100	0.033	0.020



Note : Assumptions Case 4 - Max expected flight in 1998 (2 routes)

Figure 6.5-4 Average 1-year concentration expectedline of 1,3 butadiene

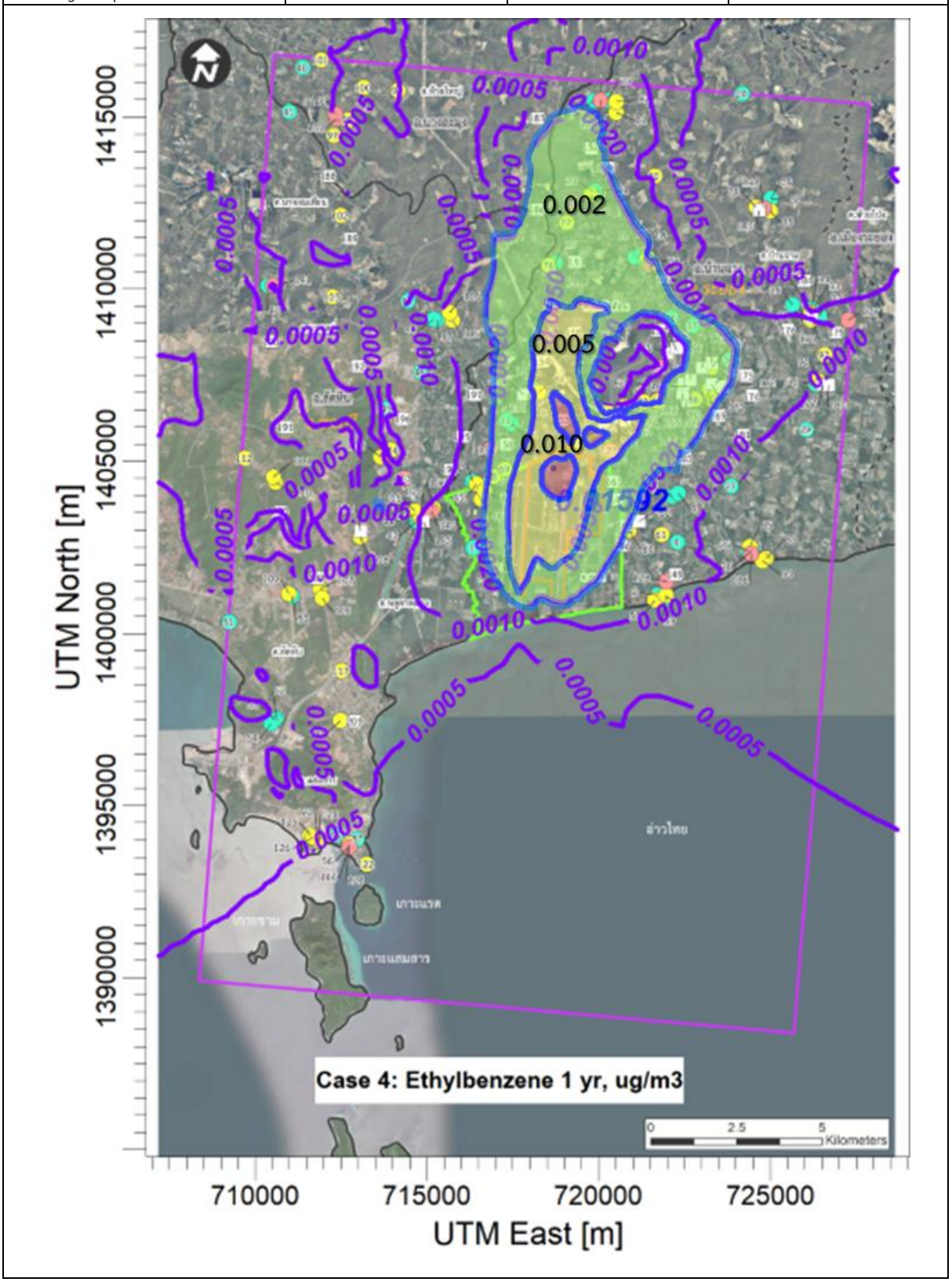
Concentration	Level 1 Peak	Level 2	Level 3
Units (x10-^{3} micrograms per cubic meter)	0.100	0.050	0.020
Units (gram per cubic meter)	0.00010	0.00005	0.00002



Note : Assumptions Case 4 - Max expected flight in 1998 (2 routes)

Figure 6.5-5 Average 1-year concentration predictedline of Isopropylbenzene or Cumene

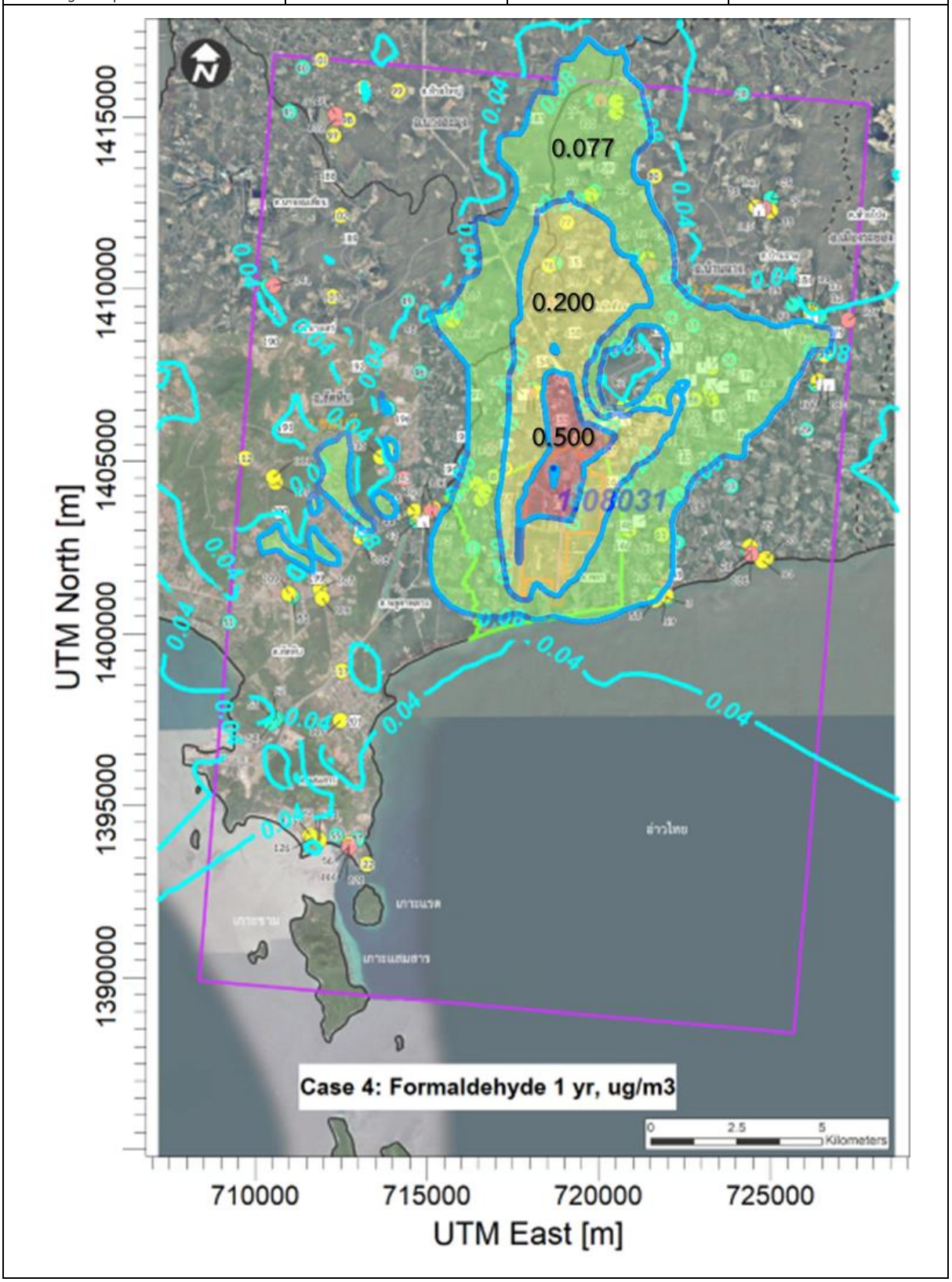
Concentration	Level 1 Peak	Level 2	Level 3
Units (gram per cubic meter)	0.010	0.005	0.002



Note : Assumptions Case 4 - Max expected flight in 1998 (2 routes)

Figure 6.5-6 Average 1-year concentration predicted line of Ethylbenzene

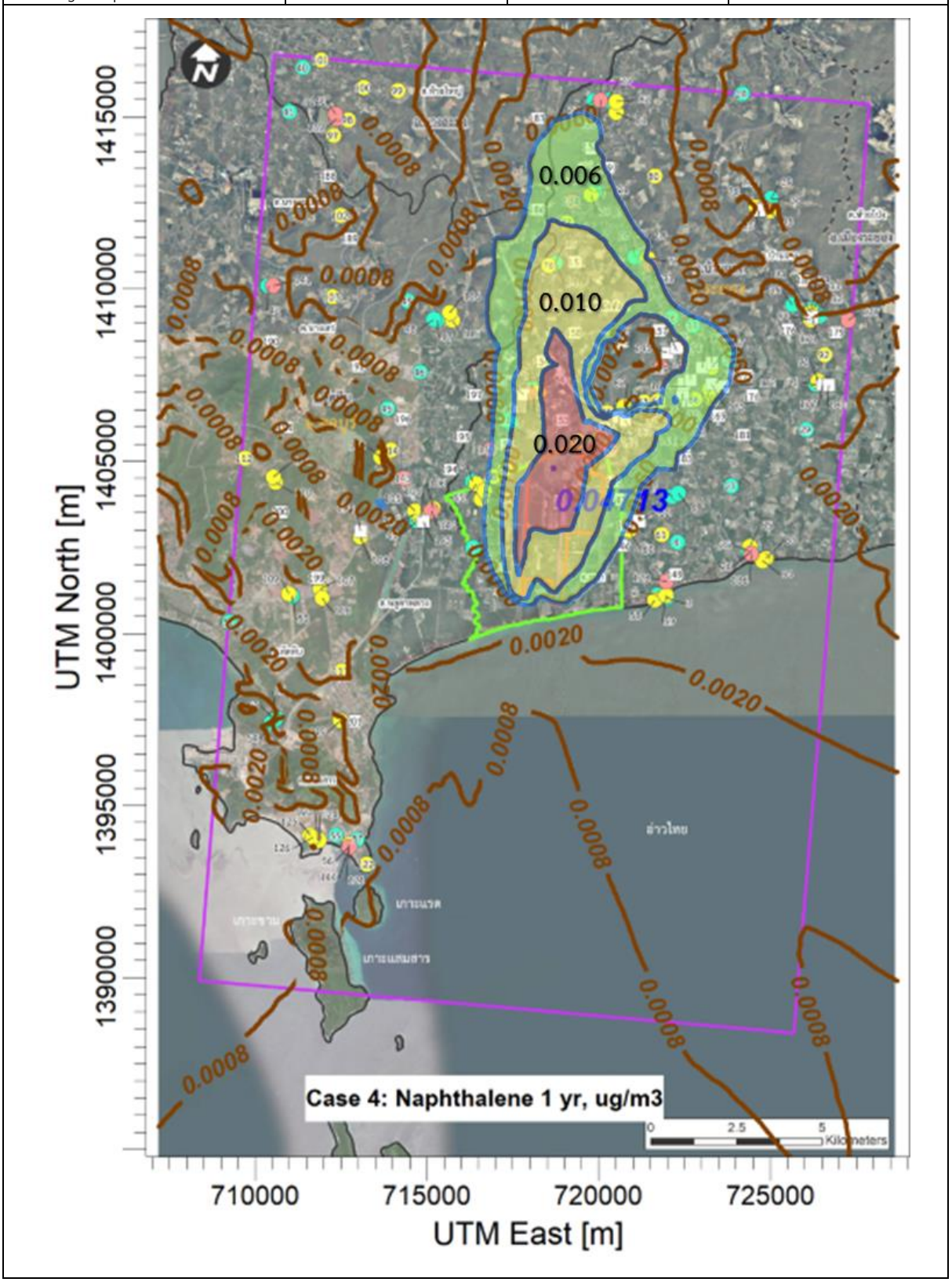
Concentration	Level 1 Peak	Level 2	Level 3
Units (gram per cubic meter)	0.500	0.200	0.077



Note : Assumptions Case 4 - Max expected flight in 1998 (2 routes)

Figure 6.5-7 Average 1-year concentration predicted line of Formaldehyde

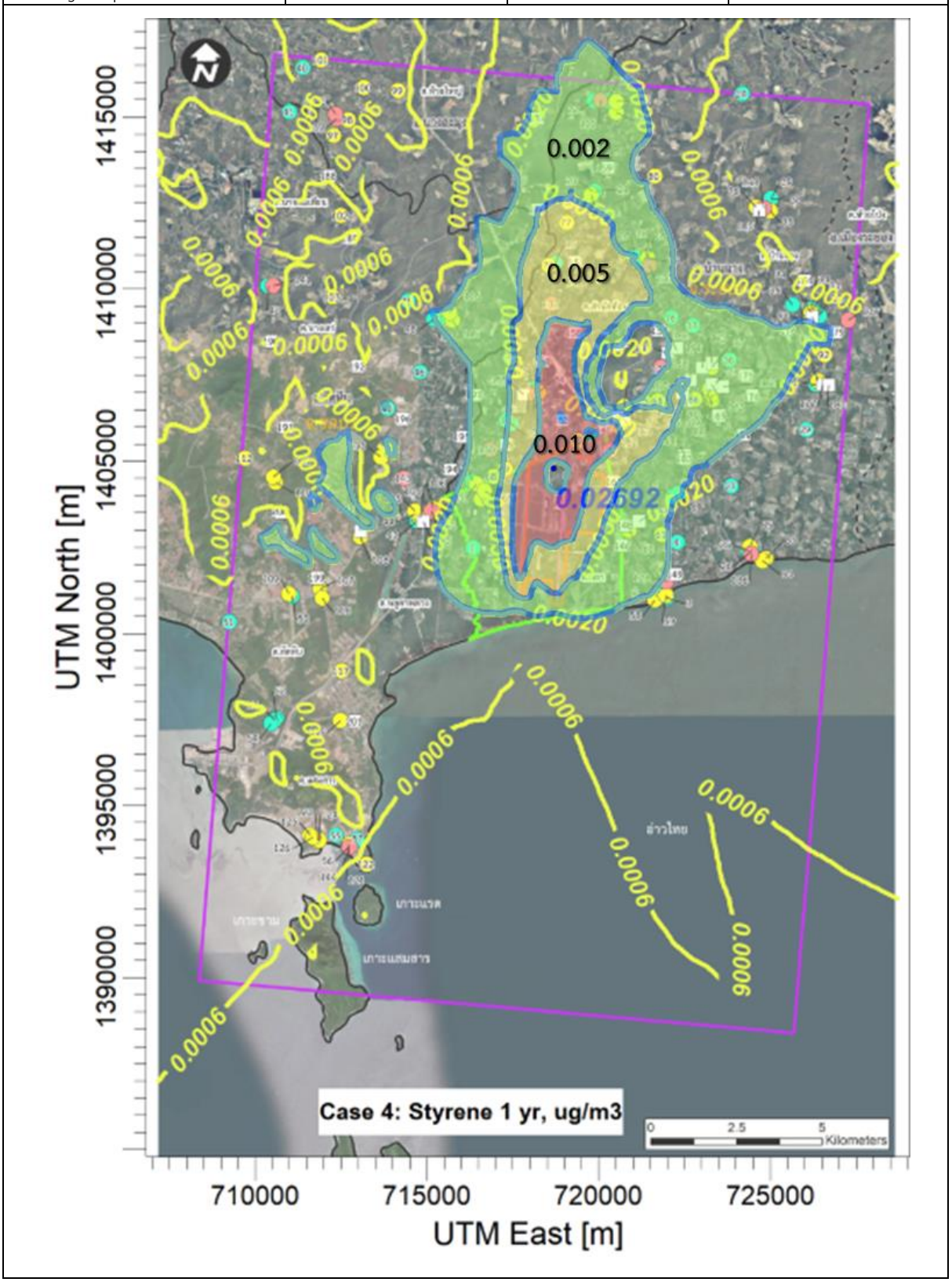
Concentration	Level 1 Peak	Level 2	Level 3
Units (gram per cubic meter)	0.020	0.010	0.006



Note : Assumptions Case 4 - Max expected flight in 1998 (2 routes)

Figure 6.5-8 Average 1-year concentration predicted line of Naphthalene

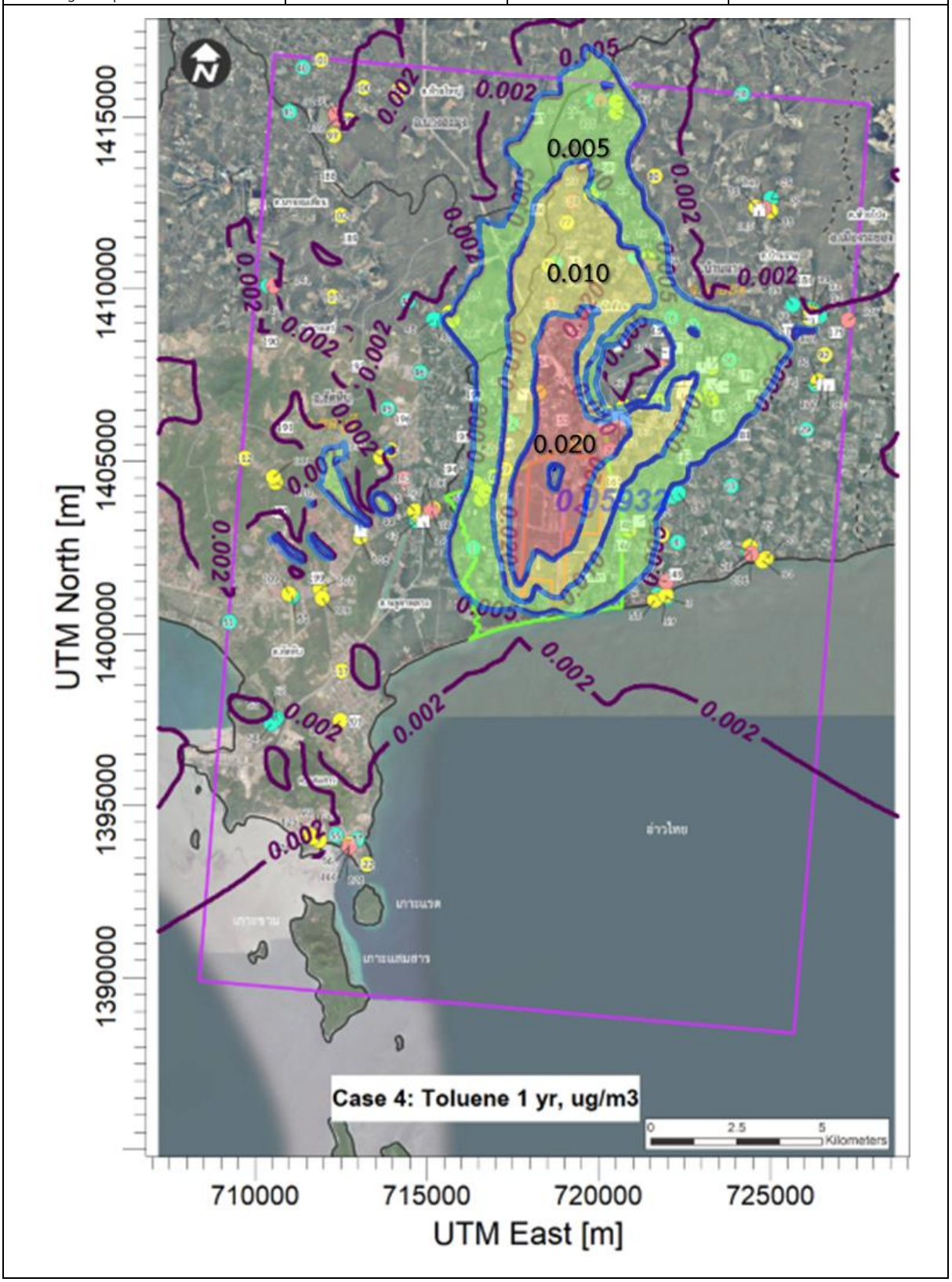
Concentration	Level 1 Peak	Level 2	Level 3
Units (gram per cubic meter)	0.010	0.005	0.002



Note : Assumptions Case 4 - Max expected flight in 1998 (2 routes)

Figure 6.5-9 Average 1-year concentration predicted line of Styrene

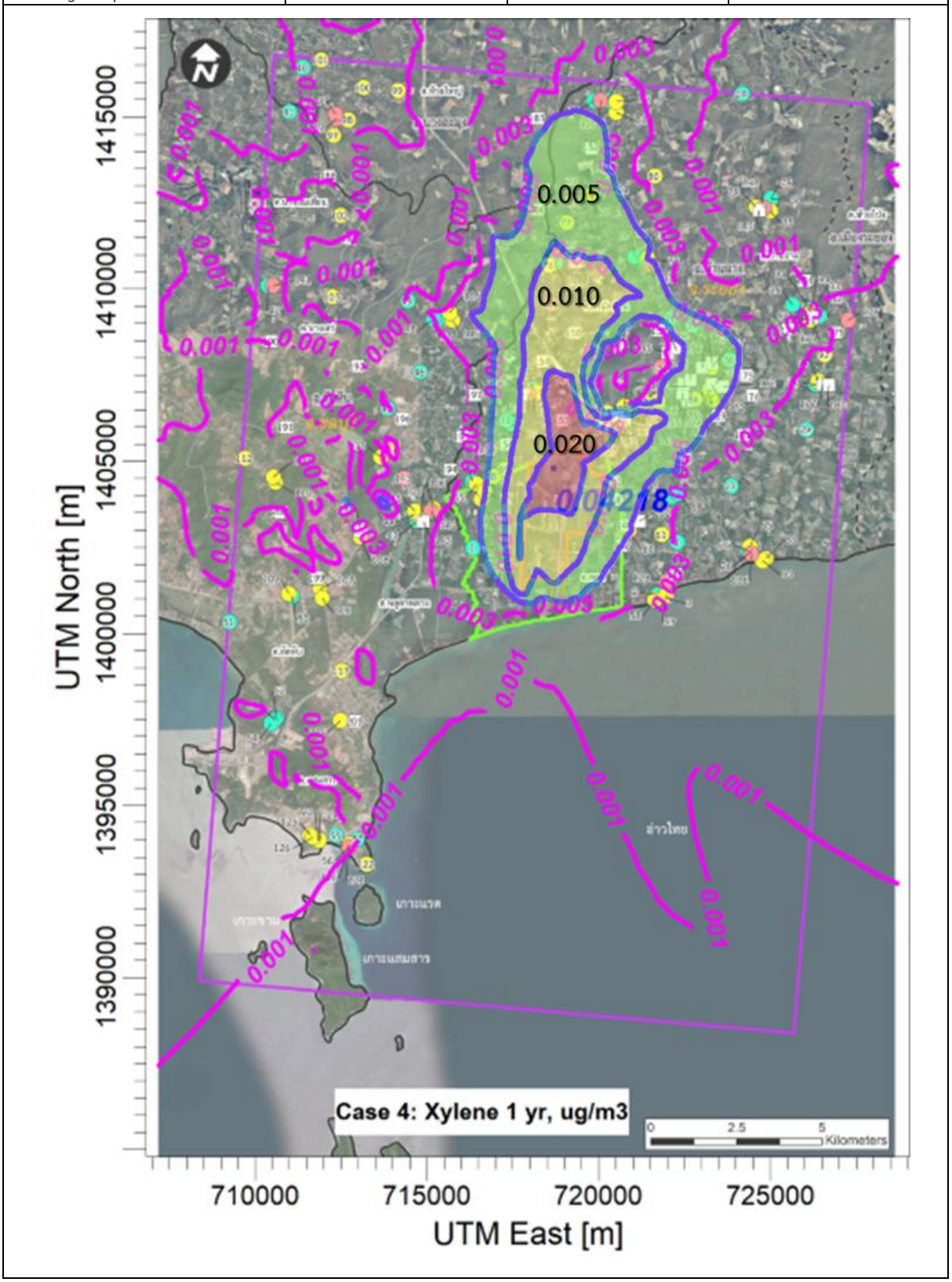
Concentration	Level 1 Peak	Level 2	Level 3
Units (gram per cubic meter)	0.020	0.010	0.005



Note : Assumptions Case 4 - Max expected flight in 1998 (2 routes)

Figure 6.5-10 Average 1-year concentration predictedline of Toluene

Concentration	Level 1 Peak	Level 2	Level 3
Units (gram per cubic meter)	0.020	0.010	0.005



Note : Assumptions Case 4 - Max expected flight in 1998 (2 routes)

Figure 6.5-11 Average 1-year concentration predicted line of Xylene

1) Non-cancer risk assessment

1.1) Risk assessment from Single Chemical Exposure

According to the risk assessment framework that defines the most serious cases, exposure assessment, Acetaldehyde, Benzene 1,3-Butadiene, Isopropylbenzene or Cumene, Ethylbenzene),Formaldehyde, Naphthalene, and Styrene, and Tulene via chronic respiration by calculating the concentration derived compared with the RfC value for the risk of exposure Hazard Quotient (HQ) of each substance. A value of less than 1 indicates that the health risk of exposure to this group of people in the study area (Isopleth level 1-3) is low. While Acrolein has approximately 1-5 times more HQ than 1, considering all concentration lines, it was found that the low-level risk was found in the region after the 3rd isopleth line onwards, that the local population in the study, especially in the north and east of U-Tapao International Airport has respiratory risks from Acrolein exposure. The details of the risk assessment results are shown inTable 6.5-8 with the area boundary of the Acrolein exposure area, details as shown in **Table 6.5-**9

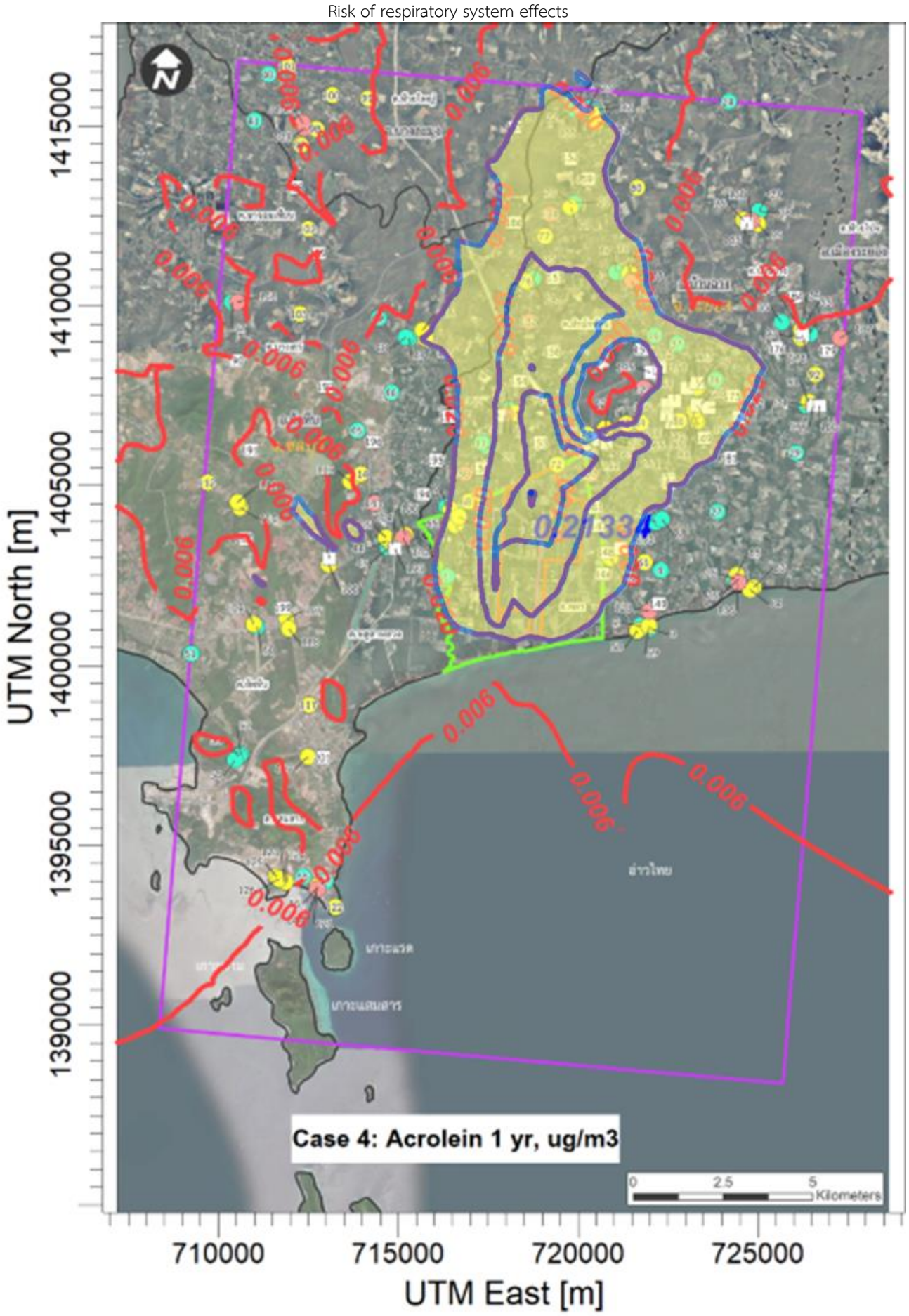
Table 6.5 8 SingleChemical Exposure

Volatile Organic Type	Reference Concentration (RfC)	Concentration value from the model (microgram per cubic meter)			Hazard Quotient (HQ)		
		Level 1 Peak	Level 2	Level 3	Level 1 Peak	Level 2	Level 3
Acetaldehyde	9	0.200	0.100	0.050	0.022	0.011	0.006
Acrolein	0.02	0.100	0.050	0.020	5.0	2.5	1.0
Benzene	30	0.050	0.020	0.010	0.0017	0.0007	0.0003
1,3-Butadiene	2	0.100	0.033	0.020	0.050	0.017	0.010
Isopropylbenzene or Cumene	400	0.00010	0.00005	0.00002	0.000000250	0.000000125	0.000000050
Ethylbenzene	1000	0.010	0.005	0.002	0.00001	0.00001	0.00000
Formaldehyde	9	0.500	0.200	0.077	0.056	0.022	0.009
Naphthalene	3	0.020	0.010	0.006	0.007	0.003	0.002
Styrene	1000	0.010	0.005	0.002	0.000010	0.000005	0.000002
Toluene	5000	0.020	0.010	0.005	0.000004	0.000002	0.000001
Xylene	100	0.020	0.010	0.005	0.00020	0.00010	0.00005

Table 6.5□9 Area boundary of risk from exposure to Acrolein at the airport area around U-TapaoInternational Airport

Area boundary of risks	Risk area details

The area of risk under the same concentration line of Acrolein averages 1 year.
Concentrations of more than 0.02 micrograms per cubic meter (HQ more than 1)
Risk of respiratory system effects



- Risk areas with concentrations exceeding the value of RfC are located in the areas of U-Tapao International Airport and in the areas surrounding North and East, namely:
  - Huai Yai subdistrict, Bang Lamung district and Phlu Ta Luang subdistrict, Sattahip district, Chonburi
  - Areas of Phala subdistrict, Samnugton subdistrict, Ban Chang subdistrict, Ban Chang district, Rayong
- There are 7 health care facilities located in hazardous areas, including:
  1) Eastern Community Public Health Service Center - Nong Muang
  2) Ban Khlong Bang Phai Health Promotion Hospital
  3) Ban Sa Kaeo Subdistrict Health Promotion Hospital
  4) Ban Khao Khrok Subdistrict Health Promotion Hospital
  5) Ban Yai Ra Subdistrict Health Promotion Hospital
  6) Samnugton Subdistrict Health Promotion Hospital
  7) Ban Chak Mak Subdistrict Health Promotion Hospital
- There are educational facilities located in 19 risk areas, including
  1) Early Childhood Daycare, RTN 6, Royal Thai Naval Air Division
  2) Phatthanavej Suksa School
  3) Phatthanavej Technological College
  4) Ban Chang 1 Municipality School (Khiri Pawanaram Temple)
  5) Khiri Pawanaram Temple School
  6) Saeng Song La Child Development Center 3
  7) Sa Kaeo Temple School
  8) Ban Chang Temple School (Boonrodprachanukul)
  9) Aksorn Business Administration Technological College
  10) Ban Chang Kanjanakulthi School
  11) Sajja Suksa School
  12) Somburanaram Temple School (Temraj Anusorn)
  13) Samnugton Subdistrict Municipality Children's Development Center at Somburanaram Temple School
  14) Suwan Rangsan Temple Community School
  15) Ban Yai Ra Child Development Center
  16) Center for external education and education according to Ban Chang District
  17) Samnugton Temple School
  18) Baan Samnugton Child Development Center
  19) Burapathit Child Development Center, Samnugton SAO
- There are 10 religious sites in risk areas, including
  1) Ban Khlong Bang Phai Temple
  2) Ban Chang Church
  3) Islamic Davao Masjid
  4) Sa Kaeo Temple
  5) Ban Chang Temple
  6) Somburanaram Temple
  7) Suwan Rangsan Temple
  8) Ban Chang Abundant Grace Church
  9) Samnug Kraton Temple
  10) Chak Mak Temple

1.2) Assessment results of the cumulative risk (Hazard Index:HI)

Cumulative Risk Assessment for patients receiving more than one pollutant at the same time. The combined HQ of each substance (HQ_i) that affects the target organ/ system of the body or the hazard index (HI). In this regard, the HI value must not exceed 1 as well as the HQ value. It is found that the 11 substances affect 8 organs or body function systems comprising of (1) respiratory system, (2) blood system, (3) liver, (4), the reproductive systemTable 6.5-10Calculated

Based on the calculation of HI values for each target organ, it was found that the HI risk ratio of the blood, liver, reproductive, renal, and adrenal glands, endocrine, neurological, and cardiovascular systems is lower than 1 except for respiratory system with the value of HI exceeding 1 due to ethylene. However, the distance further away from U-Tapao International Airport the risk decreases. The risk of air pollution has affected the increased the risk of respiratory illness in the area, which is the primary cause of illness. The risk calculation is shown in **Table 6.5-10** Calculated.

Table 6.5-10 Calculatedcumulative risk results from exposure to air pollutants via inhalation

Volatile Organic Type	Hazard Index (HI)																							
	(1) Respiratory System			(2) Blood system (Hematologic System)			(3) Liver (Alimentary System)			(4) Reproduction/Development			(5) Kidneys and adrenal glands Adrenal Gland, Kidney			(6) Endocrine System			(7) Neurological System			(8) Cardiovascular System		
	Level 1	Level 2	Level 3	Level 1	Level 2	Level 3	Level 1	Level 2	Level 3	Level 1	Level 2	Level 3	Level 1	Level 2	Level 3	Level 1	Level 2	Level 3	Level 1	Level 2	Level 3	Level 1	Level 2	Level 3
Acetaldehyde	0.022	0.011	0.006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acrolein	5.0	2.5	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	-	-	-	0.0017	0.0007	0.0003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Butadiene	-	-	-	-	-	-	-	-	-	0.050	0.017	0.010	-	-	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene or Cumene	-	-	-	-	-	-	-	-	-	-	-	-	0.000000250	0.000000125	0.000000050	-	-	-	-	-	-	0.000000250	0.000000125	0.000000050
Ethylbenzene	-	-	-	-	-	-	0.000010	0.000005	0.000002	0.000010	0.000005	0.000002	0.000010	0.000005	0.000002	0.000010	0.000005	0.000002	-	-	-	-	-	-
Formaldehyde	0.056	0.022	0.009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	0.007	0.003	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.000010	0.000005	0.000002	-	-	-
Toluene	0.000004	0.000002	0.000001	-	-	-	-	-	-	0.000004	0.000002	0.000001	-	-	-	-	-	-	0.000004	0.000002	0.000001	-	-	-
Xylene	0.00020	0.00010	0.00005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.00020	0.00010	0.00005	-	-	-
Total risk (HI) value (must not exceed 1)	**5.085**	**2.537**	**1.016**	**0.0017**	**0.0007**	**0.0003**	**0.00001**	**0.000005**	**0.000002**	**0.05001**	**0.01651**	**0.01000**	**0.000010250**	**0.000005125**	**0.000002050**	**0.00001**	**0.000005**	**0.000002**	**0.000214**	**0.000107**	**0.000053**	**0.000000250**	**0.000000125**	**0.000000050**

Note : The Chronic Inhalation Hazard Index Target Organ System(s) is based on the Air Toxics Hot Spots Program Risk Assessment Guidelines, The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, February 2015, Air, Community, and Environmental Research. Branch, Office of Environmental Health Hazard Assessment California Environmental Protection Agency, Agency George V. Alexeeff, Ph.D., Director.

2) Cancer Risk Assessment

Due to Benzene 1,3-Butadiene and Formaldehyde are classified as Category 1 carcinogens, carcinogenic to humans (IARC, 2011), thus assessing the health effects of inhalation exposure to all 3 substances. The risk assessment of cancer occurrence is considered by the U.S.EPA Integrated Risk Information System (IRIS) and the risk of cancer due to Pollutant-Specific Inhalation Unit Risk Factor (URF) for Benzene is configured as $2.2x10^{-6}$ to $7.8x10^{-6}$ per micrograms per cubic meter 1,3-Butadiene is equal to $3.0x10^{-5}$ per microgram per cubic meter and Formaldehyde equal to $1.3x10^{-5}$ per microgram per cubic meter. The assessment considered the scope of the area of risk based on the same concentration line (Isopleth) at the highest concentration in the area around the 3 levels of the project area.

The results of the evaluation shows that the highest risk of cancer due to benzene occurs through breathing it in the maximum concentration scope of 1 in the estimate of $1.10x10^{-7}$ to $3.90x10^{-7}$ or equals the risk of cancer caused by exposure to benzene in the highest expected concentration for 2 to 4 people aged 70 years in the exposure of ten million persons, with the highest risk area in the U-Tapao International Airport area. This may be said that the population around U-Tapao International Airport has a low risk of Benzene cancer in the project.

For the highest risk of cancer from exposure value 1,3-Butadiene and Formaldehyde through breathing takes place in the scope of the maximum expected concentration of $3.00x10^{-6}$ and $6.50x10^{-6}$ or equal to risk of cancer from exposure 1,3-Butadiene and Formaldehyde in the highest concentration predicted over the age of 70 at 3 and 7 patients, respectively. The highest risk areas are also located in the U-Tapao International Airport area. However, as the distance from U-Tapao International Airport increases, the risk reduces, which may be said that the people around U-Tapao International Airport are at low risk of cancer from the pollution of the project. Details are shown Table **6.5-11** Results with a area boundary from exposure to 3 carcinogens as shown in **Table 6.5-**12**.**

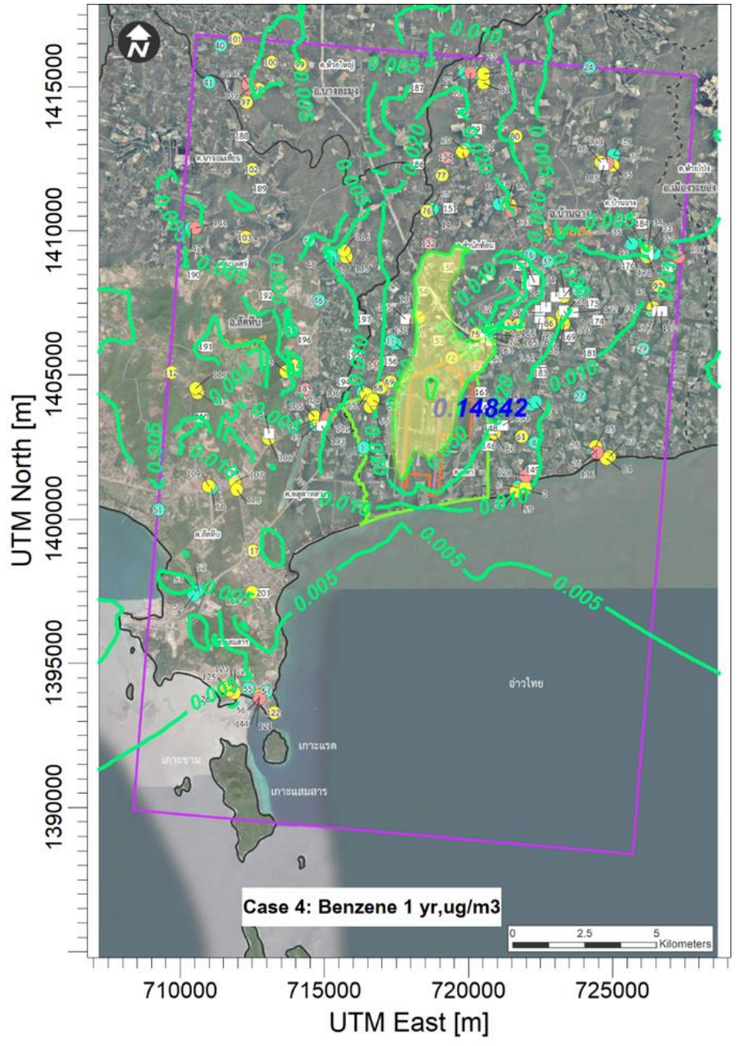
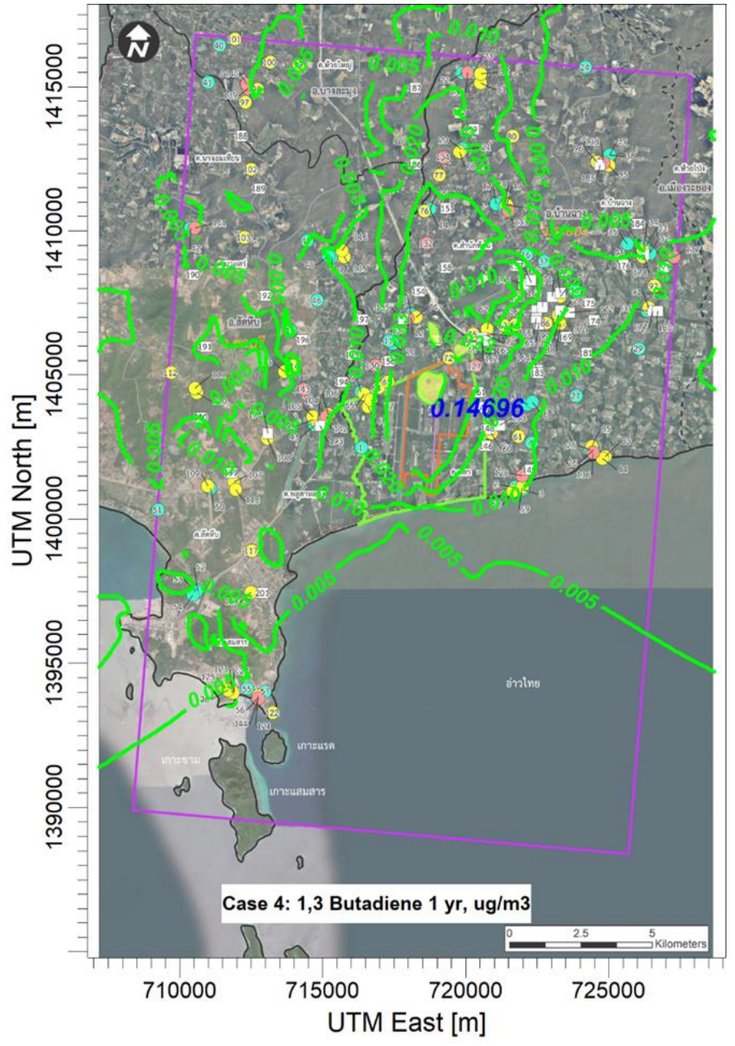
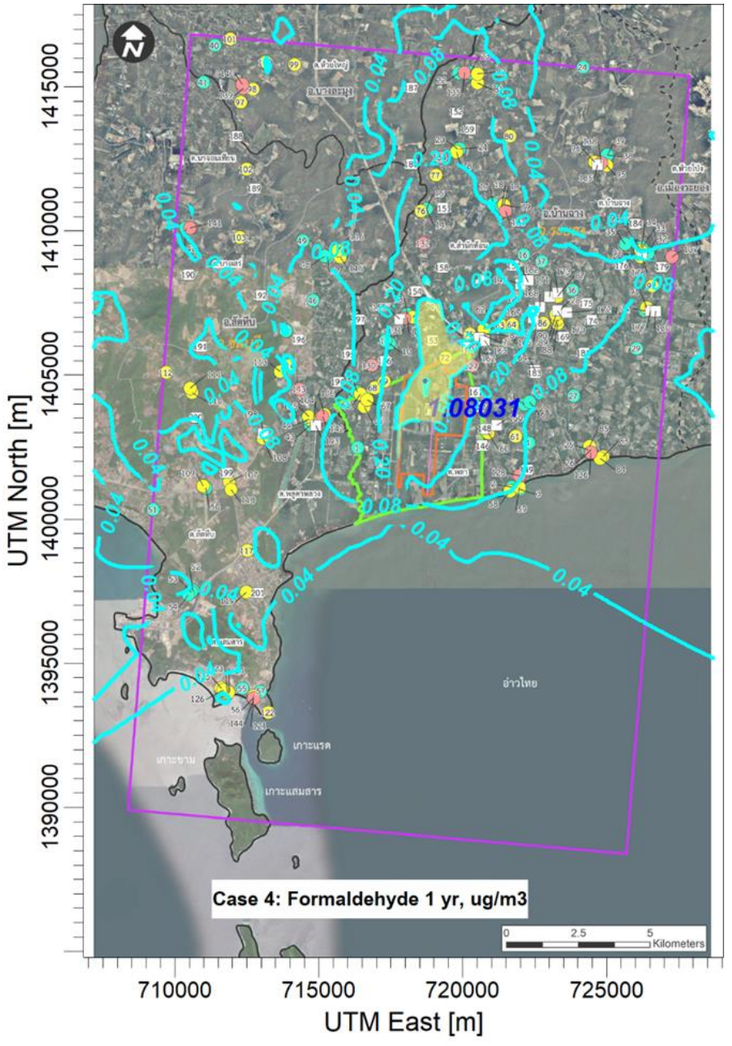
Table 6.5-11 Resultsof assessment of health risk of cancer based on expected concentration values from the AERMOD model

Volatile Organic Type[1/]	Concentration from model (□g/mm3)			Cancer Risk		
	Level 1 Peak	Level 2	Level 3	Level 1 Peak	Level 2	Level 3
Benzene URF[2/] = 2.2x10-6 per microgram per cubic meter	0.050	0.020	0.010	1.10x10-7	4.40 x10-8	2.20 x10-8
Benzene URF[2/] = 7.8x10-6 per microgram per cubic meter				3.90x10-7	1.56x10-7	7.80 x10-8
1,3-Butadiene URF[2/] = 3.0 x10-5 per microgram per cubic meter	0.100	0.033	0.020	3.00 x10-6	9.90 x10-7	6.00 x10-7
Formaldehyde URF[2/] = 1.3 x10-5 per micrograms per cubic meter	0.500	0.200	0.077	6.50 x10-6	2.60 x10-6	1.00 x10-6

Note: [1/] Assess risk of cancer from exposure to Benzene, 1,3-Butadiene, and Formaldehyde. (Formaldehyde) which is classified as a Category 1 carcinogen, carcinogenic to humans (IARC, 2011).

[2/] The risk of developing cancer from the Pollutant-specific Inhalation Unit Risk Factor (URF) is determined by the U.S.EPA Integrated Risk Information System (IRIS).

Table 6.5□12 Area Boundary of cancer risk from exposure to Benzene, 1,3-Butadiene and Formaldehyde at the area around U-Tapao International Airport

Benzene	1,3-Butadiene	Formaldehyde
In the maximum concentration boundary area of level 1 (0.050 microgram per cubic meter). There is a risk of cancer from exposure to benzene, which is 1.10 x10-^{7} to 3.90 x10-^{7,} or there is a risk of cancer of 2 to 4 persons in exposure of ten million persons.	In the maximum concentration boundary area of level 1 (0.100 micrograms per cubic meter). There is a risk of cancer from exposure of 1,3-butadiene, which is 3.00 x10-^{6} or there is a risk of cancer of 3 persons in one million people.	In the maximum concentration boundary area of level 1 (0.769 micrograms per cubic meter). There is a risk of cancer from exposure to formaldehyde of 6.50 x10-^{6} or there is a risk of 7 people developing cancer in one million people.
		
The area is at risk of developing cancer in the area of U-Tapao International Airport and the northern area at, Village 3, Ban Sa Kaeo Village 6, Ban Khao Krog Village 8, Cherg Khao Sa Kaeo Subdistrict Community 1, Sumnugton Subdistrict, and Ban Chang-Phala Community, Khiri Pawanawararam Temple Ban Chang Subdistrict, Ban Chang District, Rayong.	The area is at risk of developing cancer in the area of U-Tapao International Airport and in the northern part of Village 3, Ban Sa Kaeo, Samnugton Subdistrict, Ban Chang District, Rayong.	The area is at risk of developing cancer in the area of U-Tapao International Airport and in the northern part of Village 3, Ban Sa Kaeo, Samnugton Subdistrict, Ban Chang District, Rayong.

6.5.2.2 Risk level based on environmental standards for other airborne substances

Details of the expected concentrations of Nitrogen Dioxide gas (NO_2), Sulfur Dioxide (SO_2), Total Suspended Particle (TSP) and Particulate Matter ($PM_{2.5}$ and PM_{10}) using the AERMOD model are presented in Chapter 5. For risk assessment of these substances, there is still no reference safety value as recommended by IRIS or other health organizations. Therefore, risk assessment in this group uses a comparison of Thai standard values and other related standards as per **equation (5)** as follows:

Percentage of ratio (%) = [Substance Concentration (X)/Consistent Standard (y)] x100 **Equation (5)**

Details of the evaluation are as follows:

1) Health risks from exposure to Nitrogen Dioxide gas (NO_2)

Since NO_2 in the atmosphere is less stable, the World Health Organization recommends using an annual average concentration for risk assessment. In this study, both the 1 hour peak concentration of nitrogen dioxide and the 1 year average concentration value in the risk assessment are used. The standard value of Nitrogen Dioxide from short-term exposure requires that the 1 hour average must not exceed 200 micrograms per cubic meter and the 1 year average must not exceed 40 micrograms per cubic meter (WHO, 2005) and compared with Thailand's standard values according to the National Environment Board announcement, which specifies that the values for Nitrogen-Dioxide average 1 hour and average 1 year are 320 and 57 micrograms per cubic meter, respectively.

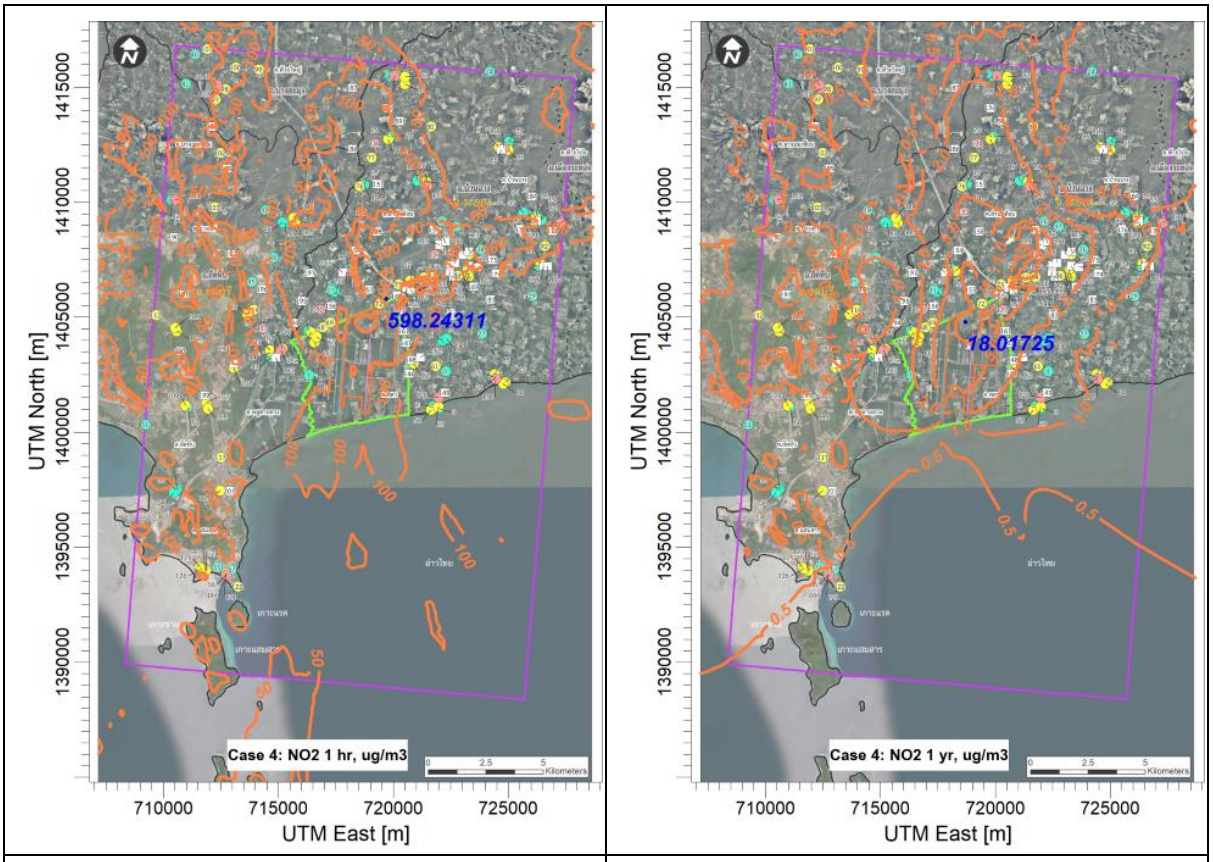
Based on the study comparing the ratio of the highest Nitrogen Dioxide concentration to the standard values, it was found that the expected value exceeds the average of 1 hour but not exceeding the annual average. When considering the long-term health impact, comparing the annual average with the standard value in Thailand, the highest estimate was 31.61 percent or more than half the standard value, with such concentration occurring within the area of U-Tapao International Airport. For areas outside the scope, it was found that the level of expected risk is within the acceptable range, that is, the expected value is below the standard value. Details are shown in **Table 6.5-**13 and the NO_2 concentration predicted line are shown in **Figure 6.5-**12 Predicted.

Table 6.5-13 Predicted ratios of Nitrogen Dioxide (NO_2) after 2 runnings with values of Nitrogen Dioxide concentration for a maximum of 1 hour and an average of 1 year

Mean maximum concentration in time	Concentration NO_2 (µg/m)				
	Maximum concentration value (Cmax) from the AERMOD model after 2 ways of running	Standard value		Ratio Per standard (%)	
		WHO[1/]	Thai[2/]	WHO	Thai
1 hour	598.24311	200	320	299.12	186.95
1 year	18.01725	40	57	45.04	31.61

Notes : * [1/] WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide Global update 2005

[2/] The standard according to the National Environment Board Notification No. 33 (2009), regarding the standard of nitrogen dioxide gas in the general atmosphere, which specifies that the average value of nitrogen dioxide gas in 1 hour must not exceed 0.32 milligrams per cubic meter (320 micrograms per cubic meter), and in 1 year must not exceed 0.057 milligrams per cubic meter (57 micrograms per cubic meter).



Maximum NO_2 concentration in 1 hour 598.24311 micrograms per cubic meter	Maximum NO_2 concentration in 1 year 18.01725 micrograms per cubic meter

Note : Assumptions Case 4 - Max expected flight in 1998 (2 routes)

Figure 6.5-12 Predictedline of Nitrogen Dioxide concentration (NO_2)

2) Health risks from exposure to Sulfur Dioxide gas (SO_2)

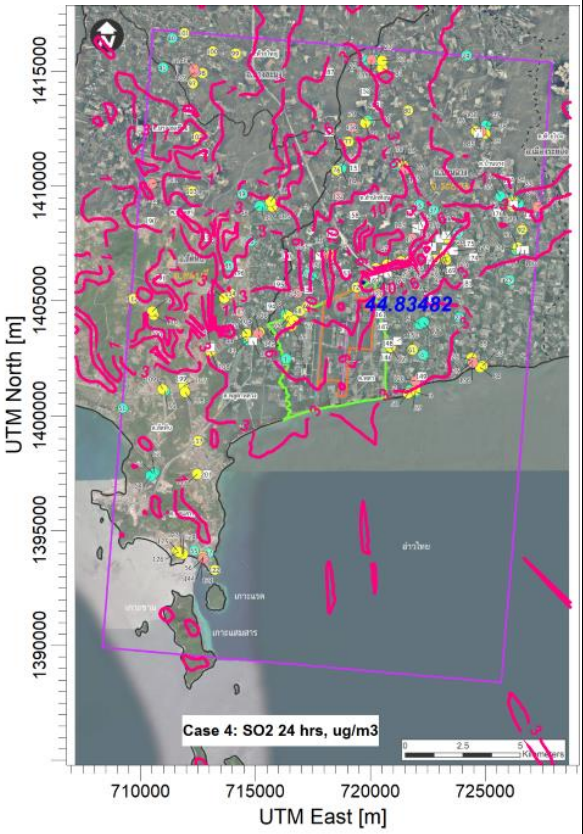
Sulfur dioxide enters the body through inhalation and direct contact with the skin and mucous membranes. Once this gas comes in contact with water and some starts to form Sulfurous Acid, causing irritation to the upper respiratory tract and mucous membranes. The main chronic symptoms are nasal and airway inflammation, dry throat, and the vapor that enters the bloodstream spreads to the liver, spleen and kidneys, irritating the cells that come into contact. The severity of the poisoning depends on the concentration of the substance in the air and the duration of the exposure. Acute toxicity causes severe eye irritation, lacrimation, irritation of the skin, nose, throat and respiratory tract, runny nose, cough, chest tightness, suffocation, narrowing of the bronchi, bronchitis, pulmonary edema, and death.

In Thailand, the National Environment Board established the 24-hour average Sulfur Dioxide standard in the atmosphere of 300 micrograms per cubic meter and the average Sulfur Dioxide value in the atmosphere at 100 micrograms per cubic meter annually. Compared with the highest Sulfur Dioxide concentration (considered by the development of the project, supporting the highest flight in 1998), with the average value in Thailand at 1 year. It was found that the expected value is approximately 4.54 of the standard value, which is much lower than the standard value. It is said that the effects of this respiratory gas exposure are still low, as detailed in **Table 6.5-14 Predicted** and the SO_2 concentration expected line are shown in **Figure 6.5-**13 Expected Sulfur Dioxide concentration.

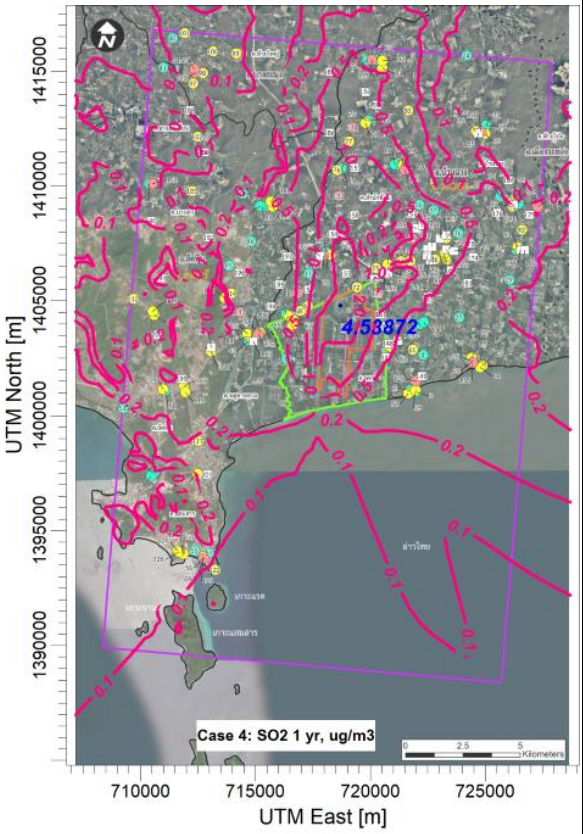
Table 6.5-14 Predictedvalue of Sulfur Dioxide (SO_2) after 2 runnings, with average of 24 hours and averaged 1 year

Mean concentration time	Concentration SO_2 (□g/m)		Ratio to standard (percentage)
	Maximum concentration value (Cmax) from the AERMOD model after 2 ways of running	Standard Value in Thailand	
24 hours	44.83482	300	14.94
1 year	4.53872	100	4.54

Note : The standard according to the National Environment Board No. 24 (2004) regarding the establishment the quality standards of air in a general atmosphere, which specifies that the average of Sulfur Dioxide gas in 24 hours must not exceed 0.3 milligrams per cubic meter (300 micrograms per cubic meter), and in 1 year must not exceed 0.1 milligrams per cubic meter (100 micrograms per cubic meter).



The maximum concentration of SO_2 in 24 hours
44.83482 micrograms per cubic meter



Maximum SO_2 concentration in 1 year
4.53872 micrograms per cubic meter

Note : Assumptions Case 4 - Max expected flight in 1998 (2 routes)

Figure 6.5-13 Expected Sulfur Dioxide concentrationline (SO_2)

3) Health risks from exposure to dust ($PM_{2.5}$ and PM_{10})

Danger of particulate matter from exposure to exposure may cause eye irritation including respiratory tract damage. When we inhale particulate air, irritation occurs according to various parts of the respiratory system depending on the size of the particulate matter. Large dust will be trapped at the nasal hair. Small dust can escape into the respiratory system, causing irritation, nasal burning, coughing, sneezing, sputum, or accumulation of dust in the pulmonary duct, resulting in degeneration.

Assessment of the level of risk to be tolerated of $PM_{2.5}$ and PM_{10} in this study were considered by the ratio between the expected dust concentration after 2 routes and the standard value of Thailand according to the Notification of the National Environment Board, which sets the PM standard$_{2.5}$ and PM_{10}, average 24 hours in the atmosphere, equal to 50 and 120 micrograms per cubic meter. Adverse health evaluation from exposure to $PM_{2.5}$ and PM_{10} cumulative based on PM standard$_{2.5}$ and PM_{10}, which is the average 1 year in the atmosphere, is 25 and 50 micrograms per cubic meter.

From the PM Study$_{2.5}$ compared to Thai standards, 24 hours average and 1 year average of predicted values were 12.29 percent and 4.32 percentage of the 24-hour average and 1 year average, respectively. In addition, when considering the expected concentration of PM_{10} compared to the standard of Thailand, the average of 24 hours and the average of 1 year of predicted value is 5.15 percent and 2.17 percent of the 24 hours average and 1 year average respectively. In summary, the impact of exposure to dust is low, as detailed in **Table 6.5-15** and predicted line, concentration $PM_{2.5}$ and PM_{10} are shown in **Figure 6.5-**14 Predicted dust concentration and **Figure 6.5-15** Predicted PM_{10} dust concentration respectively.

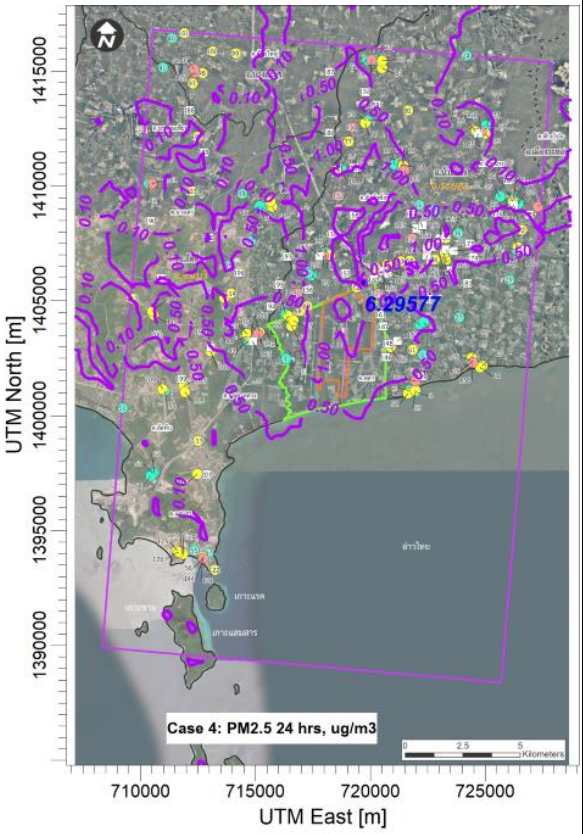
Table 6.5-15 Predicted value of particulate matter concentration $PM_{2.5}$ and PM_{10} after 2 ways run, with average of 24 hours and averaged 1 year.

Mean concentration time	Concentrations $PM_{2.5}$ and PM_{10} (micrograms per cubic meter)				Ratio to standard (percentage)	
	Maximum concentration value (Cmax) from the AERMOD model after 2 ways of running		Standard Value in Thailand			
	$PM_{2.5}$	PM_{10}	$PM_{2.5}$[1/]	PM_{10}[2/]	$PM_{2.5}$	PM_{10}
24 hours	6.29577	6.33753	50	120	12.59	5.28
1 year	0.63057	0.63479	25	50	2.52	1.27

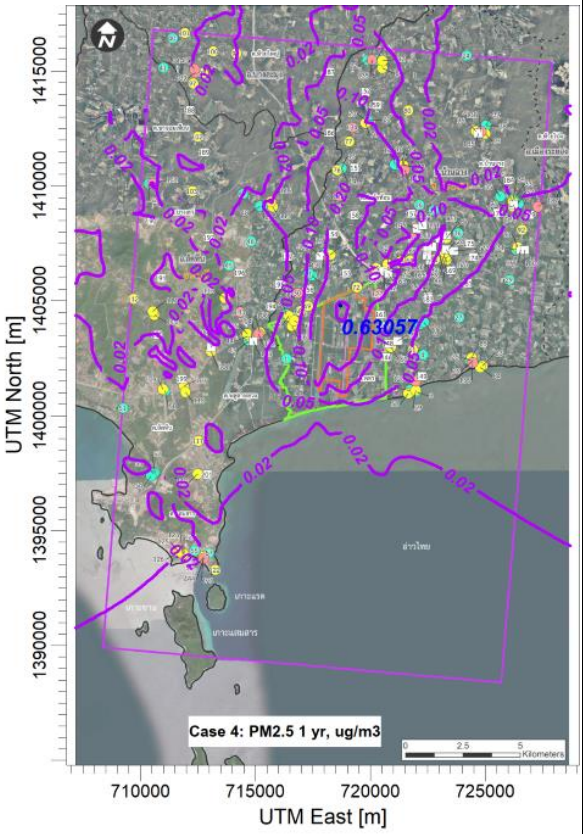
Note : the result of expected $PM_{2.5}$ concentration values is equal to PM_{10}.

[1/] The standard according to the National Environment Board No. 24 (2004) regarding the establishment of air quality standards in a general atmosphere, which defines the average of no more than 10 micron of dust in 24 hours, no more than 0.12 milligrams per cubic meter (120 micrograms per cubic meter), and in 1 year, no more than 0.05 milligrams per cubic meter (50 micrograms per cubic meter).

[2/] The standard according to the National Environment Board's Notification No. 36 (2010), regarding the standard of no more than 2.5 micron of dust in general atmosphere, which specifies that the average amount of dust not exceeding 2.5 micron in 24 hours must not exceed 0.05 mg per cubic meter (50 micrograms per cubic meter) and in 1 year must not exceed 0.025 milligrams per cubic meter (25 micrograms per cubic meter).



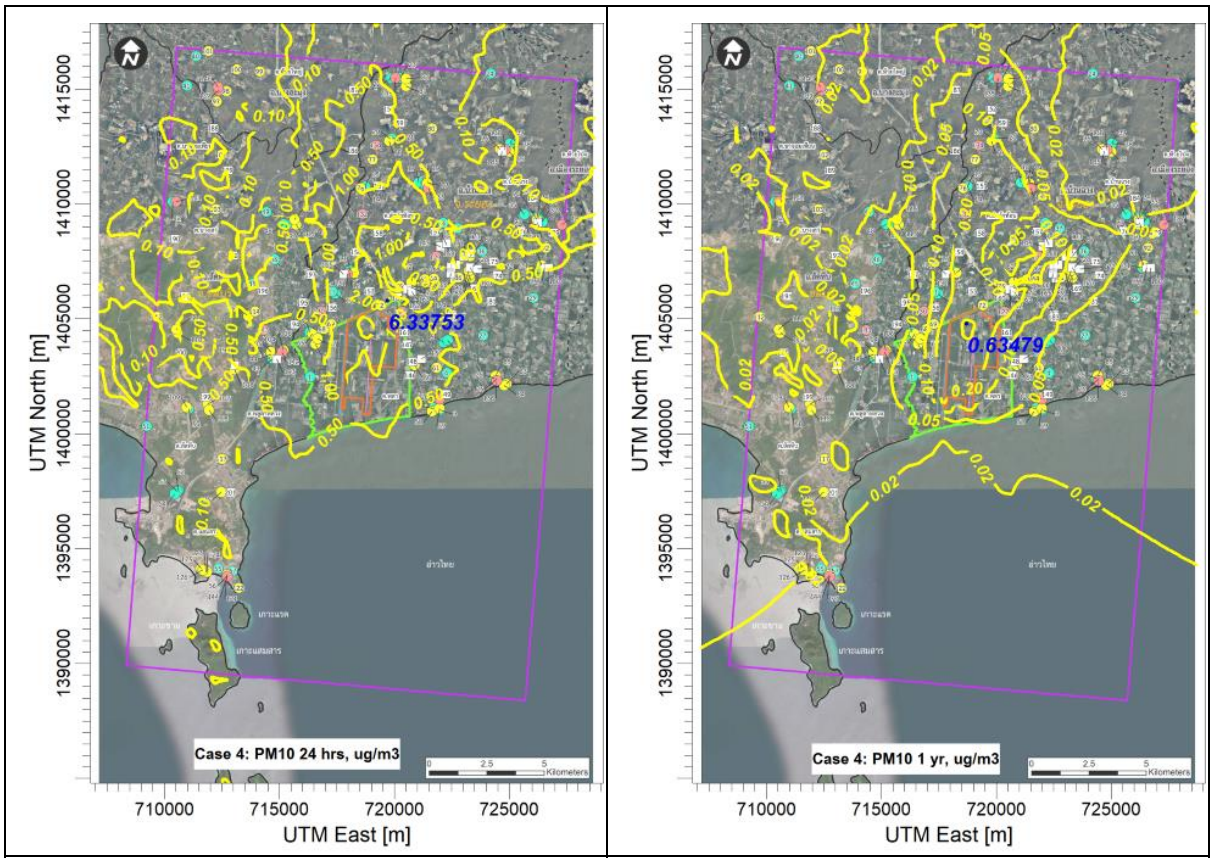
Peak $PM_{2.5}$ concentration in 24 hours
6.29577 micrograms per cubic meter



Maximum $PM_{2.5}$ concentration in 1 year
0.63057 micrograms per cubic meter

Note : Assumptions Case 4 - Max expected flight in 1998 (2 routes)

Figure 6.5-14 Predicted dust concentrationline $PM_{2.5}$



Maximum PM_{10} concentration in 24 hours 6.33753 micrograms per cubic meter	Maximum PM_{10} concentration in 1 year 0.63479 micrograms per cubic meter

Note : Assumptions Case 4 - Max expected flight in 1998 (2 routes)

Figure 6.5-15 Predicted PM_{10} dust concentrationline

6.5.2.3 Risk level for project employees

11 expected types of volatile organics, including Acetaldehyde, Acrolein, Benzene, 1,3-Butadiene, Isopropylbenzene or Cumene, Ethylbenzene, Formaldehyde, Naphthalene, Styrene, Touluene and Xylene where the level of risk and the scope of the area expected to be affected was assessed using a 24-hour mean peak concentration (Cmax). From a mathematical model occurring in the project area (within the area of U-Tapao International Airport) compared with the concentration of substances that allow work exposure, which is calculated as the time average, considering 8 hours of work each day to 40 hours in a week (PEL- TWA: Permissible Exposure Limit-Time Weighted Average). It was found that during the normal operation of the project, the concentrations predicted by the model are lower than the PEL-TWA values. Therefore, project employees are expected to be affected by low levels of VOCs from the project. The results of the comparison of VOC concentrations from the project and the PEL - TWA values are shown in Table 6.5-16 and the highest VOC concentrations at 24 hours are shown in **Figure 6.5-16**

Table 6.5-16 Comparison of Project-Concentrations of Volatile Organic Substances and PEL-TWA

Types of volatile organic compounds	PEL-TWA (Time Weighted Average) (gram per cubic meter)	Average of 24 hours Max (Cmax) that

	OSHA[1/]	ACGIH[2/]	NIOSH[3/]	Thai[4/]	occurred in the project area (gram per cubic meter)
Acetaldehyde	360,327	45,041 C	3,603,272 IDLH/Ca	-	0.649
Acrolein	229	229 C	229	-	2.098
Benzene	3,195	1,597	319Ca	159,734	0.778
1,3-Butadiene	2,212	4425	4,424,540 IDLH/Ca	-	1.445
Isopropylbenzene or Cumene	245,787	245,787	245,787	-	2.568
Ethylbenzene	434,192	86,838	434,192	-	0.155
Formaldehyde	921	368 C	20 Ca	12,282	10.606
Naphthalene	52,429	52,429	52,429	-	0.463
Styrene	426,012	85,202	213,006	2,556,074	0.265
Toluene	753,620	75,362	376,810	1,884,049	0.576
Xylene	434,192	434,192	434,192	-	0.241
Volatile Organic Substances (VOCs)	-	-	-	-	111.74

Note : Assumptions Case 4 - Max expected flight in 1998 (2 routes)

[1/] OSHA Regulation Standards- 29 CFR Part 1910.1000 Table Z-1, Z-2 www.osha.gov, August 2013

[2/] ACGIH: Threshold Limit Value for Chemical Substance and Physical Agents and Biological Exposure Applications 2010

[3/]NIOSH Publication Number 2005-149 http://www.cdc.gov/niosh/docs/2005-149/

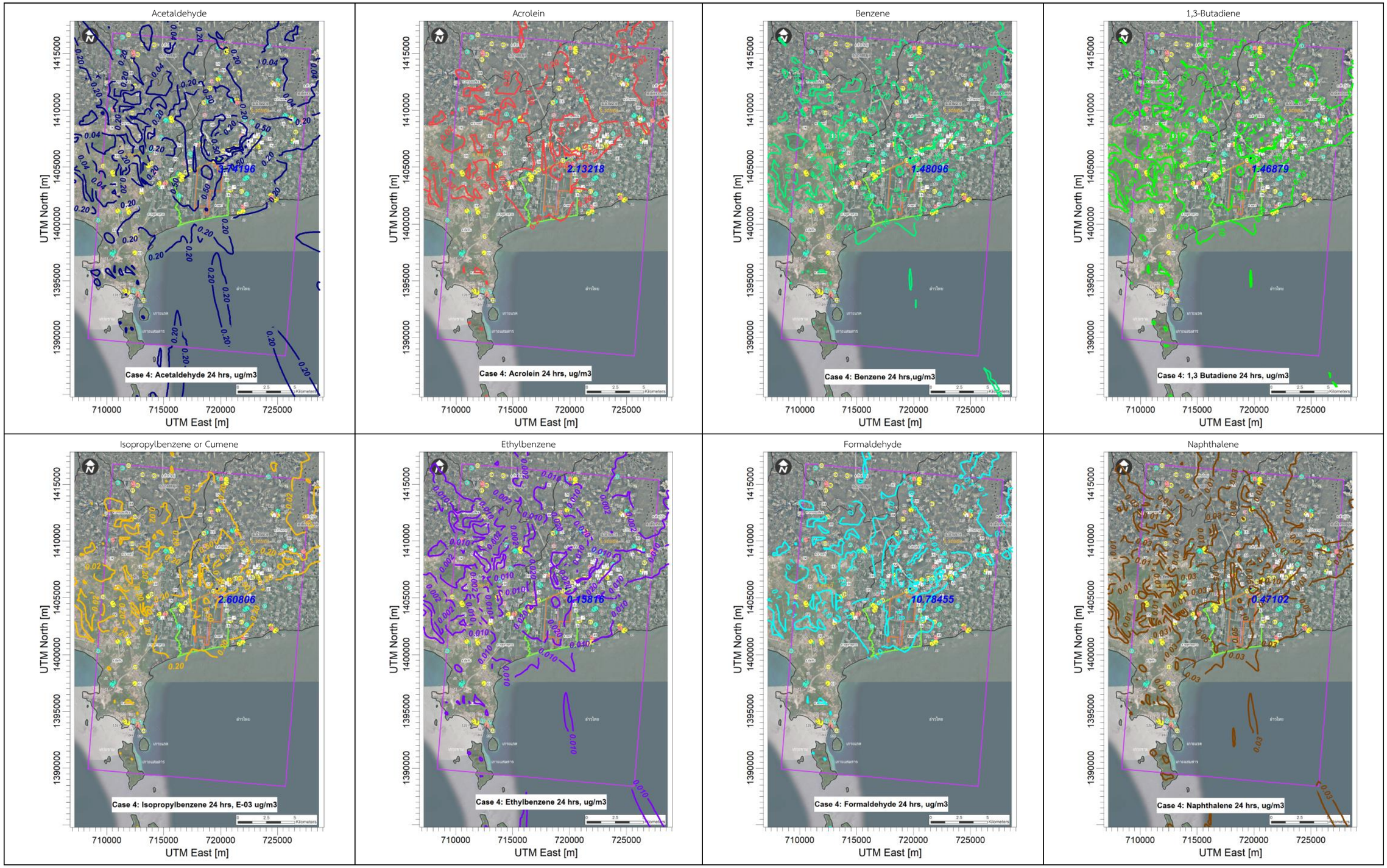
[4/]Announcement of the Ministry of Interior on Working Safety in the Environment (Chemicals)

C means Ceiling standard values prohibit chemicals in the working environment from exceeding this limit, regardless of the duration.

IDLH refers to the concentration of chemicals in the atmosphere that are life-threatening if received even for a short period of time.

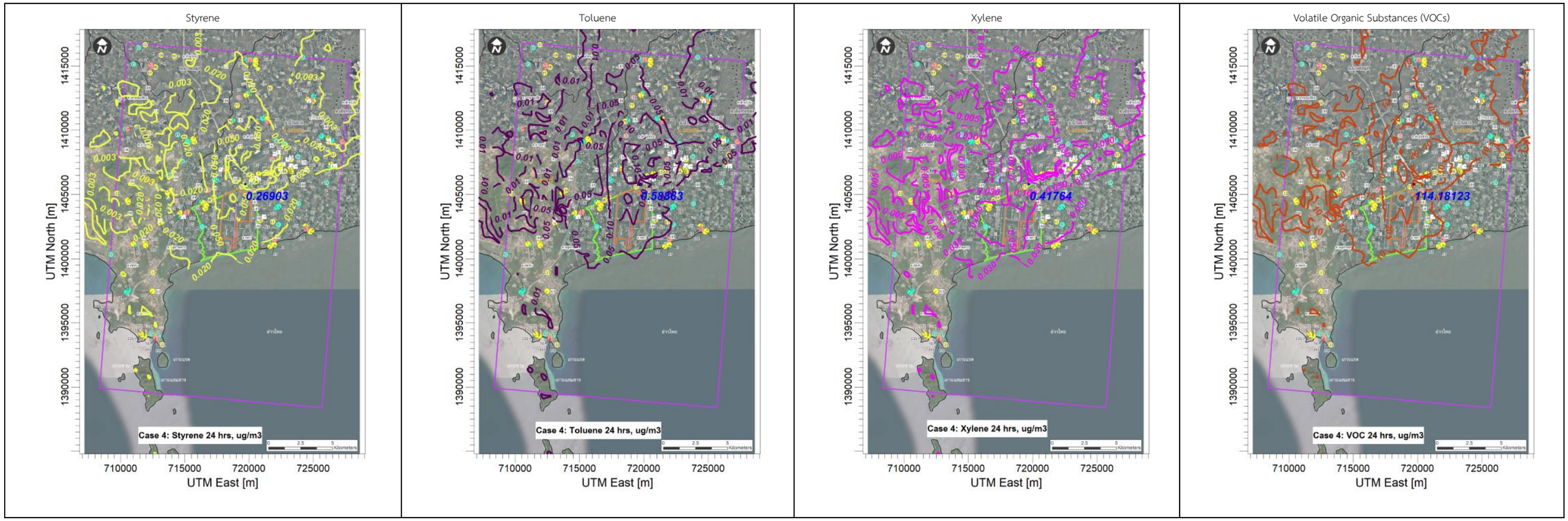
Ca refers to substances that have the potential to cause cancer from exposure.

(-) indicates that there is no standard specified.



Note : Assumptions Case 4 - Max expected flight in 1998 (2 routes)

Figure 6.5-16 Maximum concentration values of volatile organic compounds in 24 hours



Note : Assumptions Case 4 - Max expected flight in 1998 (2 routes)

Figure 6.5 16 Maximum concentration values of volatile organic compounds in 24 hours

From the long-term assessment of health risks from exposure to all 11 types of substances through continuous inhalation, it was found that there was a low level of impact on the people in the residences around U-Tapao International Airport, except exposure to adrenaline with a risk of respiratory illness. As there is a higher HQ of 1 approximately 1-5 times more in the community area around U-Tapao International Airport on the North and East side. However, this risk does not require to migrate people in case of emergency, due to the concentration of Acrolein in the said area. The maximum concentration is not allowed to be in the short contact[4] with the maximum concentration of (IDLH: Immediately Dangerous Life Health) the required Acrolein is 4,580 microgram per cubic meter (Refer to NIOSH POCKET GUIDE TO CHEMICAL HAZARDS, 2007).

The guidelines to reduce the risk of exposure to air pollution that can be managed from the source are the controls at the source before the pollution can travel through environmental mediums and affect exposure. The project has put in place measures for reducing the impacts of air quality (source) such as environmental measures, measures to control ground air pollution within airports, measures to solve the problem of air pollution in the event that the runway is closed for repairs, measures requiring aircrafts to turn off their engines while approaching a tunnel or passenger loading bridge and to use electrical supply and air conditioning equipment supported by airport utilities systems and machinery as well as encouraging Ground Support Equipment (GSEs) to use low-emission fuels, such as within the airside area, to use electric fuel, for areas outside the airport (Landside) use natural gas or electricity. In addition, air pollution monitoring results must be analyzed regularly from air monitoring data. To be a continuous management approach from environmental management to health management leading to the appropriate methods and action plans to reduce emissions to the environment and the project must comply with measures to prevent and correct environmental impacts on air quality. During the rigorous operation there is a regular monitoring and measurement of air pollution especially in areas at risk of air pollution including coordinating and cooperating with public health agencies to monitor the health of at-risk groups. Furthermore, the environmental impact monitoring results must be analyzed together with health status to consider the potential impact on the risk group after opening the operation and provide appropriate solutions to the impact and requires the project to promote and support the potential of air pollution surveillance by agencies and public health volunteer groups.

These are the details of measures to prevent and correct environmental impacts, air quality, health and public health, as well as occupational health and safety. Details are shown in **Chapter 7, Action Plan, Environmental, Preventive and Remedy Measures for Environmental Impact, and Monitoring of Environmental Impact.**

[4] IDLH (Immediately Dangerous Life Health) refers to the concentration of chemicals in the atmosphere that are life-threatening. If received for a short period of time, refer to NIOSH POCKET GUIDE TO CHEMICAL HAZARDS, September 2007 (NIOSH Publication Number 2005-149), accessible from http://www.cdc.gov/niosh/docs/2005-149/