

Final Environmental Impact Assessment Report

Polypropylene Compound Plant Project

IRPC Public Company Limited

Choengnoen Sub-District, Muang Rayong District

Rayong Province



Executive Summary Report

Prepared by



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Executive Summary Report
Polypropylene Compound Plant Project
IRPC Public Company Limited
IRPC Industrial Park, Choengnoen Sub-District, Muang Rayong District, Rayong Province

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**Executive Summary Report
Polypropylene Compound Plant Project
IRPC Public Company Limited
IRPC Industrial Park, Choengnoen Sub-District,
Muang Rayong District, Rayong Province**

1. BACKGROUND AND OBJECTIVE OF THE PROJECT

Due to the current fluctuation of petrochemical business, IRPC Public Company Limited needs to create new products to sustain their business in the highly competing market. IRPC focuses on minimizing use of natural resources and environmentally friendly products. In order to decrease exportation, IRPC has studied and compared various petrochemical products. The study result found that Polypropylene products are highly demanded and the market growth rate is rather high. Therefore, IRPC plans to establish polypropylene compound plant (plant capacity = 150,000 tons/year). Polypropylene compound plastic is used in everyday life and in frozen food industry since it is endurance with temperature alteration. Polypropylene compound plastic is strong, endurance to crashing, and can be replaced some metal parts of the car since it is light and can reduce energy use. Also, the price of polypropylene compound plastic is inexpensive.

The Environmental Impact Assessment (EIA) report is required for polypropylene compound plant project with capacity of 150,000 tons/year or approximately 450 tons/day in accordance of the Notification of Ministry of Natural Resources and Environment entitled EIA report guideline dated 24 April B.E. 2555. Petrochemical industry having production capacity more than 100 tons/day must submit EIA report. As a result, IRPC Public Company Limited has assigned Vision E Consultant Co., Ltd to conduct EIA report in consistency of the above regulation and the company intention. IRPC is engrossed in developing its' business and improving environment, social, and health of the surrounded communities in the same time.

2. PROJECT DESCRIPTION

2.1 Project Location and Composition

2.1.1 Location

Polypropylene compound plant project is located in IRPC Industrial Park (Southern Sukhumvit Road) in Choengnoen Sub-District, Muang Rayong District, Rayong Province at km 226 of Sukhumvit Road. The distance between the plant and Muang Rayong District is 6 km to the East direction as shown in **Figure S-1**. The total project area is approximately 8.5 rai. The area is abandoned and pending for development. The boundary is connected to parts of IRPC Industrial Park as follows;

| | | |
|-------|-------|-----------------------------------|
| North | reach | Canteen |
| South | reach | HDPE Plant |
| East | reach | Central Facility and Utility unit |
| West | reach | Fire Extinguisher Station 01 |

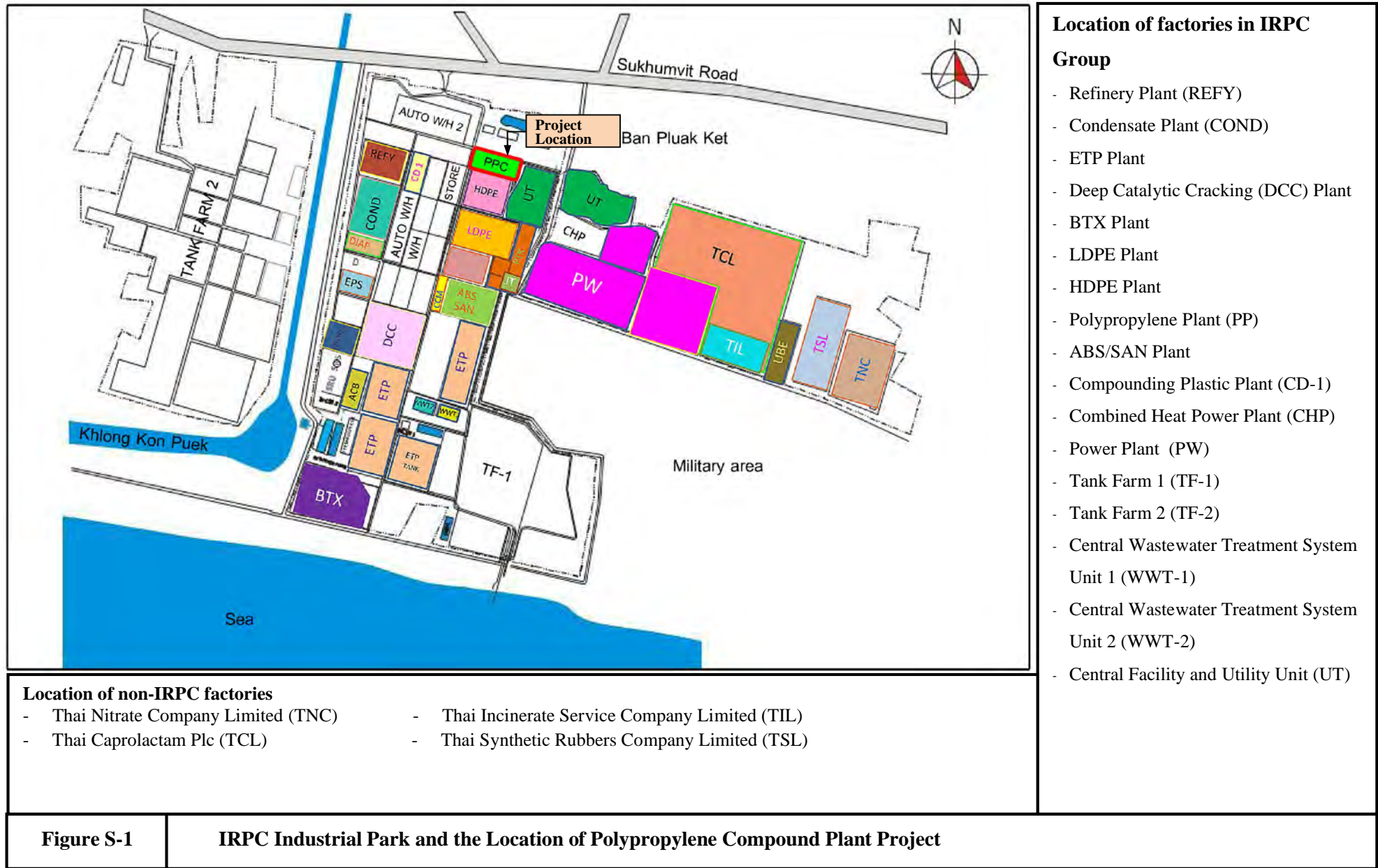


Figure S-1

IRPC Industrial Park and the Location of Polypropylene Compound Plant Project

2.1.2 Composition of the Project

The composition is divided into 4 main parts; production process unit, facility and utility unit, green area, and space. The total project area is 13,600 m² (8.5 rai). The layout of project is shown in **Figure S-2**.

2.2 Alternative

2.2.1 Project Location

Two alternatives were considered to be a location of polypropylene compound plant project;

Alternative 1 8.5 rai of space in the North of HDPE plant in IRPC Industrial Park (Southern Sukhumvit Road)

Alternative 2 8.5 rai of space in the North of HDPE plant in IRPC Industrial Park (Northern Sukhumvit Road)

According to the site selection of Polypropylene Compound Plant, the alternative 1 (8.5 rai of vacant in the North of HDPE plant) is more appropriate than the alternative 2. The considerations are shown in **Table S-1**.

2.2.2 Technology

Horizone (Chisso) process technology by Japan Polypropylene Cooperation is selected. Japan Polypropylene Corporation (JPP) has a long and wide experience in the polypropylene business, and has developed polypropylene manufacturing technology. The JPP horizone reactor is example result of development. Horizone Reactor produces a wide range of superior quality products, especially impact copolymer. A narrow powder residence time distribution is achieved in the reactor by plug flow powder movement. In additions, the surface of powder bed is larger than the vertical reactor. Therefore, heat from polymerization reaction in the power bed regularly distributes and easy for temperature reduction. As a result, the system is stable. Since the qualification of horizon reactor is similar to plug flow, changing product's grade can be done simply and quickly. However, changing of product's grade leads to 40% off-grade plastic grade which is still less than other type of reactors (Stirred-type reactor or Fluidized bed reactor). Therefore, horizone reactor is appropriate for processing of homopolymer, random copolymer, and impact copolymer.

**Table S-27 Environmental Mitigation Measure for Polypropylene Compound Plant Project (Construction Phase)
IRPC Public Company Limited in Choengnoen Sub-District, Muang District, Rayong Province**

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|--|--|--|---------------------------|-------------------------------|
| 1. Air Quality Dust dispersion may be generated from ground cleaning and construction material transportation. | 1.1 General measures to minimized dust must be followed; - Water must be sprayed on the construction site and access road at least twice a day (morning and afternoon). - Construction area must be cleaned after working every day. - Construction material pile must be covered or stored in proper area. | - Construction area and access road | - Over construction phase | - IRPC Public Company Limited |
| | 1.2 Cart of truck must be entirely covered with canvas to prevent construction material falling and dust dispersion. | - Throughout transportation route | - Over construction phase | - IRPC Public Company Limited |
| | 1.3 Equipment/machine must be regularly examined. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 1.4 Truck wheels must be cleaned before leaving the construction site. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 1.5 All drivers must implement and limit speed in IRPC Industrial Park following the IRPC Regulation: not exceed 20 km/hr in the plant area and not exceed 40 km/hr in IRPC Industrial Park. Limited speed in the community area must implement according to traffic rule. | - Construction area and construction material transportation route | - Over construction phase | - IRPC Public Company Limited |

Table S-27 (Cont'd-1)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|--|---|---------------------------------|---------------------------|-------------------------------|
| 2. Noise Nuisance noise may be generated from construction machines and material transportation. | 2.1 Vehicles and machines must be maintained and inspected in good condition, especially loud noise machine. | - Machine/equipment and vehicle | - Over construction phase | - IRPC Public Company Limited |
| | 2.2 Consider to use equipment/machine that produce low noise. | - Machine/equipment | - Over construction phase | - IRPC Public Company Limited |
| | 2.3 Construction and equipment installation that may cause loud noise must be conducted in day time (8.00 am-5.00 pm). | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 2.4 Personal protective equipment (PPE) e.g. ear plugs and ear muffs must be arranged for workers in loud noise area (Over than 85 dB(A)). It should be maintained in good condition for using. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 2.5 To reduce the impact of noise over 85 dB(A), work suspension or worker circulation may specify. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| 3. Water Quality Wastewater is generated from domestic water use and construction activities. | 3.1 Contractor must arrange mobile toilet for workers and provide licensed waste disposal contractor to dispose the waste. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 3.2 Contractor must clean construction area, access road and water drainage system immediately when construction material falls in water drainage system. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 3.3 Construct temporary water drainage with water pit at specific interval of water drainage system. Setting pond must be existed at water drainage station to block soil, stone, coarse sand, and garbage before release water from the project area to water drainage system of IRPC industrial Park. | - Construction area | - Over construction phase | - IRPC Public Company Limited |

Table S-27 (Cont'd-2)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|---|---|--|---------------------------|-------------------------------|
| 4. Solid Waste and Garbage There are 600 construction workers as maximum. Solid waste is expected to generate about 480 kg/day. Some construction wastes can be reused. | 4.1 Trash bins with lids for each waste type must be arranged and placed in construction area as appropriate. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 4.2 Contractor must separate wastes e.g. wood or iron to recycle or sell to recycle waste trader. Some construction wastes e.g. brick fragment must be disposed as appropriate. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 4.3 Construction material stock yard must be arranged and far from water drainage system. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 4.4 Garbage must be collected and disposed by local government agency. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 4.5 Set up measure to prevent solid waste getting into the drainage systems and water resources nearby the construction area. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| 5. Transportation Increasing traffic volume may occur from construction material transportation. | 5.1 Contractor must provide truck driver training program to follow traffic regulation and drive carefully only in residential area. | - Construction area and community area | - Over construction phase | - IRPC Public Company Limited |
| | 5.2 Speed and weight of construction material loading truck must be controlled following traffic regulation to prevent road damage and traffic accident. | - Construction area and public road | - Over construction phase | - IRPC Public Company Limited |
| | 5.3 Construction material transportation must be carefully conducted to prevent material falling on public road (e.g. wood, rock or other materials) and make traffic accident. | - Construction area and public road | - Over construction phase | - IRPC Public Company Limited |
| | 5.4 Contractor must avoid transporting construction material in rush hour e.g. 7.00-9.00 am and 5.00-7.00 pm. | - Construction area and public road | - Over construction phase | - IRPC Public Company Limited |
| | 5.5 Contractor must arrange safety guard to control traffic at access road. | - Construction area | - Over construction phase | - IRPC Public Company Limited |

Table S-27 (Cont'd-3)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|--|---|--|-------------------------------|-------------------------------|
| 6. Socio-Economic | 6.1 Local skilled labor should be employed to work with project to make a good relationship with local people. | - Construction area and nearby community | - Over construction phase | - IRPC Public Company Limited |
| | 6.2 Contractor must inform progress construction activity to local people via medias including public relation boards of local people or government agencies. | - Construction area and nearby community | - Over construction phase | - IRPC Public Company Limited |
| | 6.3 Contractor must setup Emergency Control Center (ECC) to respond complaint all 24 hours. (ECC telephone number : 038-802560 and 1800-800-008) | - Construction area and nearby community | - Over construction phase | - IRPC Public Company Limited |
| | 6.4 If there is any complaints, project must follow complaint management procedure. In the case of complaints cause by the project activities, project must urgently take an action to solve the problem and report to petitioner and project director. | - Construction area and nearby community | - Over construction phase | - IRPC Public Company Limited |
| | 6.5 CSR staffs must make a good relation with local people, community leader and government officer to get and respond their complaints. | - Construction area and nearby community | - Over construction phase | - IRPC Public Company Limited |
| 7. Occupational Health and Safety | A. General measures | | | |
| | 7.1 Project must consider contractor, who has occupational health and safety measures. The workers must have good health as health standard. Contractor must employ good health workers without contagious diseases. Contractor must submit health checkup report of workers to project before construction commencement. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.2 Occupational health and safety training must be set up to the workers to increase awareness and knowledge of regulations including PPE training. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| 7.3 The machine and equipment must be maintained in good condition to reduce accident. | - Construction area | - Over construction phase | - IRPC Public Company Limited | |

Table S-27 (Cont'd-4)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|---|--|---------------------|---------------------------|-------------------------------|
| 7. Occupational Health and Safety (Cont'd) | 7.4 Lavatory and toilet must be provided not less than standard as defined by Ministerial Regulation, Volume 2, under Factory Act B.E.2535. Contractor must provide mobile toilet. The waste must be disposed by licensed waste disposal agencies. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.5 Trash bins with lids for each waste type must be arranged and placed in construction area as appropriate. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.6 Sufficient first aid equipment must be provided at the construction area. For emergency case, injured person must be transferred to nearby hospital. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.7 Accident information must be recorded including cause of accident and solution. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.8 The workers must wear proper personal protective equipment (PPE) following personal proactive equipment standards of project. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.9 Fire extinguisher must be sufficiently arranged in construction area. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.10 Contractor must install signs “No Smoking”, “Construction Zone”, “Unauthorized person is not allow” in construction area. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | B. Controlling of contractor and contractor company working in the project area | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.11 Contractor must strictly implement following IRPC’s Regulations including Work Permit Regulation, Contractor Regulation Manual. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.12 Project contractor must follow law according to Labor Protection Act, Ministerial Regulations and other safety regulations. | - Construction area | - Over construction phase | - IRPC Public Company Limited |

Table S-27 (Cont'd-5)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|---|---|---------------------|---------------------------|-------------------------------|
| 7. Occupational Health and Safety (Cont'd) | 7.13 Contractor must prepare, provide equipment and staff according to company regulations by considering work type and risk. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.14 All construction workers must pass the training and safety test from company before commencement. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.15 All construction workers must pass the alcohol and drug testing from company before commencement. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.16 All construction workers who work on high area must pass blood pressure check from company before commencement. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.17 Do not bring cigarette, lighter, and communication devices which create heat and spark e.g. mobilephone, radio into the battery limit area. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.18 Internal combustion automotive tool/engine must be worn spark arrestor before enter production site and battery limit area. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.19 Daily clean the construction area, separating remaining materials and waste both hazardous and non-hazardous types. The separation or disposal waste must conduct daily in appropriate way by not cause any accident and safety of employee. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.20 Before deliver work submission, contractor must demolish construction site and take out all remaining materials from the project area. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.21 Contractor must assign project responsible person including site manager, leader, security guard and fire watch man to prevent the occurrence of open fire in hazardous area. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.22 Site manager must prepare the hazard identification and risk assessment report before project is started by What If Analysis Method or other methods as appropriate. | - Construction area | - Over construction phase | - IRPC Public Company Limited |

Table S-27 (Cont'd-6)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|---|--|---------------------|---------------------------|-------------------------------|
| 7. Occupational Health and Safety (Cont'd) | 7.23 When accidents or near-miss accidents, site manager must review hazard identification and risk assessment. New mitigation measures may be assigned to prevent the reoccurrence. All information must be recorded in report. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.24 Specify procedure of each construction work type to increase the safety during working including <ol style="list-style-type: none"> 1) Use of electronic devices 2) Construction work or work area which can be partitioned 3) Use of Mobile crane 4) Use of forklift 5) Excavation work and the use of high pressure jet gun 6) Radiography 7) Cold Work 8) Hot Work 9) Confined space area 10) Use of gases in welding work 11) Sandblast work 12) Use of vehicle | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.25 When contractor fail to follow the procedure, the contractor must be punished as indicated by project. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | C. Personal Protective Equipment 7.26 Contractor must prepare basic personal protective equipment (PPE) including helmet, safety shoes and safety glasses which are passed Thai industrial standards (TIS) and other personal protective equipment for specific work according to the regulations and standards. | - Construction area | - Over construction phase | - IRPC Public Company Limited |

Table S-27 (Cont'd-7)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|---|--|---------------------|---------------------------|-------------------------------|
| 7. Occupational Health and Safety (Cont'd) | D. Emergency 7.27 When emergency occur, siren loud will be warned 7 times continually, the workers must follow these following procedures. 1) Stop working immediately 2) Turn switch off of equipment and engine 3) Worker worked in confined space must leave from that area immediately 4) Worker worked in the high area must move to low area 5) When gas leak is occur, worker must leave that area immediately 6) Worker riding vehicles, must stop or pull over immediately 7) Contractor must assemble at assigned assembly point or assigned area 8) Worker who responsible for electricity must turn off electricity 9) Must not gather around fire fighting of firefighters 10) Foreman must check that all workers exist fully 11) When the situation return to normal, long siren will be given at once 12) All workers must be ready for fire prevention, when fire is seen, worker must call number 77 immediately 13) IRPC Public Company Limited has ambulance ready 24 hr which can be reached at number 1111 or 6 | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 7.28 To retrain emergency occurrence during construction phase, IRPC emergency procedure need to be followed. | - Construction area | - Over construction phase | - IRPC Public Company Limited |

Table S-27 (Cont'd-8)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|--|--|--------------------|----------------------------------|--------------------------------------|
| <p>7. Occupational Health and Safety (Cont'd)</p> | <p>E. Regulations for Camp Site and Workers During Construction Phase</p> <p>7.29 Regulation for camp site and workers during the construction phase of the project</p> <p><u>Safety measures for camp site</u></p> <ol style="list-style-type: none"> 1) Provide security guard at the entrance and camp site for 24 hours. 2) Hedge around camp site of all workers 3) Provide security guard to check all persons who pass the entrance. 4) Not allow these following persons enter the camp site <ul style="list-style-type: none"> - Have or own any alcohol-drug - Under alcohol and drug influence - Violate safety measures - Wrangle with anyone - Own weapon, camera or offensive weapon 5) Steal or try to steal properties of company. 6) Workers who live in camp site must show employee card every time at the entrance . 7) Vehicle which want to enter the camp site must get approve from security guard. Exchange passing card and fill in the form are required before entering the camp site. 8) Organize camp boss to take control the camp site 9) Not allow workers to light fire or burn waste in the camp site 10) Install extinguisher at the set points which are visible and convenience to use. 11) Check extinguisher monthly and record the result at label every time. 12) Appoint occupational health and safety committee. 13) Organize the meeting between occupational health and safety committee every month. | <p>- Camp Site</p> | <p>- Over construction phase</p> | <p>- IRPC Public Company Limited</p> |

Table S-27 (Cont'd-9)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|--|--|----------------------------|----------------------------------|--------------------------------------|
| <p>7. Occupational Health and Safety (Cont'd)</p> | <p><u>Worker regulation during construction phase</u></p> <ol style="list-style-type: none"> 1) Worker must show employee card to security guard every time . 2) Outsider must exchange card to security guard every time and give visiting purpose before enter the area. 3) Not allow outsider enter the project area if not get permission 4) Not allow to engage in gambling. 5) Must not sell alcohol and any drug in the project area. 6) Must not bring weapon, dynamite and illegal stuffs in the construction area. 7) Not wrangle. 8) Not allow any worker to renovate or demolish before getting the permission. 9) Not allow any worker to discard trash and food remains in the project area. 10) All workers must keep the project area clean and discard trash in provided place. | <p>- Construction area</p> | <p>- Over construction phase</p> | <p>- IRPC Public Company Limited</p> |

Table S-27 (Cont'd-10)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|---|---|--|---------------------------|-------------------------------|
| 8. Major Hazard | 8.1 Contractor must strictly implement following IRPC's regulations including work permit regulation, contractor regulation manual. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 8.2 All vehicles of contractors which enter the construction area must be examined condition and installed spark arrestor. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 8.3 Unauthorized person is prohibited to enter in construction area. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 8.4 Contractor must coordinate with Emergency Control Center (ECC) following emergency control manual of IRPC Public Company Limited e.g. fire, explosion and chemical substance leakage. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| 9. Health Sanitation system must be arranged in construction area and camp site to prevent contagious diseases. | 9.1 Hygienic/ sufficient camp site and environmental sanitation system i.e. potable water, waste management system, lavatory must be provided. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 9.2 Contractor must strictly control workers behavior. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 9.3 Security guard must be arranged in construction area all 24 hours. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 9.4 Contractor must assign occupational health officer to train communicable and non-communicable disease prevention, occupational health and safety for workers. | - Construction area | - Over construction phase | - IRPC Public Company Limited |
| | 9.5 Project must support activities of local public health agencies as appropriate including budget and health volunteer activities etc. | - Construction area and local public health agencies | - Over construction phase | - IRPC Public Company Limited |
| | 9.6 Contractor must inform number of workers to local public health agencies to prepare health service. | - Construction area and local public health agencies | - Over construction phase | - IRPC Public Company Limited |

Remark : IRPC Public Company Limited must strictly supervise contractor to implement following environmental mitigation measures.

**Table S-28 Environmental Mitigation Measure for Polypropylene Compound Plant Project (Operation Phase)
IRPC Public Company Limited in Choengnoen Sub-District, Muang District, Rayong Province**

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|----------------------------|---|----------------|------------------------|-------------------------------|
| 1. General measures | 1.1 Environment mitigation and monitoring measures addressed in the EIA report of polypropylene compound plant project of IRPC Public Company Limited located in Choengnoen Sub-District, Muang District, Rayong Province prepared by Vision E Consultant Limited must be followed. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 1.2 If the monitoring result shows environmental problem, IRPC Public Company Limited must immediately take corrective action. Environmental mitigation and monitoring measures must be seriously followed in order to consider the duration of imminent monitoring. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 1.3 IRPC Public Company Limited must inform about the potential environmental impact to Department of Industry, Rayong Industrial Office, Rayong Natural Resources and Environment Office, and ONEP to consult and solve the problem together. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 1.4 IRPC Public Company Limited shall submit mitigation measures implementation and monitoring report to Rayong Industrial Office, Department of Industry, Rayong Natural Resources and Environment Office, and ONEP in every 6 months in accordance of the ONEP's regulation. | - Project area | - Over operation phase | - IRPC Public Company Limited |

Table S-28 (Cont'd-1)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|-------------------------------------|--|---------------------------------------|------------------------|-------------------------------|
| 1. General measures (Cont'd) | 1.5 In case that IRPC Public Company Limited needs to change project description or mitigation measures addressed in the approved EIA report, IRPC Public Company Limited shall inform the related agencies as follows; <ul style="list-style-type: none"> • If the consequences of change lead to better or equal effect to the environment, the approving agency shall record and enforce the related regulations. The copy of record must be submitted to ONEP for information. • If the consequences of change might affect the content of approved EIA report, ONEP must propose these changes to the expert committees for approval. Once the change is approved, the operation can be conducted. Result of change must be reported to ONEP for information. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 1.6 The result of HAZOP study must be concluded. Worst case scenario with P&ID must be proposed and compared to other cases. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 1.7 Incidents and accidents from similar industries both domestic and international must be reviewed. The information must be included in the environmental mitigation measures annual report in order to use information for review and complete the creation of environment impact mitigation plan of the project. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 1.8 If project do not conduct the construction within 2 years after ONEP send consideration of EIA report from Expert Review Committee, project must review information of impact and measures proposed to ONEP to consider periodically. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 1.9 The third party must be assigned to follow up the implementation of mitigation and monitoring measures. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 1.10 Activities during air sampling in each air quality sampling station must be reported. | - Around air quality sampling station | - Over operation phase | - IRPC Public Company Limited |

Table S-28 (Cont'd-2)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|-------------------------------------|---|----------------|------------------------|-------------------------------|
| 1. General measures (Cont'd) | 1.11 Conduct employee health information database to use for analysis of any uncommon situation annually in each production process area especially high risk area. Age of employee must be included to use for consideration to monitor the hazard exposure. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 1.12 Conduct Environmental Compliance Audit or ISO14000 audit from third party at least once a year | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 1.13 If air monitoring result is close to the standard, the project shall cooperate with the related agencies to solve the air quality problem. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| 2. Air quality | 2.1 Project do not emit nitrogen dioxide gas (NO ₂), sulfur dioxide gas (SO ₂) and total suspended particle (TSP) as major pollutants | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 2.2 The project do not use VOCs in the list of Notification of National Environmental Board no.30 (B.E.2550) entitled one year VOCs standard (9 types)and the Notification of Pollution Control Department entitled VOCs monitoring standard 24 hours (19 types). | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 2.3 VOCs emission inventory must be set up in accordance of (draft) VOCs inventory guideline of the Department of Industry. VOCs emission inventory must be completed within 1 year and to be continued in accordance of the related regulations. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 2.4 Project must reduce controlled value of VOCs leak from each equipment 30% of (draft) Notification of Ministry of Industry entitled criteria and procedures of VOCs control in the factory B.E.2554 to mitigate the impact from VOCs. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 2.5 Project must control the release rate of VOCs from polymerization unit not exceed 0.12 kg TOC/ton product according the benchmark as indicated in DDD-Standard of performance for Volatile Organic Compound (VOC) emission from the polymer manufacturing industry of federal regulation 40 CFR part 60, USA. | - Project area | - Over operation phase | - IRPC Public Company Limited |

Table S-28 (Cont'd-3)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|-------------------------|---|----------------|-------------------------------|-------------------------------|
| 2. Air Quality (Cont'd) | 2.6 Monitoring plan must be conducted around the project area in 8 points as shown in Figure S-30 . VOCs must be monitored every week in the first year and monitor regularly during the project operation. The result is recorded in document form of VOCs measurement. When abnormal situation is occurred, cause will be investigated and solved immediately. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 2.7 Prepare reserved equipment which are possibly to cause the leak of VOCs e.g. Flange Seal, connection and Valve to be ready and enough to use. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 2.8 Measure the leak of VOCs from equipment at least once a year. When VOCs value is higher than controlled value, corrective action must be immediately conducted e.g. compression of seals of valve or flange. After that, VOCs value need to be rechecked. If the VOCs value is still higher than the controlled value, the maintenance section must solve the problem through special technique e.g. On-line stop leak which use as temporary method until stop production for the maintenance. The maintenance need to be done within 15 days. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 2.9 Waste gas produced during emergency occurrence must be sent to flare which is designed to meet the standard of the American Petroleum Institute (API) | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 2.10 Polypropylene compound plant project can be commercially operated in only case of the other flare of BTX flare located at Benzene, Toluene and Xylene Plant are completely modified to be enough to support waste gas produced during emergency case from propylene production unit project and polypropylene compound plant project. | - BTX Flare | - Before commercial operation | - IRPC Public Company Limited |

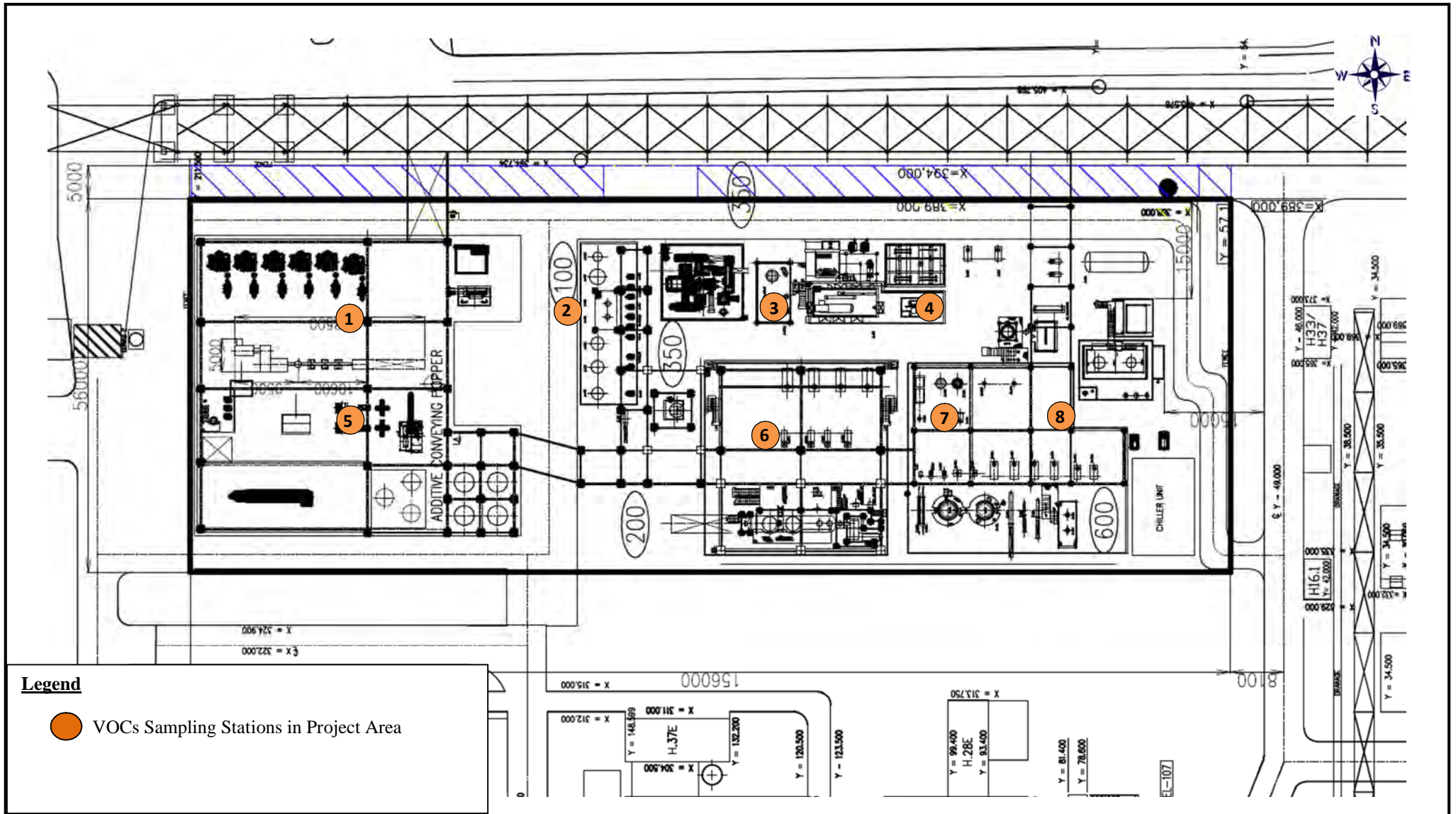


Table S-28 (Cont'd-4)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|--------------------------------|---|-------------------------------------|------------------------|-------------------------------|
| 2. Air Quality (Cont'd) | 2.11 Control burning condition of flare. Pilot burner need to be ignited all the time and cause burning immediately once hydrocarbon or vent gas are delivered. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 2.12 Provide air pollution treatment system supervisor as indicated in the Notification of Ministry of Industry entitled Descriptions of Factory Types and Sizes, Procedure for the Control of Discharges of Wastes, Pollutions, or Any Substance that may Cause Adverse Affects on the Environment, Qualifications of Supervisors and Operators, and Criteria for Registration of the Supervisors of Pollution Prevention Systems volume 2 B.E., 2554. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| 3. Water quality | 3.1 Contaminated and non-contaminated runoff must be separated. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 3.2 Condensated water must be collected and transferred to central facility and utility unit to treat before being produced to be steam. The steam will be sent to use in the project. | - Project area/Central Utility Unit | - Over operation phase | - IRPC Public Company Limited |
| | 3.3 Wastewater management measures are specified as followings: <ul style="list-style-type: none"> - Wastewater from catalyst preparation and feeding unit will be collected and transferred to private company who obtained license (Ro.Ngo.101) from the government agency or Department of Industry. - Wastewater from product finishing unit will be collected in A1 sump before transfer to central wastewater treatment system unit 1 of IRPC Industrial Park. - Wastewater from floor cleaning in production process area and from product finishing unit will be collected in A1 sump before transfer to central wastewater treatment system unit 1 of IRPC Industrial Park. | - Project area | - Over operation phase | - IRPC Public Company Limited |

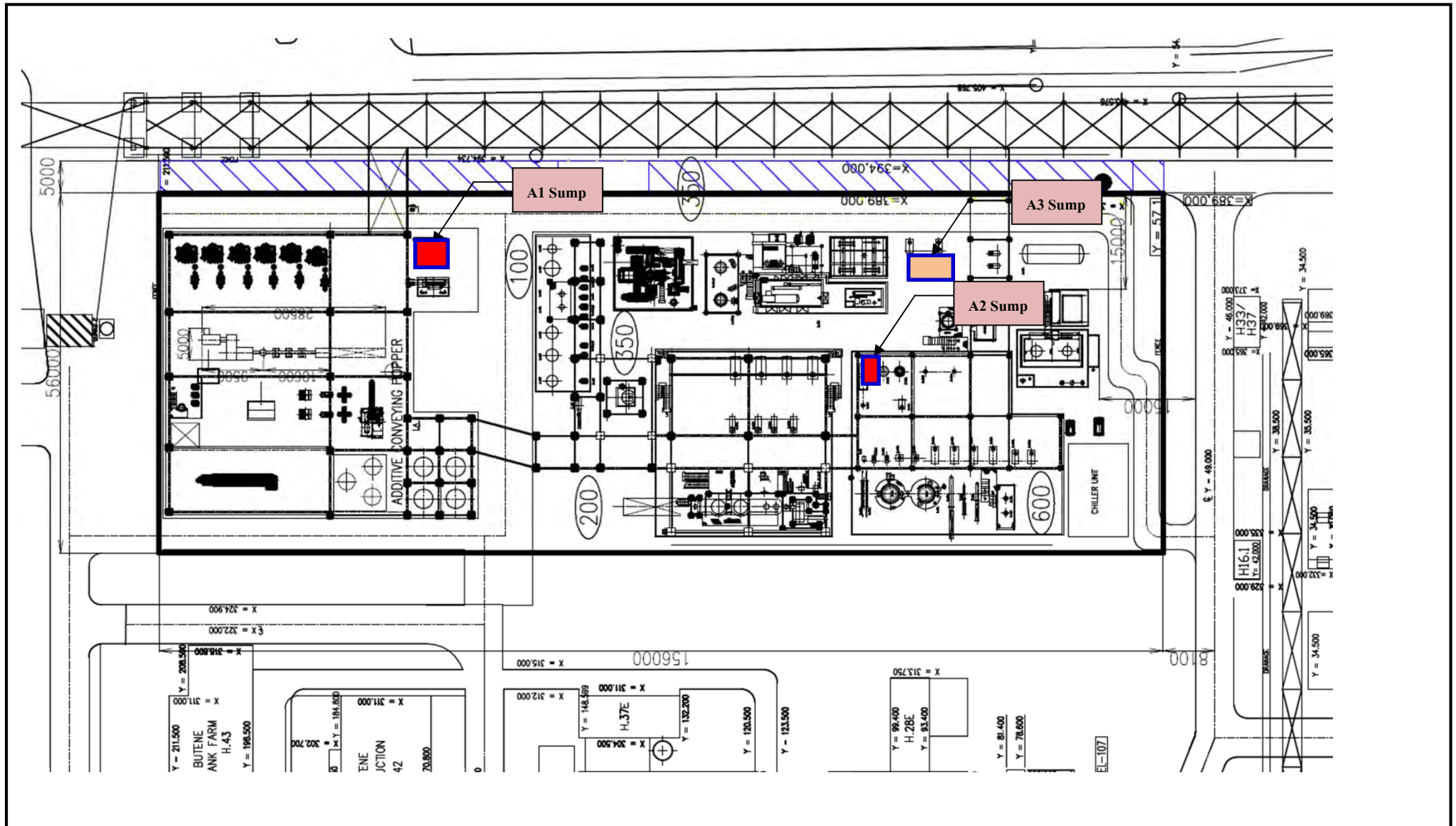


Figure S-31 **Wastewater Sump of the Project**

Table S-28 (Cont'd-5)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|----------------------------------|---|---|-------------------------------|-------------------------------|
| 3. Water quality (Cont'd) | <ul style="list-style-type: none"> - Wastewater from bleed liquid purification unit will be collected in A2 sump before transfer to central wastewater treatment system unit 1 of IRPC Industrial Park. - Wastewater from floor cleaning of production process area and from catalyst preparation and feeding unit, polymerization unit, powder deactivation unit, bleed liquid purification unit will be collected in A2 sump before transfer to central wastewater treatment system unit 1 of IRPC Industrial Park. | | | |
| | 3.4 Collect rain water in the first 15 min in A3 sump before transfer to central wastewater treatment system unit 1 of IRPC Industrial Park. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 3.5 Polypropylene compound plant project can be commercially operated in only case of central wastewater treatment system unit 1 of IRPC Industrial Park is completed in expansion and improvement so that it will be ready to receive the wastewater from polypropylene compound plant and other projects of IRPC Industrial Park as approved by ONEP. | - Project area and Central Wastewater Treatment System Unit 1 | - Before commercial operation | - IRPC Public Company Limited |
| | 3.6 Provide septic tank to treat wastewater from office before collect through drain pipe and collected in retention pond of IRPC industrial park prior to discharging to Konpuk Canal connected to the sea. | - Wastewater from office | - Over operation phase | - IRPC Public Company Limited |
| | 3.7 The project must control quality of wastewater before discharging to central wastewater treatment system unit 1 of IRPC Industrial Park as standard indicated below: <ul style="list-style-type: none"> - BOD < 1,000 mg/l - COD < 1,500 mg/l - SS < 500 mg/l - Oil & Grease < 5 mg/l - pH In range of 5.5-9.0 | - Project area | - Over operation phase | - IRPC Public Company Limited |

Table S-28 (Cont'd-6)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|----------------------------------|--|--------------------------------------|------------------------|-------------------------------|
| 3. Water Quality (Cont'd) | 3.8 Control treated wastewater which is treated by wastewater treatment system unit 1 as indicated in Notification of the Ministry of Science, Technology and Environment including - BOD < 20 mg/l - COD < 120 mg/l - SS < 50 mg/l - TDS < 3,000 mg/l - Oil & Grease < 5 mg/l - pH 5.5-9.0 | - Wastewater treatment system unit 1 | - Over operation phase | - IRPC Public Company Limited |
| | 3.9 Treated wastewater treated by receiving pond 1&2 of wastewater treatment system unit 1 which is not meet the standard must be retreated until meet the standard. | - Wastewater treatment system unit 1 | - Over operation phase | - IRPC Public Company Limited |
| | 3.10 When water pipe and gutter are clogged, they must be cleaned to remove the clog | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 3.11 Provide wastewater treatment system supervisor as indicated in the Notification of Ministry of Industry entitled Descriptions of Factory Types and Sizes, Procedure for the Control of Discharges of Wastes, Pollutions, or Any Substance that may Cause Adverse Affects on the Environment, Qualifications of Supervisors and Operators, and Criteria for Registration of the Supervisors of Pollution Prevention Systems volume 2 B.E., 2554. | - Project area | - Over operation phase | - IRPC Public Company Limited |

Table S-28 (Cont'd-7)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|------------------------|---|----------------|---|-------------------------------|
| 4. Noise level | 4.1 The machine must be regularly maintained in accordance of the Preventive Maintenance (PM) to avoid noise level exceeding. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 4.2 Silencer/Enclosure must be installed at machine/ noisy area where noise is exceed 85 dB (A). | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 4.3 Warning sign must be installed at the area which TWA 8 hours is more than 85 dB(A). The staffs must wear ear muffs or ear plugs when working in the area. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 4.4 Hearing efficiency of staffs who work in the noisy area must be checked every year. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 4.5 When time-weighted average of noise level (TWA) in the project area during all 8 working hours are higher than 85 dB(A), project must conduct hearing conservation project following Notification of Department of Labor Protection and Welfare, Entitled : Criteria and Method for Hearing Conservation Program in Establishment (B.E.2010). | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 4.6 Noise Contour Map must be conducted for noise management in the plant. | - Project area | - Once a year after operation and must be monitored every 3 years | - IRPC Public Company Limited |

Table S-28 (Cont'd-8)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|-------------------------------------|--|----------------|------------------------|-------------------------------|
| 5. Solid waste and hazardous | 5.1 The guideline for solid waste and hazardous management from production process and office of the project is as follows: <ul style="list-style-type: none"> - Scrap produced from product finishing unit approximately 2 tons will be collected and packed in 650 kg/bag for further distribution. - Deteriorated adsorbent 12-20 tons/2 years approximately will be collected and deliver to private waste disposal company obtained license (Ro.Ngo.101) from the government agency or Department of Industry. - Waste mineral oil approximately 3.5 m³/year will be collect in used TEAL bulk container and return to chemical substance suppliers. - Solid waste approximately 4.44 kg/day will be collected and deliver to private waste disposal company obtained license from the local government agency. - Recycle waste approximately 23.68 kg/day will be collected and deliver to private company who obtained license from the local government agency. - Hazardous waste approximately 1.48 kg/day will be collected and delivered to private waste disposal company obtained license (Ro.Ngo.101) from the government agency or Department of Industry. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 5.2 3Rs principal (Reduce Reuse Recycle) must be applied in waste management of the project. | - Project area | - Over operation phase | - IRPC Public Company Limited |

Table S-28 (Cont'd-9)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|--|--|----------------|------------------------|-------------------------------|
| 5. Solid waste and hazardous (Cont'd) | 5.3 Waste management contractor must apply GPS (Global Positioning System) in order to track and trace waste transportation route. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 5.4 Waste from production process will be collected at the waste storage building under the roof pending for General Affair (GA) of IRPC Industrial Park to transport and dispose. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 5.5 Provide and distribute trash containers for solid waste, recycle waste and hazardous waste to collect waste and wait for agency of IRPC industrial park to be further disposed. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 5.6 Manifest Form must be issued and informed to the Department of Industry every time. The manifest form must be collected for at least 3 years for tracking. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 5.7 Provide solid and hazardous waste treatment system supervisor as indicated in the Notification of Ministry of Industry entitled Descriptions of Factory Types and Sizes, Procedure for the Control of Discharges of Wastes, Pollutions, or Any Substance that may Cause Adverse Affects on the Environment, Qualifications of Supervisors and Operators, and Criteria for Registration of the Supervisors of Pollution Prevention Systems volume 2 B.E., 2554. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 5.8 Prepare the summary report of the quantity of waste to reuse, recycle and disposal for the project as well as submitting the report to ONEP every 6 months. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 5.9 Provide the training for staffs who works on chemical substance and waste management from production process to aware of wearing personal protective equipment to work with efficacy and safety. | - Project area | - Over operation phase | - IRPC Public Company Limited |

Table S-28 (Cont'd-10)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|--------------------------|--|---|------------------------|-------------------------------|
| 6. Transportation | 6.1 The driver must follow the traffic regulation for safety of transportation. | - Transportation route | - Over operation phase | - IRPC Public Company Limited |
| | 6.2 Transportation during rush hour (7-9 am and 5-6 pm) should be avoided | - Transportation route | - Over operation phase | - IRPC Public Company Limited |
| | 6.3 Chemical substance transportation must be conducted in accordance of the law and safety. | - Transportation route | - Over operation phase | - IRPC Public Company Limited |
| | 6.4 Accident including cause, damage, and solution must be recorded to avoid repeating accident in the future. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 6.5 The tag must be attached with the chemical substance loading truck. Information in the tag includes type of chemical substance, handling procedure, and telephone number of IRPC Public Company Limited and transportation contractor. | - Transportation route | - Over operation phase | - IRPC Public Company Limited |
| | 6.6 Chemical substance loading truck must be checked before using to prevent accident and falling. | - Transportation route | - Over operation phase | - IRPC Public Company Limited |
| | 6.7 Speed limit of chemical substance loading and worker transportation vehicles in the IRPC industrial park must be set up in accordance of IRPC Public Company Limited regulation which could not exceed 20 kms/hr in plant area, and 40 kms/hr in the industrial park. Transportation in the community area must be conducted in accordance of the traffic law. | - Project area/Route pass the community | - Over operation phase | - IRPC Public Company Limited |

Table S-28 (Cont'd-11)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|---|---|------------------------|-------------------------------|-------------------------------|
| 7. Occupational health and safety | A. General measures | | | |
| | 7.1 The occupational health and safety committees must be set up. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 7.2 Policy in quality, environment, safety and occupational health must be set up and make an announcement. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 7.3 Conduct the annual occupational health and safety plan as well as review yearly to be able to conduct work on occupational health and safety with efficacy. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 7.4 Arrange the safety audit to assess safety of the working area both unsafe condition and safe condition in order to find the appropriate way to reduce the accidents and propose the plan for accident prevention. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 7.5 Arrange the appropriate occupational health and safety training for employee to increase knowledge and awareness of safety. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 7.6 Sufficient personal protective equipments such as ear muff, glasses, boots, helmet, gloves, mask, coat, and first aid kit must be provided and always prompt to use. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 7.7 Specialist must be stationed in the first aid unit to provide first aid. The doctor must be provided to consult the patient. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 7.8 The physical health of employee must be checked every year by occupational physician. The result must be recorded to compare with the next year. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| 7.9 Accident, cause of accident, and corrective action must be recorded case by case. | - Project area | - Over operation phase | - IRPC Public Company Limited | |

Table S-28 (Cont'd-12)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|---|--|----------------|------------------------|-------------------------------|
| 7. Occupational health and safety (Cont'd) | 7.10 Occupational health and safety activity such as safety week and poster must be promoted. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 7.11 First aid kit and ambulance must be prepared for emergency. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 7.12 Warning signs such as no smoking, falling, and chemical substance harm must be installed at the risk area. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 7.13 Occupational health and safety must be communicated to the employee via public relation board, magazine, and electronic mail. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 7.14 Work permit system must be set up. Only employee who had been trained about occupational health and safety are permitted to work. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | B. Health checkup 7.15 Provide health check before the work commencement, annual for current employee, and employee who transfer or change their works by following the list regulated by the environmental mitigation measures (operation phase). | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 7.16 Arrange the health record for each employee individually to collect as the database for health monitoring from working. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 7.17 When the result of health check is not normal, rechecked will be conducted by occupational physician or specialist to diagnose and give further recommendation. | - Project area | - Over operation phase | - IRPC Public Company Limited |

Table S-28 (Cont'd-13)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|---|---|----------------|------------------------|-------------------------------|
| 7. Occupational health and safety (Cont'd) | C. Fire protection measures 7.18 Flammable gas detector must be installed at high risk area where flammable gas could be leaked. The alarm must be set up at 2 levels (20% LEL and 40% LEL). The detector must be regularly inspected. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 7.19 Fire protection equipments such as fire hydrant, firewater distribution system, fire extinguisher, flammable gas detector, and fire alarm must be regularly maintained for ready to use all the time. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 7.20 Emergency and fire response plan must be set up. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | D. Noise measures 7.21 Noise level capacity during 8 hours working must be set up to limit noise level not exceed 85 dB(A). For the area that is unable to be controlled by the engineering technique, the personal protective equipments and warning signs must be provided. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | E. Mitigation measures for chemical substance leak 7.22 The employee must wear personal protective equipments to protect harm of hydrocarbon such as gloves, glasses, and mask during working in the potential risk area. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 7.23 Safety guideline for chemical substance handling and emergency response must be provided. | - Project area | - Over operation phase | - IRPC Public Company Limited |

Table S-28 (Cont'd-14)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|---|---|----------------|------------------------|-------------------------------|
| 7. Occupational health and safety (Cont'd) | 7.24 The drivers and operators must be trained about chemical and flammable substance handling procedures in IRPC Public Company Limited. before working. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 7.25 Set the project emergency plan to prevent the leak of hazardous chemical substance leakage. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | F. Emergency Response Plan | | | |
| | 7.26 Set the training and field training for fire, explosion, and hazardous chemical substance leak at least 4 times/year along with the people from IRPC Company Limited (emergency procedure plans are shown in Figure S-32 and Figure S-33) | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 7.27 Coordinate with external agencies to control the incidence in the emergency case | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 7.28 Determine chemical substance transportation company must have emergency response plan and training plan by being supervised by IRPC Public Company Limited | - Project area | - Over operation phase | - IRPC Public Company Limited |
| 8. Major Hazard | A. General measures | | | |
| | 8.1 Strictly examine conditions of machines and equipment to prevent any hazard that may occur. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 8.2 Provide work regulations/rules and manual of all equipment which are available in the plant | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 8.3 Provide the safety equipment as appropriate in the area that hazardous incident may occur. | - Project area | - Over operation phase | - IRPC Public Company Limited |

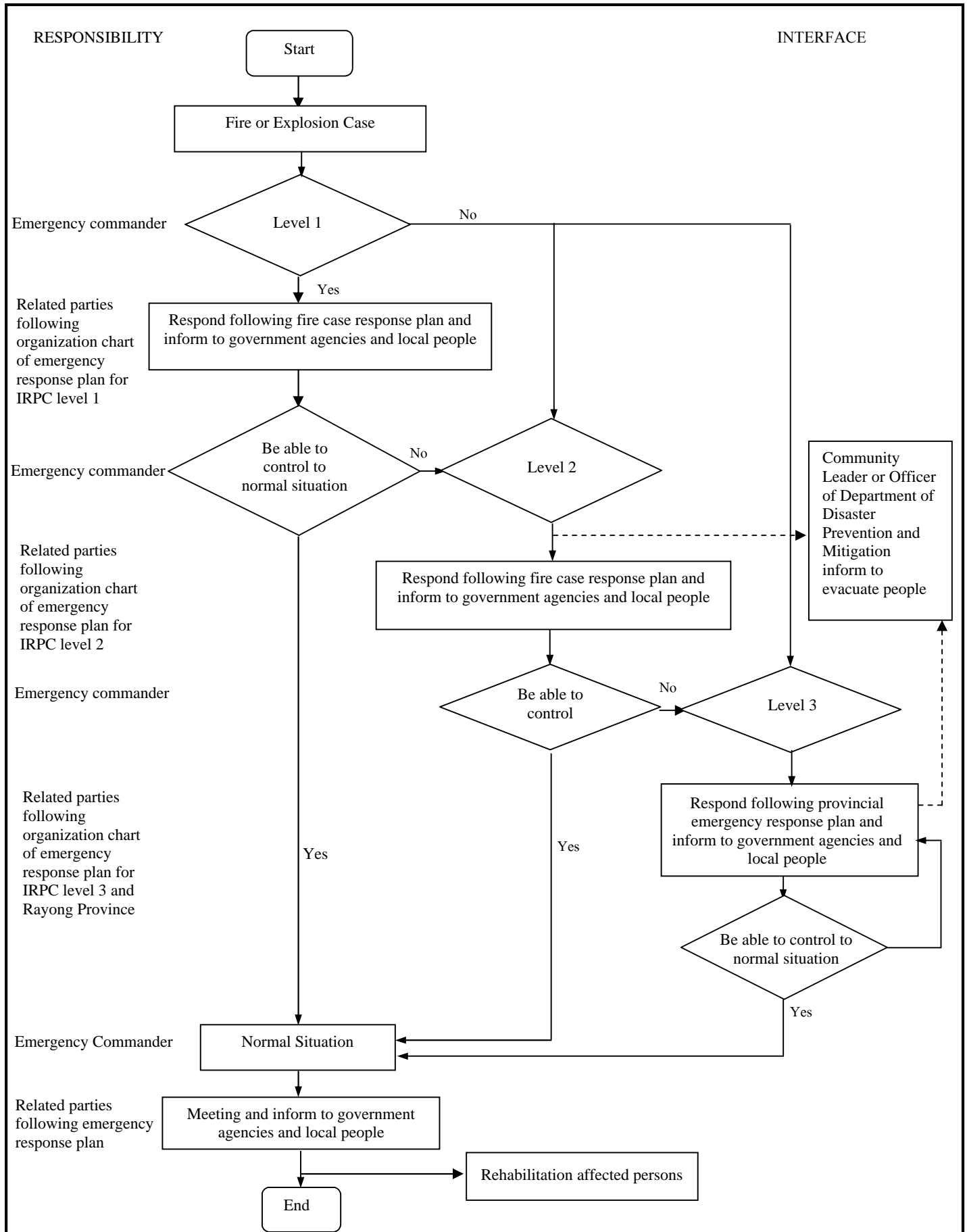


Figure S-32 Fire and Explosion Response Flowchart

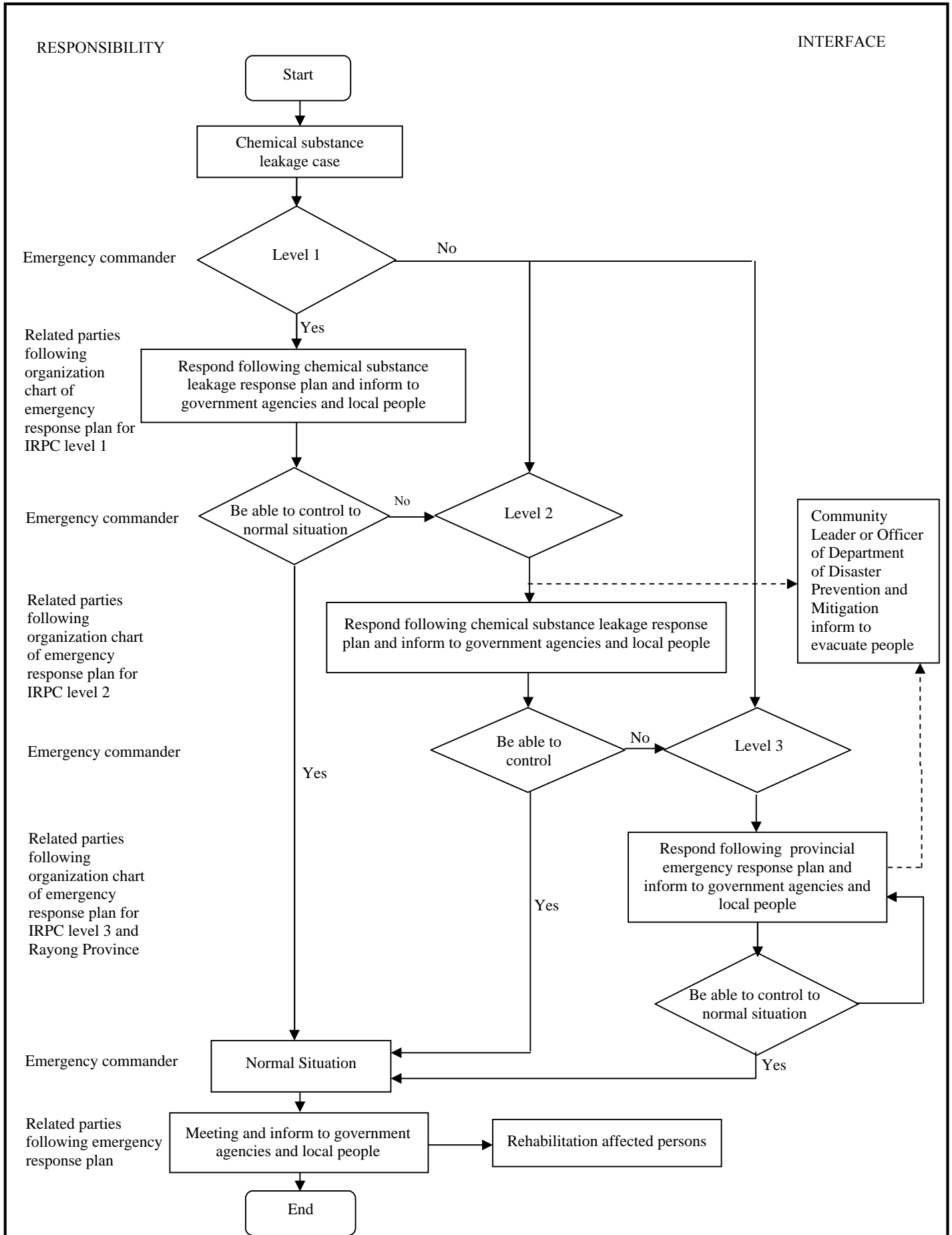


Figure S-33 **Chemical Leakage Response Flowchart**

Table S-28 (Cont'd-15)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|---|--|------------------------|--|-------------------------------|
| 8. Major Hazard (Cont'd) | 8.4 Provide preventive maintenance for any production process equipment and safety control system. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 8.5 Provide work permit for the use in the project and issued only person who participated the training. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 8.6 Conduct the risk assessment in the design and operation phases. | - Project area | - Detail design phase and project description change | - IRPC Public Company Limited |
| | B. Production process safety measures | | | |
| | 8.7 Design reactors and distribution system to support abnormal high pressure and regularly monitoring to prevent the corrosion. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 8.8 Provide Distributed Control System (DCS) to efficiently control the production process. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 8.9 Provide safety equipment available in production process and distribution system of raw material and product, for example, pressure release valve, safety valve and interlock system and regularly monitor these equipment to make it in good condition. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 8.10 Provide interlock system in raw material and chemical substance pipelines and other production process units and regularly monitor these equipment to make it in good condition. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| 8.11 Set up the automatic system to efficiently control the chemical substance distribution, chemical substance level and pressure. | - Project area | - Over operation phase | - IRPC Public Company Limited | |

Table S-28 (Cont'd-16)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|---------------------------------|--|----------------------------|------------------------|-------------------------------|
| 8. Major Hazard (Cont'd) | 8.12 Each equipment of the project must be installed by having safe equipment spacing, appropriately. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 8.13 Install fire wall and blast wall to mitigate major hazard impact as Figure S-34 . | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 8.14 Provide emergency shutdown system in case of emergency incident occurs in the production process. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 8.15 Provide pressure safety valve to release gas to BTX flare in emergency case to keep the system as safe as possible. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 8.16 Determine preventive maintenance plan for raw material pipeline. | - Raw material feeder line | - Over operation phase | - IRPC Public Company Limited |
| | 8.17 Set up the buffer pole between pipe rack and road area around the project area, especially the area where pipeline route is at low level possibly causing the vehicle accidents | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 8.18 Design and select special equipment e.g. spiral wound, tight shut off valve class 5 and double mechanical seal to prevent leakage better than normal. | - Project area | - Over operation phase | - IRPC Public Company Limited |

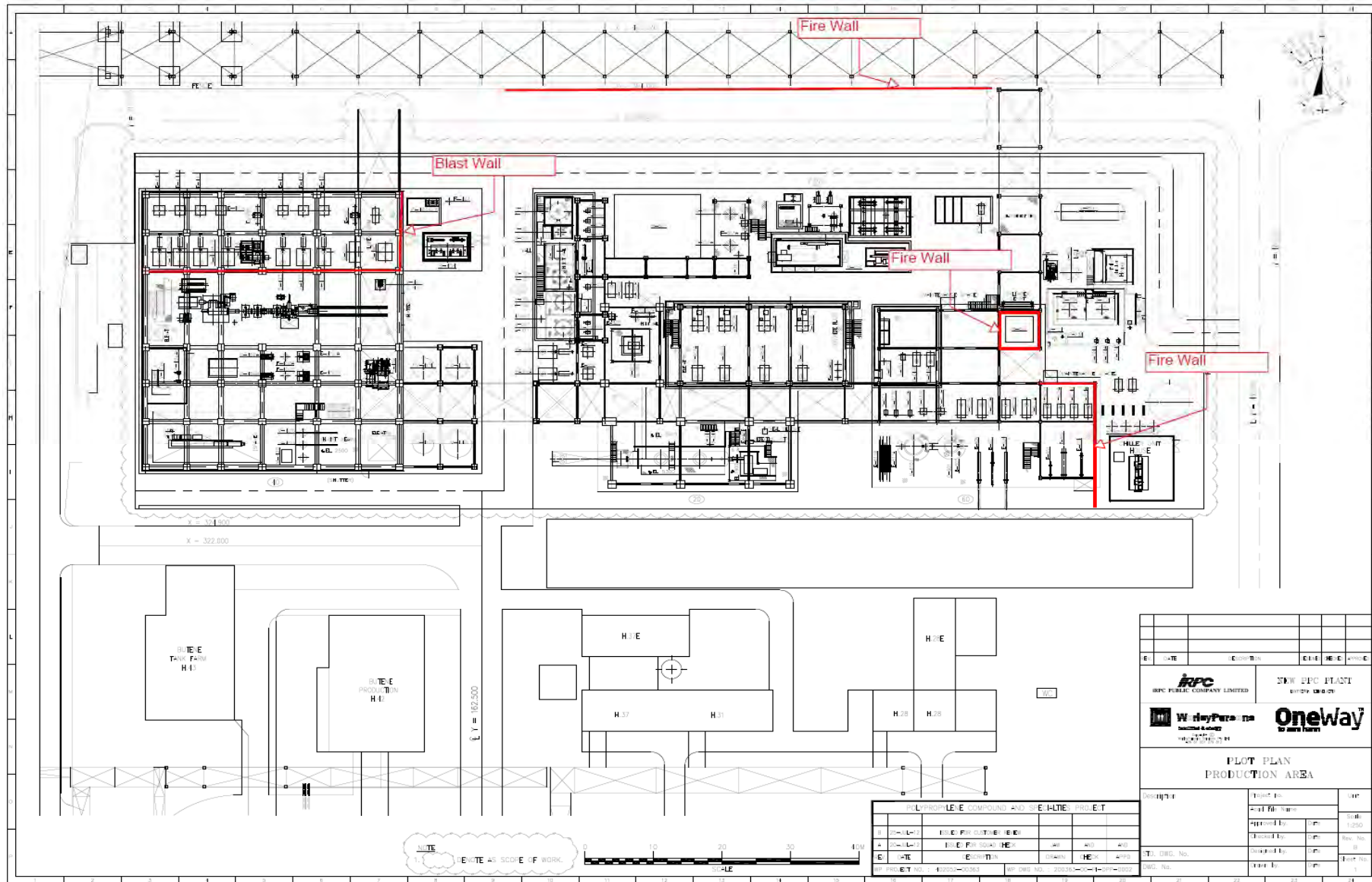


Figure S-34

Location for Fire Wall and Blast Wall Installation

Table S-28 (Cont'd-17)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|-------------------------------|--|--------------------|------------------------|-------------------------------|
| 9. Socio-economic | 9.1 Strictly implement following air and water pollution mitigation measures. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 9.2 Local skilled labor must be considered firstly to work with project as appropriate in order to directly promote socio-economic and create good relationship with community | - Nearby community | - Over operation phase | - IRPC Public Company Limited |
| | 9.3 Project should setup site visit activity and invite local people representatives to visit plant and operation of project. | - Nearby community | - Once a year | - IRPC Public Company Limited |
| | 9.4 Setup cooperative social responsibility and public relation activities for nearby communities of IRPC Industrial Park including Community Center, Health Enhancement Center, Consulting Center for Local Product Development. The public relation activities include community relation activity, educational activity, art and cultural activities, quality of life development activity, occupational development activity, environmental conservation activity. Staffs of project should take part in the activity (volunteer). | - Nearby community | - Over operation phase | - IRPC Public Company Limited |
| 10. Complaints respond | 10.1 Setup Emergency Control Center (ECC) to respond complaint all 24 hours. (ECC telephone number: 038-802-560 and 1800-800-008). Complaint respond schematic is shown in Figure S-35 . | - Community area | - Over operation phase | - IRPC Public Company Limited |
| | 10.2 Conduct complaint respond and inform to complainer following Regulation of IRPC Public Company Limited. | - Community area | - Over operation phase | - IRPC Public Company Limited |
| | 10.3 Complaint from project operation and solution must be recorded and submitted to Sutive every year. | - Project area | - Over operation phase | - IRPC Public Company Limited |

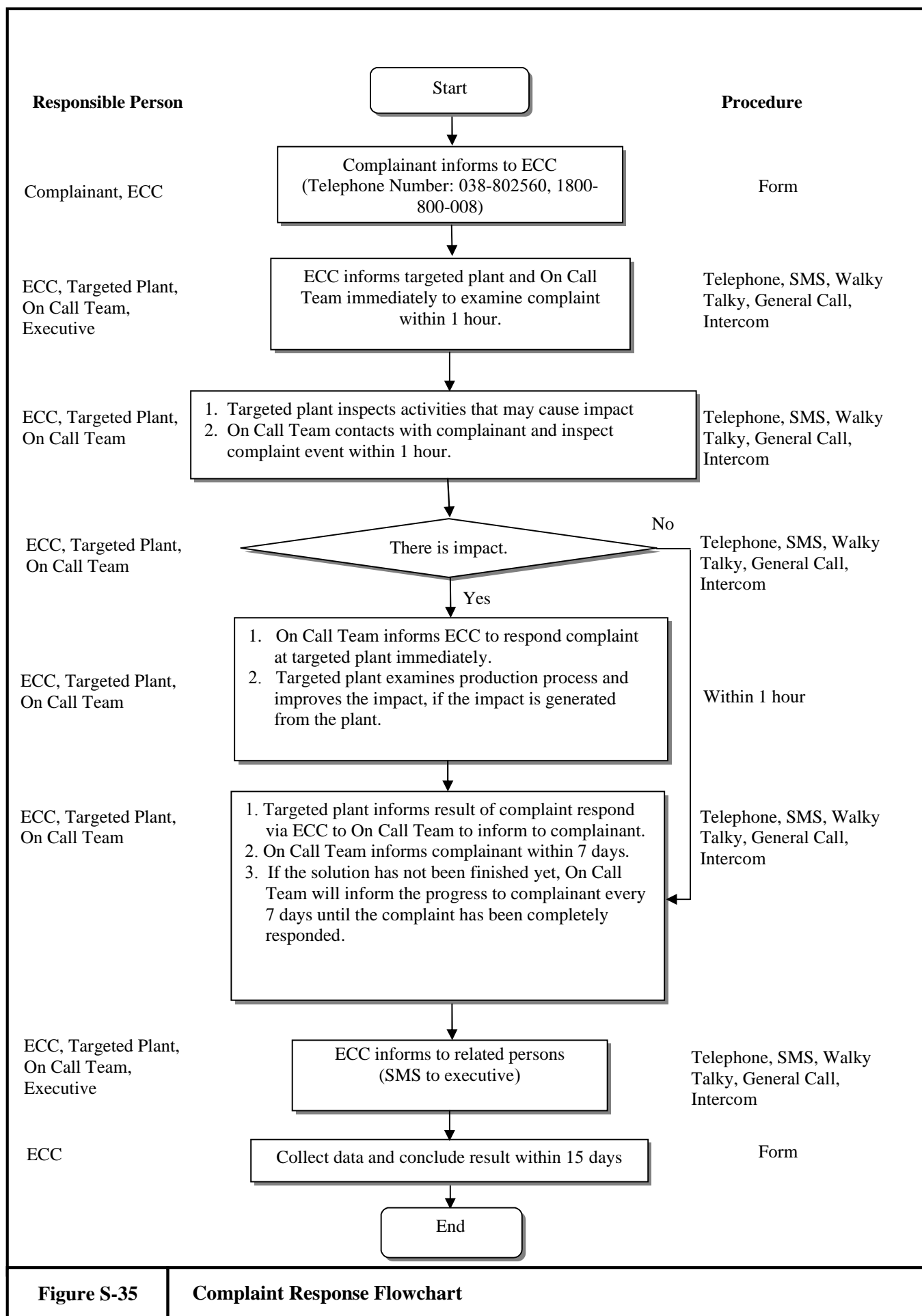


Figure S-35

Complaint Response Flowchart

Table S-28 (Cont'd-18)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|--|---|------------------------|-------------------------------|-------------------------------|
| 11. Health | A. Pollutant Control of Point Source | | | |
| | 11.1 Control the leakage of VOCs to be lower than 30% of the specified value in phase 2 following Notifications of Ministry of Industry entitled: Criteria and Inspection Procedure and Leakage Control for VOCs from Equipment in Industrial Plant (B.E.2555). | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 11.2 Strictly implement air quality mitigation measures to prevent health impact to surrounding communities. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | B. Contact reduction | | | |
| | 11.3 Personal protective equipment e.g. ear plugs, eye glasses, safety shoe, helmet, mask, safety glove etc. must be provided for employees. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | 11.4 Employee must be trained about chemical substance hazard, toxicity and first aid. | - Project area | - Over operation phase | - IRPC Public Company Limited |
| | C. Surveillance | | | |
| | 11.5 Environmental monitoring result must be informed to local people via media such as community radio, broadcast tower, local administration office, public health office | - Nearby community | - Over operation phase | - IRPC Public Company Limited |
| 11.6 Public relation about health checkup service must be conducted to local people. The health checkup service will be conducted at least once a month. | - Nearby community | - Over operation phase | - IRPC Public Company Limited | |
| 11.7 Conduct attitude survey of surrounding community of IRPC Industrial Park annually to get opinion regarding project operation | - Nearby community | - Over operation phase | - IRPC Public Company Limited | |

Table S-28 (Cont'd-19)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|----------------------------|--|--|------------------------|-------------------------------|
| 11. Health (Cont'd) | 11.8 Organize emergency response drill to be ready for any accidents that may occur and cause an impact to community especially nearby community area. Emergency response drill level 1 is organized 4 times/year. Emergency response drill level 2 and 3 are organized according to company plan and province plan, respectively. | - Project area/nearby community (nearby community only emergency plan level 3) | - Over operation phase | - IRPC Public Company Limited |
| | D. Health enhancement 11.9 The project must provide project information to disseminate to community representatives, environmental and health volunteers. The project information include production process, chemical substance hazard, environmental and health impacts, impact surveillance etc. | - nearby community | - Over operation phase | - IRPC Public Company Limited |
| | 11.10 The project should invite community leader, local people representatives and related agencies to visit plant and operation including production process, environmental protection and safety measure of the plant etc. | - nearby community | - Once a year | - IRPC Public Company Limited |
| | 11.11 The project must support activities of local public health agencies. | - Public health agency in community area | - Over operation phase | - IRPC Public Company Limited |
| | 11.12 The project must support activities of local public health agencies such as inviting public health service officer to give information about health to community, taking care of elder and people with disabilities. | - nearby community | - Over operation phase | - IRPC Public Company Limited |
| | 11.13 The project must support environmental and health information of project to public health officers to make understanding about pollution of project to plan proper health monitoring measures for local people. | - nearby community | - Over operation phase | - IRPC Public Company Limited |

Table S-28 (Cont'd-20)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|----------------------------|---|--------------------|------------------------|-------------------------------|
| 11. Health (Cont'd) | 11.14 The project must support environmental and health activities to monitor environmental impact and make good environmental and health conditions to local people. | - nearby community | - Over operation phase | - IRPC Public Company Limited |
| | E. Rehabilitation 11.15 After emergency case of project, CSR staffs must coordinate to give primary assist. | - nearby community | - Over operation phase | - IRPC Public Company Limited |
| | 11.16 If injury or illness is proved that occur from the project operation, project must respond appropriately. | - nearby community | - Over operation phase | - IRPC Public Company Limited |
| 12. Green area | 12.1 Green area must be arranged about at least 5% of total plant area and regularly maintained (Green area layout is shown in Figure S-36) | - Project area | - Over operation phase | - IRPC Public Company Limited |

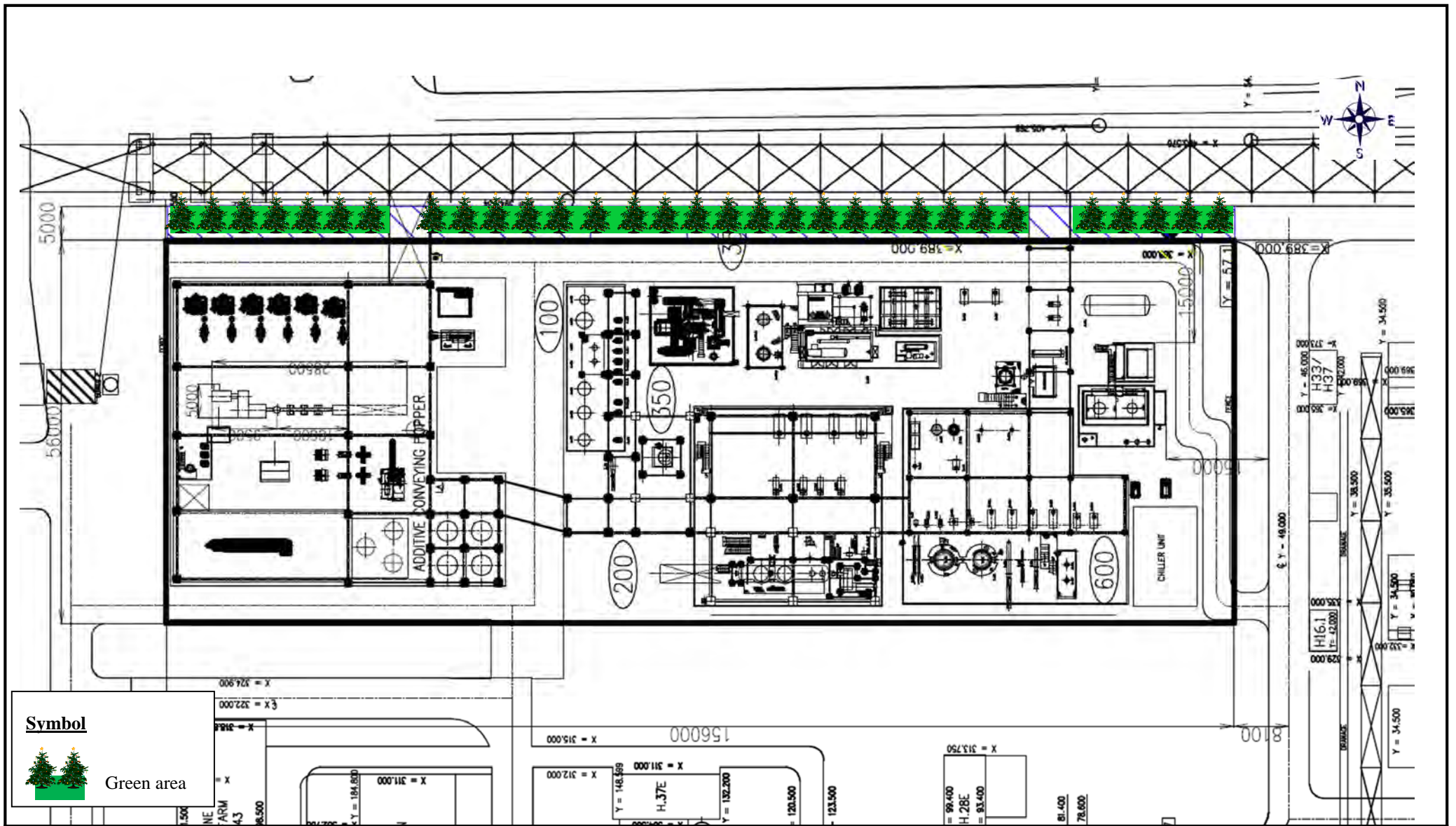


Figure S-36

Green Area of the Project

**Table S-29 Environmental Monitoring Measures for Polypropylene Compound Plant Project (Operation Phase during Annual Shutdown/Turnaround)
IRPC Public Company Limited in Choengnoen Sub-District, Muang Rayong District, Rayong Province**

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|--|---|-------------------------------------|---|--|
| 1. General Measures | 1.1 Project must inform Rayong Industrial Office before conducting the annual shutdown/turnaround and pre-startup after finishing the annual shutdown/turnaround. | - Project area | - Before and after annual shutdown/turnaround phase | - IRPC Public Company Limited |
| | 1.2 Inform community and other local organizations through media such as poster advertisement, advertisement board before conducting the annual shutdown/turnaround and pre-startup after finishing the annual shutdown/turnaround. | - Project area and nearby community | - Before and after annual shutdown/turnaround phase | - IRPC Public Company Limited |
| | 1.3 Provide public relation staffs to talk with people in community, community leader, local organization as well as receive complaint during conducting the annual shutdown/turnaround. | - nearby community | - Annual shutdown/turnaround phase | - IRPC Public Company Limited and Contractor |
| 2. Occupational Health and Safety | 2.1 Contractor must strictly implement following IRPC's Regulations including work permit regulation, contractor regulation manual. | - Project area | - Annual shutdown/turnaround phase | - IRPC Public Company Limited |
| | 2.2 All contractors must pass the training and safety test from company before commencement. | - Project area | - Annual shutdown/turnaround phase | - IRPC Public Company Limited |
| | 2.3 All contractors must pass the alcohol and drug testing from company before commencement. | - Project area | - Annual shutdown/turnaround phase | - IRPC Public Company Limited |
| | 2.4 All workers who work on high area must pass blood pressure check from company before commencement. | - Project area | - Annual shutdown/turnaround phase | - IRPC Public Company Limited |
| | 2.5 Do not bring cigarette, lighter, and communication devices which create heat and spark e.g. mobile phone, radio into the control area. | - Project area | - Annual shutdown/turnaround phase | - IRPC Public Company Limited |
| | 2.6 Internal combustion automotive tool/engine must be installed spark arrestor before enter production process site and control area. | - Project area | - Annual shutdown/turnaround phase | - IRPC Public Company Limited |

Table S-29 (Cont'd-1)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|---|---|----------------|--|-------------------------------|
| 2. Occupational Health and Safety (Cont'd) | 2.7 Fire protection and safety equipment must be examined and tested such as fire hydrant, firewater distribution system, fire extinguisher, flammable gas detector and fire alarm before the annual shutdown/turnaround phase. | - Project area | - Before annual shutdown/ turnaround phase | - IRPC Public Company Limited |
| | 2.8 Contractor must prepare hazard identification and risk assessment report before annual shutdown/turnaround phase by what if analysis method or other methods which are appropriate for each work. | - Project area | - Annual shutdown/ turnaround phase | - IRPC Public Company Limited |
| | 2.9 When emergency occur, siren loud will be warned 7 times continually, the workers must follow these following procedures. 1) Stop working immediately when hearing siren sound. 2) Turn switch off of equipment and engine. 3) Worker worked in confined space must leave from that area immediately. 4) Worker worked in the high area must move slowly to low area. 5) When gas leak is occur, worker must leave that area immediately. 6) Worker riding vehicles, must stop or pull over immediately. 7) Contractor must assemble at assigned assembly point or assigned area. 8) Worker who responsible for electricity must turn off electricity. 9) Must not gather around firefighting of firefighters. 10) Foreman must check that all workers exist fully. 11) When the situation return to normal, long siren will be given at once. 12) All workers must be ready for fire prevention, when fire is seen, worker must call number 77 immediately. | - Project area | - Annual shutdown/ turnaround phase | - IRPC Public Company Limited |

Table S-29 (Cont'd-2)

| Environmental Resource | Environmental Mitigation Measure | Location | Phase | Responsible Agencies |
|---|---|----------------|------------------------------------|-------------------------------|
| 2. Occupational Health and Safety (Cont'd) | 2.10 IRPC Public Company Limited has ambulance ready 24 hr which can be reached at number 1111 or 61. | - Project area | - Annual shutdown/turnaround phase | - IRPC Public Company Limited |
| | 2.11 Emergency response drill during annual shutdown/turnaround phase will be conducted following IRPC emergency response. | - Project area | - Annual shutdown/turnaround phase | - IRPC Public Company Limited |
| | 2.12 All vehicles of contractors which enter the construction area must be examined condition and installed spark arrestor. | - Project area | - Annual shutdown/turnaround phase | - IRPC Public Company Limited |
| | 2.13 Unauthorized person is prohibited to enter in project area during annual shutdown/turnaround phase. | - Project area | - Annual shutdown/turnaround phase | - IRPC Public Company Limited |
| | 2.14 Coordinate with Emergency Control Center (ECC) following emergency control manual of IRPC Public Company Limited e.g. fire, explosion and chemical substance leakage during shutdown/turnaround phase. | - Project area | - Annual shutdown/turnaround phase | - IRPC Public Company Limited |
| | 2.15 Project must provide procedure for cleaning all production process equipment. | - Project area | - Annual shutdown/turnaround phase | - IRPC Public Company Limited |

**Table S-30 Environmental Monitoring Measures for Polypropylene Compound Plant Project (Construction Phase)
IRPC Public Company Limited in Choengnoen Sub-District, Muang Rarong District, Rayong Province**

| Environmental Quality | Parameter | Method | Sampling Station | Phase/Frequency | Responsible Agencies |
|--|--|---|--|---|---|
| 1. Air Quality in Atmosphere | <ul style="list-style-type: none"> - TSP 24 hours - PM10 - Wind speed and direction | <ul style="list-style-type: none"> - US.EPA 802 Gravimetric Method - US.EPA 076 CFR Gravimetric Method - Cup Anemometer and Anodized Aluminum vane | <ul style="list-style-type: none"> - 10th years building of IRPC Public Company Limited - Wat Pluak Ket School (Figure S-37) | <ul style="list-style-type: none"> - Monitor once a day, 7 days continually during ground clearing | <ul style="list-style-type: none"> - IRPC Public Company Limited |
| 2. Noise Level | <ul style="list-style-type: none"> - Leq 24 hr - L90 - Lmax | <ul style="list-style-type: none"> - IEC 60804 or IEC 61672 | <ul style="list-style-type: none"> - Wat Pluak Ket School - Rayong Polytechnical School (Figure S-37) | <ul style="list-style-type: none"> - Monitor 7 days continually in every 3 months | <ul style="list-style-type: none"> - IRPC Public Company Limited |
| 3. Occupational Health and Safety | <p>Provide construction accident report and submit to Office of Labor Protection and Welfare of Rayong Province as following details;</p> <ul style="list-style-type: none"> - Cause of accident or unusual event. - Number of injured person. - Severity of accident/damage. - Solution and suggestion. | - | <ul style="list-style-type: none"> - Construction area | <ul style="list-style-type: none"> - Record accidental event over construction phase | <ul style="list-style-type: none"> - IRPC Public Company Limited |
| 4. Complaint | <p>Record complaint, cause, solution and monitoring result</p> <ul style="list-style-type: none"> - Provide annual summary report and submit to Sutive. Details of annual summary report include number of complaint, mitigation measure and solution. | - | <ul style="list-style-type: none"> - Construction area and nearby community | <ul style="list-style-type: none"> - Over construction phase | <ul style="list-style-type: none"> - IRPC Public Company Limited |



Figure S-37

Environmental Quality Monitoring Stations during Construction Phase

**Table S-31 Environmental Monitoring Measures for Polypropylene Compound Plant Project during (Operation Phase)
IRPC Public Company Limited in Choengnoen Sub-District, Muang Rayong District, Rayong Province**

| Environmental Quality | Parameter | Method | Sampling Station | Phase/frequency | Responsible Agencies |
|-------------------------|--|---|---|---|---|
| 1. Air Quality | <ul style="list-style-type: none"> - Total volatile organic compounds (VOCs) - Propylene - n-Hexane | <ul style="list-style-type: none"> - US.EPA Compendium Method TO-14A or TO-15 | <ul style="list-style-type: none"> - Rayong Polytechnical School - Wat Pluak Ket School - HDPE Plant <p>(Figure S-38)</p> | <ul style="list-style-type: none"> - Every 3 months, 7 days continually during January-March, April-June, July-September, October-December | <ul style="list-style-type: none"> - IRPC Public Company Limited |
| 2. Water Quality | <ul style="list-style-type: none"> - TDS - SS - BOD - COD - pH - Propylene - Hexane | <ul style="list-style-type: none"> - Dried at 103-105 °C - Dried at 103-105 °C - Azide Modification Method - Potassium Dichromate Digestion - Electrometric Method - Purge and Trap Capillary-Column Gas Chromatographic/Mass Spectrometric Method - Purge and Trap Capillary-Column Gas Chromatographic/Mass Spectrometric Method | <ul style="list-style-type: none"> - Three wastewater sumps (A1, A2 and A3 Sump) before enter the central wastewater treatment system unit 1 of IRPC Industrial Park (Figure S-39). | <ul style="list-style-type: none"> - Every month | <ul style="list-style-type: none"> - IRPC Public Company Limited |
| 3. Noise Level | <ul style="list-style-type: none"> - Leq 24 hr - L90 - Lmax | <ul style="list-style-type: none"> - IEC 60804 or IEC 61672 | <ul style="list-style-type: none"> - Rayong Polytechnical School - Wat Pluak Ket School <p>(Figure S-40)</p> | <ul style="list-style-type: none"> - Twice a year, 7 days continually during March- April and November-December | <ul style="list-style-type: none"> - IRPC Public Company Limited |



Figure S-38

Air Quality Sampling Stations

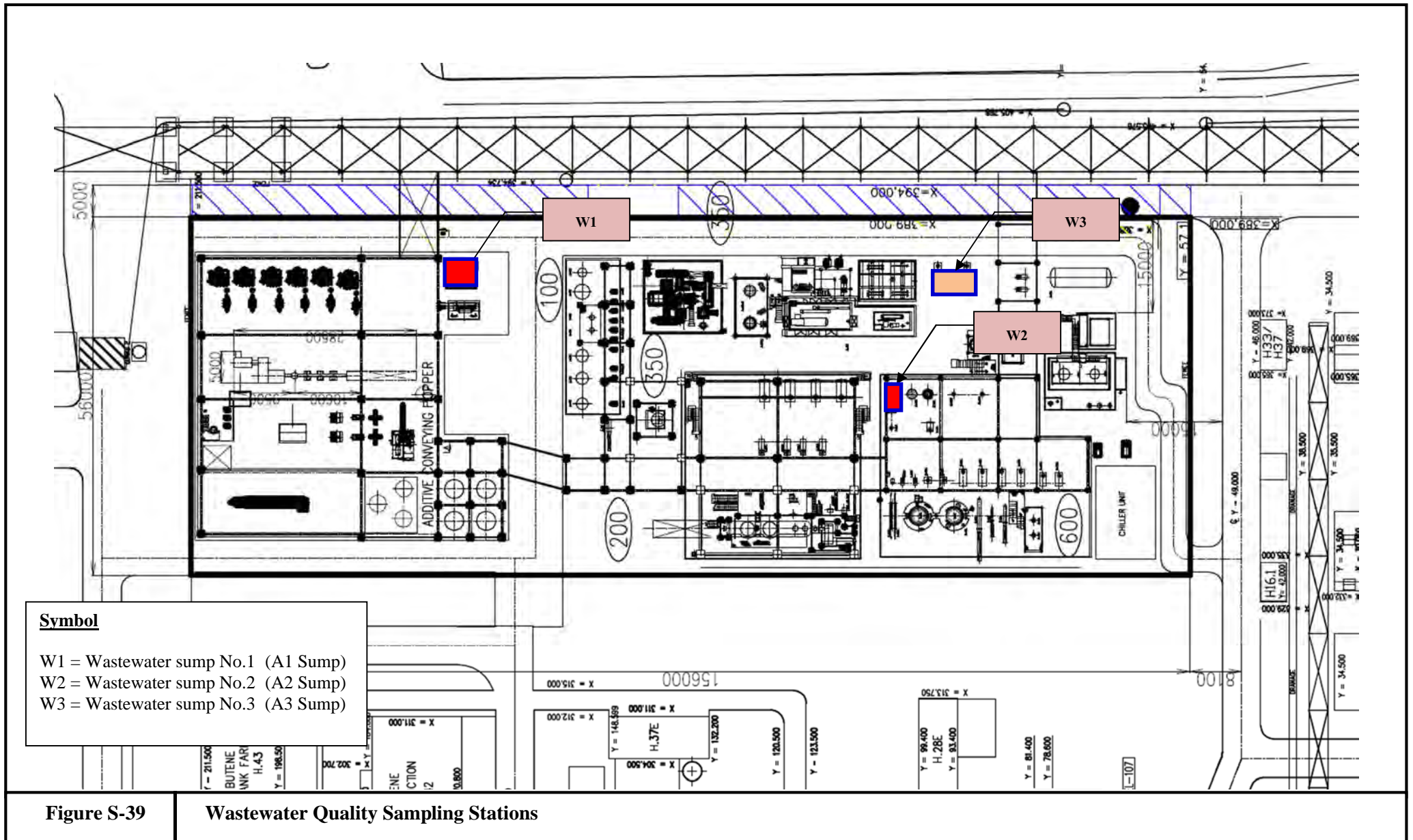


Figure S-39

Wastewater Quality Sampling Stations



Figure Exec-40

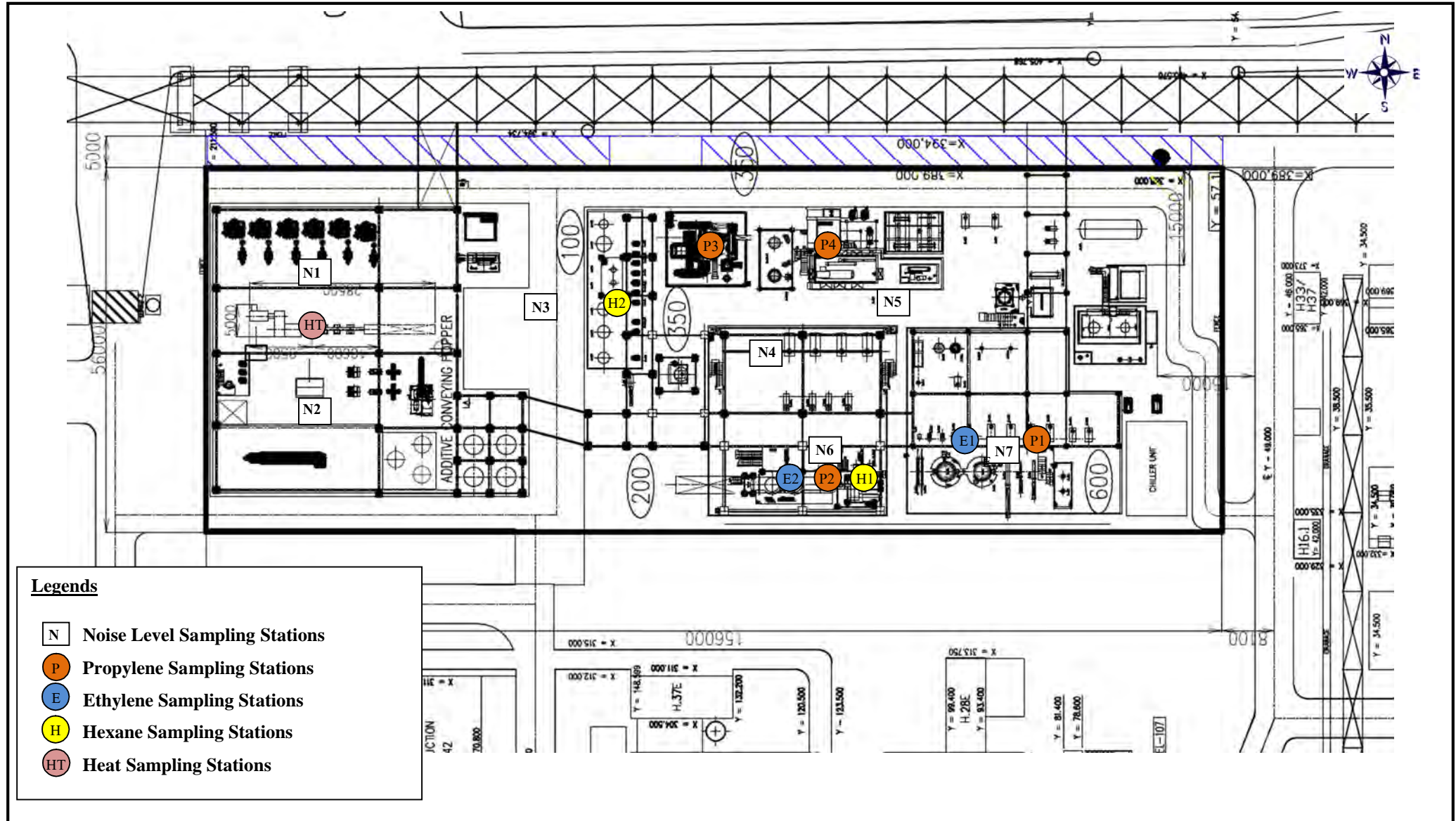
Noise Level Monitoring Stations

Table S-31 (Cont'd-1)

| Environmental Quality | Parameter | Method | Sampling Station | Phase/Frequency | Responsible Agencies |
|--|--|--|--|--|---|
| <p>4. Solid waste and hazardous</p> | <p>Project will manage solid waste and hazardous produced from project operation including</p> <ul style="list-style-type: none"> - Scrap approximately 2 tons/month will be collected and packed in 650 kg/bag for further distribution. - Deteriorate adsorbent approximately 12-20 tons/2 years will be collected and delivered to private waste disposal company obtained license (Ro.Ngo.101) from the government agency or Department of Industry. - Waste mineral oil approximately 3.5 m³/year will be collected in used TEAL bulk container before sending back to chemical substance supplier. - Solid waste approximately 4.44 kg/day will be collected and delivered to private company obtained license from the local government agency - Recycle waste approximately 23.68 kg/day will be collected and deliver to private waste disposal company obtained license from the local government agency | <ul style="list-style-type: none"> - Record of type, property, quantity, collection, distribution and displacement. | <ul style="list-style-type: none"> - Project area | <ul style="list-style-type: none"> - Record monthly and annual summary report | <ul style="list-style-type: none"> - IRPC Public Company Limited |

Table S-31 (Cont'd-2)

| Environmental Quality | Parameter | Method | Sampling Station | Phase/Frequency | Responsible Agencies |
|--|---|--|--|---|-------------------------------|
| 4. Solid Waste and Hazardous (Cont'd) | - Hazardous waste approximately 1.48 kg/day will be collected and delivered to private waste disposal company obtained license (Ro.Ngo.101) from the government agency or Department of Industry. | | | | |
| 5. Working Environment | 5.1 Noise Level at Working Area - Leq 8 hr | - IEC 615 or equal or better | - Project area (Figure S-41) including <ul style="list-style-type: none"> • Catalyst preparation and feeding unit • Purification unit • Polymerization unit • Powder deactivation unit • Bleed liquid purification unit • Product finishing unit • Pellet dryer unit | - Every 3 months | - IRPC Public Company Limited |
| | 5.2 Noise Level Noise level is measured within the project area to create noise conduct map | - Noise level measurement by method of IEC615 or equal | - Production process area | - Once a year, within one year after starting the operation and review every 3 year | - IRPC Public Company Limited |
| | 5.3 Air Quality in Working Area - Ethylene | - NIOSH (GC/FID) or other methods as regulated | - Purification unit /polymerization unit | - Every 3 months | - IRPC Public Company Limited |



Legends

- N Noise Level Sampling Stations
- P Propylene Sampling Stations
- E Ethylene Sampling Stations
- H Hexane Sampling Stations
- HT Heat Sampling Stations

Figure S-41

Working Environment Sampling Stations

Table S-31 (Cont'd-3)

| Environmental Quality | Parameter | Method | Sampling Station | Phase/frequency | Responsible Agencies |
|--|---|--|--|---|-------------------------------|
| 5. Working Environment (Cont'd) | - Propylene | - NIOSH (GC/FID) or other methods as regulated | - Purification unit/polymerization unit | | |
| | - n-Hexane | - NIOSH 1500 or other methods as regulated | - Powder deactivation/Bleed liquid purification unit | | |
| | - Respirable Dust | - NIOSH 0600 or other methods as regulated | - Catalyst preparation and feeding unit/Polymerization unit/ Powder deactivation unit/Bleed liquid purification unit | | |
| | 5.4 Heat | - NIOSH 0600 or other methods as regulated | - Packaging unit (Figure S-41) | | |
| | | - Wet Bulb Globe Thermometer (WBGT) | - Product finishing unit (Figure S-41) | - Every 3 months | - IRPC Public Company Limited |
| 6. Health Checkup | - Physical examination (PE) - Chest X-Ray (CXR) - Complete blood count (CBC) - Kidney function test (BUN) & Creatinine - Liver function test (SGOT/SGPT) - Pulmonary function test (PFT) - Hearing test and Audiogram - Hexane derivative in urine | - | - Project employee | - New employee after recruitment - Once a year for all employee over operation phase | - IRPC Public Company Limited |
| 7. Accident Record | - Record accident statistic, severity and solution | - | - Project employee | - Report every time and make annual report | - IRPC Public Company Limited |

Table S-31 (Cont'd-4)

| Environmental Quality | Parameter | Method | Sampling Station | Phase/frequency | Responsible Agencies |
|------------------------------|---|-----------------|---|---|-------------------------------|
| 8. Major Hazard | <ul style="list-style-type: none"> - Inspect leakage of propylene, ethylene, hydrogen and hexane pipeline - Record pressure and temperature of pipeline that display in control room - Record inspection results of alarm system, ground wire and gas detector - Record inspection results of valve connection and safety valve | - | - Project area | <ul style="list-style-type: none"> - Daily monitor - Daily monitor - Every 3 months monitor - Daily monitor | - IRPC Public Company Limited |
| 9. Public Health | - Cooperate and support health promoting activity for nearby communities. | - | - Project area and nearby community | - Over operation phase | - IRPC Public Company Limited |
| 10. Complaint Respond | <ul style="list-style-type: none"> - Record complaint, cause, solution and monitoring result. - Collect number of complaint, cause and solution and make annual summary report to submit to Sutive. | - | - Project area and nearby community | - Over operation phase | - IRPC Public Company Limited |
| 11. Socio-Economic | - Conduct attitude survey around project site e.g. community leader, local people and related government officer to collect opinion toward IRPC's operation. | - Questionnaire | - Nearby community in 5 km around project site ((Figure S-42)) | - Once a year | - IRPC Public Company Limited |

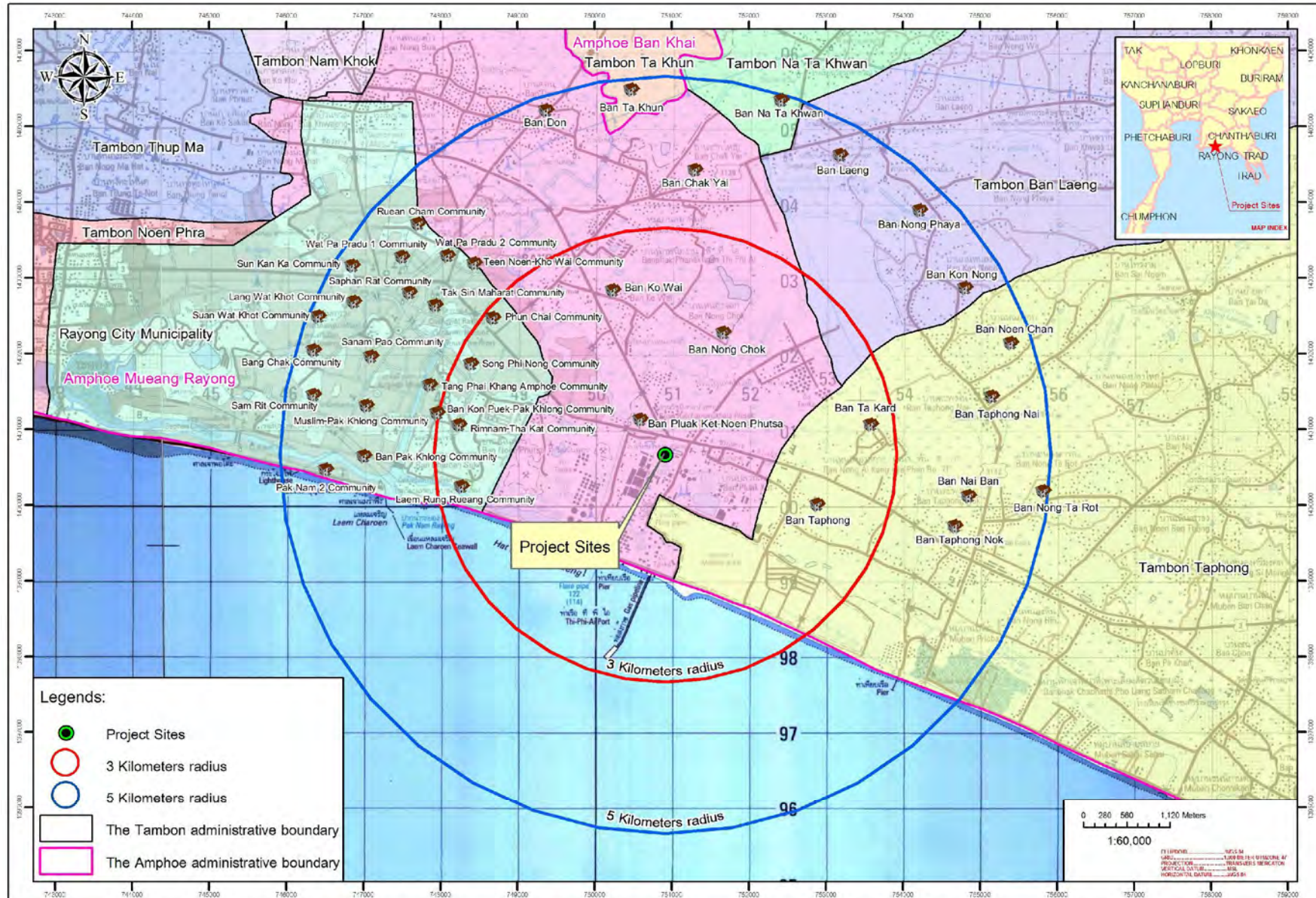


Figure S-42 Study Area of Community Leaders and Related Government Officers Attitude Survey around IRPC Industrial Park