

# EXECUTIVE SUMMARY

## PROPOSED CONSTRUCTION AND OPERATION OF PYROLYSIS PLASTIC PLANT FOR NIBONG TEBAL TECHNOLOGY SDN BHD, AT LOT 610, JALAN BANDAR BARU, SUNGAI KECHIL, 14300 NIBONG TEBAL, PULAU PINANG

### INTRODUCTION

- Pyrolysis plastic plant is an innovative process for the treatment of plastic waste that involves heating the plastic material in the absence of oxygen to produce valuable products such as pyrolysis oil, charcoal, and synthetic gas.
- The proposed plant will process up to 12,000 kg per day of the plastic waste

### PROJECT PROPONENT



**NIBONG TEBAL  
TECHNOLOGY  
SDN. BHD.**

### ENVIRONMENTAL CONSULTANT



**WIRANDA (M)  
SDN. BHD.**

### STATEMENT OF NEED

- The growing concerns over plastic pollution and the increasing volume of plastic waste, plastic pyrolysis has emerged as a potential solution to address this problem
- Helps to reduce the volume of plastic waste while recovering valuable materials and energy from it
- Offers a promising solution for addressing the growing problem of plastic waste and mitigating its negative impact on the environment
- The project is in line with development policy such as Circular Economy Policy Framework for Manufacturing Sector in Malaysia and Malaysia Plastic Sustainability Roadmap.
- Pyrolysis requirement in NTPM operation:
  - Revenue generation from high-value by-products
  - Significant cost saving on waste disposal
  - Strengthened market position through sustainability
  - Local economic development and job creation

### LEGISLATIVE REQUIREMENT

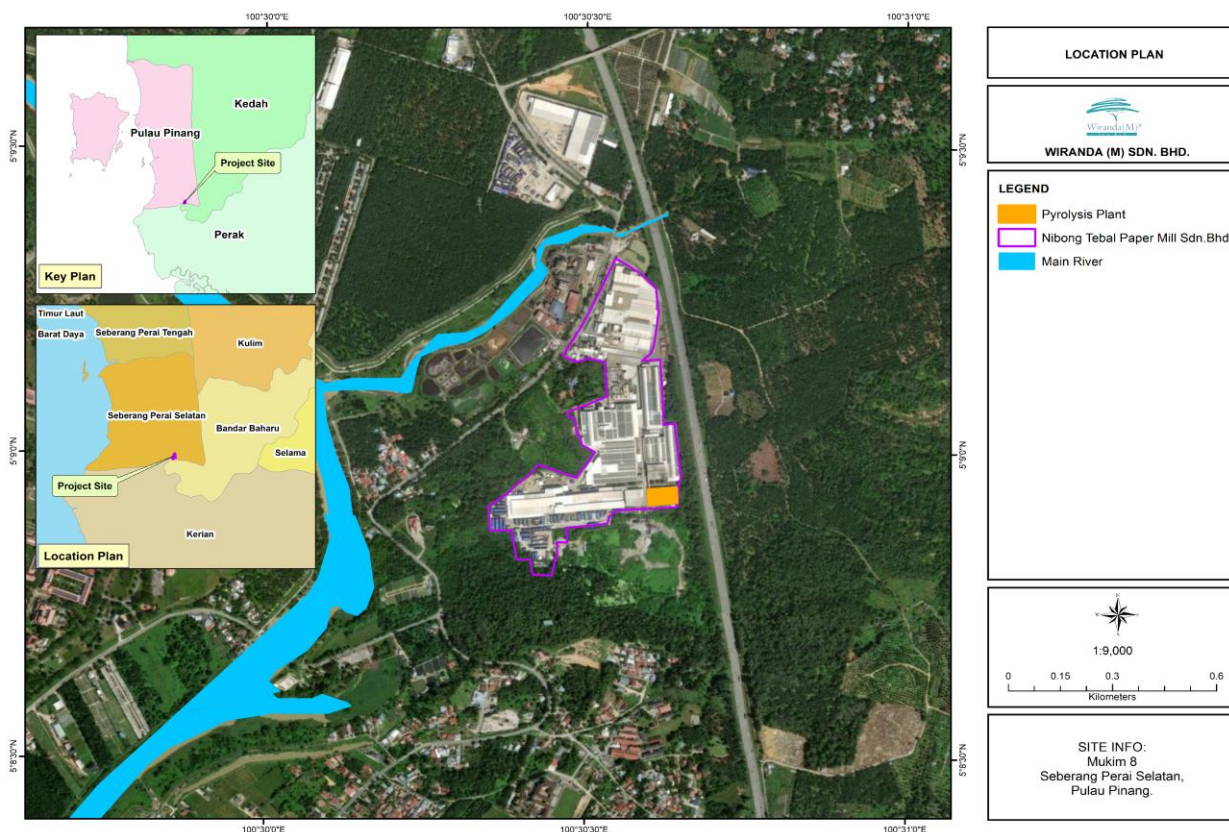
#### First Schedule

#### 14. WASTE TREATMENT AND DISPOSAL:

- (b) Solid waste
- (ii) Construction of recovery plant or recycling plant

### PROJECT LOCATION

- Lot 610, Nibong Tebal Paper Mill Sdn Bhd, Jalan Bandar Baru, Sungai Kecil, 14300 Nibong Tebal, Penang
- Nearest town is Nibong Tebal town



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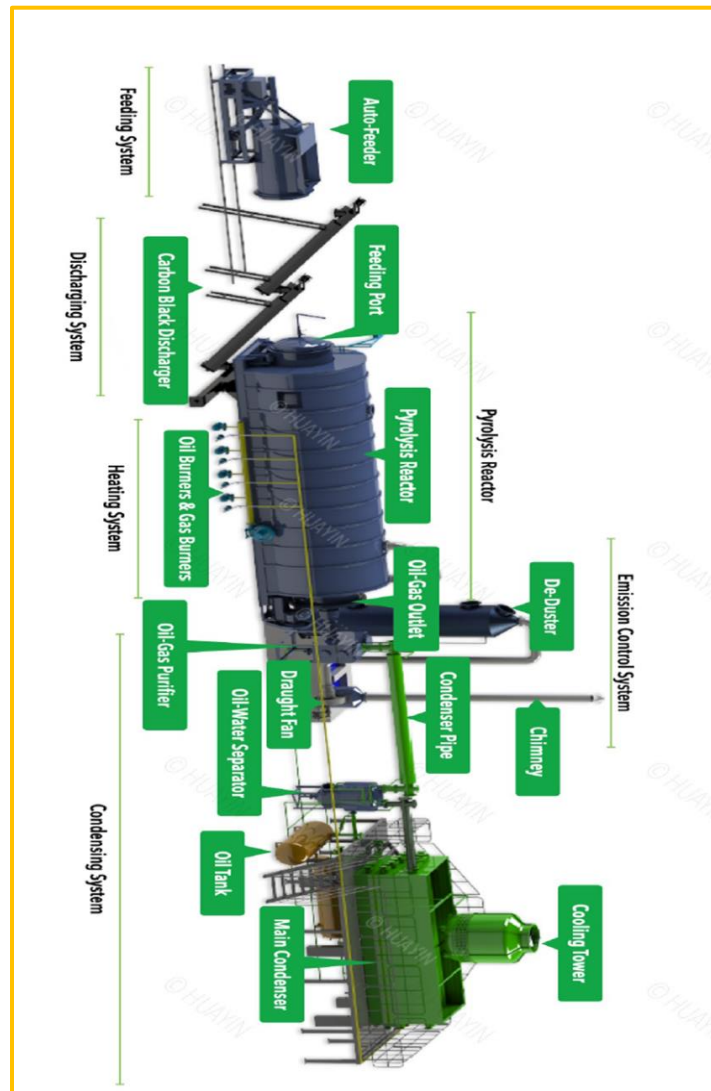
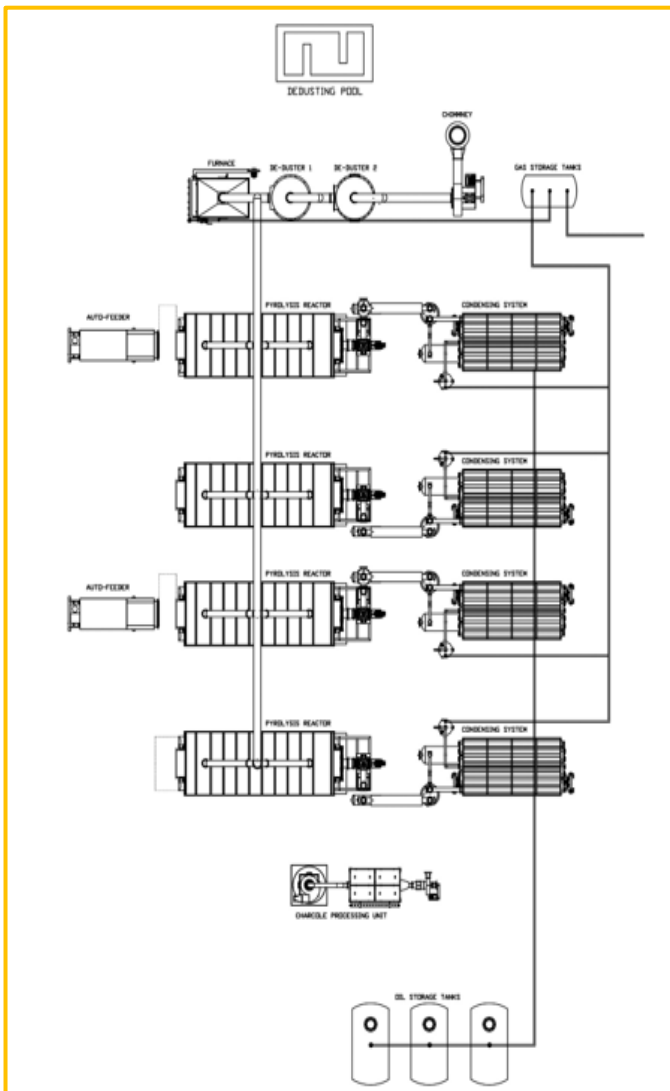
### PROJECT CONCEPT

- Plastic waste for the pyrolysis process will coming from the daily NTPM processing activities.
- The types of plastic waste will be coming from High-Density Polyethylene (HDPE), Low-Density Polyethylene (LDPE) and Polypropylene (PP)
- Maximum of 48,000 kg of plastic waste will be utilized for one time through 4 unit of pyrolysis reactor which will produce syngas, pyrolysis oil and black carbon.

### PROJECT COMPONENT

NO.	COMPONENT	NO. OF UNIT
1.	Pyrolysis Reactor	4
2.	Condensing System	4
3.	Auto Feeder	2
4.	De-duster	2
5.	Furnace	1
6.	De-dusting pool	1
7.	Chimney	1
8.	Gas storage tank	1
9.	Oil storage tank	4
10.	Charcoal processing unit	1




### PROJECT LAYOUT



# EXECUTIVE SUMMARY

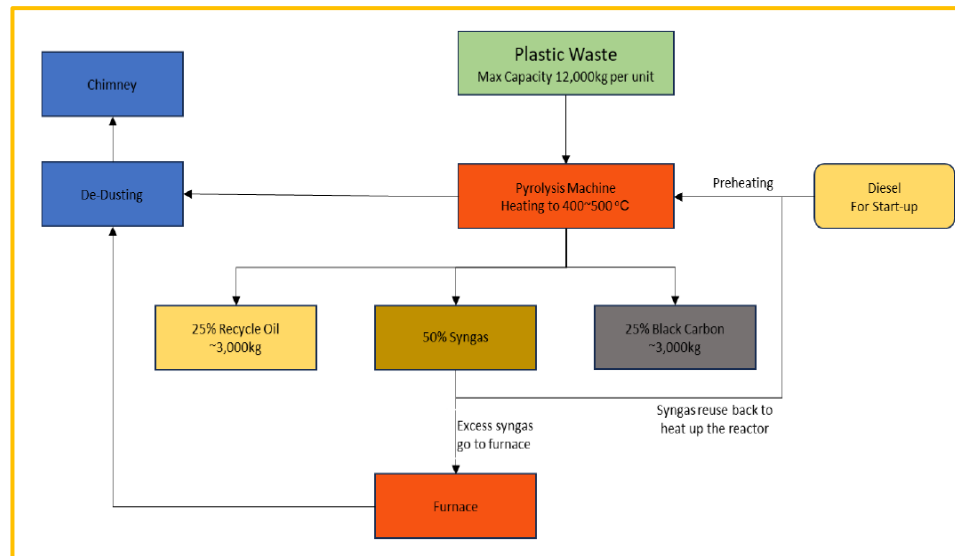
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### RAW MATERIALS

SYMBOL	NAME	PROPERTIES
	High Density Polyethylene (HDPE) is a thermoplastic made from ethylene.	<ul style="list-style-type: none"> <li>• Excellent barrier to water and most solvents.</li> <li>• Higher tensile strength compared to other forms of polyethylene.</li> </ul>
	Low-Density Polyethylene (LDPE) is a thermoplastic polymer made from ethylene.	<ul style="list-style-type: none"> <li>• Toughness, flexibility and transparency.</li> <li>• Excellent resistance to acids, bases and vegetable oils.</li> </ul>
	Polypropylene (PP) is made from propylene monomers and is one of the most commonly produced plastics globally.	<ul style="list-style-type: none"> <li>• Excellence resistance to chemical.</li> <li>• Excellent optical clarity in biaxially oriented films and stretch blow moulded containers.</li> <li>• Low moisture vapour transmission.</li> </ul>

### MASS BALANCE

- The mass balance for plastic pyrolysis highlights the efficient breakdown of plastic waste into 25% recycle oil, 50% syngas, and 25% black carbon.
- With 50% syngas, the process has a high energy yield, which can be harnessed to power the system.



### PROJECT ACTIVITIES

#### Pre-development

- Site investigation survey
- Authority submission & approval (EIA, KM, Building Plan, etc)
- Detail design stage

#### During Development

- Installation of pyrolysis plant

#### Post-development

- Plant operation
- Maintenance works
- Scheduled waste management
- Closure / abandonment

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### EXISTING ENVIRONMENT

#### LAND USE

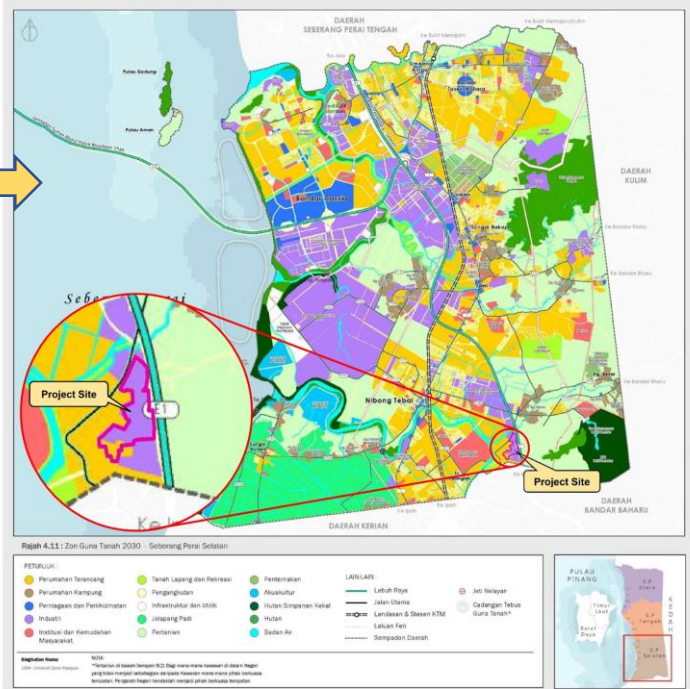
- Project area is already under industrial zoning area
- The surroundings consist of an industrial area, residential areas, commercial and institutional establishments, aquaculture activity area, infrastructure, utilities and water bodies.

#### HYDROLOGY

- No river within the project site
- A river just next to the project site which is Sg. Kecil.
- Sg. Kechil flows into Sg. Kerian which is the main river which finally discharge into the Straits of Malacca

#### METEOROLOGY

- The lowest average annual rainfall was recorded in 2022 at 153.5 mm, whilst the highest average annual rainfall was recorded in 2018 at 197.0 mm.
- The dominant winds blow from the east (27.4%)



#### AMBIENT AIR QUALITY

- 5 sampling stations
- All sampling points complied with the limits prescribed in the New Malaysia Ambient Air Quality Standard 2020.

#### WATER QUALITY

- 5 sampling points were selected

#### NOISE LEVEL

- 5 sampling stations

Point	Description	WQI	Class	Status
WQ1	Sg. Kechil (Upstream)	78.40	II	SP
WQ2	Sg. Kechil (Intermediate)	78.20	II	SP
WQ3	Sg. Kechil (Downstream)	62.76	III	SP
WQ4	Sg. Kerian (Upstream)	82.78	II	C
WQ5	Sg. Kerian (Downstream)	82.39	II	C

	Parameters	Point 1 (N1) Industrial Zone	Point 2 (N2)	Point 3 (N3)	Point 4 (N4)	Point 5 (N5)
Day time	Leq (dBA)	70.0	64.9	62.6	56.6	58.1
	DOE Standard (dBA) (Leq)	<70	<60	<60	<60	<60
Night time	Leq (dBA)	67.2	59.9	58.4	50.1	51.7
	DOE Standard (dBA) (Leq)	<65	<55	<55	<55	<55

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### EXISTING ENVIRONMENT

#### ODOUR LEVEL

Sampling Location	Dilution to Threshold (D/T)			*Range 1
	Morning	Afternoon	Night-time	
<b>Plant Boundary</b>				
BO1: At parking area of the project site	2 (Oleo)	15 (Oleo)	2 (Oleo)	2 - 15
O2: At an open space, near Kampung Teluk	2 (Oleo)	0	0	0-2
O3: At open space, near Kampung Sungai Kechil	4 (Cow dung)	0	0	0 - 4
O4: At open space, near Kampung Seri Ampangan	0	0	0	0
O5: At open space, near Kampung Permatang Pasir	0	0	<2 (Grass)	0 - <2
<b>Range 2</b>	<b>0-4</b>	<b>0-15</b>	<b>0-2</b>	<b>0- 15</b>



D/T	Word Category
2	Noticeable
7	Objectionable
15	Nuisance
31	Nauseating

Note: 0 means not detected (no odour perceived) while <2 means very faint odour perceived (above odour threshold)

\*Range 1 is sampling location based while Range 2 is sampling period based.

#### SOCIO – ECONOMY

- 33 residential area identified at 5-km radius
- Total of respondents = 220

#### PUBLIC HEALTH

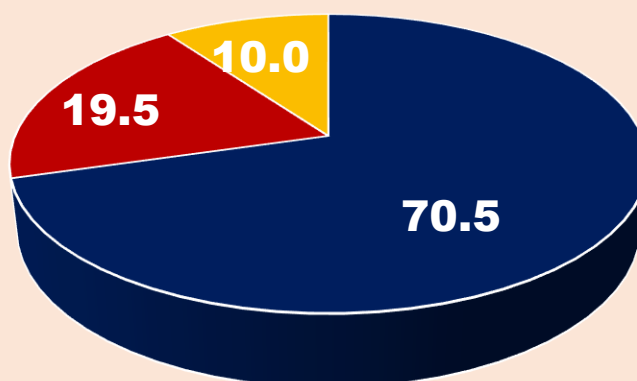
##### Diagnosed with Selected Diseases (Last 1 Year)

Disease	Number	(%)
Allergic	1	0.5
Asthma	1	0.5
Hypertension	5	2.3
Heart problem	2	0.9
Cervical cancer	1	0.5
Nerve problem	1	0.5
Intestine disease	1	0.5

##### Reasons for Seeking Medical Treatments (Last 3 Months)

Disease	Number	(%)
Fever	4	1.8
Cold/ Cough	1	0.5
Heart problem	1	0.5
Skin disease	1	0.5

#### PROJECT ACCEPTANCE



■ Acceptance ■ Non-Acceptance ■ No Opinion

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### POTENTIAL IMPACT & MITIGATION MEASURES

#### POTENTIAL IMPACTS

##### AIR QUALITY

###### Construction stage

- Fugitive dust from construction activities

###### Operation stage

- Emission from diesel and petrol engines from vehicles
- Stack of pyrolysis plant that emits total PM, CO, SO<sub>2</sub>, NO<sub>2</sub>, H<sub>2</sub>S, HCl and VOCs

#### MITIGATION MEASURES

- Cement, sand, debris or other dusty materials stored outside the site should be covered up or kept moist
- Spray water before breaking, grinding, sand papering or wood cutting operation
- The load carried by the vehicle should be covered by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle
- Installation of Fuel Burning Equipment and Air Pollution Control Systems for the design of the fuel burning equipment and chimney for the proposed Consolidated APCS
- Installation of Continuous Emission Monitoring System (CEMS)
- Conduct regular inspection, monitoring and maintenance of abatement equipment
- Periodic ambient air quality monitoring

### AIR QUALITY MODELLING

#### NORMAL SCENARIO

- GLCs for identified criteria air pollutants at the identified off-site ASRs i.e. ASR2, ASR3, ASR4 and ASR5 met the Malaysian Ambient Air Quality Standards 2020 (MAAQS 2020) and the adopted Ontario Ambient Air Quality Criteria (H<sub>2</sub>S and HCl).
- Further assessment on the contribution of the Plant to the airshed based on 25% threshold of the adopted IFC standard indicates that the predicted MAICs for the MAAQS 2020 criteria pollutants were within the calculated thresholds.

#### ABNORMAL SCENARIO

- GLCs for identified criteria air pollutants at the identified off-site ASRs i.e. ASR2, ASR3, ASR4 and ASR5 met the Malaysian Ambient Air Quality Standards 2020 (MAAQS 2020) and the adopted Ontario Ambient Air Quality Criteria (H<sub>2</sub>S and HCl).
- The contribution of identified criteria air pollutants from the Plant to the surrounding environment was assessed to be minimal.
- The predicted 1-hour averaging time was assessed to have significant impact to the surrounding environment.
- It is recommended that the proposed raw materials to exclude the pyrolysis of significant quantities of tyre waste as it is known to release residual odourous pollutants of VOCs and VSOCs

#### POTENTIAL IMPACTS

##### ODOUR

- Residual odour nuisance during operation

#### MITIGATION MEASURES

- Conduct regular inspections, monitoring and maintenance of production areas and abatement equipment
- Use of odour neutralizing sprays and additives to be considered where odours cannot be prevented
- Conduct periodic odour sampling and determination exercise using the Nasal Ranger® Field Olfactometer

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### POTENTIAL IMPACT & MITIGATION MEASURES

#### POTENTIAL IMPACTS

#### MITIGATION MEASURES

##### NOISE LEVEL

###### Construction stage

- Movement of vehicles and operation of equipment such as electric drills and hoist equipment, and hammers are possible source of intermittent noise

###### Operation stage

- Noise from plant operation
  - Mechanical equipment & machineries
  - Air Compressors & Blowers
  - Cooling & Condensation System
  - Material Handling & Transport

- Equipment and machineries need to be well-maintained
- Noise level of these machineries / equipment shall be minimized by proper lubrication, modernization, maintenance, muffling and provision of silencers wherever possible
- Appropriate warning signs on the use of hearing protection shall be placed at visible locations
- Environmental monitoring for noise

##### WATER QUALITY

###### Operation Stage

- Wastewater discharge from pyrolysis plant
- Leaks or spills of pyrolysis oil and tars
- Cooling water
- Rainwater wash contaminants from plant surfaces

- Reuse treated water for cooling and cleaning processes.
- Use oil-water separators to remove hydrocarbons from wastewater before further treatment.
- Install bund walls and containment trays around storage tanks and processing areas to prevent leaks from reaching water sources
- Conduct routine checks on pipelines, tanks, and pumps to detect leaks early.
- Use corrosion-resistant materials for pipes and storage tanks to prevent leaks
- To conduct monthly compliance monitoring at the final discharge point to ensure complying with the Standard B of Environmental Quality (Industrial Effluent) Regulation 2009.

##### WASTE GENERATION

- Solid Waste (Construction & operation stage)
- Construction waste (Construction stage)
- Scheduled waste (Construction & operation stage)

- Prohibition of open burning
- Provide designated area for temporary construction waste disposal / construction waste bin
- Promoting the 3R concept (Reduce, Reuse & Recycle)
- Providing the scheduled waste storage area / building
- Disposed out the scheduled waste by licensed scheduled waste contractor

##### SOCIO-ECONOMY

- Job opportunities
- Influx of foreign workers
- Environmental nuisance and impact

- To hire local residents as a manpower either during construction or operation stage
- Provide adequate utilities and facilities to the workers and health examination
- Conducting environmental monitoring program
- Implementation of CSR program

##### RISK

- Pool Fire from oil storage tank
- Jet Fire from pyrolysis reactor and gas storage tank
- Flash Fire from pyrolysis reactor and gas storage tank
- Explosion from pyrolysis reactor and gas storage tank

- Conduct fire and gas detection mapping
- Emergency Response Plan (ERP) shall be prepared to address all potential scenarios in relation to those identified in this QRA
- Design changes during the subsequent engineering phases post EIA should be analysed
- Ensure the implementation of an effective health and safety management system

##### GENERAL PUBLIC HEALTH

- Airborne emission
- Respiratory issue
- Occupational hazards
- Water pollution

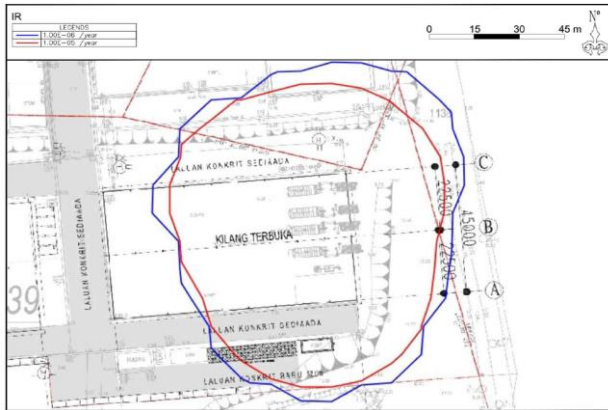
- Emission control technologies
- Material handling management
- Personal protective equipment (PPE) for workers
- Health & safety training
- Community & environmental protection program

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### POTENTIAL IMPACT & MITIGATION MEASURES

### QUANTITATIVE RISK ASSESSMENT MODELLING



Individual Risk (IR) Contour



WCS and WCCS for Fire Event



WCS for Explosion Event

- **IR contour** of the proposed project remains within the NTPM's site boundary and does not encompass involuntary recipients of industrial risks
- **The WCS and WCCS for fire event** is pool fire arising from the catastrophic release of Pyrolysis Oil from Oil Storage Tank, which operates at 50oC and 1.2 barg pressure.
- This resulted in the 37.5 kW/m<sup>2</sup> heat radiation hazard zone (that corresponds to a radiation intensity sufficient to cause up to 100% fatalities and damage process equipment) of up to 29.00 m
- The 12.5 kW/m<sup>2</sup> and 4 kW/m<sup>2</sup> heat radiation hazard zone (that typically corresponds to a radiation intensity to cause up to 50% fatalities and damage process equipment; and 3% fatalities and below which no injuries or damage would be expected) extends a maximum of 42.00 m and 66.00 m, respectively
- **The WCS for explosion event** originates from the vapour cloud explosion (VCE) resulting from a delayed ignited catastrophic release of Syngas from Gas Storage Tank, which operates at 50oC and 1.6 barg pressure
- This result in a 0.02068 bar explosion overpressure hazard zone (where minor damage and injuries are to be expected) extends up to 47.00 m but remains within the industrial area.

### MATERIAL HANDLING (PLASTIC WASTE TRANSPORTATION & PROCESS)

- Air pollution
  - Dust & microplastic emissions
  - Vehicle emissions
  - Odour pollution
- Water & Soil Contamination
  - Leachate generation
- Worker exposure risk
  - Inhalation of plastic dust
  - Chemical exposure

- Fire & Explosion Risk
  - Flammable plastics
  - Overheating machinery
- Contamination Issues
  - Non-plastic waste mix
  - PVC and hazardous plastics

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### MONITORING PROGRAM

#### CONSTRUCTION STAGE

Impact / Monitoring Aspect	Parameter	Compliance Limit	Monitoring Frequency	IM	CM	PM
Surface Water Quality	pH Temperature DO COD BOD TSS Oil & Grease Ammoniacal Nitrogen Faecal Coliform Turbidity	6.0 – 9.0 - 5 – 7 mg/l 25 mg/l 3 mg/l 50 mg/l 7;N 0.3 mg/l  100 CFU/100ml 50 NTU  (NWQS Class IIB Standards)	Monthly	√	√	Not Applicable
Ambient Air Quality (A)	PM10 PM2.5	100 µg/m <sup>3</sup> 35 µg/m <sup>3</sup>	Quarterly	√	√	Not Applicable
Noise Level (N)	L10 L50 L90 Lmin Lmax Laeq	Laeq, Daytime – 55.0 dBA Nighttime – 50.0 dBA				

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### MONITORING PROGRAM

#### OPERATION STAGE

Impact / Monitoring Aspect	Monitoring Parameter	Compliance Limit	Monitoring Frequency	Impact Monitoring (IM)	Compliance Monitoring (CM)	Performance Monitoring (PM)
Surface Water Quality	pH	6.0 – 9.0	Monthly	√	√	Not Applicable
	Temperature	-				
	DO	5 – 7 mg/l				
	COD	25 mg/l				
	BOD	3 mg/l				
	TSS	50 mg/l				
	Oil & Grease	7;N				
	NH3N	0.3 mg/l				
	Faecal Coliform	100 CFU/100ml				
	Turbidity	50 NTU				
		(NWQS Class IIB Standards & Baseline)				
Final Discharge from NTPM IETS	Temperature	40°C	Monthly	√	√	√
	pH value	5.5 – 9.0				
	BOD	50 mg/l				
	TSS	100 mg/l				
	Mercury	0.05 mg/l				
	Cadmium	0.02 mg/l				
	Chromium, Hexavalent	0.05 mg/l				
	Chromium, Trivalent	1.0 mg/l				
	Arsenic	0.10 mg/l				
	Cyanide	0.10 mg/l				
	Lead	0.5 mg/l				
	Copper	1.0 mg/l				
	Manganese	1.0 mg/l				
	Nickel	1.0 mg/l				
	Tin	1.0 mg/l				
	Zinc	2.0 mg/l				
	Boron	4.0 mg/l				
	Iron (Fe)	5.0 mg/l				
	Silver	1.0 mg/l				
	Aluminium	15 mg/l				
	Selenium	0.5 mg/l				
	Barium	2.0 mg/l				
	Fluoride	5.0 mg/l				
	Formaldehyde	2.0 mg/l				
	Phenol	1.0 mg/l				
	Free Chlorine	2.0 mg/l				
	Sulphide	0.50 mg/l				
O&G	10 mg/l					
AN	20 mg/l					
Colour	200 ADMI					

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### MONITORING PROGRAM

#### OPERATION STAGE

Impact / Monitoring Aspect	Monitoring Parameter	Compliance Limit	Monitoring Frequency	Impact Monitoring (IM)	Compliance Monitoring (CM)	Performance Monitoring (PM)
Stack Emission	Total PM CO SO <sub>2</sub> NO <sub>2</sub> H <sub>2</sub> S HCl VOC	150 mg/m <sup>3</sup> 1000 mg/m <sup>3</sup> 400 mg/m <sup>3</sup> 400 mg/m <sup>3</sup> 5.0 mg/m <sup>3</sup> 30 mg/m <sup>3</sup> 150 mg/m <sup>3</sup>	Monthly / Periodic	√	√	√
Ambient Air Quality	PM <sub>10</sub> PM <sub>2.5</sub> SO <sub>2</sub> NO <sub>2</sub> CO O <sub>3</sub>	100 µg/m <sup>3</sup> 35 µg/m <sup>3</sup> 80 µg/m <sup>3</sup> 70 µg/m <sup>3</sup> 10 µg/m <sup>3</sup> 100 µg/m <sup>3</sup>	Quarterly	√	√	Not Applicable
Noise Level (N)	L <sub>10</sub> L <sub>50</sub> L <sub>90</sub> L <sub>min</sub> L <sub>max</sub> L <sub>aeq</sub>	L <sub>aeq</sub> , Daytime – 55.0 dBA Nighttime – 50.0 dBA	Quarterly	√	√	Not Applicable
Odour	Dilution to Threshold (D/T)	<i>Charles McGinley, P.E. (2000)</i>	Quarterly	√	√	Not Applicable