PT. ANGEL NICKEL INDUSTRY

DETAILED PLAN
MANAGEMENT AND MONITORING
ENVIRONMENT
(RKL - RPL)

CONSTRUCTION AND OPERATION ACTIVITIES OF PYROMETALLURGICAL SMELTERS AND PLTU IN THE INDUSTRIAL AREA INDONESIA WEDA BAY INDUSTRIAL PARK

BY

PT ANGEL NICKEL INDUSTRY

CENTRAL HALMAHERA, FEBRUARY 2021

FOREWORD

The Detailed Environmental Management Plan Document and Environmental Monitoring Plan are part of PT Angel Nickel Industry's obligations as a Tenant in the PT Industrial Area. Indonesia Weda Bay Industrial Park (PT. IWIP).

The format for writing the RKL-RPL document for industrial area development activity plans by PT Angel Nickel Industry is prepared in accordance with Minister of Environment and Forestry Regulation Number 26 of 2016 concerning Guidelines for Preparation and Assessment and Examination of Environmental Documents in the Implementation of Electronically Integrated Business Licensing Services Appendix III. Apart from that, it also continues to refer to PT's RKL–RPL. IWIP as environmental permit holder.

To the relevant parties, especially to the AMDAL Assessment Commission and the ranks of related Service Agencies/Institutions at the North Maluku Province level, we as the initiators of the activity would like to express our gratitude for all their participation, attention, assistance and cooperation until the preparation of this Andal Document.

Jakarta, February 2021

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I. INTRODUCTION

I.1 Aims and Objectives of RKL-RPL Implementation

PT. Angel Nickel Industry will build and operate a nickel processing plant with a pyrometallurgical smelter, equipped with a power plant in an industrial area owned by PT. Indonesia Weda Bay Industrial Park (PT. IWIP). In general, the preparation of PT Angel Nickel Industry's detailed RKL-RPL documents is intended so that environmental management can run effectively and efficiently in accordance with the targets to be achieved. Specifically, the aims and objectives of environmental management and monitoring include the following:

1. Implement environmental laws and regulations related to the planned development and operational activities of the Pyrometallurgical Smelter, PLTU and PT Port. Angel Nickel Industry in the industrial area by PT IWIP;
2. As direction and guidance in managing and monitoring impacts that arise on componentsenvironment by planned operational development activities for the Pyrometallurgical Smelter, PLTU and Port of PT. Angel Nickel Industry in the PT IWIP industrial area;
3. Prevent, overcome and control negative environmental impacts and increase positive impacts arising from planned operational development activities for the Pyrometallurgical Smelter, PLTU and Port of PT. Angel Nickel Industry in the PT IWIP industrial area;
4. Monitoringsuccessful implementation of detailed RKL - RPL in preventing or minimizing negative environmental impacts from planned activities, in accordance with environmental quality standards;
5. Making detailed RKL-RPL implementation results an indicator for evaluating compliance with applicable regulations, analyzing trend patterns and critical levels of environmental conditions based on implemented environmental management.

I.2 Company identity

1.	Company name	:PT. Angel Nickel Industry
2.	Office address	: Sopo del Tower A lt. 21 Jl. Mega Kuningan Barat III Lot 10.1-6 South Jakarta 12950
3.	Tel. Office	: 021 50806586
4.	NIB	:0221010231003
5.	NPWP number	: 96.745.238.4-067.000
6.	Type of Business/Activity	:KBLI 24202 (Basic Metal Processing Industry Not Iron
7.	Investment Status	: PMA

8.	Business/Activity Location	:Tanjung Uli, Lelilef Sawai Village, District Central Veda, Kab. Central Hamahera, Prov. North Maluku
9.	Industrial area	: Indonesia Weda Bay Industrial Park
10.	Leader's Name	:Ye Changqing
11.	Person in charge of RKL-RPL	:Ye Changqing

I.3 Summary of Business Plan / Activities

PT. Angel Nickel Industrywill establish and operate a nickel ore refining plant equipped with business support facilities, namely a steam power plant (PLTU). The business location is in the Industrial Area managed by PT. IWIP in Weda Tengah District, Central Halmahera Regency, North Maluku Province.

Smelter PT. Angel Nickel Industry will use RKEF (Rotary Kiln - Electric Furnace) technology to process laterite nickel ore into NPI (nickel pig iron) with a nickel content of up to 12%. PT. Angel Nickel Industry will operate 4 production lines which are estimated to produce 400,000 tons of NPI per year. Consumption of wet nickel ore is estimated to reach 3 million tons per year. The laterite nickel ore that will be used comes from North Maluku, Southeast Sulawesi and Central Sulawesi.

The PLTU will be owned by PT. Angel Nickel Industry as a means of supporting production will use supercritical steam generation technology which utilizes crushed coal as steam heating fuel. The capacity of the PLTU to be built is 380 MW. This PLTU will be equipped with an electrostatic precipitator (ESP) to control dust in the exhaust gas. Sea water will be used as a cooling medium in the condenser. Coal consumption is estimated at around 1,000 kilotons and seawater used is 17 million m^3 per year for 7,200 operational hours.

I.4 Environmental Policy Statement

PT. Angel Nickel Industry as a tenant in the PT Industrial area. IWIP is committed to complying with all applicable laws and regulations in Indonesia in the fields of environment, occupational health and safety and participating in regional economic development activities. PT. Angel Nickel Industry realizes that in order to be successful, environmental management must be integrated with all stages of PT activities and events. Another Angel Nickel Industry. The following are the environmental policies that apply to the PT Project. Angel Nickel Industry:

a. Develop an Environmental Management Program supported by an Environmental Management System with continuous improvement, to implement the principles of Environmental Policy;
b. Ensure that all employees, managers, contractors and sub-contractors are informed about the Environmental Policy and understand their roles and responsibilities towards the environment through appropriate training;
c. Work constructively with stakeholders including governments at all levels, communities, non-governmental organizations on environmental matters;

d. Comply with all relevant Indonesian laws and regulations and anticipate, through constant consultation with competent authorities, any future changes that may affect the project;
e. Design and operate projects in accordance with the International Finance Cooperation Performance Standards and related guidelines and good practices of the international mining and metallurgy industry;
f. Encourage the process of sharing environmental and scientific knowledge and the use of good practices;
g. Using raw materials, energy and water efficiently, minimizing the generation of waste and hazardous emissions into air, water and land and providing safe storage and disposal of waste and process residues;
h. Promote safe and responsible use, recycling and end-of-life of products;
i. Design and plan all operations so that adequate resources are available to meet environmental and socio-economic requirements at the time of mine closure;
j. Protect local communities and indigenous groups in accessing ecosystem services and traditional knowledge regarding the use of biodiversity; And
k. Protect and conserve biodiversity by implementing the Mitigation Hierarchy and, where residual impacts remain unavoidable, develop biodiversity offsets following good practices to ensure no net loss and wherever possible generate net gains in terms of biodiversity.
l. Implementing the RKL-RPL in accordance with relevant environmental laws and regulations;
m. Improving environmental management and monitoring on an ongoing basis in the form of preventing, overcoming and controlling environmental impacts caused by activities;
n. Conduct training for employees in the field of environmental management.

II. DESCRIPTION OF BUSINESS PLAN/ACTIVITIES

II.1. Pyrometallurgical Smelter Construction and Operational Activities

The composition of laterite deposits depends on the type of parent rock, the climate in which the deposit was formed and its weathering history. This creates many specific relationships between laterite deposit elements and subsequent processing options. There are several processing processes available for nickel laterite: hydrometallurgy, pyrometallurgy, and the Caron method.

Laterite processing using the pyrometallurgical process has so far been limited to ore feed containing more than 2% nickel and more than 25% iron. These restrictions, especially in terms of nickel content, exclude pyrometallurgical processes for the PT project. Angel Nickel Industry in 2009. The average quality of a significant proportion of the measured saprolite reserves at that time proved too low to be profitable.

However, over the past few years, driven by the implementation of Indonesia's ore export ban in 2014, relatively flexible commercial pyrometallurgical processing methods for laterite have developed rapidly in Indonesia using Chinese technology. This technology has proven successful in overcoming the problem of minimum nickel content limits as mentioned above. This makes it economically possible to feed ore with nickel grades starting from 1.8%.

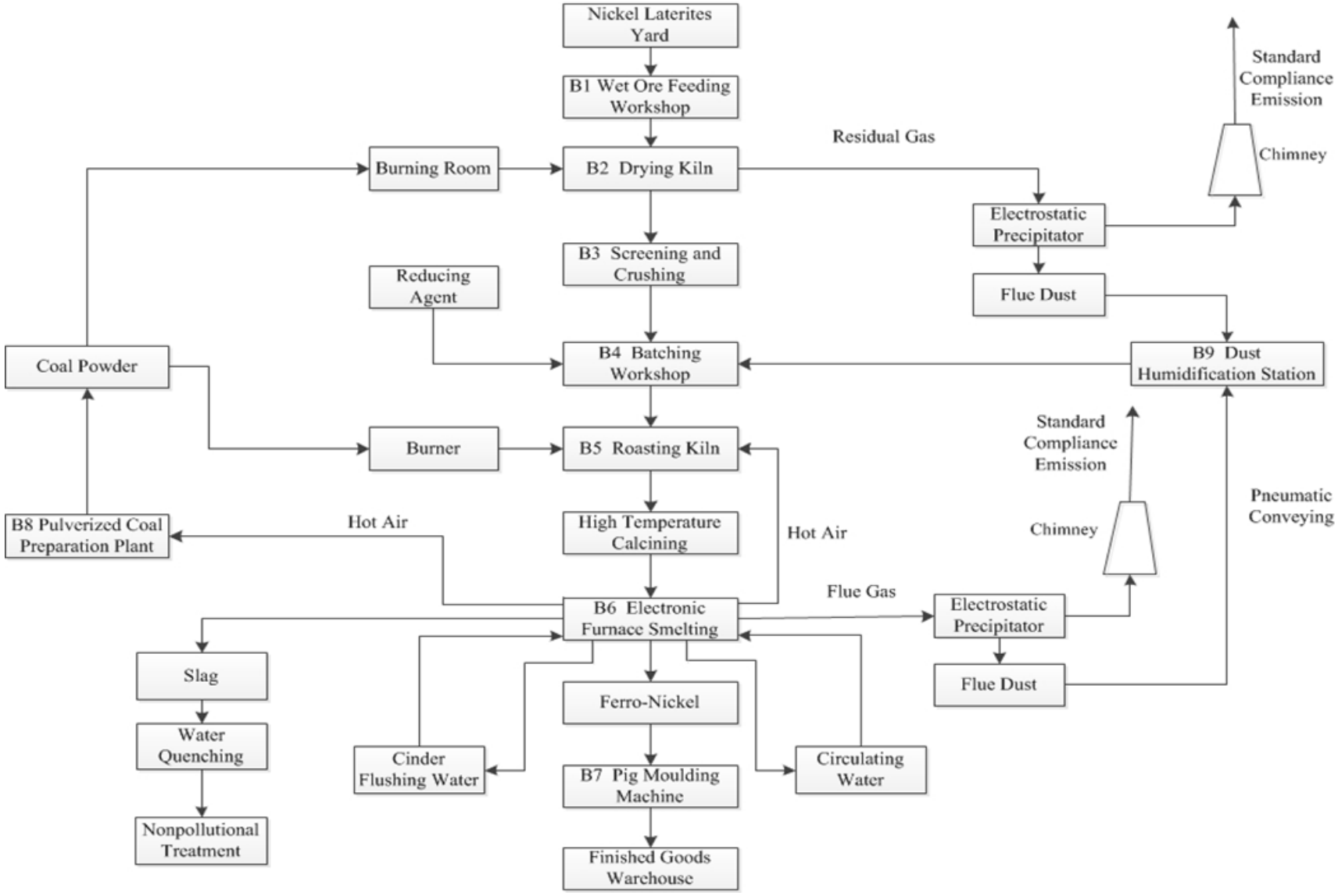
The pyrometallurgical processing process for laterite ore involves drying, reduction (calcination) and smelting. There are two smelting methods, namely using Blast Furnace technology, where the product produced is Nickel Pig Iron (NPI) with a nickel content ranging between 4-8%; and rotary kiln - electric furnace (RKEF) technology which produces Nickel Pig Iron (NPI) which has a nickel content above 10%.

Design of the pyrometallurgical plant to be built by PT. Angel Nickel Industry adopts RKEF technology which has been developed by PT Sulawesi Mining Investment Co., Ltd. (SMI) for its smelter which produces NPI with a nickel content of 10-12%, where annual production is projected to reach 400,000 tons of NPI. Flow diagram of the RKEF PT pyrometallurgical process. Angel Nickel Industry is as indicated byPictureII-1. By using a process that is a duplication of the PT process scheme. SMI developed by Tsingshan Group, similar characteristics of PT input ore. SMI with that used by PT. Angel Nickel Industry will determine the smooth operation of the factory to be built. The input and output characteristics of PT. This SMI in 2016 can be seen atTableII-1,TableII-2,TableII-3.

All tested elements contained in PT. SMI shows a similar grade level to that referred to in the composition of PT's process feed laterite ore. Angel Nickel Industry (TableII-4). By matching the values of 3 important parameters, namely humidity, Fe/Ni ratio and SiO2/MgO ratio, it can be concluded that the ore processing results of PT. Angel Nickel Industry will be proportional to PT's output. SMI in 2016.

Thus it is assumed that the PT factory. Angel Nickel Industry will have a performance guarantee to produce a minimum of 400,000 tons of nickel contained in NPI products from an input of 1.8 million tons of dry laterite ore in the selected pyrometallurgical process.

PictureII-1: Pyrometallurgical Process Flow Diagram developed by Tsingshan Group



TableII-1: Characteristics of PT. Input Ore. SMI in 2016

Month in 2016	Amount of ore fed in wet tons	Amount of ore fed in dry tons	Ore Composition									
			Ni	Fe	Fe/Ni	MgO	CaO	Al2O3	Cr2O3	SiO2	Moisture	SiO2/MgO
			%wt	%wt		%wt	%wt	%wt	%wt	%wt	%wt	
January	238,917	155,057	1.87	19.80	10.59	17.93	0.40	4.20	1.24	33.32	35.10	1.86
February	215,091	136.153	1.86	19.30	10.38	17.83	0.46	3.91	1.22	32.89	36.70	1.84
March	247,651	153,296	1.85	19.90	10.76	18.03	0.39	4.10	1.18	33.88	38.10	1.88
April	227.123	144,450	1.88	20.10	10.69	18,19	0.36	4.30	1.26	33.85	36.40	1.86
May	244,960	149,671	1.89	19.80	10.48	17.59	0.35	4.20	1.25	32.99	38.90	1.88
June	231,793	149,506	1.88	19.60	10.43	17.57	0.45	4.50	1.31	33.06	35.50	1.88
July	256,743	163,032	1.86	20.50	11.02	17.43	0.37	4.02	1.21	32.98	36.50	1.89
Augustus	248,459	150,566	1.84	19.50	10.60	18.31	0.55	3.65	1.22	33.92	39.40	1.85
September	257,336	159,291	1.82	18.50	10.16	19.55	0.51	3.21	1.19	35.99	38.10	1.84
October	254,007	159,516	1.83	19.48	10.64	18.32	0.49	3.34	1.21	34.33	37.20	1.87
November	239,721	151,504	1.86	20.40	10.97	18.30	0.46	3.91	1.26	34.39	36.80	1.88
December	244,703	152,939	1.87	20.50	10.96	17.76	0.45	4.01	1.21	33.02	37.50	1.86
TOTAL 2016	**2,906,504**	**1,824,981**										

TableII-2: Product Characteristics of NPI PT. SMI in 2016

2016	NPI amount in tons	Nickel content in tons	NPI Composition (%wt)							
			Ni*	Fe**	Co**	C	Cr	Si	S***	P****
January	23,665	2,605	11.01	81%	0.7%	3.03	0.57	0.15	0.16	0.02
February	20,945	2,459	11.74	81%	0.7%	3.05	0.45	0.10	0.17	0.02
March	23,846	2,775	11.64	81%	0.7%	3.12	0.46	0.09	0.17	0.03
April	22,853	2,598	11.37	81%	0.7%	3.08	0.64	0.18	0.15	0.02
May	23,168	2,768	11.95	81%	0.7%	3.00	0.61	0.19	0.16	0.02
June	23,757	2,839	11.95	81%	0.7%	2.95	0.46	0.12	0.19	0.02
July	24,381	2,862	11.74	81%	0.7%	3.00	0.47	0.08	0.19	0.02
Augustus	23,155	2,820	12.18	81%	0.7%	3.19	0.42	0.06	0.20	0.02
September	21,833	2,764	12.66	81%	0.7%	3.20	0.38	0.04	0.20	0.01
October	23,400	2,880	12.31	81%	0.7%	2.99	0.39	0.04	0.20	0.02
November	23,821	2,918	12.25	81%	0.7%	3.06	0.39	0.03	0.19	0.01
December	23,398	3,004	12.84	81%	0.7%	2.93	0.35	0.02	0.20	0.01
TOTAL 2016	**278,227**	**33,296**								

* minimum Nickel content is 10%
** yearly average
*** maximum Sulfur content is 0.3%
**** maximum Phosphorus content is 0.03%

TableII-3: Characteristics of Slag PT. SMI in 2016

Slag in tons	Slag Composition (%wt)							
	Ni	Fe	Co	CaO	Cr2O3	SiO2	MgO	Al2O3
1,872,285	0.06	8-10	0.02	0.79	1.54	50.76	26.93	4.65

II.1.1. Nickel Ore Processing and Refining Process

The pyrometallurgical plant is designed to operate continuously 24 hours a day with an input of laterite ore with an average nickel content of 1.89%; The complete composition of the ore input can be seen inTableII-4under.

TableII-4: Process Feed Laterite Ore Composition (%wt)

Composition	Ni	Fe	Co	MgO	SiO2
%	1.8 – 1.9	15 - 20	0.06	18 - 23	33 - 39
Composition	**CaO**	**Al2O3**	**Cr2O3**	**O**	**Humidity**
%	0.41	3.96	1.2 - 1.6	7.2	35 - 40

With a Fe/Ni ratio between 7.7 – 10.7; SiO2/MgO ratio above 1.6 and below 1.9; and assuming the moisture content does not exceed 40%, annual ore consumption for this project is estimated at 3 million tons of wet ore.

II.1.1.1. Wet Ore Storage

Wet ore imported from the mine site with a size of less than 100 mm will be stored in an open area before being transferred to a constant feeder plate. There will be two wet ore storage areas. Wet ore, using a constant feed plate, will be passed in a predetermined amount on a conveyor belt which then goes with constant flow to the drying kiln. The quantitative feeding system used adopts frequency control of the motor speed.

II.1.1.2. Drying

This stage aims to reduce the initial humidity of 40% in the wet ore and control it until it reaches a moisture level of 20 - 25%. The drying process will be carried out using 4 drying kilns, each with dimensions of Ø5 x 45m, with a main motor power of 250 kW to enable downstream drying performance at a speed of 4.5 r/min. Apart from coal, water containing lignite is used as an additional fuel. The operating temperature of the drying kiln head is around 800-900°C.

After drying, the ore is taken using a belt conveyor to the screening & crushing workshop.

II.1.1.3. *Screening*and Dry Ore Crushing

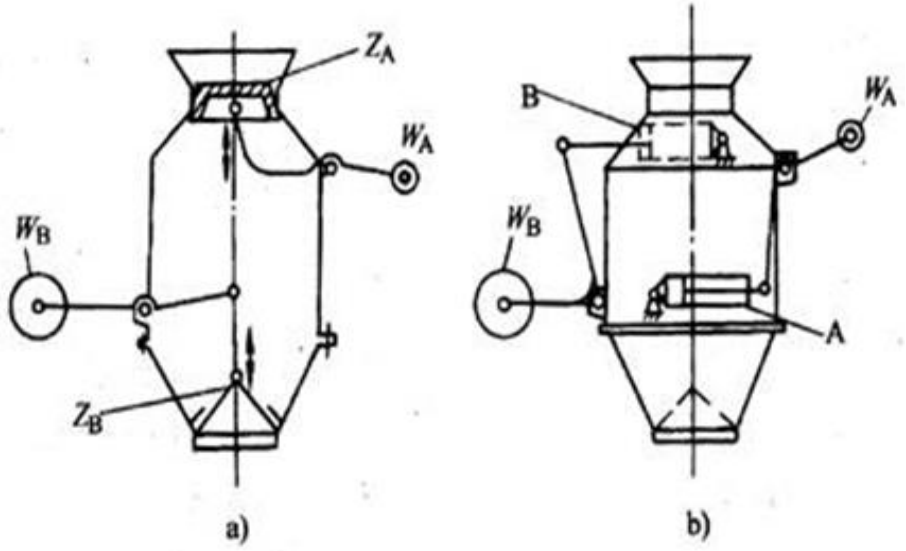
Screening is carried out to sort dry ore based on particle size, this is important considering that fine particles can cause clogging in the rotary kiln in the next process. By using a sieve with openings measuring 1500 µm, the fine ore that falls will be passed to the dust granulating station. Meanwhile, ore larger than 50 mm is directed to an impact crusher to be crushed and then directed through a belt conveyor to be stored in a special dry ore warehouse.

II.1.1.4. Dry Ore Storage and Batching

Dry ore consumption for this project is around 1.8 million tons/year. This dry ore supply is stored in a special warehouse with a capacity of 72,000 tons and can then be fed to the batching feeder (PictureII-2). In this warehouse, additional materials such as lignite and coke together with return materials, for example from calcining kilns, are stockpiled. In the batching feeder the dry ore and additional materials will be mixed according to the required amount and homogenized.

The mixing of dry ore and coke must meet process requirements that will regulate the proportion of slag in the subsequent process. The production design calls for 2 dry ore hoppers, 2 coke hoppers, 2 return hoppers, and 2 reserve hoppers. This is because when the slag composition deviates from the model, a certain amount of dolomite or limestone is needed as a correction. Next, the mixture in the batching feeder will be fed to undergo the calcination process.

PictureII-2: Calcining Batching Feeder



II.1.1.5. Calcination

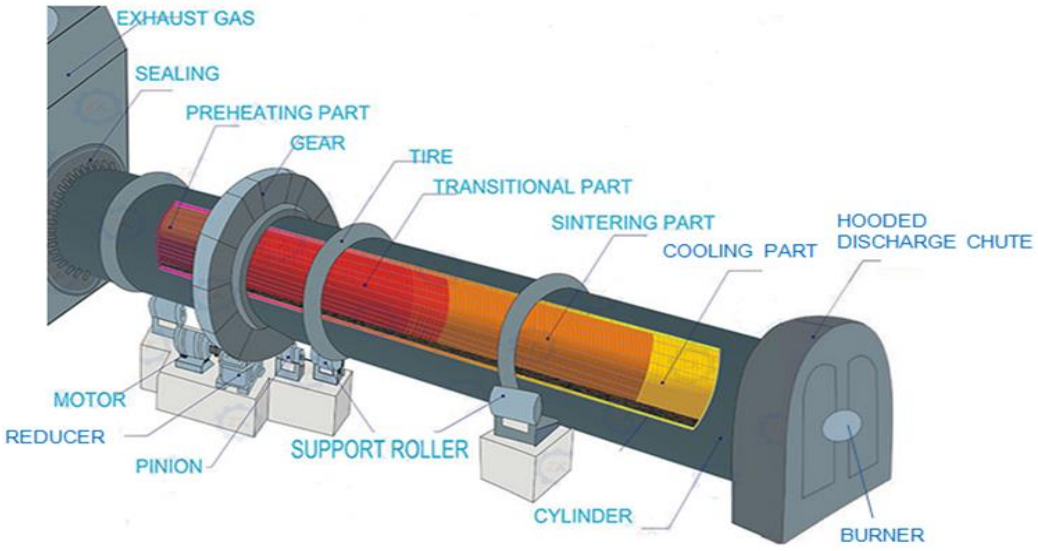
After homogenization of dry ore and coke in the batching feeder, calcination is carried out in a rotary calcining kiln. The function of this furnace is to increase the temperature of the ore which will provide enough latent heat to optimize the energy requirements needed further during the complete reduction process in the electric furnace. During the process of increasing the temperature, the reactions that occur are:

- Complete elimination of free water still contained in dry ore;
- Preliminary reduction of iron, nickel and cobalt oxide compounds.

The calcination furnace is a cylindrical apparatus with dimensions of Ø4.6 x 100 m with a main motor power of 450 kW, and a supporting motor power of 75 kW to allow a rotation speed of between 0.2 – 1.2 r/min. The capacity of this furnace is 120 tons of dry ore/hour.

A typical cross-section of a rotary kiln can be seen inPictureII-3.

PictureII-3: Typical Cross-Section of a Rotary Kiln



The design of the charging end is funnel-shaped to accommodate feeding from the batching feeder, where this is also the place where waste gas is released. Sorted from the charging end, there are 4 reaction zones, namely:

1) Pre-heating zone: completes water evaporation and increases ore temperature;
2) Calcination zone: the temperature in this zone must be controlled at 1000℃, where if it exceeds this temperature there is a risk of ring formation. This phenomenon occurs when excessive local heating occurs which causes excess production of the melt phase which then sticks to the furnace walls and forms a kind of ring;
3) Reduction zone: the reductive atmosphere produced by coal initiates the partial reduction process of iron, nickel and cobalt oxides with coke as a reducing agent. The temperature is set at 1250 - 1350℃;
4) Cooling zone: namely the zone closest to the kiln head, where the temperature of the ore is lowered before it goes to discharge.

*Kiln heads*completed by:

1) *pulverized coal burner*to achieve controlled perfect combustion to produce a reductive atmosphere.
2) *grizzly bars*which will ensure even distribution of ore in the cooler.

The inner side of the rotary kiln is lined with a 230 mm thick liner made of refractory castable clay for the first half, and the half at the discharge end has an aluminum castable insulation layer. The total weight of the furnace reaches 2,800 tons, of which half is the weight of this refractory material.

The calcination product is at a temperature of 750 - 850℃. This calcine is then stored in a calcined ore tank which requires calcine tank sealing material, thermal insulation to reduce heat loss and oxidation.

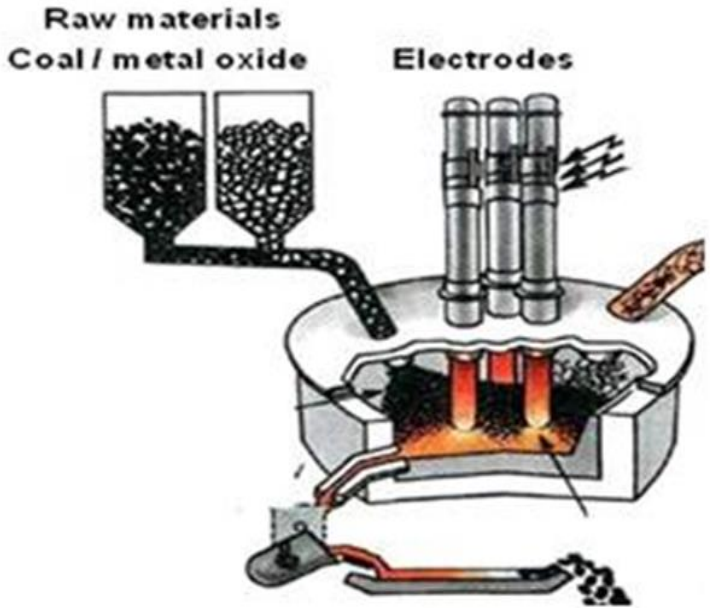
II.1.1.6. Smelting

The calcined ore will be sent to the smelting workshop using a container truck and fed into the calcined ore hopper positioned above the furnace using a trolley and crane. The hopper is

equipped with a protective layer to prevent heat loss and smoke pollution. Feeding into the furnace is via feed pipes, there are several, and is regulated by a constant rate control valve using weight indication.

The furnace is designed to have a two-layer steel support structure with an elastic structural frame, which can ensure even brick clamping. Magnesia refractory will be used as a heat-resistant coating material, while the electrodes used are self-roasting electrodes.

PictureII-4: Illustration of a Cross-section of a Smelting Furnace



The dome-shaped furnace roof with an air cooling system has three holes arranged in a triangle for the electrode which is supported by a clamp mechanism. The hydraulic mechanism allows independent lifting and lowering of all three. There is a seal on the hole to prevent the gas formed during the melting process from escaping from the furnace.

The reaction that occurs during melting is the complete reduction of nickel oxide and some iron oxide which produces a nickel-rich metal melt and leaves impurities in the slag melt. The metallic iron-nickel or NPI phase melts at a temperature of around 1450°C (overheating of around 50°C) and is separated from the slag phase which melts at a temperature of 1550°C thanks to the difference in specific gravity between the two. Thus, the melted slag and NPI can be poured through the respective output holes/tap holes. Copper cooling water jackets are used on the furnace walls at the slag level to help extend the service life of the furnace. NPI is regularly poured into a 45 ton capacity ladle which is then directed to the ingot molding machine.

In this process the furnace releases large amounts of flue gas containing carbon monoxide (CO) which can be used as a fuel source. In a closed type furnace, CO gas is sucked out by a fan. After that, the gas can be burned by controlling the temperature below 1000°C to avoid dust sintering.

II.1.2. Input Materials

II.1.2.1. Consumables

Lignite

The drying and calcination process consumes 405,000 tons of lignite/lignite as fuel/year. The lignite used, i.e. in powder form, can be purchased from local markets; where the typical composition can be seen inTableII-5.

TableII-5: Lignite Composition Analysis

Component		**%wt**
Fixed Carbon		40
Volatile Compounds		36
Humidity		21
Gray Part		3
Gray Part Composition	SiO2	**35**
	Al2O3	25
	MgO	5
	Fe2O3	20
	CaO	6
	Other	9
Element Analysis	C	72
	H	5
	N	1
	O	22
	S	0.2

Coke

Coke is used as a reducing agent, where consumption is estimated at 150,000 tons/year. Coke will be provided by one of PT's tenants. IWIP and PT. PT. Angel Nickel Industry bought from the tenant. The required coke composition can be seen inTableII-6.

TableII-6: Coke Composition

Granulometry (mm)	**Composition (%)**				
	Fixed Carbon	**Volatile Compounds**	**Dust**	**P**	**S**
8 - 18	82	8	12	0.02	0.8

Solar

As fuel, diesel is used by the majority of vehicles in factories. Meanwhile, for drying kilns, rotary kilns and blowing-on smelting processes in electric furnaces, diesel is only used as additional fuel. Annual consumption is estimated at around 3,000 tons. Solar will be provided by PT. IWIP.

Coal

The use of coal as fuel for drying furnaces and reducing agents for calcination reaches an annual consumption of 655,400 tons. The composition specifications of the coal used are typical of coal found in local markets (TableII-7). Coal will be taken from the PLTU coal inventory so that the coal storage process will not be included in environmental management and monitoring in the PT smelter area. Angel Nickel Industry.

TableII-7: Coal Specifications

Parameter		**Units**	**Design Coal**	**CheckCoal**
Carbon as received basis		%	42.48	37
Hydrogen as received basis		%	2.95	2.7
Oxygen as received basis		%	12.98	15.04
Nitrogen as received basis		%	0.59	0.71
Sulfur as received basis		%	0.12	0.14
As received basis		%	3	6.5
Moisture as received basis		%	38	37.9
Moisture as air dried base		%	20	20
Volatile matter (dried base without ash)		%	40	53.4
Net Calorific Value as received basis		kcal/kg	3,700	3,045
Hardgrove Grindability Index			65	62
Ashcomposition	*Transforming temperature*	°C	1200	
	Softening temperature	°C	1220	
	Melting temperature	°C	1310	
	SiO2	%	33.5	
	Al2O3	%	23.7	
	Fe2O3	%	19	
	CaO	%	6	
	MgO	%	5	
	Na2O	%	0.2	
	K2O	%	0.5	
	TiO2	%	0.4	
	SO2	%	8	
	Mn3O4	%	3.5	
	P2O	%	0.2	

Etc

Other consumables include:

1) Carbon paste electrode and shell electrode
   Annual consumption reaches 10,500 tons of electrode paste and 900 tons of electrode shell.
2) Refractory Materials

Equipment such as drying kilns, combustion chambers and rotary kilns consume a number of refractory bricks of 5,400 tons/year.

3) Nitrogen and Oxygen Gas

Oxygen is used mainly for tap hole operations and welding purposes, while nitrogen is a fire control material. The nitrogen and oxygen gas supplier is provided by the IWIP industrial area.

II.1.2.2. Transport Materials

Transportation corridors will be managed based on their scope, and are divided into 2: internal and external transportation. Seen onTableII-8factory internal transport volume per year per material. This route will use a cement concrete road with a main road width of 12 meters, a secondary road of 8 meters, and a general road bend radius of 9 meters.

TableII-8: Internal Material Transport

Material	Volume(tons/ year)	Loading/unloading location	Type of Transportation
Process feed ore	3,000,000	Stock - dryer	frontloader
Coke	150,000	Stock - solo	frontloader
lignite	405,000	Stock - solo	frontloader
Coal	655,400	Stock - solo	belt
Refractory materials	5,400	Stock - solo	Forklift
Paste electrode	10,500	Warehouse – each user	Forklift
Electrode shell	900	Machine workshop - smelter	Forklift
Total	4,227,200		

External factory transportation will use industrial area roads for transportation from special ports to the stockpile and ships for transportation from material sources to special ports owned by PT. Angel Nickel Industry.

II.1.2.3. Energy Requirements and Power Distribution

The main load of this project is the non-linear load of the electric furnace. 12 11,000 kVA single phase transformers are needed for 4 42 MVA furnaces, corresponding to a total of 12 furnace electrodes that distribute electrical energy. The active load of the furnace electrode must be controllable for small load fluctuations, voltage, and flicker in cycles between 10 seconds – 30 minutes. Power requirements are as described inTableII-9will be fulfilled by a coal-based power plant which will be built and operated by PT. Angel Nickel Industry, where this plant will be the main source of electricity and a diesel generator will be installed to cover emergency needs.

TableII-9: Load and Power Consumption

Items	Units	Data
Total installed power	kW	155,925
Equipment working power	kW	148,500
Calculated active power	kW	134,357
Calculated reactive power	kVar	52,657
Calculated cryptic power	kVA	144,307
Power factor	%	92
Annual power consumption	kWh	1,200,000,000

The distribution system to be used is specific to this project. The generator output voltage is 10 kV with a neutral non-grounding system and double circuit transmission at a frequency of 50 Hz. Load distribution will be carried out through 2 10 kV switching stations which function for diversion to backup lines in case of failure. The voltage is increased to 42 kV for furnace needs using a transformer generator unit, where the protection configuration of this unit allows for the absence of a circuit breaker. In the melting workshop, a single busbar arrangement is used. Lower voltages, 380V and 220V, use a TN-S grounding system and a single busbar with circuit breaker. The circuit breaker is designed to have 3 main changing lines, 2 spare changing lines, 4 outlets with adequate busbar equipment, and 1 spare outlet.

II.1.2.4. Balance SheetWater

Water intake from a practical point of view is divided into three types:

1. Freshwater

   Clean water intake from water sources provided by PT. IWIP. To be used as process water, several requirements are as shown inTableII-10below must be met.

2. Circulating water

   That is, water flows in a closed circuit and continues to circulate in the process. This water will be taken from the water source provided by PT. IWIP and so on will continue to circulate in the process as long as there are no leaks or other problems. The water lost in this process will be replaced by new water intake.

3. Return water

   Waste water that has gone through a processing process so that it no longer contains pollutants and can be reused for factory needs.

TableII-10: Process Water Requirements for nickel refining

pH index	Total suspended solids	Hardness	Oil content
7.5 - 8.5	<50mg/l	<10 °dH	<5mg/l

The calculation of the amount of water used is attached toTableII-11.

TableII-11: Equilibrium of Water Consumption and Supply

Water usage for	Total Usage		Circulating water	Return water	Freshwater
	(m3/day)		(m3/day)	(m3/day)	(m3/day)
A. Smelting process		**126,845**			
A.1. Cooling water use	**8,061**				
Rotary drying kilns	1,548		1,512	15	46.5
Rotary calcining kiln	3,480		3,415	36	106.5
Electric furnaces	2,988		2,847		88.5
Casting machines	45		42	1.5	5
A.2. Other uses	**118,784**				
Soot granulating water	74,232		72,022	1,282	2,228
Flushing water	44,552		39,940	1,546	2,433
B. Coal Mill		**8,196**			
B.1. Cooling water use	**6,864**				
Pulverized coal mill	540		540	4.5	16.5
Coal dust ventilation	180		180	3	6
Air compressors	6,144		5,905	61.5	186
B.2. Other uses	**1,332**				
Refrigerated dryer	1,332		1,296	13.5	40.5
C. Dust Collecting System		**3,996**			
C.1. Cooling water use	**3,996**				
Fans	2,520		4,044	21.5	76.5
Conveyors	1,476		1,440	15	45
D. Oxygen Station		**1,584**	1547		
E. Domestic Water Usage		**312**			312
Contingencies		480			
Total		**141,413**	**134,730**	**3,203**	**5,639**
per hour		5,892			

II.1.3. Processing Equipment

II.1.3.1. Main Processing Equipment

The following is a table of the main processing equipment used:

TableII-12: Type, Number and Capacity of Main Processing Equipment

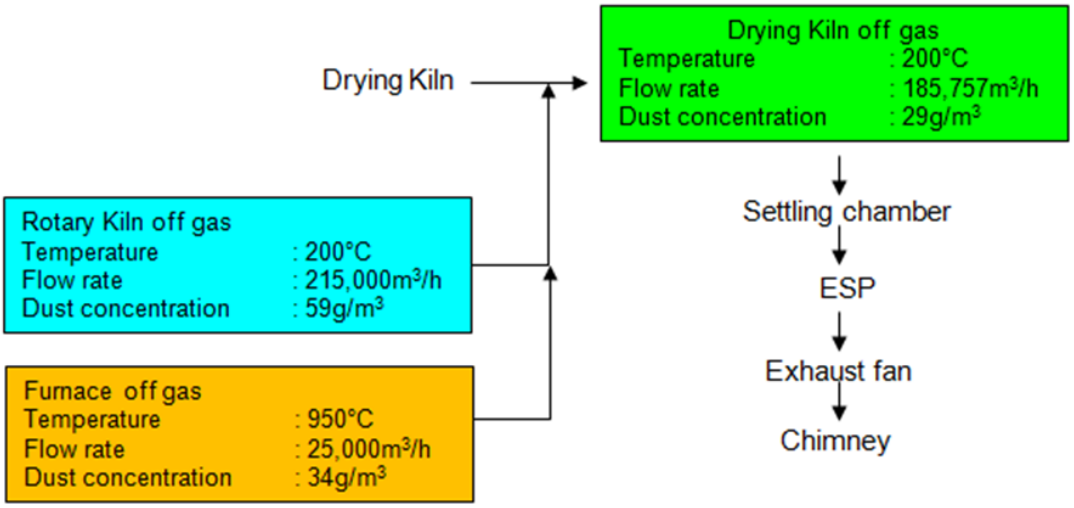
Type	Type	Amount	Specification	Workshops
Feeders	BWJ165 Plate Constant Feeder	10	Capacity: 180 t/h	Ore Feeding
	PTM1237 Constant Feeder	16	Capacity: 5-90 t/h	Batching
Jaw Crusher	PE400*600 Jaw Crusher	10	Blanking size: 40-100mm	Ore Feeding
Conveyors	B1000 Ribbon Conveyor	4	Capacity: 200 t/h	Ore Feeding
	B800 Ribbon Conveyor	4	Capacity: 200 t/h	Batching
Kilns	Drying Kilns	4	Capacity: ± 5000 t/hr Ø 5m; p = 45m; vr = 0.49-1.99 r/min	Drying
	Roasting Kiln	4	Capacity: 120t/h Øin 4.6mm; p = 100m 250 x 2 kW Slope: 3.5% vr,main =0.21-1.56 r/min vr, support =0.13 r/min	Calcining
Furnace	Arc Furnace	4	Power: 42,000 kVA Capacity: 45 t/tapping	Smelting
Vertical Mill	HRM2400 Vertical Mill	1	Capacity: 40-60 t/h Ørefiner: 2400 mm	Pulverized Coal Preparation

PictureII-5: Main Processing Equipment

II.1.3.2. Dust Management

The technology used is Electrostatic precipitators or ESP, a technology for filtration of fine particles such as dust from exhaust gases by utilizing an induced magnetic field. This tool consists of a discharge electrode (cathode) and a dust collecting pole (anode). Both play a role in ionizing the gas under the influence of an electric field, making the dust particles have a charge and collect on the electrode. When the accumulated dust reaches a certain thickness, with the effect of the vibrating device the dust particles will fall into the dust granulating hopper which passes them into the dust bag collector. The filtered flue gas is passed to the chimney through a fan, the chimney is made of steel with a height of more than 50 meters. There are 2 chimneys available for a total of 4 production lines. The fan speed will vary to adapt to fluctuating exhaust gas conditions, this is so that the motor speed can be controlled and reduce power consumption. The exhaust gas and dust handling flow is as shown inPictureII-6.

PictureII-6: Exhaust Gas and Dust Handling Circuit



The flue gas produced by the rotary kiln and electric furnace will be directed straight to the drying kiln to enter the settling chamber and follow the same route as the drying kiln flue gas: passing through the ESP and then directed to the humidification station for the recycling process, where the residual gas is disposed of. into the atmosphere through the chimney.

All flue gas and dust collection pipes adopt external thermal insulation to prevent condensation of flue gas which may cause corrosion.

II.1.3.3. Measurement Instruments

Reliable control of process parameters depends on the selection of appropriate instrumentation and its strategic placement throughout the process stages. Options taken include:

- *electric - pneumatic valve positioner*with the HART communication protocol, namely a hybrid analog+digital industrial automation protocol, to facilitate instrument calibration and validation;
- *oxygen concentration alarm*for gas phase analysis and for liquid phase an industrial pH-meter is selected;
- *actuator*The ones selected must demonstrate high reliability, low failure rates, and low maintenance costs, such as pneumatic piston or cylinder actuators.
- dustproof, waterproof, anti-corrosion and lightning protection. Considering the high potential dielectric strength in the atmosphere in some places such as heavy diesel workshops, the instrument must be equipped with explosion-proof devices.

The standards used include:

- *Process detection and using graphic symbols and letters in control flow diagram GB2625-81*
- *Design rules of controlling room HG20507-92*
- *Industrial automation instrument with power supply and voltage GB3368-82*
- *Industrial automation instrument of measuring air pressure range and quality GB4830-84*

- *Alarm signal, design requirements of interlock system HG20511-92*
- *Instrument piping, wiring design rules HG20512-92*
- *Corrosion and erosion influence of industrial automation instrument working conditions for corrosion and erosion JB/T9237.1-1999*
- *Industrial controlling computer system installation of environmental conditions JB/T9269-1999*
- *The code for fire protection design of petrochemical enterprises GB50160-92*
- *Combustible gas detection alarm design specifications of Petrochemical enterprises SH3063-94*

Temperature measurements are carried out using thermal resistance thermocouples technology which is adapted to the type of measurement needs. For NPI and slag, a rapid micro thermocouple is adopted, while temperature measurements that require non-contact measurement use radiation technology.

Pressure measurement is carried out by adopting an intelligence pressure transmitter to measure gauge pressure and a differential pressure transmitter.

Rate measurements use a thermal conductivity gas mass flow meter to measure gas speed, while for conductive liquids (such as water) use an ultrasonic flow meter or thermal conductivity flow switch, and for non-conductive liquids use a Coriolis mass flow meter.

Level measurement for solid materials uses a guided wave radar level meter and for liquid materials an ultrasonic liquid level meter and radar level gauge are used.

TableII-13: Variables and Types of Measurements used

Parameter	System	Variable	Scan type
Pressure	Smelting	Drying kilns	Control
		Electric furnaces	Detection
	Dust collecting	ESP	Detection
		Fan outlets	Detection
		Cooler outlets	Detection
		Bag dust collector	Detection
	Gas	Oxygen manifold	Detection
		Nitrogen gas manifold	Detection
	Circulating water	Hot and cold water pump outlets	Detection
Temperature	Smelting	Rotary kilns, electric furnaces	Detection
		Drying kilns	Control
	Dust collecting	ESP inlet and outlet	Detection
		Fan outlet	Detection
		Cooler outlets	Detection
		Bag dust collector inlet	Control
		Bag dust collector outlet	Detection

Parameter	System	Variable	Scan type
		ESP incubator and interlock	Detection
	Circulating water	Outlet temperature of hot and cold water pump	Detection
Rate	Smelting	Fan colling water	Detection
	Gas	Oxygen manifold	Detection
		Nitrogen gas manifold	Detection
		Hot and cold water pump outlets	Detection
Levels	smelting	Bin and alarm interlocking	Detection
		Batching feeding	Control
		Air/coal ratio of drying kiln and burning kiln	Control
	Circulating water	Cold and hot liquid tanks	Detection

II.1.4. Infrastructure

Industrial buildings, whether with a single-span or multi-span construction design, use zinc-allum column structures, with chrome steel plate roofs, and walls made of light steel structures and compressed steel plates. Supporting buildings generally adopt a reinforced concrete frame structure, as well as for floors and roofs cast-in-place reinforced concrete is chosen because of its long-lasting tenacity as a supporting structure.

The following specifications will be adopted:

- *Load code for the design of building structures GB50009-2001*
- *Concrete structure design code GB50010-2002*
- *Masonry structure design code GB50003-2001*
- *Building foundation design specification GB50007-2002*
- *Building pile foundation technical specification JGJ94-94*
- *Building anti-seismic design code GB50011-2001*
- *Structure anti-seismic design specification GB50191-93*
- *Steel structure design code GBJ17-88*
- *Foundation design code of dynamic machines GB50040-96*
- *Anti-corrosion design of industrial building specification GB50046-95*
- *Non-ferrous metallurgy construction design specification YS - 16-78*
- *Design of buildings and the code for fire protection GB50016-2006*
- *Architectural lighting design specifications GB/Y50033-2001*
- *The geotechnical engineering exploration specification GB50021-2001*
- *Funnel design specification GB50051-2002*
- *The general measurement unit and the basic terminology GBJ83-85*

Considering several aspects such as production capacity, use of heavy equipment, the presence of dust and corrosive gases, high temperatures, vibration and noise; the project pays special attention to insulation, ventilation, drainage and fire evacuation:

1. Insulation includes heat (thermal) insulation and sound insulation

2. Natural ventilation is a priority, where large amounts of waste heat and smoke are released, air inlets will be installed in the walls of the workshop, and in some workshops exhaust fans will be installed on the roof to compensate for the lack of natural ventilation.
3. The workshop roof drainage adopts two types of slopes: 5% and 2%, while the groundwater drainage is 1%. Sumps will be designed for water evacuation in places with a slope of land, in addition to gutters that will be provided if necessary.
4. The factory is equipped with emergency evacuation routes. In places where flammable and explosive materials are used, independent evacuation facilities such as basements.

TableII-14: Building List

Building Name	Length (m)	Width (m)	Construction area (m2)	Amount	Total area (m2)
Dry ore yards and batching plant (capacity ~ 72,000 t)	192	62	11,904	2	23,808
Feeding plants	84	24	2,016	2	4,032
Smelting plant	204	48	9,792	1	9,792
Ingot plant	204	34	6,936	1	6,936
Crushing and Screening	12	9	108	2	216
Wet mineral feeding plant	48	17	816	2	1,632
Vertical mill workshop	27	24	648	1	648
Operating room	48	22	1,056	1	1,056
Air compressor and dust control room	13.8	17	234.6	1	234.6
Fire house and mechanical maintenance workshop	17	9.5	161.5	1	161.5
TOTAL			33,672.10	14	48,516.10

For other supporting needs related to the processing process of PT. Angel Nickel Industry will utilize the facilities in the IWIP industrial area.

II.1.5. Fire Extinguishing System

Automatic Fire Alarm

Based on the requirements of the Automatic fire alarm system design specifications, the automatic fire alarm system in places such as the main control room, equipment room and general voltage substation is designed with fire alarm facilities such as regional fire alarm

controllers, intelligent design photoelectric smoke detectors manual alarm buttons, sound and light alarm system and fire protection telephone in the detection area.

Firefighter Network

The design of the fire pump discharge at the factory location is 1,500m3/hour and 480m3/hour at the port. Pumpmust allow power sources from electricity and diesel engines to ensure operational capability at all times. The jockey will ensure continuous pressure without interruption. At strategic locations, hydrants, fire suppression foam, water curtains and portable fire extinguishers will be placed.

II.1.6. Computer Network Systems and Monitoring

The central computer network will use three layer network protocols as the core of the communications network responsible for internet access. By adopting a star topology, the equipment switching arrangements in each building are configured with a computer network. The cable system is made of a super five-wire system.

For monitoring, industrial television monitoring systems provide intuitive video data to provide real-time scheduling, which is very useful for providing production instructions, as well as increasing efficiency. Through a transmission network connected to the control room, surveillance cameras installed in all strategic sectors in the main building can send monitoring signals to the control room. Factory security can also be monitored using this system. Taking into account interference in industrial environments, the video signal quality guarantee for the monitoring system is provided by digital network cameras and the signal is transmitted via fiber optic cable.

II.1.7. Type, Quantity, Quality/Content of Processing Results

Results of ore mineralogical characteristics tests carried out by the parent company PT. Weda Bay Nickel in the IWIP industrial area is used as data in making PT's pyrometallurgical process design. PT. Angel Nickel Industry. This is because PT. Angel Nickel Industry will buy and process ore from PT. WBN.

PictureII-7: Ore Characteristics for Refining Plant Design Basis

Ore classification		Limonite	*Earthy* Saprolite	*Rocky* Saprolite
Elements of classification		$Fe_2O_3 > 50\%$ or $MgO < 5\%$	$5\% < MgO < 22\%$ or $15\% < Fe_2O_3 < 50\%$	$MgO > 22\%$ (typically 22-35%) or $Fe_2O_3 < 15\%$
Look		Earthy	Earthy	Rocky
Occurance / dry weight proportion in the reserves	Bukit Limber	≈ 1/3	≈ 1/3	≈ 1/3
	Coastal Deposits	10-34%	90% - 66%, depending on the deposits mine	
	Kao Rahai	≈ 20%	≈ 80%	

Using a dry ore mixture formula of high grade limonite and saprolite 10/90 for input to the pyrometallurgical plant, the chemical analysis of the ore blends obtained is as shown inTableII-15.

TableII-15: Chemical Analysis of Ore Blends

		Tahun 1-3		Tahun 4-6		Tahun 7-9		Tahun 10-12		Tahun 13-15	
		Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Ni	%	1.90 - 1.92	1,91	1.90 - 1.93	1,92	1.87 - 1.91	1,89	1.88 - 1.89	1,88	1.86 - 1.88	1,87
Fe	%	13.08 - 15.05	14,16	14.67 - 15.17	14,88	14.40 - 15.40	14,92	13.96 - 14.84	14,52	14.31 - 14.85	14,64
MgO	%	22.22 - 23.72	22,81	22.33 - 22.94	22,55	21.93 - 22.52	22,18	23.72 - 24.01	23,85	19.39 - 23.82	22,14
SiO2	%	38.43 - 40.88	39,60	38.27 - 38.86	38,51	38.04 - 40.05	39,13	37.86 - 39.12	38,30	38.30 - 42.94	40,02

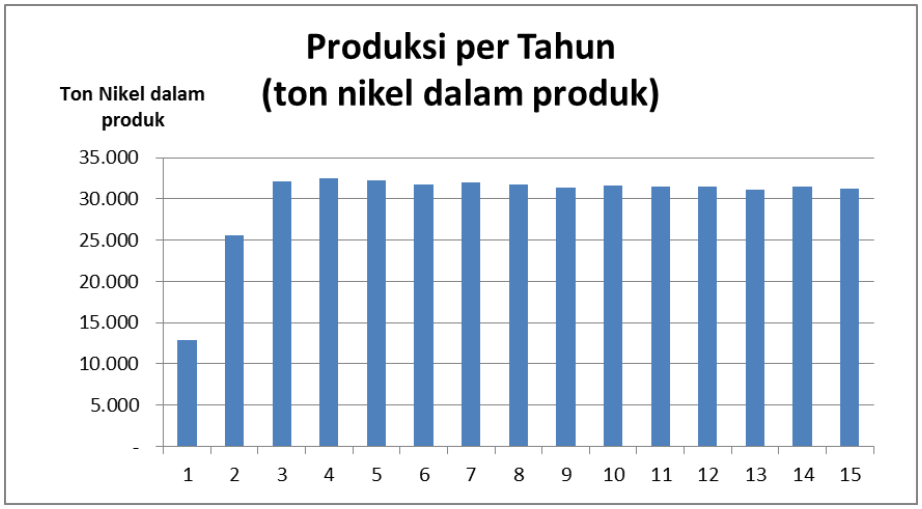
With the data above, the resulting NPI product is targeted to have a composition of nickel and other main elements as shown ininTableII-16.

TableII-16: NPI Composition (wt%)

Composition	Ni	Fe	Co	C	Cr	Si	S	P
%	11	80.54	0.69	2.01	0.55	4.4	0.35	0.01

The annual production plan can be seen atPictureII-8AndTableII-17.

PictureII-8: Annual Production Plan



TableII-17: Total Production Year to Year

20th year	Production per Year (tonnes of nickel in product)
1	12,847
2	25,574
3	32,160
4	32,476
5	32,236
6	31,792
7	31,962
8	31,728

20th year	Production per Year (tonnes of nickel in product)
9	31,335
10	31,670
11	31,553
12	31,545
13	31,187
14	31,457
15	31,219

Sample testing will be carried out to obtain an analysis of the composition of all materials starting from feed laterite ore, soot, slag, calcine products, and NPI. The analysis includes the following main elements: Ni, Co, Fe, S, C, P, CaO, SiO2, MgO, Al2O3, P2O5, CoO, NiO, FeO, Cr, Si, Cr2O, H2O. The analysis is planned to be submitted to the nearest laboratory.

II.2. Construction and Operational Activities of Steam Power Plants (PLTU)

The PLTU that was built and operated is the main supporting facility for PT's Pyrometallurgical smelter activities. Angel Nickel Industry. This power plant is designed to be able to meet the main load from the arc furnace with a load level of 33 kV. The unstable arc furnace load in the smelter production line is a big challenge for the installed power generation generator. During the operational period, apart from ensuring the electricity supply to the arc furnace, it is also necessary to ensure adequate electricity supply for other operational equipment. Therefore, in designing power plants, efforts are made to achieve an optimal configuration with adequate capacity without pursuing excessive power.

The total burden of PT's smelter activities. Angel Nickel Industry is estimated to reach 35 kV with power requirements per production line of around 40 MW. PT. Angel Nickel Industry will operate 4 production lines requiring up to 160 MW of power. The installed capacity of the PLTU was chosen at 380 MW to ensure overall operational stability and reliability.

II.2.1. PLTU Construction Activities

The PLTU area is located on the south side of the Ferronickel smelter cluster area. The diverted Trans-Halmahera Road separates the PLTU area and the smelter area.

To save investment costs, the PLTU owned by PT. Angel Nickel Industry will be designed in such a way that several complementary operational facilities will utilize shared facilities provided by the industrial area and used by several power plants within the area. Responsibility for these shared facilities lies with the industrial area manager.

These facilities include:

- Coal storage place along with transfer facilities from a special marine terminal to the storage location
- Coal crushing unit
- Start-up boiler with light diesel fuel and generator

- 8 units of diesel generator with a capacity of 2000 kW
- Air compressor system equipment
- The structure of the main buildings
- 150kV GIS (gas insulated substation)
- Energy storage unit in a lithium battery with a capacity of 50 MWh
- Seawater intake, processing and discharge unit for cooling
- Boiler water and condensate water purification units
- Raw water storage unit for other process water
- Oily waste water treatment unit
- Workshop and warehouse for equipment and machine maintenance
- Roads, street lighting and drainage in the PLTU area

The main units will be operated solely by PT. Angel Nickel Industry includes:

- Feeder units
- Boiler unit along with turbine and generator
- Transformer unit
- Flying dust capture unit (ESP: electrostatic precipitator)
- Silos for fly dust and ground dust
- Condenser unit
- Central control system
- The gas exhaust chimney is equipped with a CEMS (Continuous Emission Monitoring System)

All concrete structures, steel structures and foundation structures are designed according to the specifications of the People's Republic of China:

- Small thermal power plant design specifications (GB50049-2011)
- Technical regulations for the design of small thermal power plants (DL5000-2000)
- Thermal power plant building design procedures (DL/T 5094-2012)
- Technical regulations for civil engineering structure design of thermal power plants (DL5022-2012)
- Concrete structure design specifications (GB50010-2010)
- Technical regulations for the design of stone building structures (GB50003-2011)
- Building structure load specifications (GB50009-2012)
- Building seismic design specifications (GB50011-2010)
- Structural seismic design specifications (GB50191-2012)
- Technical specifications Removal of building foundations (JGJ79-2012)
- Building foundation design specifications (GB50007-2011)
- Technical specifications for building pile foundations (JGJ94-2008)
- Specifications for fire protection design of thermal power plants and substations (GB50229-2006)
- Architectural design standards for thermal power plant buildings (DL/T5029-2012)
- Steel structure design specifications (GB50017-2003)
- Design and construction procedures for steel-concrete combined floor structures (YB9238-92)

- Chimney design specifications (GB50051-2013)
- Building specifications for collapsible loess soil area (GB50025-2004)
- Power machine basic design specifications (GB 50040-96)

Construction activities will be handed over to PT. IWIP is the area manager and is part of the services provided by the area manager.

II.2.2. PLTU operations

The PLTU that will be built applies Supercritical Steam Generation technology using pulverized coal (coal powder) as fuel to produce steam in supercritical conditions (temperature 540 - 580°C and pressure 22.1 - 25 MPa). This technology has higher efficiency than Subcritical Steam Generation which operates at pressures below 22 MPa. The amount of coal needed is less, so the emissions produced are also lower.

II.2.2.1. Coal Storage in the Coal Stockyard

The coal stockyard for the PLTU will be made in an area of ±15 ha with a stockpiling area of ±11 ha and a pile height of 5 m. The storage capacity is around 700,000 tons for the operation needs of the three boilers for 30 days. The coal stockyard location is on the east side of the main building and adjacent to the special terminal. The coal storage facility is a facility that is shared with other power plants in the IWIP industrial area and its operation is the responsibility of the industrial area manager.

The storage area is divided into 2 parts: wet coal storage area and dry coal storage warehouse. The wet coal storage area is open land with an area of ± 8 ha which is divided into 2 storage areas. The dry coal warehouse will be designed closed with dimensions of 105 m x 250 m and the humidity inside will be controlled so that the water content in the coal can be reduced. The coal stockyard will be equipped with a water spraying system that functions to control dust and handle the possibility of self-heating and spontaneous ignition. The base of the storage area is covered with C30 class concrete with a thickness of 100 mm and reinforced with a steel frame.

*Stockyards*will be equipped with drainage built around the land and two coal leachate storage ponds on the east and west sides of the land. The holding pond consists of an oil trap and a settling pond. Water that has gone through the oil separation and settling process will be reused in the dust control system and self-combustion treatment in the stockyard area.

A conveyor belt system will be placed in the stockyard to distribute coal transported from a special terminal to the stockpiling area. The length of this conveyor belt system is 500 m with a width of 2 m and a transport capacity of 4,500 tons/hour at a speed of 3.5 m/second. There are 2 transfer stations (transfer towers) to distribute coal in both heap areas. At each transfer station a dust control system will be installed.

From the storage area, coal will be taken using 2 bucketwheel stacker/reclaimer units to be placed into a second conveyor belt system leading to the coal grinding unit (crusher). The second conveyor belt system consists of two lanes with a width of 1.4 m each and a transport capacity of 1,500 tons/hour at a speed of 2.5 m/second.

Four underground hopper units will also be prepared in the dry coal warehouse as backup equipment if the conveyor or reclaimer unit is not functioning properly or is undergoing maintenance.

The Coal Stockyard plan can be seen atPictureII-9.

II.2.2.2. Coal milling

The coal grinding unit (crusher) that will be used is a ring hammer type equipped with a roller screen to classify the grinding results. The capacity of each grinder is 1,000 tons/hour and the roller screen capacity is 1,500 tons/hour. The roller screen specifications were chosen to be able to separate particles up to ≤ 30 mm with an efficiency of up to 90%.

The milling results are brought to 5 Coal Bunker units located in the main building using a 2-lane conveyor belt. The area of the coal warehouse is 10 m x 230 m. The height of the coal warehouse is 45 m which is divided into 5 levels. The conveyor belt from the crusher enters the coal warehouse at a height of 38.7 m. The bottom of the warehouse is equipped with a maintenance area, feeder machine and coal grinding machine (pulverizer). Each bunker is equipped with 1 feeder unit and 1 pulverizer unit, so the total of each unit installed is 5 units. One feeder and pulverizer device is spare equipment. The bunker outlet is installed with an isolation valve which functions to prevent leakage of fine coal from the bunker and vibrator to prevent blockage.

The feeder unit functions to provide a controlled flow of coal from the bunker to the pulverizer based on combustion needs. The feeder unit used is a gravimetric type which operates by measuring the weight of the incoming coal. The feeder unit is installed at a height of 12.6 m.

The pulverizer unit grinds the coal from the feeder until it becomes a powder measuring ≤300 μm. Each pulverizer unit is equipped with 2 primary fan units (primary wind / primary air generator) to dry and convey coal powder with the desired particle fineness to the boiler. The primary fan is divided into two paths, one path carries hot primary air that has passed through the preheater, the other path is used as cold, pressurized primary air. By controlling the hot primary wind and cold primary wind at the pulverizer inlet, the required temperature and flow of the powder making dryer is obtained. An air volume measuring device is installed at the inlet to measure the volume of incoming primary air and make it easier to adjust the coal combustion air. Coal powder that is not the right size will return to the pulverizer to be ground again, hard objects or foreign objects that are not easily crushed will be removed from the pulverizer through the discharge valve. The remaining waste will be stored in a simple closed container that can be easily moved using a forklift.

The coal powder that comes out of the pulverizer unit is carried by the primary wind through 4 pipes to the same boiler to be burned.

II.2.2.3. Steam Generation (Steam Generator / Boiler)

Light fuel oil or diesel will be used for initial combustion of the boiler and for flame stabilization during low-load operations and as a combustion supplement when burning coal in a wet state. Diesel fuel is taken from a storage tank managed by the area manager.

The boiler unit that will be used is the Supercritical (SC) once-through steam generator type. Pulverized coal is used as fuel to heat boiler water in the superheater and reheater pipes in the boiler, thereby producing a high-pressure steam flow needed to drive the turbine.

The main steam pipe is routed out from one side of the superheater outlet and connected to the main steam valve at the front of the high pressure turbine head. The high temperature reheat

steam pipes are directed out from both sides of the reheater outlet, combined into one pipe outside the boiler and then divided into two steam pipes, each connected to a medium pressure combination steam valve on the left and right sides of the medium pressure turbine. The low pressure steam that comes out of the turbine steam exhaust pipe is divided into two pipes connected to the reheater inlet.

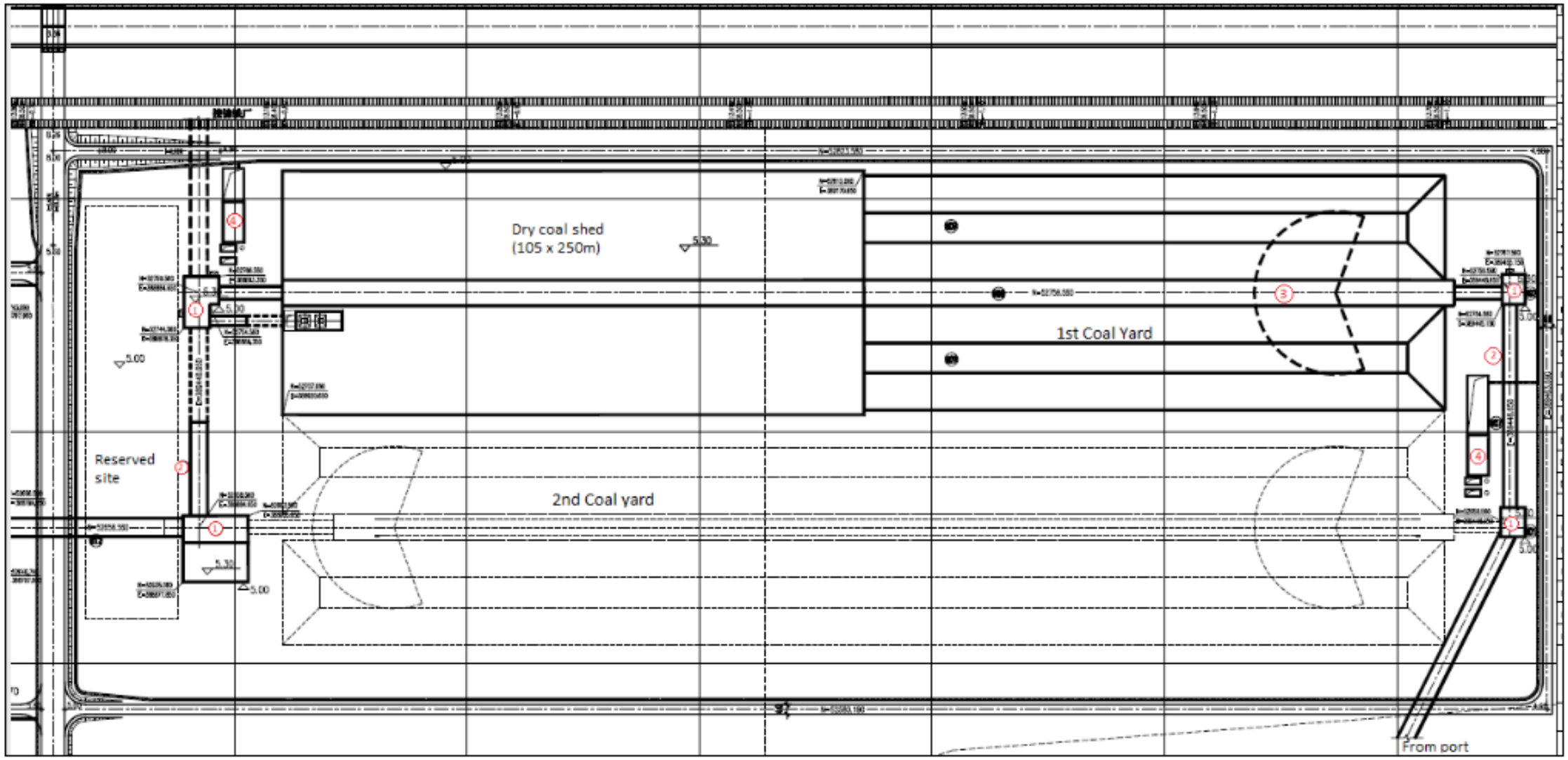
The main steam pipe and reheat steam pipe will each be equipped with valves leading to drainage to remove condensate from the pipe if a disturbance occurs so that the turbine is protected from condensate water. Each drainage pipe is connected to an expansion container in the condenser. Attemperator / water spray will also be provided in the main steam pipe and reheat steam pipe to anticipate overheating in the pipe system. The steam flow scheme in the boiler and turbine can be seen inPictureII-10.

In addition to the main steam generator system, a bypass system with a capacity of 60% BMCR is designed to increase boiler flexibility in dealing with fluctuating operational loads, improve boiler performance, and shorten boiler start-up time.

High pressure bypass steam is removed from the main steam pipe, after experiencing a decrease in temperature and pressure it will flow to the reheater. Low pressure bypass steam is removed from the reheater steam pipe, after experiencing a decrease in temperature and pressure it will flow to the condenser.

The main steam pipe uses an inner diameter seamless steel pipe manufactured according to the American ASTM A335P91 standard. The high temperature reheat steam pipe uses seamless steel pipe manufactured according to the American standard ASTM A335P91, while the low temperature reheat steam pipe uses A691Gr.1-4CrCL22 (high exhaust before control valve) and A672B70CL32 (after control valve).

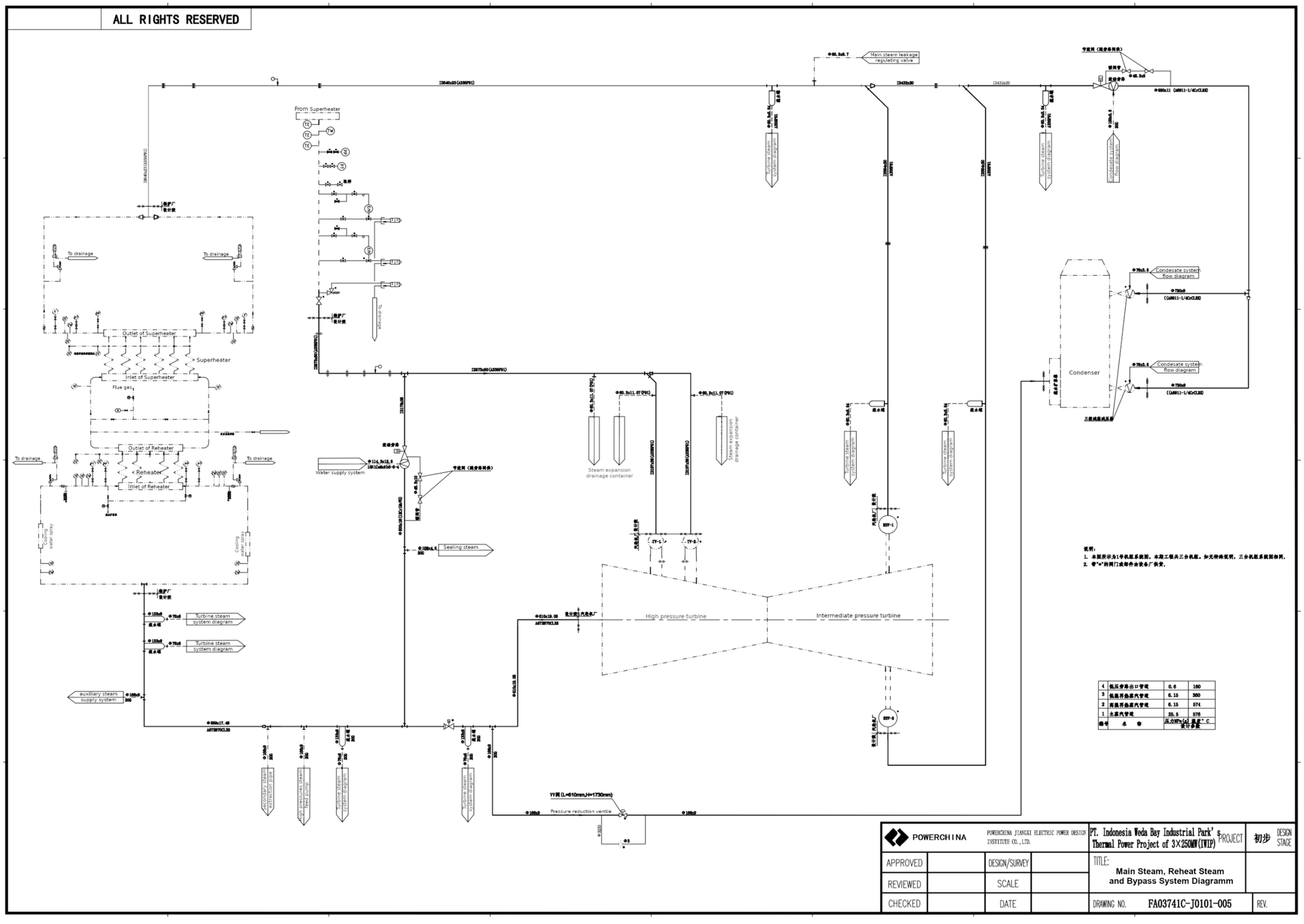
PictureII-9: Coal Stockyard Plan



Information:

1. *Transfer towers*
2. *Conveyor belt corridor*
3. *Bucket-wheel stacker reclaimer*
4. *Coal water ponds*

Picturell-10: Steam Flow Scheme in Boilers and Turbines



II.2.2.4. Power Generation, Transformers, and Energy Storage

The rotating turbine will cause the generator to produce electrical voltage. With a generator output of 380 MW, it will produce electrical energy of 380 MWh/hour. In a year, 1,800 GWh of electrical energy will be produced for an operating time of 7,200 hours/year.

The generator outlet voltage used is 18 kV. From the generator, the voltage will be increased to 150 kV at the transformer unit located at the substation. The three boilers being built will be connected to the transformer. This high voltage transformer unit applies Air-Insulated Switchgear (AIS) to isolate the voltage. The internal insulating gas used is Sulfur hexafluoride (SF6). The substation location is located on the north side of the main building.

From the 150 kV substation, the voltage will be reduced to 35 kV and then channeled via high voltage cables to the Smelter area. The transmission capacity of a 35kV substation is 160 MVA.

Excess power that is not used will be stored in energy storage using a lithium battery with a capacity of 50 MWh. The stored energy is used to meet peak demand and stabilize the power grid.

II.2.2.5. Boiler Water Processing (boiler make-up water) and Condenser Water

Boiler Water

The water used to drive the turbine is taken from the area's clean water network which is further processed in the boiler water purification unit (purification) in the PLTU area. The boiler water purification unit is included in the facilities shared by other power plants in the industrial area and its operation is the responsibility of the area manager.

In the purification unit, water will be treated through a membrane filtration process and demineralization process to remove dissolved substances, minerals and bacteria which can cause scale, corrosion or biofouling in boilers and turbines. Boiler water will be used in a closed cycle so that the large need for clean water only occurs at the start of the PLTU's operation. As long as operation is stable, the amount of water that needs to be added to the system is only equal to the amount of water lost in the process.

Raw water that is processed to become boiler water must meet certain quality standards to avoid damage to pipes and turbines that are in direct contact with the steam produced by the boiler. The boiler water quality standards used refer to the standards set by the People's Republic of China GB/T12145-2016 (TableII-18).

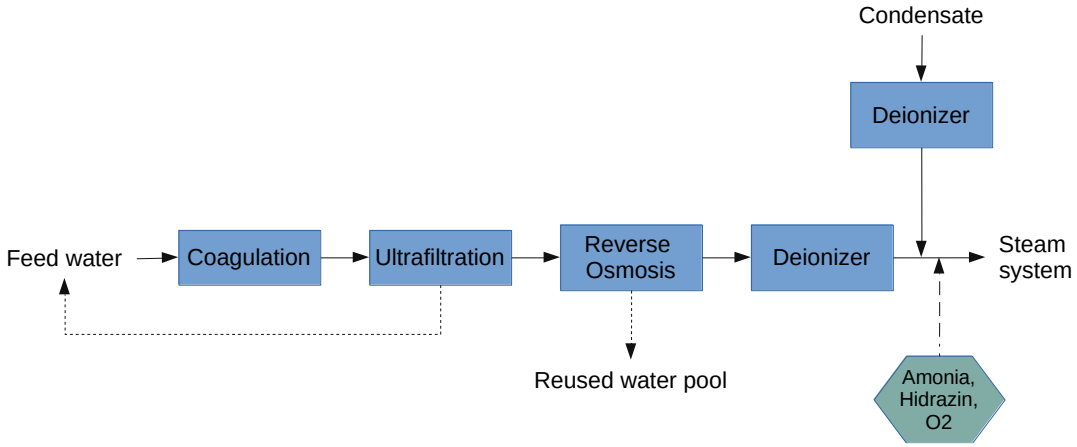
TableII-18: Boiler Water Quality Standards used

Parameter		Units	Standard value at outlet	
			Volatility processing	Oxygen processing
pH (25°C)	Copper system		8.8 - 9.3	8.5 - 9.0
	Copper-free system		9.2 - 9.6	8.0 - 9.0
Dissolved oxygen		µg/L	≤ 7	10 - 150
Hydrazine		µg/L	≤30	-

Parameter	Units	Standard value at outlet	
		Volatility processing	Oxygen processing
Conductivity (25°C)	µS/cm	≤0.10(expected≤0.08)	≤0.15 (expected≤0.10)
SiO2	µg/L	≤10 (expected≤5)	
Iron	µg/L	≤5 (expected≤3)	
Copper	µg/L	≤2 (expected≤1)	
Sodium	µg/L	≤2 (expected≤1)	
TOC	µg/L	≤200	
Chloride	µg/L	≤1	

The boiler water supply system is equipped with 2 pump units which are operated at 50% of their capacity. No pump backup. The technology chosen for the purification process is coagulation, followed by ultrafiltration combined with two stages of reverse osmosis, then continued with the demineralization process using a mixed-bed deionizer. After going through a series of purification processes, boiler water flows through a deaerator to reduce dissolved oxygen levels which can cause corrosion in steam pipes and turbines before entering the steam pipe system in the boiler (PictureII-11).

PictureII-11: Boiler Water and Condensate Purification Process



The purification unit capacity is designed at 75 m³/hour. Two lines of purification units will be provided, where one line is a reserve unit. The coagulation tank is designed for 200 m³. Permeate and backwashing water from ultrafiltration containing high TSS and COD can be returned to the initial treatment pond for reprocessing. Waste water from the reverse osmosis process can be stored in recycled water storage ponds and then reused for various purposes, such as in dust control waterspray systems. Clean water that has been processed in the demineralization stage is then stored in a demineralized water tank with a capacity of 2 x 2000m³. From this tank, the water then flows together with the condensate water to the steam generation system.

The water produced from this purification process must meet the following standards:

Hardness :± 0µmol/L
Siliconedoxide : ≤10µg/L

Conductivity (25℃) : ≤0,15µS/cm
TOC : ≤ 200µg/L

To maintain the mixed-bed deionizer, a solution of hydrochloric acid (HCl) and sodium hydroxide (NaOH) will be used as a regenerator. The necessary acid and base concentrates will be transported from the area's chemical storage warehouse using tank trucks. The HCl (31%) and NaOH (32.5%) concentrates are stored in a storage tank in the water purification unit area. The acid and base concentrates are then diluted to the required concentration and then put into a deionizer which will be regenerated using an injector. The temperature of the regeneration solution was set at 35°C to increase the effectiveness of the regeneration.

The acid and alkaline storage tank capacity is designed for 15 days' needs. The storage tank area will be equipped with a weir and shower as part of the safety and worker protection system.

Condensate Water

The low temperature steam that comes out of the turbine after passing through the expansion valve to reduce the pressure will flow to the condenser, where this steam will be condensed and flowed to the condenser water purification unit before being used again in the steam generator unit. Condensate water comes out of the condenser at a pressure of 3.63 MPa and a temperature of 43°C. The condenser that will be used is a surface condenser type with direct cooling of sea water at a design temperature of around 30°C.

The condensate treatment system consists of an oil trap unit and 3 deionizer units (1 unit as a backup). The amount of condensate to be processed is 644 m³/hour. The maximum capacity of the processing unit is 740 m³/hour. To prevent corrosion in the steam pipe system, ammonia, hydrazine and oxygen will be added to the condensate in the processing outlet pipe. The concentration of hydrazine and ammonia will be controlled, so that the remaining hydrazine concentration is around 20 - 50µg/L and the pH value is 9.0 - 9.5. The quality of condensate water after processing must meet the quality standards inTableII-19.

TableII-19: Condensate Water Quality Standards after Treatment

Parameter	Units	Standard value at outlet	
		Volatility processing	Oxygen processing
Conductivity (25°C)	µS/cm	≤0.10(expected≤0.08)	≤0.15 (expected≤0.10)
SiO2	µg/L	≤10 (expected≤5)	
Iron	µg/L	≤5 (expected≤3)	
Copper	µg/L	≤2 (expected≤1)	
Sodium	µg/L	≤2 (expected≤1)	

II.2.2.6. Refrigeration Unit Operation

Sea water is taken from a sea water intake unit equipped with two pumps for each boiler. The capacity of each pump is 5.4 m³/sec. The seawater intake structure will be built in a special terminal area at a depth of - 3 m, where the piping system will have a diameter of about 4,500 mm and a length of about 260 m. A total of 9 pipes will be built in the initial

stage. A series of filter equipment will be used in the sea water intake system consisting of bar screens and traveling screens to prevent marine biota or other solid objects from entering the water intake system. Equipment that comes into direct contact with sea water will be selected to be resistant to sea water corrosion and equipped with cathodic protection.

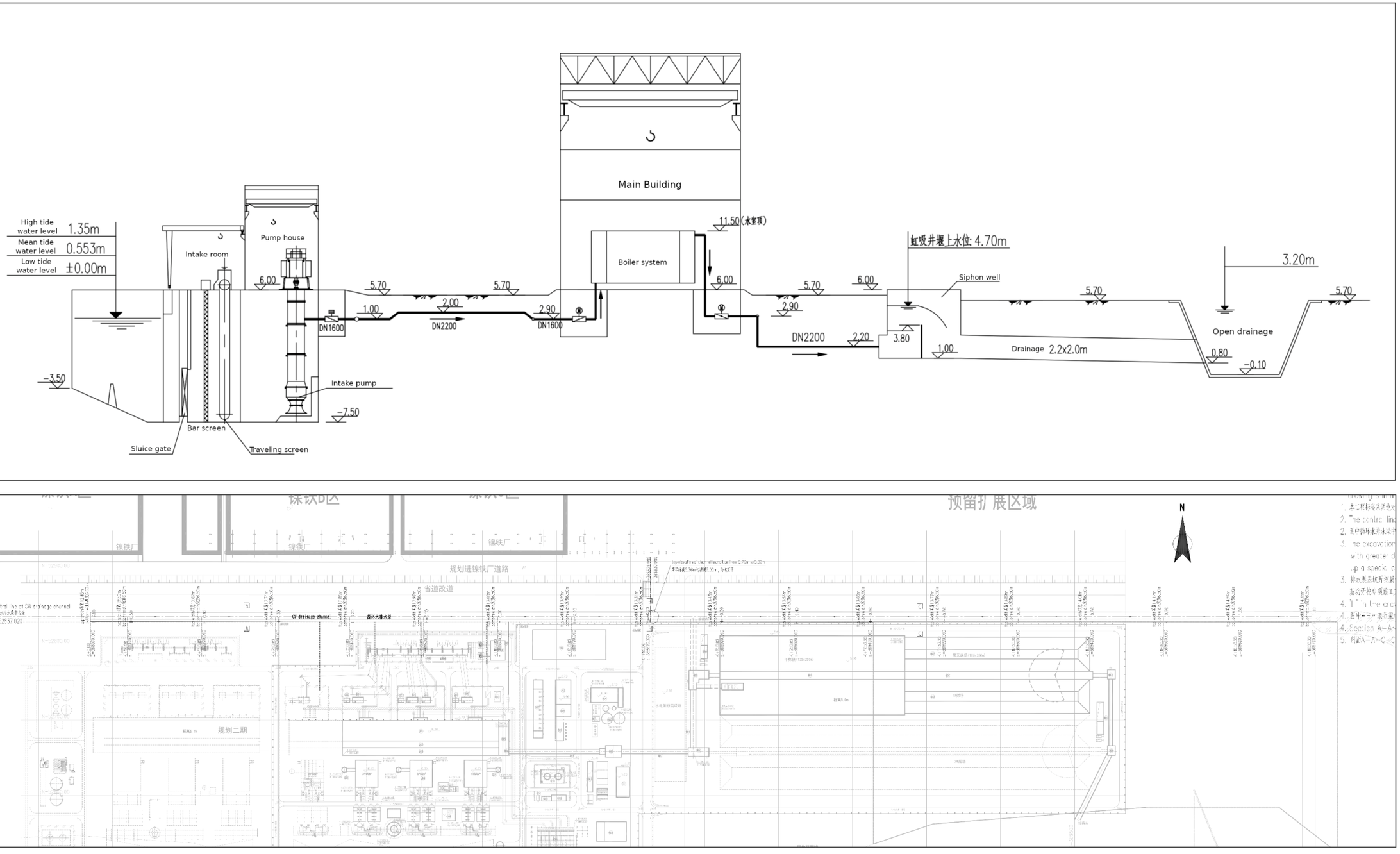
Two cooling water circulation pumps will be placed on the south side of the PLTU area for each boiler. Seawater will be chlorinated to prevent biofouling in the cooling water network. Chlorination is carried out using an electrochlorination process which converts salt in seawater as a source of chlorine, so there is no need to use additional chemicals. Chlorination was carried out continuously at a concentration of 1.0 ppm. Shock chlorination to control biofouling in the entire system was carried out at a concentration of 3.0 ppm.

From the intake unit, the processed seawater flows to the condenser to cool the boiler steam. The sea water that has passed through the condenser is then flowed through a closed pipe to an open channel, where additional cooling sea water will be mixed. From this open canal, sea water is then channeled into the regional drainage canal which flows towards the sea (PictureII-12).

The open channel is located on the north side of the substation and is built using trapezoidal concrete. The width of the base is about 6.4 m, the length of the channel±1.7 km with a slope of 1‰, Andchannel bottom depth 5.15 - 6.8 m.

The increase in cooling water temperature will be controlled below 7°C, so that when warm water is released into the sea, negative impacts on aquatic biota communities that are sensitive to increasing water temperatures can be avoided. Disposal of hot water will meet the quality standards stipulated in the Minister of Environment Regulation Number 8 of 2009 concerning waste water quality standards for thermal power generation businesses and/or activities.

PictureII-12: Cooling Water Network Scheme and Open Sewer Layout



II.2.2.7. Bottom Ash and Fly Dust Management System

Ash that falls to the bottom of the boiler from the remaining combustion products will be removed using a closed steel conveyor connected to the slag cooler. To avoid large slag which can affect conveyor operations, the bottom ash outlet is equipped with a slag crushing device which can crush slag up to <30 mm. Each boiler is equipped with 1 conveyor unit and 1 slag crusher unit which can process up to 5 tons/hour.

Cooling air enters from the end of the conveyor. In the conveyor, heat exchange occurs between the cooling air and the hot bottom ash, so that the ash temperature drops to below 100°C and the air temperature rises to 300°C. This hot air is used as combustion air which is fed into the boiler. This cooling air volume is controlled to obtain an optimal air coefficient for boiler operation.

After cooling, the bottom ash is stored in an ash silo with an Ø 6 m and an effective volume of 40 m^3. Each silo can store bottom ash from 52 hours of boiler operation. The basic ash silo is equipped with 1 ash conditioning unit with an output of 100 tons/hour which functions to increase the humidity of the ash by mixing water so that the ash does not easily spread into the air when moved. Each silo is also equipped with 1 unloader unit with an output of 100 tons/hour and can separate dry ash from wet ash. The ash that is released is then transported by truck to a temporary ash storage area managed by the industrial area manager.

The flying dust contained in the combustion gases will be carried by the induced wind produced by four induction fan units (1 unit as a backup). The induced wind speed is 6 m^3/min with a wind pressure of 65 kPa. Dust will be filtered through an ash control unit (ESP) with an efficiency of 99.4%. ESP utilizes a physical process where particulates suspended in a gas flow are charged in a corona field. Each part of this magnetic field will be equipped with a high voltage electric power source. The three aspects of this process are:

- Provides a charge to suspended particulates;
- Collects particulates using magnetic fields; And
- Captures particulates from capture and discharge surfaces.

This ESP is designed to achieve a particulate emission concentration of no more than 50 mg/Nm3. Each boiler is equipped with two double chamber ESP units which can be operated separately for ease and flexibility of operation. Underneath the ESP unit is equipped with hoppers to collect the dust that has been collected. The hoppers are connected to a pneumatic conveyor which utilizes compressed air to transport dust particles. The installed air compressor has a capacity of 20 m^3/min with an outlet pressure of 0.8 MPa. Three compressor units will be installed for 3 boilers, of which 1 unit is a backup unit.

Fly dust captured in the ESP will be stored in a silo with an Ø 10 m and an effective volume of 800 m^3. The silo capacity is designed to store flying dust from 58 hours of boiler operation. For operation of 3 boilers, 2 flying dust silos will be provided. Below the flying dust silo will be equipped with a dry dust dispensing unit with a capacity of 100

tons/hour. The dust released is then transported by truck to a temporary ash storage area managed by the industrial area manager.

An estimate of the amount of bottom ash and fly dust produced by each boiler can be seen inTableII-20.

TableII-20: Estimated Bottom Ash and Fly Dust produced by Each Boiler

	Hourly amount(ton)	**Amount per day1**(ton)	**Amount per year²**(ton)
Basic ash	0.82	18.04	5,900
Flying dust	7.3	160.6	52,560

[1]One day's operating time is calculated as 22 hours
[2]Operating time per year is 7,200 hours

II.2.2.8. Combustion Residual Gas Emission Control System (Flue Gas Desulphurization and Denitrification)

The coal fuel that will be used has a very low sulfur content (<2%). Therefore, direct disposal of combustion gas will remain below the SO2 emission quality standard set at 750 mg/Nm³ in the Minister of Environment Regulation Number 21 of 2008 concerning stationary source emission quality standards for power generation businesses and/or activities. thermal electricity.

The design of the combustion process in the boiler will take into account the NOx formation process. By controlling the combustion process and temperature in the boiler, NOx formation can be reduced, so that the NOx emission quality standards in Ministerial Regulation Number 21 of 2009 concerning stationary source emission quality standards for thermal power generation businesses and/or activities can still be met.

The boiler is equipped with 2 units of 50% capacity primary fans, 2 units of 50% capacity blowers and 2 units of 50% capacity induction fans. The flue gas system uses a balanced ventilation method, by matching the power of the blower and induction fan to balance the boiler pressure. After the cold air released by the blower goes through the preheater heating, the air is used as secondary air for broiler combustion. Combustion exhaust gas (flue gas) which is sucked in by the induction fan after passing through the air preheater and electrostatic precipitator will enter the chimney and ultimately be discharged into the atmosphere.

The chimney structure will be made of concrete with a height of 150 m and an outer diameter of 9.5 m. The exhaust gas temperature shall not exceed 150°C. The exhaust gas content is estimated as inTableII-21.

TableII-21: Pollutant Concentration in Exhaust Gas

Pollutant	Exhaust gas concentration* (mg/Nm3)	
	Coal check	Emission standards LH Ministerial Decree 21/2008
Dust	73.8	300
SO2	435	750
NOx	300	750

*Measured at an O2 level of 7%

Land for a desulfurization and denitrification unit will be provided on the south side of the combustion exhaust gas chimney unit. The installation of desulfurization and denitrification units will be built when regulations regarding thermal power plant emission control tighten and can no longer be met with existing systems.

The chimney will be equipped with a continuous emission monitoring system (CEMS) at a height of 40 m to monitor exhaust gas concentrations. In accordance with Minister of Environment Regulation No. 21 of 2008 concerning Quality Standards for Stationary Source Emissions for Thermal Power Generation Businesses and/or Activities, the parameters that will be monitored through CEMS include SO2, NO2, TSP, and opacity. An ash particle monitoring system will be installed on the chimney with a certain correlation of opacity (%) and emission concentration. Additionally, sensor units for cleaning will also be provided. An ultrasonic type flow meter will be used for continuous monitoring and installed on the chimney.

II.2.3. Input Materials

II.2.3.1. Consumables

Coal

The coal that will be used as the main fuel for the boiler will be purchased from a supplier from Kalimantan. Coal purchasing and storage will be carried out by the industrial area manager. Coal consumption per hour is estimated at 151 tons (BMCR operational conditions), so the need for 7,200 operational hours a year is estimated at around 1,087 kilotons/year.

The required coal specifications can be seen atTableII-22.

TableII-22 Coal specificationsfor PLTU

Parameter	Symbols	Units	*Design coal*	*Check coal*
Receiving Moisture content	Mar	%	30	35
Receiving ash content	Aar	%	5	5
Dry ash free of carbon content	Cdaf	%	68.57	68.2
Dry ash free of hydrogen	Hdaf	%	5.16	5.7

Parameter	Symbols	Units	*Design coal*	*Check coal*
Dry ash is oxygen free	Odaf	%	24.76	23.17
Dry ash is nitrogen free	Ndaf	%	1.18	1.13
Dry ash free of Sulphur	Sdaf	%	0.33	1.8
Air dried Moisture content	Mad	%	18	18
Receiving volatile content	Var	%	35	35
Receiving carbon content	Car	%	30	25
Received gross calorific value	Qgr, ar	kcal/kg	4,200	4,000
Received net calorific value	Qnet, ar	kcal kg	3,865	3,639
Hardgrove grindability index	HGI		60	50
Ash deformation temperature	DT	℃	1,150	1,050
Ash shrinkage temperature	ST	℃	1,200	1,100
Ash hemisphere temperature	HT	℃	1,250	1,150
Ash flow temperature	FT	℃	1,300	1,200
Ash composition analysis				
Silica	SiO2	%	16	34
Aluminum oxide	Al2O3	%	9	6
Ferric oxide	Fe2O3	%	36	39
Calcium Oxide	CaO	%	19.7	10
Magnesium oxide	MgO	%	10	5
Potassium oxide	K2O	%	1.3	1.3
Sodium oxide	Na2O	%	0.18	0.71
Titanium dioxide	TiO2	%	0.48	0.48
Phosphorus pentoxide	P2O5	%	0.51	0.51
Sulfur trioxide	SO3	%	2.83	1
Manganese oxide	Mn3O4	%	4	2

Solar

Light diesel fuel will be used to operate the boiler start-up, support the combustion process in the main boiler, operate the boiler at low load and operate the emergency generator. The purchase and storage of diesel will be handed over to the industrial area management. To support operational activities of power plants in industrial areas, PT. IWIP will build a solar storage and distribution system. In the initial stage, it is planned to build a tank with a capacity of 2 x 300 m^3 equipped with 3 inlet pumps, 2 outlet pumps and other supporting facilities.

The required diesel specifications can be seen atTableII-23.

TableII-23: Solar Specifications for PLTU

Parameter	Units	Average value
Kinematic viscosity (20°C)	10-6·m2/s	3.0~8.0
Flash point (closed)	°C	≥ 65
Freezing point	°C	≤ 0
10% residual carbon	%	≤ 0.4
Actual gum	mm/100ml	≤ 70
Acidity level	mm/100ml	≤ 10
Soluble in water (Acid or alkali)		No
Sulfur	%	≤ 0.2
Ash	%	≤ 0.025
Humidity	%	Trace
Mechanical impurities	%	No
Low calorific value	kJ/kg	± 41,870

Additional Boiler Water (make-up boiler water)

The water requirement to replace boiler water periodically for three boiler operations is estimated at 61 m³/hour or 439,200 m³/year at 7,200 hours/year of operation. Estimated steam losses in the boiler are shown inTableII-24.

TableII-24: Additional Boiler Water Estimates

Additional water requirements	Quantity (tons/hour)
Estimated water vapor loss in the system	50
Other estimated losses	3
Additional demineralized water for abnormal conditions	8
Total additional water required	**61**

Sea water

The total use of sea water for cooling 3 boilers is around 115,000 m3/hour, or 830 million m³/year with operating hours per year at 7,200 hours. Each boiler requires 10.67 m³/second of cooling water.

Additional Chemicals

Some chemicals that will be used in PLTU operations:

1. PAC (Polyaluminium chlorid) and PAM (Polyacrylamide) coagulants for industrial raw water processing.
2. HCl (31%) and NaOH (32.5%) solutions are used to regenerate the deionizer in the boiler water and condensate water purification process.

3. Ammonia, hydrazine and oxygen gas (99%) are used as chemical additives in the processing of boiler water and condensate water.
4. SF6 gas is used as an insulator gas in high voltage substations.

II.2.3.2. Water Balance

The PLTU's main source of fresh water is taken from raw water provided by the industrial area. To maintain water availability for PLTU operations, reservoir ponds with a semi-underground structure will be built in the PLTU area: one pond with a capacity of 400 m³ (14.8m x 7.4m x 4m) for boiler water supply and two ponds with a capacity of 600 m³ (14.8m x 11m x 4m) for other needs including fire extinguishing system needs.

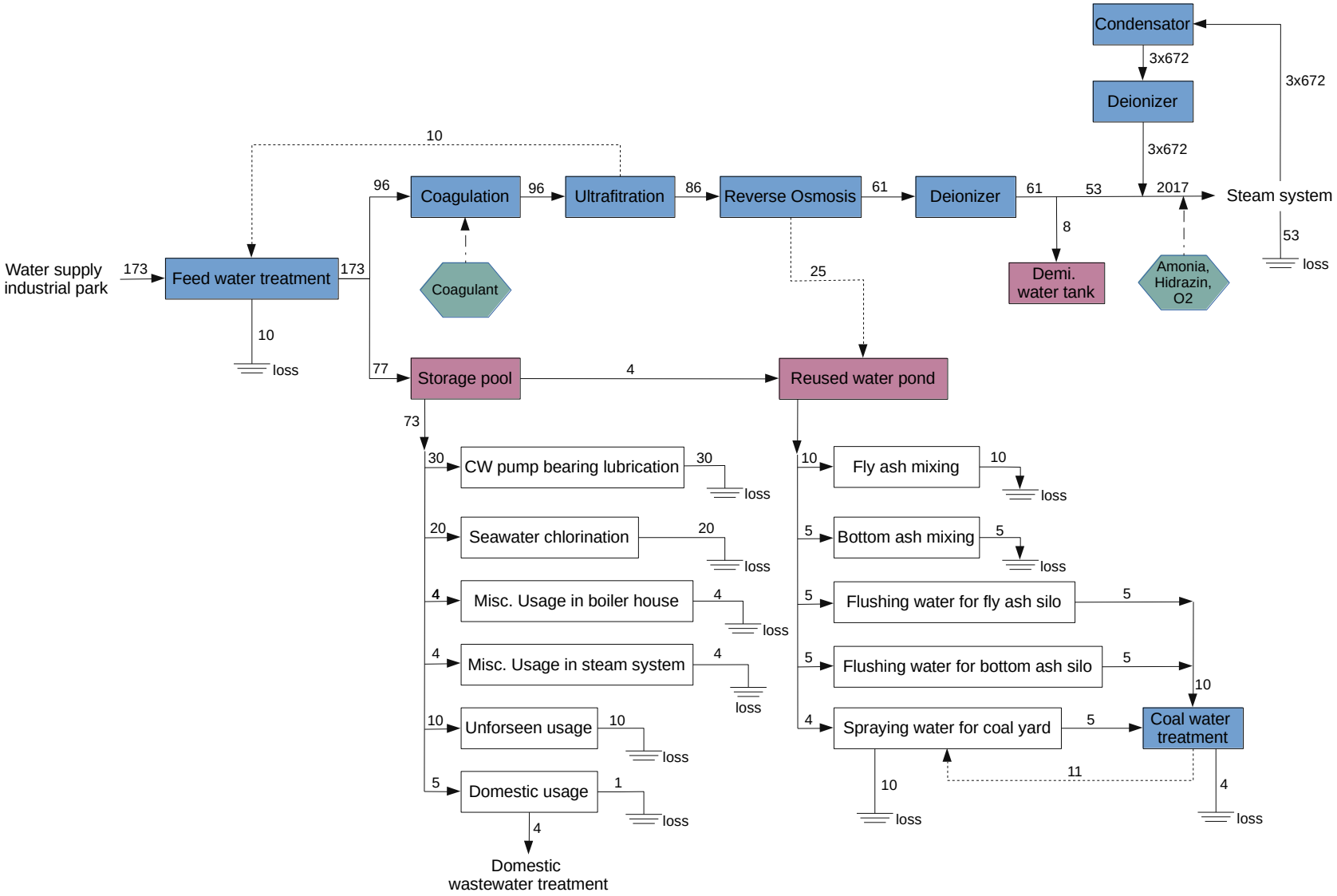
The water balance of PLTU activities is shown inTableII-25AndPictureII-13following.

TableII-25: Balance of Fresh Water Use in PLTU

Water User Process	Amount of water (m³/hour)			
	Used	Recycle	Lost	Exit/saved
Industrial Raw Water				
Addition of boiler water	96	35	53	8
Cooling water pump bearing lubricant	30	-	30	-
Chlorination of sea water	20	-	20	-
Various uses in boiler rooms	4	-	4	-
Various uses in steam systems	4	-	4	-
Unexpected water use	10	-	10	-
Domestic activities	5	-	1	4
Addition to the recycled water pool	4	-	-	-
Losses from industrial water treatment	-	-	10	-
Sub-Total	**173**	**35**	**132**	**12**
Recycled Water				
Humidification of flying dust	10	-	10	-
Humidification of falling ash	5	-	5	-
Watering silo floor flying dust	5	5	-	-
Watering the floor of the silo falling ash	5	5	-	-
Flushing of coal transportation and storage systems	15	1	14	-
Sub-Total	**40**	**11**	**29**	**0**
Total	**213**	**46**	**161**	**12**

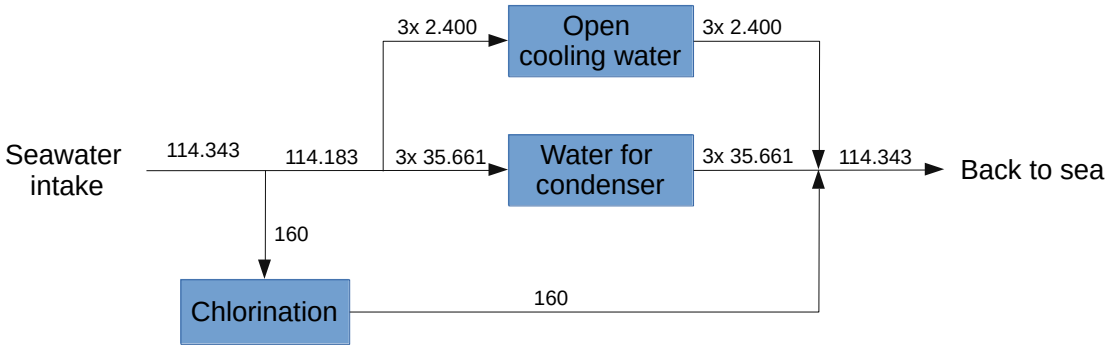
Notes: Figures are estimates of average hourly water usage. Not included in this is the use of water for a desulfurization system that has not been installed and the use of water in abnormal conditions.

PictureII-13: Balance Diagram of Fresh Water Use in PLTU



Sea water will be used specifically as cooling water. The balance of sea water use can be seen inPictureII-14.

PictureII-14: Balance of Sea Water Use in PLTU



II.2.3.3. Transport materials

The largest material transportation that will be carried out is the transportation of coal, which is the main fuel for the PLTU. Coal is transported from suppliers to special terminals by sea using bulk carriers with a transportation capacity of 50,000 - 100,000 tons/vessel. To meet coal needs per month, it is estimated that there will be the movement of 2 - 3 bulk vessels.

From the special terminal the coal is unloaded to the transfer station using an unloader. From the transfer station, the coal is then sent to the coal stockyard using a reclaimer, conveyor belt and transfer station. The same system is also used to transfer coal from the coal stockyard to the crusher.

Fly dust and fallen ash stored in silos in the PLTU area will be transported out to a temporary industrial waste storage area belonging to the area operated by the area manager. Transportation is carried out using bulk loader trucks via area roads. Transportation is carried out every day.

Other materials that require transportation are additional chemicals and oxygen gas. Chemicals and oxygen gas will be provided by the area manager. Transportation will be carried out from the management's storage warehouse to the use location within the PLTU area via area roads. Frequency of transportation is adjusted to operational needs.

II.2.4. Main Equipment Used

Boilers

This type of boiler is a direct cooling boiler which operates in supercritical conditions, has only 1 combustion chamber and balanced ventilation air regulation. Open boiler layout on the operating floor, using a steel frame with a full suspension structure. Boiler specifications can be seen atTableII-26.

TableII-26: Boiler Specifications

Configuration		*Super Critical Once Through Steam Generator*, PC Fired
Combustion system		*Four-corner tangential combustion*
Maximum steam flow (BMCR)		825 tons/hour
Steam superheaters	Outlet temperature	571ºC (HP)
	Outlet pressure	25.4 MPa(g)
Reheat steam	Steam flow	690 tons/hour
	Inlet temperature/pressure	338°C / 6.15 MPa(g)
	Outlet temperature/pressure	569°C / 6.15 MPa(g)
Feed water temperature		±27°C
Fuel		Coal (pulverized, as main fuel), Diesel (for ignition, start up and emergency generators)
Thermal efficiency		>93.3% (on coal specifications according to plan)
Producer		Shanghai Electric Group Co., Ltd.

Turbine

The steam turbine design will be a standard multi-stage tandem-compound type consisting of a high pressure turbine and a medium pressure turbine. This steam turbine is designed to operate in supercritical conditions with a steam pressure of 25.4 MPa and a temperature of 571ºC. Oil lubricating system and hydraulic oil will be provided in the steam turbine operation.

Type : Supercritical turbine, two cylinders with a single shaft for high pressure and medium pressure
Producer : Shanghai Electric Group Co., Ltd.
Main vapor pressure : 24.2MPa(a)
Main steam temperature : 566°C
Vapor flow rate (VWO) : 825 t/h
Rotary speed : 3000 r/min
Design cooling water temperature : 30°C
Vapor discharge pressure : 7.3kPa(a)
Supply water temperature : 293.6°C
Guaranteed heat consumption : 7779.8kJ/kWh

Generator

Producer	: Shanghai Electric Group Co., Ltd.
Capacity	: 294 MVA
Outputs	:380 MW
Power factor value	: 0.85 (lag)
Rated electrical voltage	: 18 kV
Electrical flow value	: 9434 A
Efficiency value (guaranteed value)	: 98.6%
Frequency value	: 50Hz
Excitation method	: Static
Cooling method	: Outer cooling stator, inner cooling rotor

Conveyor belts

Conveyor belts are used to move coal from special terminals to coal stockyards and to move coal from storage areas to crushers and coal warehouses.

The length of the conveyor belt system from the special terminal to the coal stockyard is 500 m with a width of 2 m and a transport capacity of 4,500 tons/hour with a speed of 3.5 m/second. There are 2 transfer stations (transfer towers) to distribute coal in both heap areas. At each transfer station a dust control system will be installed.

The second conveyor belt system that transports coal from the stockyard to the crusher and coal warehouse consists of two lanes with a width of 1.4 m each and a transport capacity of 1,500 tons/hour at a speed of 2.5 m/second.

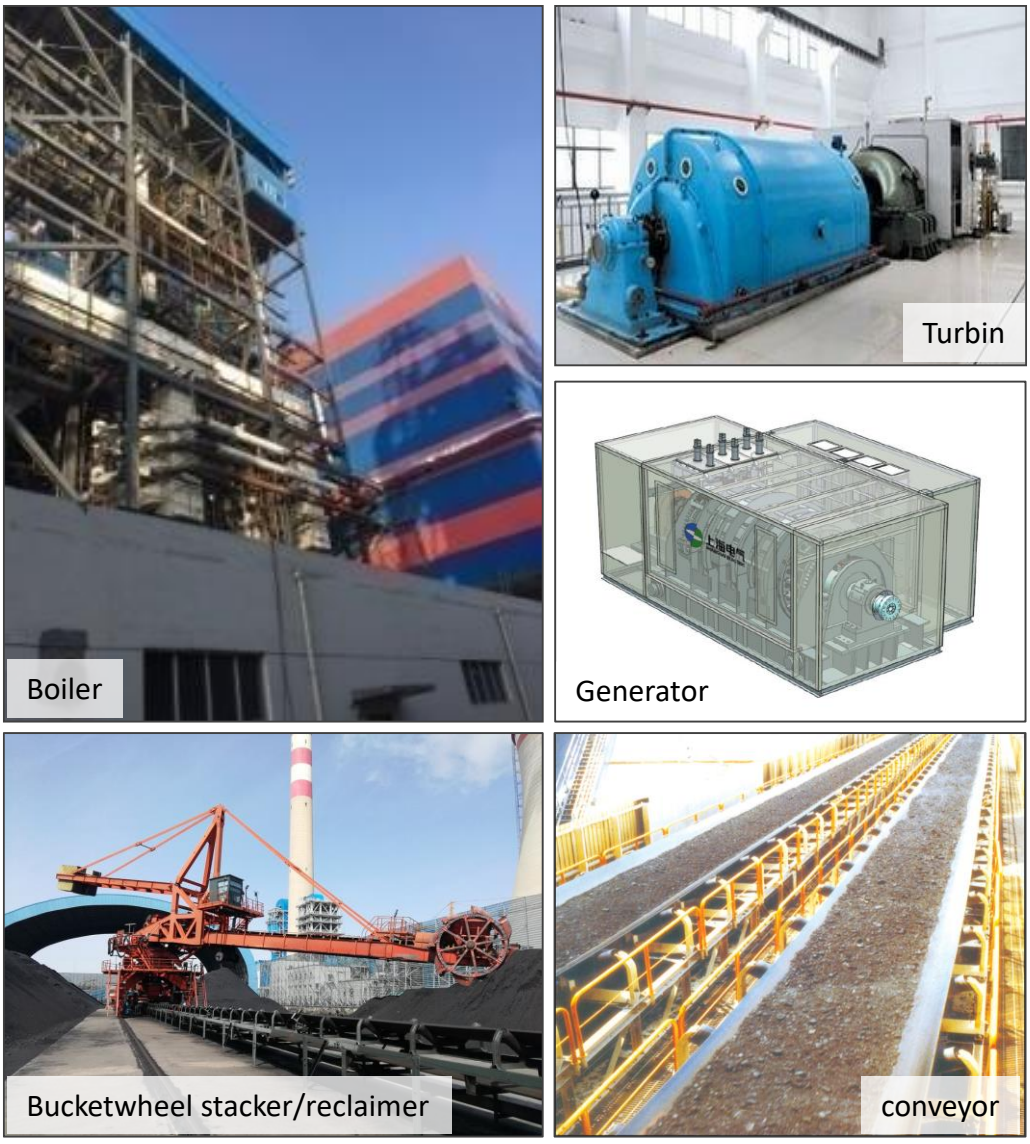
Bucketwheel Stacker/Reclaimer

The coal field has 2 long-arm folding bucket wheel stacker reclaimer units with an arm length of 35 m, a stacking capacity of 4,500 tons/hour and a reclaiming capacity of 1,500 tons/hour.

Crusher and Roller Screen

The coal grinding unit (crusher) that will be used is a ring hammer type equipped with a roller screen to classify the grinding results. The capacity of each grinder is 1,000 tons/hour and the roller screen capacity is 1,500 tons/hour. The roller screen specifications were chosen to be able to separate particles up to ≤ 30 mm with an efficiency of up to 90%.

PictureII-15: Some of the Main Equipment of PLTU



II.2.5. Infrastructure

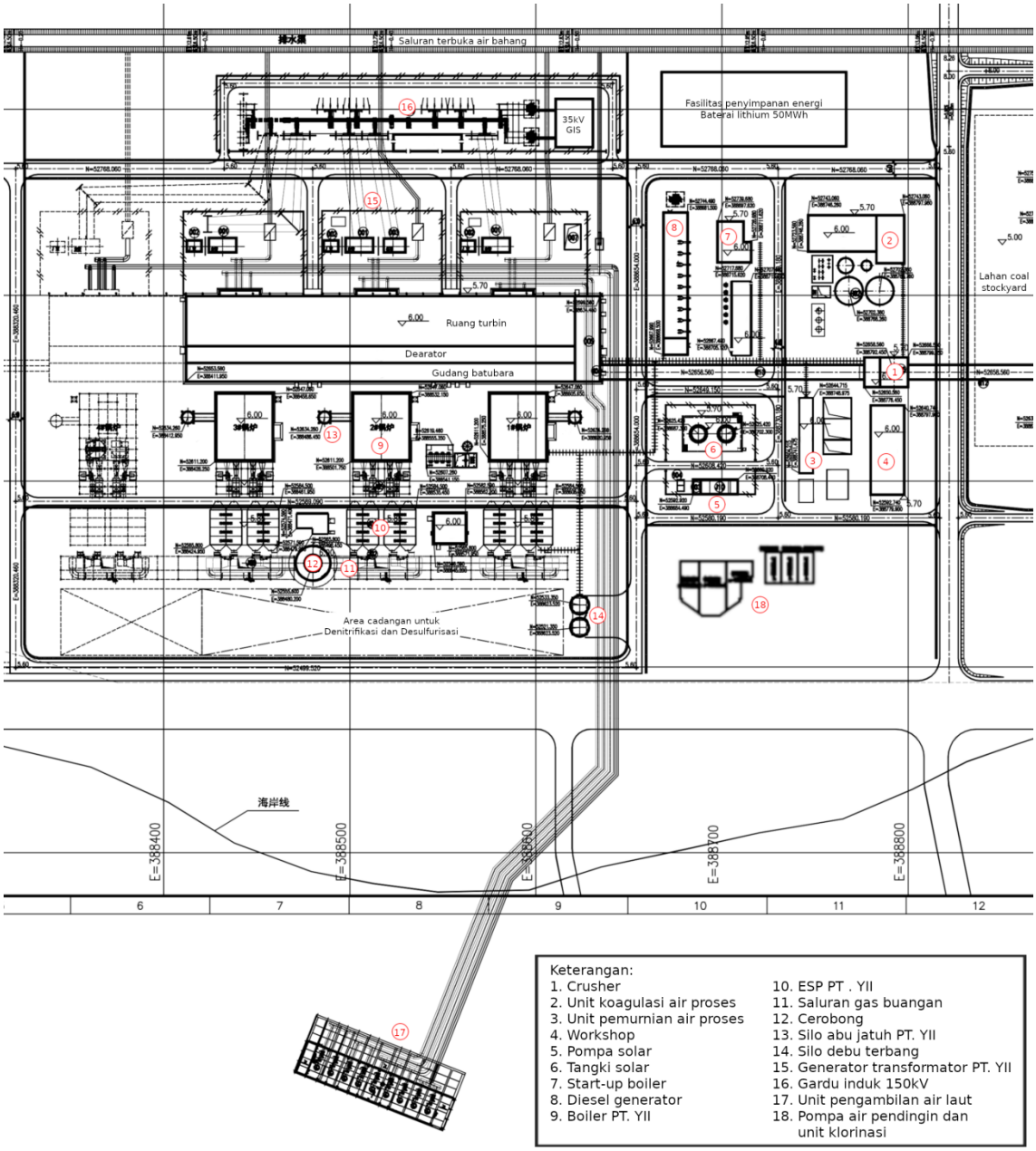
Land use in the PLTU area can be seen inTableII-27.

TableII-27: Land Use of the PLTU Area

No	Land use for	Area (Ha)
1	Building	12.07
2	Road	3.54
3	Greening	6.38
4	Other	9.91
PLTU area inside the fence (Total area for 4x 250MW)		**31.90**

No	Land use for	Area (Ha)
Building coefficient (%)		**37.85**
Road coefficient(%)		**11,10**
Level of greening(%)		**20**

PictureII-16: PLTU Building Layout and Infrastructure



II.2.5.1. Drainage and Water Disposal Systems

The drainage and water disposal systems in the PLTU area are divided into 3 separate systems: domestic wastewater canals, process wastewater drainage, and rainwater drainage.

Domestic wastewater is collected from every building in the PLTU area through a domestic waste piping system and channeled to a centralized IPAL belonging to the IWIP industrial area.

Operational wastewater drainage will collect water contaminated with coal, chemicals and oil from the PLTU operational area (coal stockyard, oil storage tank area, boiler start-up, transformer and workshop). This waste water will be processed in the PLTU area and reused.

Drainage for rainwater in the PLTU area will be provided along the road. The drainage slope design is 3 - 5 ‰ and the water flow is directed towards the sea.

II.2.5.2. Coal Leachate Water Treatment

Coal leachate originating from open coal storage areas is collected through drainage around the storage area and processed in processing facilities before being reused. The processing process includes coagulation and settling in a sedimentation tank. Processing capacity is 2x 30 m^3/hour. The sedimented sludge will be processed in a sludge conditioning tank.

II.2.5.3. Oily Water Treatment

The main sources of oily water include oil storage tank areas, oil pumps, turbine and transformer rooms and workshops. The small and uncertain amounts make the calculation difficult, so this waste water is not included in the water balance calculation. This waste water will be processed in an oil trap and then channeled into the public drainage channel.

II.2.5.4. Fire Handling System

This project's automatic fire alarm system is expanded on the basis of thermal power plant, using intelligent computer analog monitoring system, the whole system uses level 2 alarm control mode of combined control center. In addition to the fire pump room control equipment, carry out monitoring per section of the factory, the centralized control room area as the whole factory fire alarm and main fire monitoring panel, other regional areas are divided into corresponding regional alarm panels. The fire detection alarm system must be able to control relevant fire pumps, various types of fire extinguishing devices, ventilation, air conditioning and others, as well as receive feedback signals corresponding to the operation of the devices.

The following fire prevention measures:

(1) Take protective measures against overhead cable installations that are vulnerable to external fire. For example, using fire-resistant paint, fire-resistant partitions and tanks and others to reduce the number of cable fires.

(2) For parts that are susceptible to fire after the cable burns, use isolation measures per section to minimize the scope of accidents and reduce losses. If the cable duct leads to the shaft area it will be sealed with a fire retardant material; cable shafts, cables through floorboards, wall holes and factory power distribution panel cable holes are all tightly sealed using fireproof partitions and soft fireproof materials; factory area cable channels entering the building entrance are equipped with fire retaining walls and others.

The fire fighting water system in this project is taken from the PLTU reservoir pool. Indoor fire hydrants are installed in each building such as the main factory room, the main factory room is equipped with ring pipe network and necessary section maintenance valves, fire hydrants among the section maintenance valves more than 5, when a certain section fails, other pipes can provide the number necessary fire fighting water.

Partition doors are installed on both sides of the coal transportation corridor, the steel structure corridor is equipped with automatic water spraying system. The main transformer and high voltage transformer are equipped with a water spray fire extinguishing system.

In the central control room, the main factory room and electronic equipment room are equipped with a CO2 gas fire extinguishing system. The whole factory fire extinguishing system uses the standard design of the People's Republic of China:

- Fire management code for building design GB50016-2014 (rev. 2018)
- Automatic fire sprinkler system design specifications GB50084-2018
- GB50219-95 fire fighting water spray system design specifications
- Fire fighting design for thermal power plants and electrical substations GB50229-2006
- Design specifications for fire extinguisher configurations in buildings GB50140-2005
- Technical specifications for the general plan of transportation design in thermal power plants DL/T5032-2005
- Automatic fire alarm system design specifications GB50116-2013
- Fuel depot design specifications GB50074-2002
- Fire protection specifications for garages and parking lots GB50067-2014
- Preliminary design document depth provisions for thermal power plants DL/T5427-2009
- Fire protection specification for interior design in buildings GB50222-95 (rev. 2001)

II.2.6. Type, Quantity and Content of Emissions/Waste Produced

The type, quantity and content of the main emissions/waste that are expected to result from PLTU operational activities can be seen atTableII-28.

TableII-28: Type, Quantity and Content of Emissions/Waste Produced

No	Type	Quantity	Content	Information
1	Waste water from ultrafiltration boiler water purification process	10 m³/hour	TSS Salinity COD	The concentration depends on the quality of the raw water used
2	Permeate from reverse osmosis boiler water purification process	25 m³/hour	pH: 8 Salinity: ±2.5 g/L	The concentration depends on the quality of the raw water used
3	Drainage water from oil tanks & pumps, turbine & transformer rooms, workshops	Irregular	pH: 6 – 10 COD TSS Oil/fat	
4	Boiler cleaning water	800 m³/hour	TSS COD Oil/fat	Cleaning activities are planned every 5 years
5	Air preheater cleaning water	112 m³/hour	pH: 2 – 6 Fe: 3000 mg/L SS: 3000 mg/L COD: 3000 mg/L	Cleaning activities are planned every 2x per year
6	Combustion gas from the boiler	just now	Dust: 73.8 mg/m³ SO2: 325 mg/m³ NOx: 435 mg/m³	Calculations are based on design coal
7	Hot water from the cooling process	114,343 m³/hour	Temperature: ±37°C Chlorine: <1 ppm	The content of other substances depends on the quality of the sea water used
8	Domestic wastewater	4 m³/hour	COD BOD5 PO4-P NO3-N	Domestic wastewater content in general
9	Dust flies from the ESP	7.3 tons/hour	just now	
10	Bottom ash from the boiler	0.82 tons/hour	just now	

last: no data

II.3.1. Infrastructure

II.2.6.1. Communication Means

The communication facilities that will be provided at the special terminal include wired and wireless communication facilities. Wired communication facilities were developed as a means of broadcasting which were installed along the pier. The type of broadcasting system used is determined by the area manager.

Wireless communication facilities will use a wireless intercom system that uses radio waves. This communication facility is provided especially for security staff, operators and staff who work with high mobility.

Communication with ships is carried out using marine VHF wireless communication equipment which uses high frequency radio waves. The base station will be built in a special terminal area. The planned transmission power is 25 W.

II.2.6.2. Navigational Aid Equipment

To ensure safe navigation for ships that will anchor, three buoys are equipped with lights and one

In order to ensure the safe navigation of the ship, three light buoys and one light pile are required in the sea area of the project area. Sea, in addition to the newly opened waters need to sweep the sea.

II.2.6.3. Water Supply and Water Consumption Systems

Clean water will be provided by the area manager and channeled to a special terminal area using a pipe system. Main water uses include meeting the domestic water needs of ships, and water reserves for fire fighting systems.

Specifications of the piping system used and estimated water requirements are outlined inTableII-29.

TableII-29: Water Piping Systems and Estimated Water Needs

Water usage	Piping system specifications	Pressure in the pipe (MPa)	Water requirement (m^3/hour)
Water for the ship's domestic needs	DN150	0.30	90
Fire fighting system	DN250	0.50	79
Other	DN150	0.45	45

II.2.6.4. Drainage System

The drainage system is divided into two separate systems: the rainwater drainage system and the wastewater disposal system. Uncontaminated rainwater that enters the stormwater drainage system at the piers and connecting bridges will be discharged into the sea. Rainwater from areas that are easily contaminated by pollutants, such as coal

transportation areas, will be channeled along with other wastewater in the wastewater disposal system. This waste water is then collected in a holding tank and then channeled using a pump to the waste water treatment facility belonging to the industrial area. The waste water produced is estimated at 400 m^3/day.

5 units of holding tanks will be provided and each unit is equipped with a submersible pump with a capacity of 30 m^3/hour. The waste water pipe used is made of welded steel with a diameter of DN100.

II.2.6.5. Electricity Supply System and Electrical Loads required

Electricity will be provided from the PLTU in the industrial area. From the 35 kV substation, the voltage will be reduced to 10 kV and divided into 2 electricity supply lines. This electricity supply line is used to provide electricity for the unloader and conveyor belt at the dock. One distribution line with a voltage of 0.4kV equipped with two transformers with a voltage of 0.4 – 0.23 kV will be provided to provide electricity with a power capacity of 500 kVA for low voltage equipment in a special terminal area.

The cable that will be used is a fire-resistant cable with a copper core and XLPE insulation. The cables will be protected with steel pipes and placed along the conveyor belt, some of which are embedded in the pier structure.

The electricity supply system will be equipped with grounding and an anti-lightning system.

II.2.6.6. Fire Handling System

To anticipate fire incidents, roads on the pier and bridges connecting to the pier will be designed to facilitate evacuation access and mobilization of firefighters. Fire alarm sensors and temperature sensors connected to a centralized alarm system will be installed on loading and unloading equipment and cable networks.

Fire fighting equipment will be provided in appropriate locations in accordance with applicable regulatory provisions. Fire hydrants will be provided inside and outside the building. At piers and connecting bridges, hydrants will be provided every 100 m. The distance between hydrants in the building is 20 m. A portable powder extinguisher will be provided as additional equipment.

The water source for the fire extinguishing system is taken from the regional water supply network. The water network for the fire extinguishing system uses DN250 pipes with a minimum water pressure of 0.50 MPa and a minimum flow of 20 L/second.

II.2.6.7. Dust Control System

A dust control system will be installed at each transfer point in the dedicated terminal area. The system chosen is a dry system using a filtered dust collector that collects dusty air from a closed conveyor belt and a coal transfer station. The filtered air is released into the environment and the dust collected in the filter will be transported to a temporary storage area managed by the area manager.

PictureII-17: Layout of PT Angel Nickel Industry (ANI) Activities

III. IDENTIFICATION & EVALUATION ENVIRONMENTAL IMPACT

PT. Angel Nickel Industry as the tenant of the IWIP industrial area no longer carries out land procurement or clearing. It is assumed that the land allocated for smelter and PLTU activities belongs to PT. Angel Nickel Industry is land that is already owned by the IWIP industrial area, so PT. Angel Nickel Industry only has usage rights as stated in the tenant agreement. The licensing process will be handed over to the area manager who provides licensing services for tenants. Construction activities will also be completely handed over to the area manager, so that the impact of construction activities will be managed by the area manager as the environmental permit holder.

Referring to the IWIP Industrial Area AMDAL document and details of PT activities. Angel Nickel Industry, the environmental impacts that will be managed are a direct result of the operating activities of the Ferronickel Smelter and PLTU owned by PT. Angel Nickel Industry is identified as follows:

- Changes in livelihoods & income of local communities
- Increase in the number of immigrant communities
- Increased business opportunities
- Increase in local inflation
- Decreased ambient air quality
- Increased noise interference
- Decrease in sea water quality & diversity of marine biota
- Decreased groundwater quality
- Decrease in river water quantity, availability of community water sources & diversity of river biota
- Decreased environmental sanitation & worker health
- Increased sea traffic flow & potential for maritime accidents
- Increased potential for conflict with local fishermen

TableIII-1: Summary of Environmental Impact Identification & Evaluation

No	Impact Source	Environmental Components Affected	Description of Impact Evaluation
1	Acceptance of operational workforce	Livelihoods & income of local communities	**Changes in livelihoods & income of local communities.** The creation of new jobs has the potential to change the livelihoods and income of local communities. People who used to garden with an irregular income each month can change their livelihood to become PT workers. Angel Nickel Industry with a fixed income every month. This will increase the economic capacity of the community.Due to its positive nature, this impact will not be managed.
		Community migration	**Increase in the number of immigrant communities.** The recruitment of operational workers will increase the number of immigrants from outside the region to work or open businesses in the surrounding area. The increase in the number of people living and carrying out activities in the surrounding area will increase demand for primary needs (food, clothing and shelter), the need for health and education services as well as the need for infrastructure (electricity, telecommunications, transportation, waste management, etc.). Apart from that, migrant communities may have customs and customs that are different from local communities, potentially causing social friction within society. This impact can result in complex derivative impacts, so they need to be managed.
		Business opportunities	**Increased business opportunities.** This impact is a derivative impact of changes in people's income and an increase in the number of immigrants. Increasing the economic capacity of the community and increasing the number of potential consumers will create new business opportunities in the surrounding area. Due to its positive nature, this impact will not be managed.
		Local Inflation	**Increase in local inflation.** This impact is a derivative impact of changes in people's income and an increase in the number of immigrants. The increasing economic capacity of society and the increasing number of potential consumers which is not balanced by an adequate supply of goods will trigger an increase in the price of goods and result in local inflation. Inflation can affect people's purchasing power and has the potential to cause other socio-economic derivative impacts. Therefore, this impact needs to be managed.

No	Impact Source	Environmental Components Affected	Description of Impact Evaluation
2	Smelter operations; PLTU boiler operation; Use of fossil fuel transportation equipment; Removal of coal, fly dust, mineral ore bottom ash & smelter residue.	Ambient Air	**Decreased ambient air quality.** Smelter activities, PLTU boilers and the use of fossil fuel transportation equipment will produce waste gas emissions which contain, among other things, NOx, SO2, dust and greenhouse gases. Apart from increasing health risks, substances contained in exhaust gases can cause acid rain and climate change. In the process of movingcoal, fly dust, mineral ore bottom ash & smelter residue, fine particles can spread into the surrounding air. Fine dust particles can contain substances that increase health risks. Due to its impact on health and general environmental conditions, this impact needs to be managed.
3	Operation of equipment and machines in the smelter and PLTU areas that generate noise	Noise	**Increased noise interference.** Activities that use equipment and machines that emit noise will increase noise disturbance in the surrounding area. Continuous noise can have a bad impact on health. Therefore, this impact needs to be managed.
4	Discharge of hot water into the sea through regional drainage canals; Discharge of contaminated wastewater and drainage water into the sea	Sea water quality & marine biota	**Decrease in sea water quality and diversity of marine biota.** Hot water, waste water and drainage water have properties (high temperature, chlorine content, TSS, COD, oil & fat, BOD5, heavy metals) that can negatively affect sea water quality and marine biota. Therefore, this impact needs to be managed.
5	Placement of coal, mineral ore and smelter residue on open land	Groundwater quality	**Decreased groundwater quality.** Leachate from piles of coal, mineral ore and smelter residue placed in open storage areas can seep into the ground and pollute groundwater. Leachate can contain oils & fats, COD and heavy metals. Therefore, this impact needs to be managed.
		Ambient air quality	**Decreased ambient air quality.** Laying coal, mineral ore and smelter residue on open land can cause dust problems due to the wind carrying fine particles. Fine dust particles can contain substances that increase health risks. Therefore, this impact needs to be managed.

No	Impact Source	Environmental Components Affected	Description of Impact Evaluation
6	Use of river water as a source of operational raw water	River water discharge, river morphology, river water user communities, river biota	**Decreased river water discharge, changes in river morphology, decreased quantity of community water sources, and decreased diversity of river biota.** Kobe River water is the raw water source for the IWIP industrial area. Excessive withdrawal of river water can result in a decrease in river water discharge which can result in changes in river morphology, a decrease in the community's raw water sources and a decrease in the diversity of river biota. Therefore, this impact needs to be managed.
7	Domestic activities that produce waste	Environmental sanitation & worker health	**Decreased environmental sanitation and worker health.** Waste from domestic activities in the work environment that is not managed properly will reduce environmental sanitation and increase health risks for workers. Therefore, this impact needs to be managed.

IV. MANAGEMENT PLAN ENVIRONMENT (RKL)

IV.1. Basic Principles of Environmental Management

In essence, environmental management means preventing, controlling and mitigating negative impacts on the environment and increasing positive impacts that arise as a result of the planned operational development activities of PT's Pyrometallurgical Smelter. Angel Nickel Industry in the Indonesian industrial area Weda Bay Industrial Park by PT IWIP in Central Halmahera Regency, North Maluku Province. Environmental management will be oriented towards appropriate and feasible environmental management efforts. PT. Environmental management and monitoring plan. Angel Nickel Industry refers to the RKL and RPL of the IWIP Industrial Zone while still paying attention to the important impacts of operational activities carried out by PT itself. Angel Nickel Industry.

IV.2. Environmental Management Approach

Environmental management approach to the planned development and operation of PT's smelter and PLTU. Angel Nickel Industry in the Indonesian industrial area Weda Bay Industrial Park in Central Halmahera Regency, North Maluku Province includes technological, socio-economic and institutional approaches.

The aims and objectives of implementing the RKL-RPL are:

a. Comply with all applicable laws and regulations relating to pollution control, waste management and environmental quality monitoring;
b. Ensure that the activities of PT. Angel Nickel Industry follows the provisions of sustainable environmentally sound natural resource management so that natural resources can be utilized as well as possible for national economic development in general and economic and social development in Central Halmahera Regency in particular;
c. Manage environmental changes caused by the activities of the Pyro-Metallurgical Unit so that environmental quality is truly maintained;
d. Increasing positive impacts (benefits) and preventing, controlling and overcoming negative impacts (risks).
e. Determining measures to prevent, overcome and control negative impacts as well as develop positive impacts arising from the addition of the Pyro-Metallurgical Unit;
f. Involvement of relevant and authorized agencies in handling environmental management and monitoring in the region;
g. Develop a coordination mechanism for environmental impact management activities with agencies involved in implementing environmental management;
h. For the initiator, the results of environmental monitoring will be useful as an "early warning system" if something other than what was planned happens; whereas

i. For the government, the results of environmental monitoring can be used as a source of information and guidance in implementing development, monitoring and preserving the environment in the project area.

j. For the community, the results of environmental monitoring can be used as a source of information to know and understand the activities of the Pyro-Metallurgical Unit and the activities of PT. Another Angel Nickel Industry that has an environmental perspective, so that misunderstandings can be avoided and mutually beneficial cooperation can be created between the management and the surrounding community.

k. Providing sufficient funds to implement RKL and RPL so that good environmental conditions can continue to be maintained.

IV.3. Environmental Management Plan

A brief and clear description of the RKL in the form of a matrix or table containing the management of impacts arising based on activity stages with elements including: managed environmental impacts, sources of impacts, indicators of success in environmental management, forms of environmental management, location of environmental management life, environmental management period. The detailed RKL is presented inTableIV-1. All statutory regulations referred to refer to actual regulations and will be adjusted if there are changes to applicable regulations. The obligation to document environmental management activities is carried out based on applicable regulations.

TableIV-1: Environmental Management Plan Matrix (RKL) for Smelter Operation Activities, PLTU

No.	Managed Environmental Impact & source of impact	Indicators of Successful Environmental Management	Forms of Environmental Management	Location of Environmental Management	Environmental Management Period
1.	**Increase in local inflation.** Source of impact:recruitment of operational workforce	The inflation rate is controlled in line with economic growth, there is no increase in the number of poverty.	**Socioeconomic Approach:** a. Prioritize local residents in recruiting workers according to the qualifications required by the company; b. Carrying out a comprehensive inventory and mapping of the need for goods and services required by the company; c. Supervise the availability of workers' goods needs; **Institutional Approach:** d. Together with PT IWIP, we collaborate with the local government (Halteng Regency, North Weda District, surrounding villages) in controlling the increase in migration and local inflation.	Lelilef Sawai Village, Lelilef Waibulan Village, and Gemaf Village	During PT. Angel Nickel Industry
2.	**Decreased ambient air quality** Source of impact: Smelter operations; PLTU boiler operation; Use of fossil fuel transportation equipment;	1. Emissions from any stationary source from smelter operations do not exceed the quality standards stipulated in Minister of the Environment Regulation no. 4 of 2014 2. Emissions from PLTU stationary sources do not exceed the quality standards stipulated in Minister of the Environment Regulation no. 21 of 2008	**Technology Approach:** a. Using gas residue processing technology that complies with commonly used technical standards; b. Setting optimal combustion operations to minimize emissions; c. Use equipment equipped with DLE (dry low emissions) and carry out regular maintenance	a. Smelter exhaust gas chimneys, PLTU chimneys, Diesel generators b. RKEF smelter, PLTU boiler c. Exhaust exhaust gas from each means of transportation	a. During smelter and PLTU operations b. During smelter and PLTU operations c. During use of transport equipment

No.	Managed Environmental Impact & source of impact	Indicators of Successful Environmental Management	Forms of Environmental Management	Location of Environmental Management	Environmental Management Period
	Removal of coal, fly dust, mineral ore bottom ash & smelter residue.	3. Emissions from the transportation equipment used meet the quality standards stipulated in the Minister of Environment and Forestry Regulation no.P.20/MENLHK/SETJEN/KUM.1/3/2017 4. Ambient air quality parameters do not exceed the quality standards stated in Government Regulation no. 41 of 1999	d. Installing a water spraying system to control dust when moving coal, fly dust, bottom ash, mineral ore & smelter residue as well as carrying out transportation using closed trucks or covers. e. Carrying out greenery to improve ambient air quality. Types of vegetation planted: - Trembesi*(Samanea saman);* - Memories*(Canangium odoratum);* - Venus*(Cassia siamea)* - Banyan*(Ficus benjamina);* - Kiara Umbrella*(Fellicium decipiens);* - Matoa*(Pornetia pinnata);* - Mahogany*(Swettiana mahagoni);* - Jatiemas (Tectonagrandis L); - Japanese bamboo (Dracaena surculosa Lindl).	used d. Location of transfer (transfer) of coal, fly dust, bottom ash, mineral ore & smelter residue and every means of transportation used e. Green open area (RTH) at the PT activity location. Angel Nickel Industry	d. During moving and transportation activities e. During PT. Angel Nickel Industry
3.	**Increased noise interference** <u>Source of impact:</u> Operation of equipment and machines in the smelter and PLTU areas that generate noise	Noise level in offices ≤65 dB +3 dB and industry ≤70 dB +3 dB in accordance with Decree of the Minister of the Environment No. 48 of 1996 concerning Noise Level Standards.	**<u>Technology Approach:</u>** a. Use of sound dampeners in steam turbines and generators; b. The building will be equipped with siding and cladding as necessary; c. Safety valves and noisy equipment will be dampened, if necessary; d. Equipment that generates high noise will be located in areas far from human access;	a. Location of steam turbines and generators; b. In buildings where noisy equipment is located; c. on equipment that creates noise;	During PT. Angel Nickel Industry

No.	Managed Environmental Impact & source of impact	Indicators of Successful Environmental Management	Forms of Environmental Management	Location of Environmental Management	Environmental Management Period
			e. Carry out greenery to reduce noise. Type of vegetation to be planted: - Trembesi*(Samanea saman);* - Ylang ylang (Canangium odoratum); - Johar (Cassia siamea) - Banyan (Ficus benjamina); - Kiara Umbrella (Fellicium decipiens); - Matoa (Pornetia pinnata); - Mahogany (Swettiana mahagoni); - Jatiemas (Tectona grandis L); - Japanese bamboo (Dracaena surculosa Lindl).	d. Green open area (RTH) at the PT activity location. Angel Nickel Industry	
4.	**Decrease in sea water quality and diversity of marine biota.** <u>Source of impact:</u> Discharge of hot water into the sea through regional drainage canals; Discharge of contaminated wastewater and drainage water into the sea.	1. The parameters of hot water and waste water from PLTU activities at the output/compliance point do not exceed the quality standards stated in Minister of the Environment Regulation no. 8 of 2009 2. The parameters of waste water that is directly discharged into water bodies without going through the area's integrated IPAL do not exceed the quality standards stated in Minister of Environment and Forestry Regulation no.P.68/Menlhk/Setjen/Kum.1/9/2016 (for domestic wastewater),Minister of	**<u>Technology Approach:</u>** a. Hot water management: ▪ controlling the increase in hot water temperature so that the temperature at the compliance point remains below 40°C by regulating the amount of increasing water flow and the flow speed; ▪ controlling the electrochlorination process so that the chlorine concentration in the cooling water is not excessive. b. Ensure that all contaminated drainage water from the coal stockyard, oil tank	a. PLTU cooling water processing and disposal unit b. The coal stockyard area, oil tanks & pumps, turbine & transformer rooms, workshops and drainage water treatment units are contaminated. c. All operational areas of PT. Angel Nickel Industry	During PT. Angel Nickel Industry

No.	Managed Environmental Impact & source of impact	Indicators of Successful Environmental Management	Forms of Environmental Management	Location of Environmental Management	Environmental Management Period
		Environment Regulation no. 9 of 2006 (for waste water from smelters) 3. Sea water quality parameters after a radius of 30 m from the hot/waste water outlet point do not exceed the quality standards as stated in attachment I to Decree of the Minister of the Environment no. 51 of 2004	& pump, turbine & transformer room, and workshop is collected and treated in the contaminated water treatment unit in the PLTU area. Ensure that drainage water discharged into the environment meets quality standards. c. Ensure that all domestic liquid waste is channeled to the area's IPAL. d. Ensure that all waste water from smelter activities is accommodated and processed in the area IPAL.	d. Smelter activity areas: ore storage area, product & slag washing area, grinding unit	
5.	**Decreased groundwater quality.** <u>Source of impact:</u> Placement of coal, mineral ore and smelter residue on open land	1. The concentration of heavy metals in groundwater on land used as a place to store mineral ore and smelter residue remains within its natural concentration range. 2. The concentration of dissolved organic compounds in groundwater on land used as coal storage remains within its natural concentration range.	**<u>Technology Approach:</u>** a. Stockpiling of mineral ore and slag from the smelter process: ▪ Stockpiling mineral ore and slag in PT's operational area. Angel Nickel Industry complies with applicable regulations. ▪ Providing a drainage system in mineral ore storage areas, and smelter residues to collect leachate water and channel it to sedimentation ponds. ▪ Exploring efforts to utilize slag as a construction material b. *Coal stockyards*: ▪ Providing a drainage system in coal landfills to collect leachate and process leachate in holding ponds	a. Land for storing mineral ore and slag in the PT operational area. Angel Nickel Industry b. Coal stockyard in the PLTU area	a. During land operations activities for storing mineral ore and slag. b. During coal stockyard operations.

No.	Managed Environmental Impact & source of impact	Indicators of Successful Environmental Management	Forms of Environmental Management	Location of Environmental Management	Environmental Management Period
6.	**Decreased ambient air quality.** Source of impact: Placement of coal, mineral ore and smelter residue on open land	Ambient air quality parameters do not exceed the quality standards stated in Government Regulation no. 41 of 1999	**Technology Approach:** a. Equip mineral ore storage areas and smelter residues with dust control systems. b. Equip the coal stockyard with a water spray system to control dust. c. Carrying out greenery to improve ambient air quality. Types of vegetation planted: - Trembesi*(Samanea saman);* - Memories*(Canangium odoratum);* - Venus*(Cassia siamea)* - Banyan*(Ficus benjamina);* - Kiara Umbrella*(Fellicium decipiens);* - Matoa*(Pornetia pinnata);* - Mahogany*(Swettiana mahagoni);* - Jatiemas (Tectonagrandis L); - Japanese bamboo (Dracaena surculosa Lindl)	a. Land for storing mineral ore and slag in the PT operational area. Angel Nickel Industry b. Coal stockyard in the PLTU area	a. During land operations activities for storing mineral ore and slag. b. During coal stockyard operations. c. During PT. Angel Nickel Industry
7.	**Decreased river water discharge, changes in river morphology, decreased quantity of community water sources, and decreased diversity of river biota.**	There was no decrease in the average river discharge as a whole.	**Technological Approach:** a. Water use is adjusted to operational needs as stated in the tenant agreement. Water use will be monitored with measuring devices so that excess use does not occur. b. Striving to reuse wastewater from wastewater treatment facilities to reduce water withdrawals from rivers.	All areas of PT. Angel Nickel Industry which uses water.	During PT. Angel Nickel Industry

No.	Managed Environmental Impact & source of impact	Indicators of Successful Environmental Management	Forms of Environmental Management	Location of Environmental Management	Environmental Management Period
	Source of impact: Use of river water as a source of operational raw water				
8.	**Decreased environmental sanitation and worker health.** Source of impact: Domestic activities that produce waste	There is no solid waste spilled in the PT operational area. Angel Nickel Industry	**Technological Approach:** a. Implement domestic waste management in accordance with IWIP Area regulations within the PT activity area. Angel Nickel Industry b. Provide adequate waste storage places c. Meprovide adequate toilet facilities **Institutional Approach:** d. Doan appeal to workers to behave in a clean and healthy lifestyle (PHBS).	All areas of PT. Angel Nickel Industry.	During PT. Angel Nickel Industry

V. MONITORING PLAN ENVIRONMENT (RPL)

Based on the results of the Environmental Management Plan (RKL) that has been prepared, monitoring of the RKL is then carried out and outlined in the Environmental Monitoring Plan (RPL) chapter.

V.1. Basic Principles of Environmental Monitoring

Environmental monitoring is basically a tool for evaluating whether the implementation of planned environmental management can run effectively and efficiently or not. Environmental monitoring is the work of measuring, sampling, observing and collecting information on environmental components repeatedly at certain time intervals and locations.

V.2. Environmental Monitoring Approach

Technical environmental monitoring for geophysical-chemical and biological aspects is carried out by means of measurements, sampling, laboratory analysis, observations, observation and interviews. Meanwhile, socio-economic-cultural and public health aspects were carried out by observation and interviews using questionnaires with residents (respondents) to determine their perceptions of industrial area development activities.

V.3. Environmental Monitoring Plan (RPL)

A brief and clear description of the RPL in the form of a matrix or table containing monitoring of impacts arising based on activity stages which include: Impacts managed and their sources, indicators/parameters monitored, data collection and analysis methods, monitoring locations, monitoring time and frequency, implementing institutions, supervisors and recipients of reports. The detailed RPL is presented inTableV-1. All statutory regulations referred to refer to actual regulations and will be adjusted if there are changes to applicable regulations.

The reporting frequency is set once every 6 months during PT's operational activities. Angel Nickel Industry takes place. Management and monitoring reports prepared by PT. Angel Nickel Industry as the industrial area tenant will be conveyed to the PT area manager. IWIP. As the owner of an environmental permit, PT. IWIP will then submit a PT report. Angel Nickel Industry to the authorized supervisory institution as part of the overall industrial area RKL-RPL report.

TableV-1: Environmental Monitoring Plan Matrix (RKL) for Smelter and PLTU Operation Activities of PT. Angel Nickel Industry

No.	Managed Environmental Impact & source of impact	Environmental Monitoring Plan				Institution	
		Indicator/ Parameter	Method	Location	Frequency & timeframe	Executor	Monitor & receive reports
1.	**Increase in local inflation.** Source of impact:recruitment of operational workforce	Labor information received: - Amount - Origin - Position composition - Average income	**Data collection:** Recording and documenting labor information received. **Data analysis:** Tabulation and quantitative description	Operation area PT. Angel Nickel Industry	Every month during PT. Angel Nickel Industry	PT. Angel Nickel Industry	PT. IWIP
2.	**Decreased ambient air quality** Source of impact: Smelter operations; PLTU boiler operation; Use of fossil fuel transportation equipment; Removal of coal, fly dust, mineral ore bottom ash & smelter residue.	1. Parameters in Minister of Environment Regulation no. 4 of 2014 2. Parameters in Minister of Environment Regulation no. 21 of 2008 3. Parameters in Minister of Environment and Forestry Regulation no.P.20/MENLHK/ SETJEN/KUM.1/3/ 2017 4. Parameters in Government	**Data collection:** a. Continuous monitoring of SO2, NOx, TSP, H2S, Zn, Ni, opacity, temperature, PM10, air pressure, O2 and gas flow rate according to applicable SOP/SNI; b. Continuous monitoring of SO2, NOx, TSP, opacity, temperature, air pressure, O2, & gas flow rate according to applicable SOP/SNI; c. Periodic emission measurements of parameters such as SO2, NOx, TSP, opacity, temperature, air pressure, O2, & gas flow rate manually according to SNI & applicable regulations; d. Use of data from existing emission test result	a. Smelter chimney b. PLTU chimney c. Diesel generators d. Exhaust exhaust gas from each means of transportation used e. Ambient air monitoring point PT. IWIP	a. Continuously during smelter operations b. Continuously during PLTU operation c. 1x per 6 months during diesel generator operation d. 1x per 6 months as long as the transportation equipment is used e. 1x per 6 months during IWIP industrial	Point a: PT. Angel Nickel Industry; Point be: PT. IWIP	- Provincial LH Department. Malut & Kab. Halteng - Provincial Department of Industry and Trade. Embarrassed - Head of Central Veda & North Veda sub-district

No.	Managed Environmental Impact & source of impact	Environmental Monitoring Plan				Institution	
		Indicator/ Parameter	Method	Location	Frequency & timeframe	Executor	Monitor & receive reports
		Regulation no. 41 of 1999	certificates and implementation of periodic exhaust gas emission tests in accordance with applicable regulations e. Monitoring ambient air quality according to SNI & applicable regulations **Data analysis:** ▪ Data tabulation ▪ Calculation of average value and maximum value ▪ Emission load calculation ▪ Calculation of pollution index		area operations		
3.	**Increased noise interference** Source of impact: Operation of equipment and machines in the smelter and PLTU areas that generate noise	Noise level in offices ≤65 dB +3 dB and industry ≤70 dB +3 dB in accordance with Decree of the Minister of the Environment No. 48 of 1996 concerning Noise Level Standards.	**Data collection:** Leq noise level measurement with SNI & applicable regulations **Data analysis:** ▪ Data tabulation ▪ Calculation of Lsm, Ls & Lm values	a. In noisy work areas; b. PT office space. Angel Nickel Industry; c. Green open area (RTH) at the PT activity location. Angel Nickel Industry	1x per 6 months during PT operations. Angel Nickel Industry takes place	PT. Angel Nickel Industry	PT. IWIP
4.	**Decrease in sea water quality and diversity of marine biota.**	1. The parameters of hot water and waste water from PLTU activities are	**Data collection:** a. Continuous monitoring of pH, water discharge, temperature, salinity/conductivity in	a. PLTU cooling water drainage channels,	a. Continuously as long as the water is drained	PT. IWIP	- Provincial LH Department. Malut & Kab. Halteng

No.	Managed Environmental Impact & source of impact	Environmental Monitoring Plan				Institution	
		Indicator/ Parameter	Method	Location	Frequency & timeframe	Executor	Monitor & receive reports
	Source of impact: Discharge of hot water into the sea through regional drainage canals; Discharge of contaminated wastewater and drainage water into the sea.	in accordance with Minister of the Environment Regulation no. 8 of 2009 2. Waste water parameters are in accordance with Minister of Environment and Forestry Regulation no.P.68/Menlhk/Setjen/Kum.1/9/2016 (for domestic wastewater),Minister of Environment Regulation no. 9 of 2006 (for waste water from smelters) 3. Sea water quality parameters according to attachment I of Minister of Environment Decree no. 51 of 2004	accordance with SNI & applicable regulations; b. Regularly check levels of waste water quality standard parameters c. Regularly check levels of sea water quality standard parameters d. Marine biota survey **Data analysis:** ▪ Data tabulation ▪ Calculation of average value and maximum value ▪ Emission load calculation ▪ Calculation of pollution index ▪ Calculation of distribution, diversity, dominance index, uniformity index of marine biota	domestic wastewater & process wastewater; b. PLTU cooling water drains, domestic waste water, process waste water & contaminated drainage water; c. Sea water quality monitoring point PT. IWIP d. Marine biota monitoring point PT. IWIP	b. 1x per month as long as water removal is carried out c. 1x per 6 months during IWIP industrial area operations d. 1x per year during IWIP industrial area operations		- Provincial Department of Industry and Trade. Embarrassed - Provincial Fisheries and Marine Service. Embarrassed

No.	Managed Environmental Impact & source of impact	Environmental Monitoring Plan				Institution	
		Indicator/ Parameter	Method	Location	Frequency & timeframe	Executor	Monitor & receive reports
5.	**Decreased groundwater quality.** <u>Source of impact:</u> Placement of coal, mineral ore and smelter residue on open land	1. Heavy metal concentrations remain within their natural concentration range. 2. The concentration of dissolved organic compounds remains within their natural concentration range.	**<u>Data collection:</u>** a. Examination of heavy metal levels, ground water level, pH, conductivity b. Examination of levels of dissolved organic compounds, ground water level, pH, conductivity **<u>Data analysis:</u>** ▪ Data tabulation ▪ Comparison with initial hue and raw water quality standards	a. Land for storing mineral ore and slag in the PT operational area. Angel Nickel Industry b. Coal stockyard in the PLTU area	1x per 6 months as long as the land is used as a storage location	a. PT. Angel Nickel Industry b. PT. IWIP	- Provincial LH Department. Malut & Kab. Halteng - Provincial Department of Industry and Trade. Embarrassed
6.	**Decreased ambient air quality.** <u>Source of impact:</u> Placement of coal, mineral ore and smelter residue on open land	Ambient air quality parameters according to Government Regulation no. 41 of 1999	**<u>Data collection:</u>** Monitoring ambient air quality according to SNI & applicable regulations **<u>Data analysis:</u>** ▪ Data tabulation ▪ Calculation of pollution index	a. Land for storing mineral ore and slag in the PT operational area. Angel Nickel Industry b. Coal stockyard in the PLTU area	1x per 6 months as long as the land is used as a storage location	a. PT. Angel Nickel Industry b. PT. IWIP	- Provincial LH Department. Malut & Kab. Halteng - Provincial Department of Industry and Trade. Embarrassed
7.	**Decreased river water discharge, changes in river morphology, decreased quantity of**	Amount of raw water used	**<u>Data collection:</u>** Recording the amount of water taken from the raw water network	Raw water intake point PT. Angel Nickel Industry from the IWIP industrial area	Cumulative 1x per month as long as raw water collection takes place	PT. Angel Nickel Industry	PT. IWIP

No.	Managed Environmental Impact & source of impact	Environmental Monitoring Plan				Institution	
		Indicator/ Parameter	Method	Location	Frequency & timeframe	Executor	Monitor & receive reports
	community water sources, and decreased diversity of river biota. Source of impact: Use of river water as a source of operational raw water		**Data analysis:** ▪ Data tabulation ▪ Calculation of average hourly, daily and per use values	raw water network			
8.	**Decreased environmental sanitation and worker health.** Source of impact: Domestic activities that produce waste	The amount and type of domestic waste produced	**Data collection:** Recording the amount and type of waste produced **Data analysis:** ▪ Data tabulation ▪ Calculation of average daily value, and per worker	All areas of PT. Angel Nickel Industry.	Cumulative 1x per month during PT operations. Angel Nickel Industry takes place	PT. Angel Nickel Industry	PT. IWIP

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