Environmental Product Declaration

In accordance with ISO 14025:2006 for:

Aluminium Ingot G1

from

PT Indonesia Asahan Aluminium

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OR
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Company Information

Owner of the EPD

PT Indonesia Asahan Aluminium
(0622) 313111/62231001
www.inalum.id, sampe@inalum.id
Kuala Tanjung, Sei Suka District, Batu Bara Regency, North Sumatra 21657, Indonesia

Description of the organisation

The smelting plant of PT Indonesia Asahan Aluminium (INALUM) was established on January 6, 1976 and began operations on February 15, 1982. The plant covers an area of approximately 200 hectares and is located in Kuala Tanjung, Sei Suka District, Batu Bara Regency, North Sumatra 21657. PT Indonesia Asahan Aluminium is an upstream industry whose main activity is the production of aluminum in the form of ingots, alloys and billets for sale to consumers. In addition, PT Indonesia Asahan Aluminium also produces anodes that are used directly in the aluminum production process.

The production facilities owned by the company are as follows:

1. Loading and Unloading Port (TUKS/Terminal for Own Activities)
2. Green Plant (Raw Anode Factory)
3. Baking Plant (Anode Baking Factory)
4. Roding Plant (Anode Rodding Factory)
5. Reduction Plant (Smelting Factory)
6. Casting Plant
7. Substation (Electricity Distribution Plant)

On December 8, 2022, the Government issued Republic of Indonesia Government Regulation No. 45 of 2022 concerning Reduction of the Republic of Indonesia State Capital Participation in the Company PT Indonesia Asahan Aluminium (Persero). Based on PP No.45/2022, PT Indonesia Asahan Aluminium was no longer a holding company and its status was changed to become a member of MIND ID, BUMN Mining Industry Holding. Then on the same date, the Government issued Republic of Indonesia Government Regulation No. 46 of 2022 dated December 8, 2022 concerning the Republic of Indonesia State Capital Participation for the Establishment of a Limited Liability Company (Persero) in the Mining Sector. Where PP No.46/2022 marked the formation of PT Mineral Industri Indonesia (Persero) as a new entity from MIND ID, as well as confirmed the transformation of the MIND ID corporation into a strategic holding company. PT Indonesia Asahan Aluminium was now aligned with other MIND ID members with the aim that MIND ID focuses more on being a strategic holding company, while PT Indonesia Asahan Aluminium focuses on developing the national aluminium downstreaming. Then, in 2023, in connection with the issuance of PP No.45/2022 and PP No.46/2022, PT Indonesia Asahan Aluminium's status, which was previously PT Indonesia Asahan Aluminium (Persero), became PT Indonesia Asahan Aluminium and was no longer a holding company.

Product-related or management system-related certifications:

- ISO 9001:2015
- ISO 14001:2015
- ISO 45001:2018
- ISO 50001:2018
- ISO 27001:2022
- ISO 37001:2025
- ASI Certification

Name and location of production site

PT Indonesia Asahan Aluminium, Kuala Tanjung, Sei Suka District, Batu Bara Regency, North Sumatra 21657, Indonesia.

Product Information

Product name: Aluminium Ingot G1

Product description: Aluminium ingot is the basic form of aluminium metal, produced through a smelting process and shaped into large bars. Its function is to serve as raw material for various industrial applications that use aluminium, such as automotive components, household appliances, electronic products, construction materials and more. The LCA study held by PT Indonesia Asahan Aluminium has included 100% of the aluminium ingot G1 produced in 2024.

UN CPC code: UN CPC 4153 Semi-finished products of aluminium or aluminium alloys.

Geographical scope: Indonesia

End-of-life treatment is not included in the system boundaries of this study. Therefore, this EPD shall not be used for communicating environmental information to consumers or end users of the product.

LCA Information

Declared unit: 1 kg of aluminium ingot G1 produced by PT Indonesia Asahan Aluminium in 2024.

Time representativeness:
Specific data: based on data in 2024 (1 January – 31 December 2024).
Generic data: 39.73% data in upstream and 3.25% data in core are from generic datasets with temporal representativeness ranges from 2010-2025.

Database(s) and LCA software used:
LCA was conducted using SimaPro version 9.5.0.0. Selected generic data used in this report was taken from Ecoinvent 3.9.1. The database used in the impact assessment of upstream and core processes.

Description of system boundaries: cradle-to-gate.

Excluded lifecycle stages: The downstream stage is not included in the system boundaries of this study as it is not mandatory based on PCR 2022:08 Basic Aluminium Products and Special Alloys, (1.0.1).

More information:

Assumptions:

1. Impact calculations in the extraction and production of alumina, extraction and production of calcined petroleum coke (CPC), extraction and production of coal tar pitch (CTP), production and transportation of raw material (AlF3), production and transportation of additional materials, production and transportation of fuels (upstream), production and transportation of fuels (core), transportation of electricity and hazardous waste treatment were conducted using the Ecoinvent 3.9.1 and USLCI dataset contained in the SimaPro software.
2. Since PLTA INALUM did not collect data inventory in 2024, the inventory for the production of electricity was obtained through projections based on 2023 data. The projections were made by comparing the amount of electricity consumption in 2024 with that in 2023 at PT Indonesia Asahan Aluminium, then applying that ratio to all data in the electricity production unit.
3. In addition to producing its own produced electricity by hydroelectric power plant (PLTA Inalum), PT Indonesia Asahan Aluminium also uses electricity purchased from PT PLN (Indonesian Government-Owned Corporation on Electricity). The calculation of CO_2 for electricity purchased from PT PLLN was carried out using an emission factor for the Sumatera region regulated by the Ministry of Energy and Mineral Resources and for CH_4 and N_2O was carried out using emission factors from EPA.
4. The management of hazardous waste at the INALUM hydroelectric power plant is assumed to be processed by incineration and the calculation of its impact is based on a dataset.

Cut-off rules:

The cut-off rules in this LCA are followed according to the PCR where the data for elementary flow to and from product systems contributing to a minimum of 99% of the declared environmental impact has been included. All input and output data related to mass, energy and the environment in each process unit in the aluminium ingot G1 production system have been collected in the inventory, but there are two additional materials that cannot be found in the SimaPro dataset so that the impact calculation for its production cannot be assessed. These additional materials are ceramic ball and thermal ceramic. Cut-off calculations for these materials have been carried out and the conclusions obtained is: the cut-off used is at the level of 0.37% (as required in PCR, the cut-off is no more than 1%).

A summary of the data quality assessment:

1. Upstream : 60.27% specific data and 39.73% generic data.
2. Core : 96.75% specific data and 3.25% generic data.

In this EPD, the infrastructure/capital goods from each generic dataset are included to the calculation. **The results of the impact categories** in the **upstream** (extraction and production of alumina, extraction and production of calcined petroleum coke (CPC), extraction and production of coal tar pitch (CTP), production of raw material (AlF_3), production of additional materials and production and transportation of fuels) and **core** (transportation of additional materials, production of fuels, transportation of fuels, transportation of electricity and hazardous waste treatment) **may be highly uncertain in LCAs that include capital goods/infrastructure in generic dataset**, in case infrastructure/capital goods contribute greatly to the total results. This is because the LCI data of infrastructure/capital goods used to quantify these indicators in currently available generic datasets sometimes lack temporal, technological and geographical representativeness. Caution should be exercised when using the results of these indicators for decision-making purposes.

Product Allocation:
In this study, the impact value is allocated based on the mass content of aluminium ingot G1 (main product) and several co-products, such as aluminium ingot S1A, aluminium ingot S1B, aluminium A356.2, aluminium billet 5 Inch, aluminium billet 7 Inch dan aluminium billet 8 Inch. The allocation of impact value is carried out on process units that process both types of products above. Percentage allocation for those products are shown in this table:

	Products	Category	Based on Mass (kg)	Percentage (%)
Allocation (%)	Ingot S1A	Co-Product	153 341.00	0.06
	Ingot S1B	Co-Product	5 705 337.00	2.09
	Ingot G1	**Product**	**223 953 834.00**	**82.01**
	Alloy A356.2	Co-Product	21 671 951.00	7.94
	Billet 5 Inch	Co-Product	13 370 816.00	4.90
	Billet 7 Inch	Co-Product	5 548 883.00	2.03
	Billet 8 Inch	Co-Product	2 669 798.00	0.98
	Total Aluminium 2024		273 073 960.00	100.00

Waste Allocation:
The selection of methodologies for the allocation of reuse, recycling and recovery has been established based on the Polluter Pays Principle. This principle presupposes that the waste generator pays for the waste/pollutant generated to be able to reduce pollution according to the level of damage that has been caused to society or even that exceeds the acceptable level or standard of pollution. The impacts resulting from the waste treatment process are borne by the waste generator. For waste being recycled or reused, processes after the end-of-waste state, if any, shall be attributed to the product system using the recycled/reused material flow (recycled materials are thereafter considered secondary raw materials). While for incineration, landfill, gasification or other waste treatment, the process load is allocated to the waste generator. In this study, allocation was carried out on hazardous waste generated from the aluminum production process. To determine the contribution from G1 aluminum ingots, allocation was carried out on hazardous waste by multiplying the percentage of G1 aluminum ingot products (82.01%) by the total waste data for each type of hazardous waste. Then, hazardous waste was categorized as follows:

1. Black dross
2. Hazardous waste, incineration (consist of: used majun, filter pocket and clinical waste)
3. Hazardous waste, recovery (cathode, anode scrap, dust from air pollution control facilities, refractory brick, sludge WWTP, used lubricant, used accu, PCB and TL lamp)

Black dross is purchased by a third party (PT KOPPEL) to be used as raw material for secondary aluminum production. All hazardous waste classified as hazardous waste is recovered and processed through recycling/reuse by third parties. As a result, both categories of hazardous waste are deemed to have met the end-of-life criteria, and the potential environmental impact of the waste processing is the responsibility of the processor. Meanwhile, the potential environmental impact of hazardous waste incineration is the responsibility of PT Indonesia Asahan Aluminium.

Content Declaration

Product

INALUM's Aluminium Ingot Quality refers to JIS H2102 (Virgin Aluminium Ingot) and JIS H1305 (Method for Optical Emission Spectrochemical Analysis of Aluminium and Aluminium Alloys). Aluminium ingot G1 compositions of PT Indonesia Asahan Aluminium:

Material	Type	Composition	
Aluminium	Primary	99.70% Max	
Si	Chemical Composition	0.01% Max	0.30% Max
Fe	Chemical Composition	0.20% Max	
Cu	Chemical Composition	0.01% Max	
Ti and Mn	Chemical Composition	0.20% Max	

Packaging

The finished product is packed in bundles for convenient fork-lift handling with plastics or steel straps. Packaging weight per declared unit is shown in this table:

Types of Packaging	Quantity per Declared Unit	Unit
Strapping Band Polyester-18.3~19.00mm	2.42E-04	kg/kg
Strapping Band Polyester-19.0X1.0mm	6.50E-05	kg/kg
Strapping Band Steel-25.4X0.90mm	7.11E-05	kg/kg

Recycled material

There was no material recycled during the life cycle stages of the product.

Below is a diagram of the common production system at PT Indonesia Asahan Aluminium.

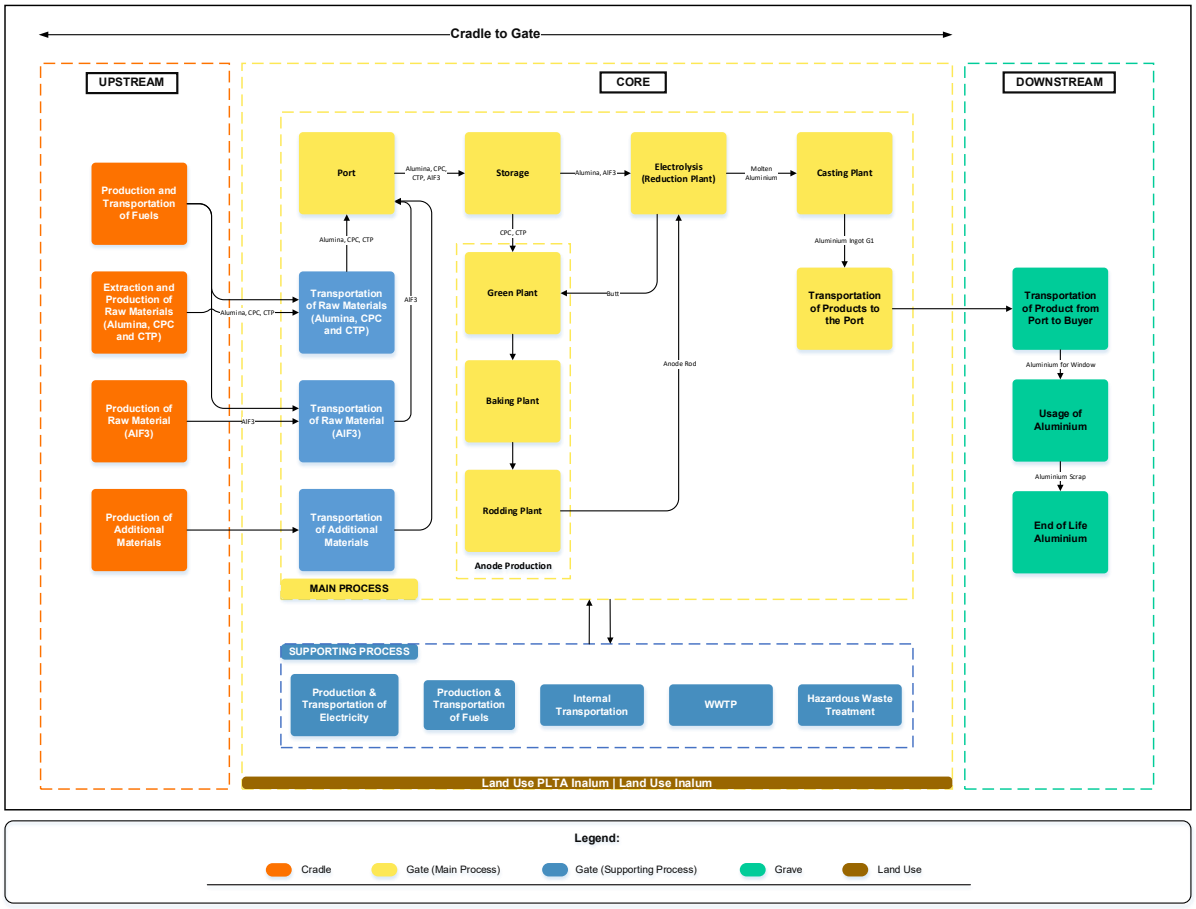

Figure 1. Diagram of Production System in PT Indonesia Asahan Aluminium

Results of the Environmental Performance Indicators

The environmental performance results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. The results of the impact of

the aluminium ingot G1 production process are presented in the impact category table analyzed using the EN15804 method in SimaPro software version 9.5.0.0., which includes EF 3.1. All reported results are expressed **per declared unit (DU)** as required by the PCR.

Impact category indicators

Impact category	Abbrev.	Unit	Method	Total	Upstream	Core
Global warming potential						
Global warming potential, fossils	GWP - Fossil	kg CO_2 eq/kg	EN 15804	1.16E+01	7.84E+00	3.75E+00
Global warming potential, biogenic	GWP - Biogenic	kg CO_2 eq/kg	EN 15804	0	0	0
Global warming potential, land use and land use change	GWP - Luluc	kg CO_2 eq/kg	EN 15804	2.17E-03	1.94E-03	2.24E-04
Global warming potential, total	GWP - Total	kg CO_2 eq/kg	EN 15804	1.16E+01	7.83E+00	3.75E+00
Acidification potential	AP	mol H+ eq/kg	EN 15804	6.69E-02	5.30E-02	1.39E-02
Eutrophication potential						
Eutrophication potential, freshwater	EP - Freshwater	kg P eq/kg	EN 15804	1.79E-03	1.75E-03	4.14E-05
Eutrophication potential, marine	EP - Marine	kg N eq/kg	EN 15804	7.56E-03	7.07E-03	4.97E-04
Eutrophication potential, terrestrial	EP - Terrestrial	Mol N eq/kg	EN 15804	7.36E-02	6.81E-02	5.51E-03
Photochemical ozone creation potential	POCP	kg NMVOC eq/kg	EN 15804	2.72E-02	2.46E-02	2.62E-03
Ozone depletion potential	ODP	Kg CFC_{11} eq/kg	EN 15804	1.67E-07	1.59E-07	7.46E-09
Abiotic depletion potential for mineral and metals (non fossil resources)	AD - Minerals & Metals	kg SB eq/kg	EN 15804	6.62E-06	4.45E-06	2.17E-06
Abiotic depletion potential for fossil resources	AD - Fossil	MJ/kg	EN 15804	8.46E+02	8.40E+02	5.60E+00
Water deprivation potential	WDP	m^3 depriv/kg	EN 15804	6.73E-01	6.33E-01	4.03E-02

*Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator

Resource use indicators

Parameter		Abbrev.	Unit	Total	Upstream	Core
Primary energy resources – Renewable	Use as energy carrier	PERE	MJ/kg, net calorific value	4.97E+01	1.36E+00	4.84E+01
	Used as raw materials	PERM	MJ/kg, net calorific value	0	0	0
	TOTAL	PERT	MJ/kg, net calorific value	4.97E+01	1.36E+00	4.84E+01
Primary energy resources – non renewable	Use as energy carrier	PERNRE	MJ/kg, net calorific value	8.46E+02	8.40E+02	5.60E+00
	Used as raw materials	PERNRRM	MJ/kg, net calorific value	0	0	0
	TOTAL	PERNRT	MJ/kg, net calorific value	8.46E+02	8.40E+02	5.60E+00
Secondary material		SM	kg/kg	0	0	0
Renewable secondary fuels		RSF	MJ/kg, net calorific value	0	0	0
Non-renewable secondary energy		NRSE	MJ/kg, net calorific value	0	0	0
Net use of fresh water		NUFW	m^3/kg	7.06E+00	6.62E+00	4.36E-01

Waste indicators

Parameter	Unit	Total	Upstream	Core
Hazardous waste disposed	kg/kg	7.74E-02	0	7.74E-02
Non-hazardous waste disposed	kg/kg	5.18E-05	4.73E-05	4.55E-06
Radioactive waste disposed	kg/kg	0	0	0

Output flow indicators

Parameter	Unit	Total	Upstream	Core	Downstream
Component for reuse	kg/kg	0	0	0	0
Material for recycling	kg/kg	0	0	0	0
Material for energy recovery	kg/kg	0	0	0	0
Exported energy, electricity	kg/kg	0	0	0	0
Exported energy, thermal	kg/kg	0	0	0	0

Impact Contribution

The following graph illustrates the relative contribution of each stage of the production process, from upstream to core, to the various environmental impact categories measured. It can be seen that some environmental impact categories have a much more dominant contribution compared to other categories. These results suggest that environmental mitigation efforts need to be focussed on the stages and impact categories that make the most significant contributions. In general, the process units that contribute most significantly to each stream are:

Upstream : Extraction and Production of Raw Materials and Production of Additional Materials
Core : Reduction Plant, Baking Plant, Transportation of Additional Materials, Production of Fuels (Core) and Transportation of Electricity

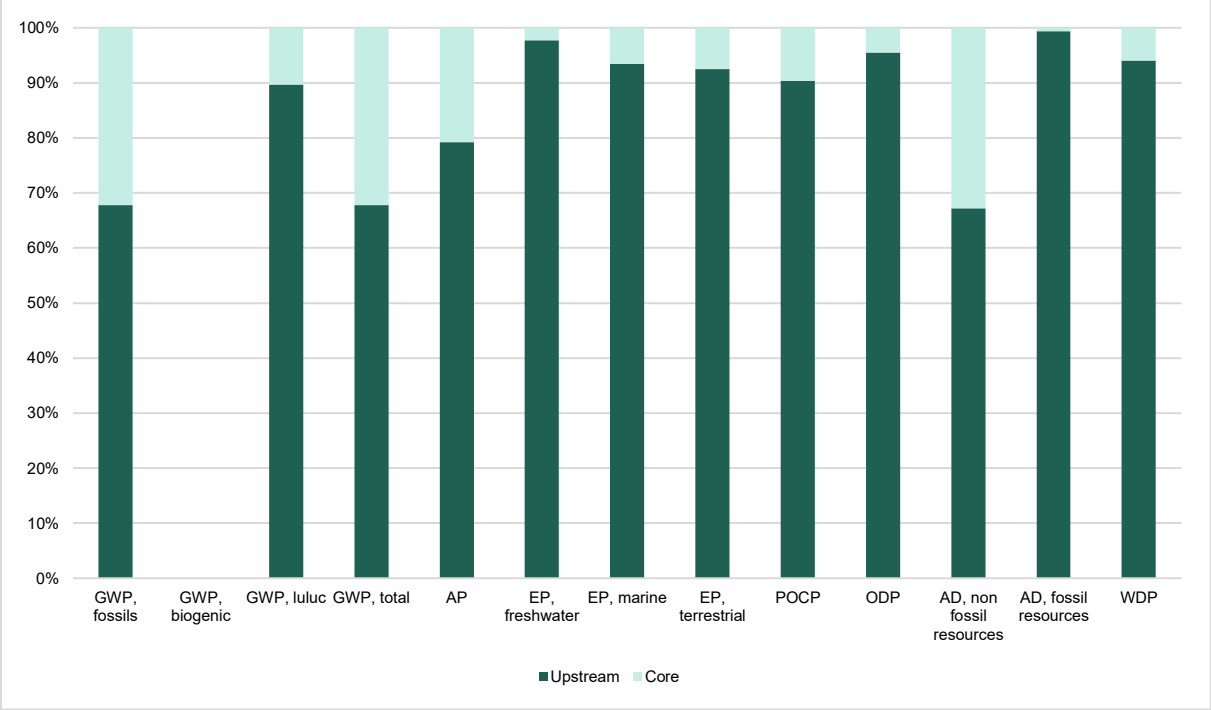

Figure 2. The Distribution of the Upstream to Core Impact Contribution

Additional Environmental Information

Biodiversity Conservation Development

Some of the biodiversity conservation programs that have been implemented by PT Indonesia Asahan Aluminium including:

1. Mangrove Planting with the Cinta Mangrove Farmer Group (KTCM) and National Armed Forces (TNI)
   In collaboration with the KTCM and the TNI, PT Inalum implemented a mangrove planting program in Silo Baru Village, which had been designated as a Maritime Village by Bakamla RI in 2019. Supported by the Ministry of Environment and Forestry and the Peatland and Mangrove Restoration Agency (BRGM), the program involved planting 670,000 mangrove seedlings across 134 hectares and provided temporary employment for 189 local residents. The initiative is carried out through the company's Corporate Social Responsibility (CSR) program..
2. Planting of Rhizophora & Avicennia Mangroves at Pantai Sejarah
   Through its innovation program, PT Inalum planted *Rhizophora* and *Avicennia* mangroves at Pantai Sejarah using the Range Wall Plant method. The *Rhizophora* mangroves serve as foster trees to support marine biota ecosystems and conservation of endangered bird species such as the Lesser Adjutant Stork (*Leptoptilos javanicus*) and Milky Stork (*Mycteria cinerea*). Meanwhile, the *Avicennia* mangroves act as natural seawalls to protect the coastal area from high waves and preserve the local ecosystem.
3. Deer Breeding at Tanjung Gading Residential Complex
   PT Inalum initiated a spotted deer (*Axis axis*) breeding program at its Tanjung Gading Residential Complex in cooperation with the Pematang Siantar Animal Park (THPS). This program arose from a CSR partnership aimed at supporting wildlife facilities, during which surplus animals from THPS were relocated to Tanjung Gading for breeding under THPS guidance. The initiative reflects Inalum's commitment to biodiversity conservation through its CSR efforts.

Environmental Risk

PT Indonesia Asahan Aluminium has consistently managed environmental risks that occur due to its production process through the identification of significant risks to the environment. The potential risks are identified as energy, water, waste water, air, hazardous waste and non hazardous waste pollutions. The environmental management performance is calculated annually and reported through a verification report on the integration of LCA studies to the Ministry of Environment and Forestry, Republic of Indonesia. Some of the environmental risk control programs carried out by PT Indonesia Asahan Aluminium can be seen in the table below.

Aspect	Program
Energy	• Optimization of the electric baking process in pots (from 72 hours to 48 hours) • Optimization of billet and alloy casting processes to reduce LPG consumption • Conversion of high-speed diesel (HSD) to liquefied natural gas (LNG) in the anode baking process
Hazardous Waste	• Reduction of anode scrap waste by circulating anode butts back into the system for anode production • Reduction of dust waste from air pollution control facilities by circulating butt dust back into the system for anode production • Reduction of hazardous waste from pot reconstruction through the implementation of partial and semi-partial pot reconstruction applications
Non-Hazardous Waste	• Utilization of used scrap waste to modify the crush breaker unit in reduction furnace cleaning activities
Water	• Recycling of main fan cooling water in the gas cleaning unit • Replacement of compressor cooling water circulation pipes in the plant utility • Recycling of outlet water from the wastewater treatment plant (WWTP) back to the baking plant
Waste Water	• Reduction of water pollutant load (fluoride) through recycling of main fan cooling water in the gas cleaning unit • Reduction of water pollutant load (COD) through recycling of WWTP outlet water back to the baking plant

Aspect	Program
	• Innovation in shellfish shell filtration to improve wastewater quality
Air Pollutant	• Revamping anode baking furnace • Installation of blue boxes for process control in reduction furnaces • Application of longitudinal slotted anodes

Noise

Noise measurements are routinely conducted in production facilities (which have the potential to generate noise). Noise level measurements at PT Indonesia Asahan Aluminium were carried out by PT Sucofindo between November 18 and 25, 2024, at the Smelter Reduction Operation and Smelter Reduction Preparation Section. The monitoring, conducted in accordance with Permenaker No. 5/2018. Throughout 2024, there were measurement results that exceeded the quality standard, with the following information:

Parameter	Unit	Results				NAB*)	Method
		1	2	3	4		
Noise	dB	91.0	89.5	94.0	88.3	85	SNI 7231:2019

*) Permenaker No. 5/2018

Based on these results, PT Indonesia Asahan Aluminium conducted several follow-up actions as follows:

- Improve and enforce discipline to employees to always use personal protective equipment (PPE), especially earplugs in the area in order to improve occupational health and safety.
- Installing warning boards that noise has exceeded the threshold at several locations in the area, so that workers can know the noise level that occurs.
- Installing warning boards to use personal protective equipment, especially earplugs. Install the warning boards in strategic locations that are easy to see, as well as in locations that are prone to noise, especially around the work environment area.

Electromagnetic Field

Measurement of electromagnetic fields (EMF) at PT Indonesia Asahan Aluminium is conducted once a year as part of occupational hygiene monitoring, in accordance with Permenaker No. 5/2018. The most recent measurement was carried out by PT Sucofindo between November 18 and 25, 2024, at three locations within the Smelter Reduction Operation/Smelter Reduction Preparation Section:

1. Reduction Building (Block 3-1)
2. Second Floor (Block 3-3 Middle)
3. Second Floor (Block 6-4 End)

Parameter	Unit	Results			NAB*)	Method
		1	2	3		
Magnetic Field	T	0.176	0.111	0.133	2	Electrometric

*) Permenaker No. 5/2018

The results recorded magnetic field strengths, respectively, all of which remain below the threshold limit value (NAB) of 2 T as stipulated by the regulation. These findings confirm that EMF exposure levels in the monitored areas are within safe limits for workers.

Land Use

Total land use of PT Indonesia Asahan Aluminium is 209.42 Ha. According to Corine Land Cover Classes, the land was used to be an open-spaces with little or no vegetation (class 3.3) dan now became an industrial area (class 1.2).

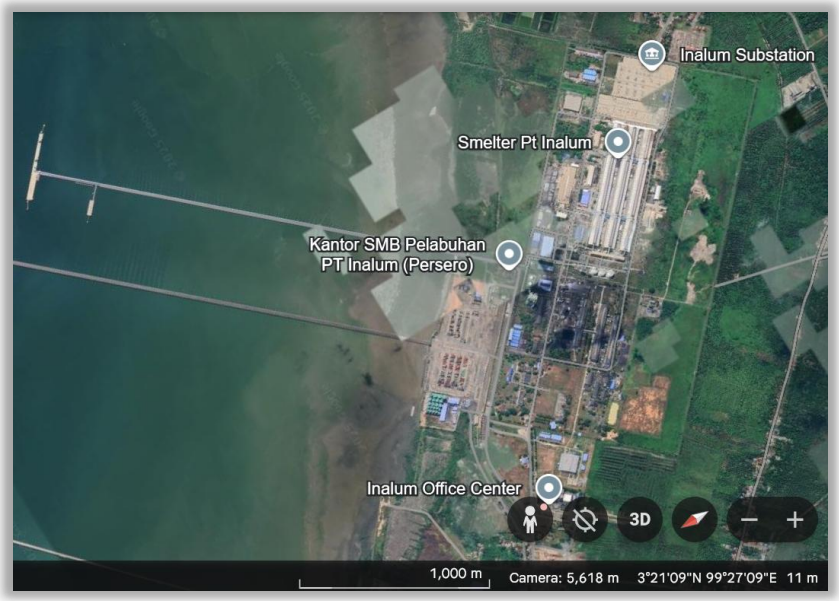

Figure 3. PT Indonesia Asahan Aluminium seen from Google Earth

Contact Information

EPD Owner

PT Indonesia Asahan Aluminium

Address:

Kuala Tanjung, Sei Suka District, Batu Bara Regency, North Sumatra 21657, Indonesia

Contact:

(0622) 313111/62231001

www.inalum.id

sampe@inalum.id

jerry@inalum.id

LCA Practicioner

PT ITS Tekno Sains

Address:

Institut Teknologi Sepuluh November, Research Center Building, Jl. Teknik Kimia Kampus, Keputih, Sukolilo District, Surabaya City, East Java 60111, Indonesia

Contact:

0812-2999-265

corporate@itsteknosains.co.id

Programme Operator

EPD International AB

Box 21060

SE-100 31 Stockholm

Sweden

Regional Hub EPD Southeast Asia

Kencana Tower Level M, Business Park Kebon Jeruk, Jl. Raya Meruya Ilir No.88, West Jakarta 11620, Indonesia

Contact:

admin@epd-southeastasia.com

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