Ditjen PEN/MJL/53/XII/2020

KEMENTERIAN PERDAGANGAN
REPUBLIK INDONESIA
MINISTRY OF TRADE

Export News

December 2020

COPPER

DIRECTORATE GENERAL OF NATIONAL EXPORT DEVELOPMENT

EDITOR DESK

Copper is a chemical element number 29 and has a symbol of Cu in the periodic table. Its symbol comes from the Latin, Cuprum. Copper has the best electrical conductivity, high ductility, malleability and resistance to corrosion. Pure copper is smooth and soft, with a reddish orange surface. Copper is one of the trade commodities which fully supported by domestic industrial sectors and government, both the mining industry, the processing industry, as well as other large and medium industries. Mining industry is economically important to fulfill domestic needs and also export transactions.

Copper, the second best metal after silver, is a mineral essential to our daily lives. It has been recognized by many people because it can be easily found in many household applications and in industrial. Its application mainly used for the production of cables, wires, and electrical products for power and building constructions, plumbing, heating and sheet metal coatings. It is a major industrial metal because of its thermal, electrical conductivity and resistance to corrosion. Copper is also easily alloyed with other metals.

China was at the top lists as the largest importer for copper in 2019 with the shipment of 115.000 tonnes worth US $ 115,75 million or 17,12 percent of total global exports. The United States, the second largest importer, has 13.370 tonnes worth US $ 98,06 million while the smallest importer was Brunei Darussalam with import transaction of only 1.000 tonnes worth US $ 37 million.

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HOT ISSUE

Indonesia in the Global Mining Industry

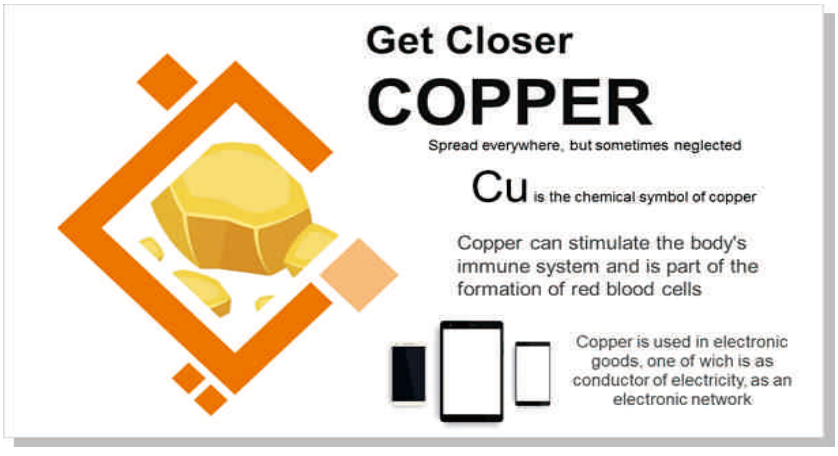
Mining in Indonesia continues to be a significant player in the global mining industry. Indonesia has significant production of copper and other metals such as coal, nickel, gold, tin and bauxite.

Metallic copper has a reddish color and a cubic crystal structure. This metal is very suitable as a conductor of electricity and heat. The production of copper in Indonesia in 2019 only reached 180.204 tonnes while the national target production was at 291.000 tonnes. Indonesia's industry and economy during this time of year have been struggling in facing global movements, one of which is related to the mining sector. In mid-2019, copper prices fell again because of the impact of the trade war between the United States and China.

The U.S government has been carrying out threats against China regarding import tariffs. These threats can pose a risk of declining demand for metals and minerals commodities. The trade war has resulted in a decline in metal demand from China which is known to be the world's largest metal consumer.

Indonesia has copper metal resources of 4.925 million tonnes and 4.161 million tonnes in reserves. Copper is the third most used metal in the world, after iron and alumunium. Although Indonesia's copper production is significant, Indonesia was behind Japan, India, Korea and Bulgaria as copper metal producers. Unlike Indonesia, these countries do not have raw materials from mine field. Indonesia is not even a part of the copper smelter capacity growth in Asia. In 20 years, Asia has increased the share of copper metal production from 10% to 60%.

The copper stockpiles had increased due to increasing smelters were being built. However, the spread of electric vehicles, semiconductors and non-renewable energy in the future which use high volumes of copper is expected to lift demand. It is predicted in 2023 will reach 25 million tonnes. The increase demand for copper in the future is an opportunity to encourage the construction of smelters. Another impact by building smelters is labors absorption and increase production capacity.



MARKET REVIEW

Copper Export Performance

Copper prices has huge impact on copper production. Higher copper prices will encourage producers to further increase their production and open up opportunities to get higher profits. The exchange rate also has a significant effect on the production. When the exchange rate depreciates, there will be an increase in copper production. It is because when the exchange rate depreciates, prices becomes cheaper so that the demand will get higher. Higher demand for copper will encourage copper mining companies to produce more so it can reach to maximum profits. Furthermore, domestic consumption also has a significant affect on the production. Higher demand consumption and the volatile of prices will highly effect production rate of coppers.

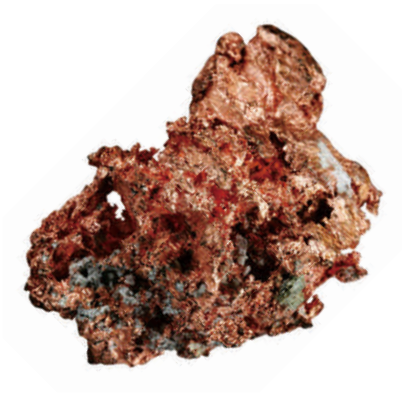
The company's working capital, however, does not have a significant effect on copper production. There is no indication of the production rate affected by working capital. It means any changes in working capital will not have effects on the production rate. Investors, lately, have a low interest to put their money in the mining sector because of the lack of socialization regarding the prospects of copper commodities but in the future, it is expected to increase so the mining sector will pick up again.

Export sales also have a significant effect on the production rate. Higher export transaction will increase the production rate. Higher export means global demand also increases and our national economy will get better due to the increase of foreign exchange trading.

Indonesia's copper is divided into unwrought copper, bar copper, sheet copper and other shapes. Copper when alloyed with other minerals such as zinc, tin, aluminum and nickel, can produce many types of products that have high economic value. Copper can be found in everyday applications such as cables, the telecommunications and electronics industry, construction and transportation, the electric motor industry, generators, motorised vehicles, coaxial tubes, microwave tubes, switches, rectifiers, transistors, and many more. Copper was also used as a material for making coins. Since ancient times, copper coins have been used a lot, although in recent times copper coins have become so rare and physical money has been replaced with electronic money.

Mineral and metal commodities in Indonesia are slowly declining due to several factors that disrupt the industry. Some mining companies have decreased their production because of the difficulties of land expansion processes, low mineral content and high rainfall season which hold up the production.

Indonesia's copper production throughout 2019 reached 176.400 tonnes, dropped from 2018 productions of 230.923 tonnes. The drop was caused by the transition of PT Freeport Indonesia from the open-pit Grasberg mining to



underground mining. Freeport Indonesia in Q1 2020, recorded sales transaction to be lower than last year in same period. Copper sales in Q1 2020 were at 127 million pounds dropped by 21% than Q1 2019 174 million pounds. The gold sales was also drop by 40,85% from 139 thousand ounces in Q1 2020 to 235 thousand ounces in Q1 2019.

The operation of Grasberg Block Cave underground mine and the Deep Mill Level Zone are proceeding according to plan amid the Covid-19 pandemic. Its operation has produced high quality ore at low cost. In the first quarter, ore production from the Grasberg Block Cave and Deep Mill Level Zone reached an average of 37.000 tonnes of ore per day. Starting in 2020, Freeport Indonesia has shifted all of its production activities to underground mining, after the copper and gold reserves of the open-pit mine were depleted.

Freeport's copper sales had increased in line with the completion of the Grasberg Block Cave and Deep Mill Level Zone underground mines. The sales of gold and copper are projected to start climbing up significantly next year, copper will be increased by 1,4 billion pounds and gold by 1,4 million ounces. Furthermore, it will began to reach their highest peak in 2023, 1,7 billion pounds of copper and 1,8 million ounces of gold.

Many mining companies expect the government to provide tax relaxation for copper and minerals particularly amid this pandemic. It is also hoped in the future that the government can collaborate with companies to open new environmentally friendly copper mining areas and to develop the newest technology so it will be less damaging to the environment. The prospect of copper export for the upcoming years is expected to provide opportunities to increase Indonesia's foreign exchange, and also increasing income and people's welfare.

It is very important to preserve the environment through responsible mining to make the business more sustain and responsible to environment and to society. One of many factors to keep exports going and increasing is good relationship with trading partners another factor is to stabilize the exchange rate of foreign currencies (especially Indonesian Rupiah (IDR) against the USD currency). It takes government efforts or policy makers to increase Indonesia's economic growth, especially the mining industry.

Global Export Opportunities for Copper:

1. **Japan**
   Japan, the second largest importer for HS 2603 copper ores and cencentrates, had closed all their mines in 1994 so Japan imports all copper ore from other countries. These are the following import regulations on copper in Japan.

   1) Custom Law
      Almost all HS codes for copper com products

from Indonesia are free of import duties due to

List of Indonesia's Copper Exporters

1. **PT. ANEKA TAMBANG (Persero) Tbk**
   Gedung Aneka Tambang, Jl. TB Simatupang No. 1 Lingkar Selatan - Tanjung Barat, Jakarta Selatan - DKI Jakarta
   Tel. : (62-21) 7891234, 7812635
   Fax. : (62-21) 7812635, 7891224
   Email : corsec@antam.com, mis_nickel@antam.com, infolm@antam.com, trenggono.sutiyoso@antam.com, hari.widjajanto@antam.com, aprilandi@antam.com, wijanarko@antam.com, dody.martimbang@antam.com
   Website : www.antam.com

2. **PT. SMELTING**
   Menara Mulia Lantai 17 Suite 1703, Jl. Jend. Gatot Subroto Kav. 9-11, Jakarta Selatan - DKI Jakarta
   Tel. : (62-21) 5222808, 5222811
   Fax. : (62-21) 5229615, 5226688
   Email : ristyw@ptsmelting.com, osiebatamhr@osielectronics.com
   Website : www.ptsmelting.com

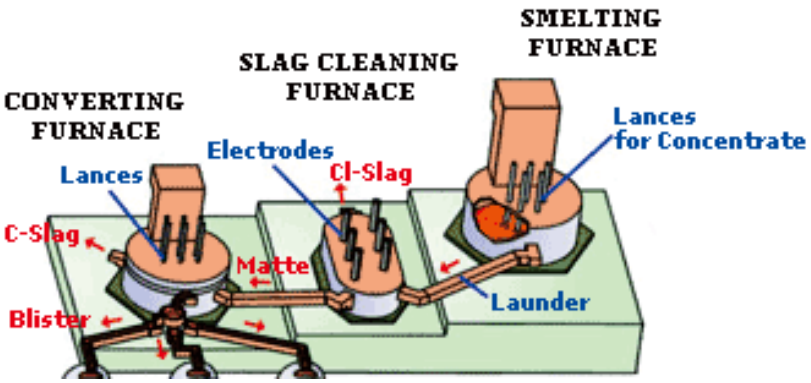
3. **PT. FREEPORT INDONESIA**
   Plaza 89 Lantai 5, Jl. HR. Rasuna Said Kav. X-7 No. 6, Jakarta Selatan - DKI Jakarta
   Tel. : (62-21) 2591818, 5225666
   Fax. : (62-21) 2591816, 2591945
   Email : maliki_ibrahim@fmi.com, webmaster-PTFI@fmi.com, pwowor@fmi.com
   Website : www.ptfi.co.id

Smelting, PT

PT Smelting was established in February 1996 as the first copper smelter and refinery in Indonesia with approximately US $500 million for direct construction cost.

The plant was originally designed to produce 200,000 tpy of "LME Grade A" copper cathode from 660,000 tpy of copper concentrate supplied by domestic mining companies. Currently copper cathode production level has been expanded to over 300,000 TPY, with priority of it is sold for Indonesian market and the rest is exported to Asian market. By-products of sulfuric acid, granulated slag and gypsum are delivered to local market, and anode slime and copper telluride are exported to international market.

PRODUCTION PROCESS FLOW



SMELTING
Mitsubishi Continuous Process

PT. Smelting applies Mitsubishi technology for copper smelting process. The Mitsubishi process is copper continuous smelting and converting technology using three furnaces. The three furnaces are linked with covered launders, through which all the molten materials are continuously transferred by gravity.

Copper concentrate (Cu: 30%, S: 30%, Fe: 25%, Gangue minerals 15%) is fed through lance pipe with oxygen enriched air into the smelting furnace then oxidized and melted by exothermic reaction to form molten mixture of matte (Cu: 68%) and slag. The matte is separated from slag by difference of specific gravity in the slag cleaning furnace. The matte is further oxidized to form blister copper (Cu: 98.5%) in the converting furnace.

The Advantage of Mitsubishi Process

1. *High Copper (Cu) Recovery Rate*
   Low copper content in the discard slag (0.6 to 0.7% Cu)

2. *Less Fugitive Gas Emission*
   Molten melt transfer through covered launder minimizes source of harmful environmental gas emission and reduces environment expenditures

3. *Stable & Higher SO2 in Off-gas*
   A compact and simple design acid plant can be applied to convert SO2 in the furnace off-gases to marketable sulphuric acid
4. *High Efficient and Flexible Operation*
   High intensity reaction below the furnace lances accelerates feed material melting and has a flexibility in treating wide range and grade of concentrates and secondary materials

5. *Compact Facilities*
   Reduction of construction cost through simplified facilities

Process Description

1. **Smelting Furnace (S-Furnace)**
   Dried concentrate and flux materials like silica sand are injected into S-furnace through vertical lances and oxidized with oxygen-enriched air to produce molten matte and slag, and their mixture overflows from the S-furnace down to the CL-furnace through launder.

2. **Slag Cleaning Furnace (Cl-Furnace)**

CL-furnace is heated by two sets of delta type electrode (2100 &1500 KVA). Matte is separated from slag by difference of specific gravity. Slag is overflowed, water-granulated and sold to cement industry while molten matte (Cu 68%) is constantly siphoned out and transferred to the C-furnace through launder.

3. **Converting Furnace (C - Furnace)**

Matte and flux (limestone) are reacted with oxygen-enriched air to form blister copper and then separated from the slag by difference of specific gravity. Slag (Cu14%) is returned to S-furnace, and blister copper is siphoned out and forwarded to Anode furnaces.

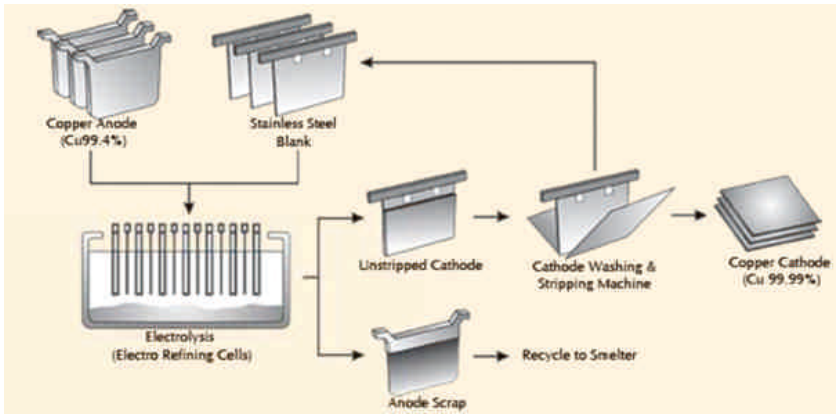
4. **Anode Furnace**

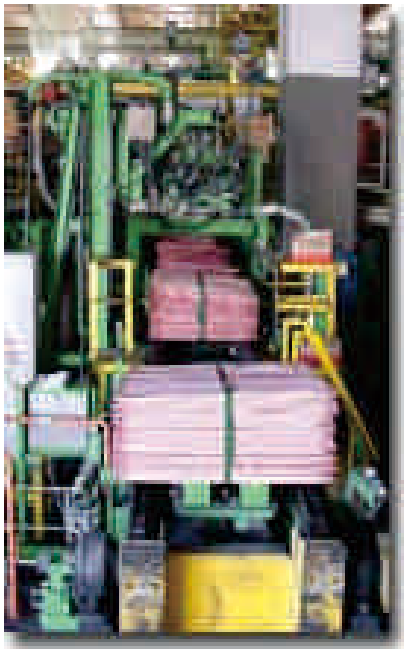
Blister copper from C-furnace is delivered into one of Anode furnaces by using switching launder system. In this furnace, oxidation and reduction reactions are occurred to produce refined copper ready for casting.

5. Hazelett Caster

Refined copper from Anode furnace is cast continuously into copper strip by a Hazelett Twin Belt Caster. This continuous copper strip is cut into anode pieces by a hydraulic shearing machine

REFINERY





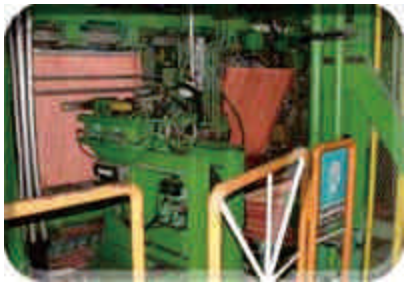
THE ISA PROCESS

Copper is electrorefined from anode by means of electrolysis process using SS-blank as cathodes. Copper anodes and SS blanks are inserted in altenatively electrorefining cells. By applying direct current to this cell, copper in anode is dissolved and deposited onto the SS-blank surface. Cu % in cathode is more than 99.99%. By products at Refinery are anode slime and copper telluride.

PROCESS DESCRIPTION

1. The copper anodes are placed in cells between stainless steel blanks submerged in electrolyte.

2. Stainless steel blanks are pulled out from the cells for the first crop of one-week deposit (50 kg cathode x 2 sheets) and second crop of 13 days (100 kg cathode x 2 sheets).

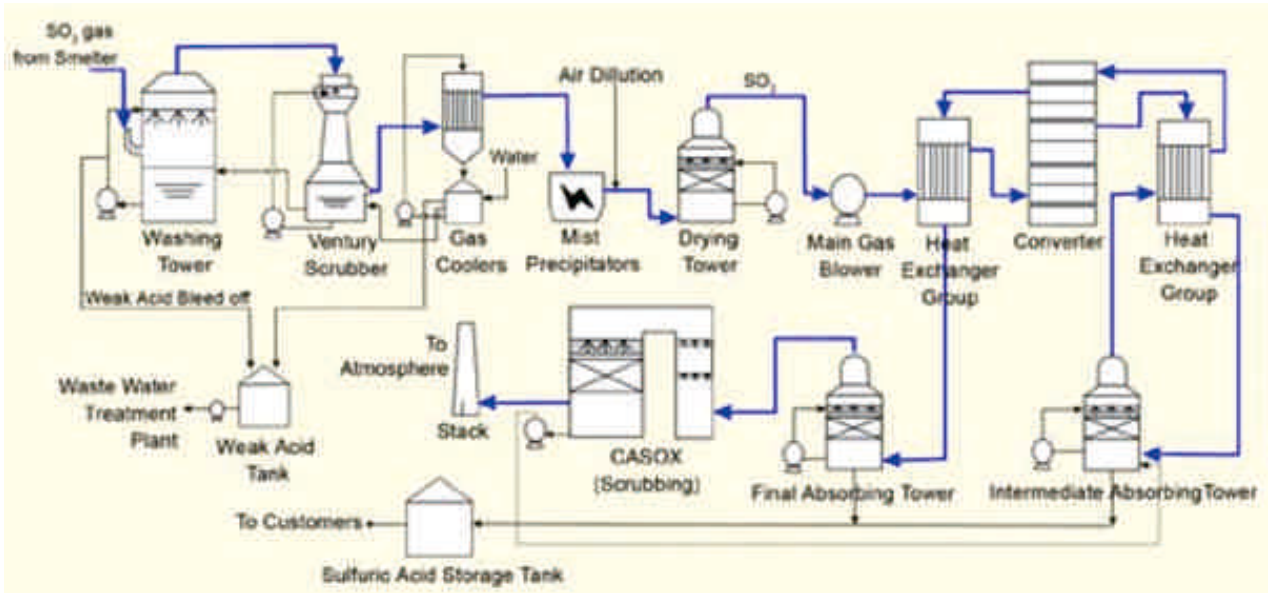


3. Copper plates are washed and stripped off at CWSM (Cathode Washing & Stripping Machine)

4. The anode scrap is recycled back to smelter.

5. Copper cathode product is automatically weighed and bundled ready for shipping.

LURGI - MITSUBISHI PROCESS : DOUBLE CONTACT / ABSORPTION



1. The SO_2 gas from smelter is cleaned from the dust in the washing tower, ventury scrubber, gas Coolers and mist precipitators.

2. The cleaned wet gas enters the drying tower in counter current flow with 96% sulfuric acid to capture the moisture.Then the dried gas delivered to converter area through main gas blower.

3. The dried SO_2 gas is converted to SO_3 by four beds of Vanadium pentaoxide (V2O5) catalyst which has overall SO_2 conversion rate more than 99.8% .

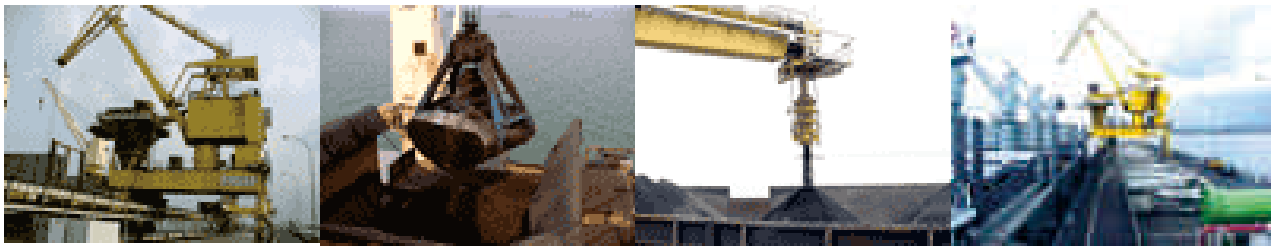
4. The SO_3 gas out of the third catalyst bed is absorbed into sulfuric acid in the intermediate absorption tower (IAT). The SO_3 gas out of the absorption tower (IAT). The SO_3 gas out of the final catalyst bed is absorbed into sulfuric acid in the final absorption tower (FAT) to produce sulfuric acid.

FACILITIES

Jetty & Wharf

Two kilometers jetty and 230 meters wharf are designed to handle 35,000 tons vessels with normal unloading capacity of 350 tons/hour.

The wharf can be also used for slag loading to ship by the reversible belt conveyor.



MAINTENANCE WORKSHOP

Workshop is designed for daily supporting maintenance of smelter plant, acid & WWT plant, refinery plant, raw material handling and ancillary facilities.

UTILITY CONSUMPTION

>> Electricity Power	310,000	MWh/year
>> Natural Gas	18,000	kNm^3/year
>> Oxygen	210,000	kNm^3/year
>> Process Water	175	m^3/hour
>> Sea Water as non-contact cooling	13,000	m^3/hour

LABORATORY

Laboratory has 4 Subsidiary:

Sampling	Sampling work consist of onsite sampling such as sampling Raw Material from PT Freeport Indonesia or PT Newmont in Hopper and preparation sample in Laboratory.
Process	Be responsible to analyze sample for control of Process and for Environmental Monitoring.
Raw Material and Product	Be responsible to analyze sample to control Raw Material quality and manage quality of Copper Cathode Product.
Fire Assay	Responsible to analyze Precious Metal

Equipment and Instrumental

Sampling Equipment	All samples are prepared with advance sampling equipment, such as: Auto sampler for Copper Concentrate, Melting Furnace, Power Mill, etc.
Instrumental	All samples are analyzed with advance computerized instrumental, such as: ICPS, XRF Spectrometer, Sulfur and Oxygen Determinator, HYD -Atomic Absorption Spectrophotometer, Graphite -Atomic Absorption Spectro photometer, etc.

COMPUTER BUSINESS SYSTEM

Smelting utilizes JDEdwards software as Enterprise Resource Planning (ERP) database application runs in IBM AS/400 server.

JDEdwards handles business activities integrally such as Accounting, Purchasing and Warehouse.

MAIN PRODUCT

Product : Copper Cathode
Weight : 50 kg & 100 kg
Capacity : 300,000 Ton/year
Application : Wire, Cable, Tube

COPPER CATHODE MSDS		
Product and Company Identification	Product Name	Copper Cathode
	No	GSR - SDS 003
	Manufacturer Information	Manufacturer's Name PT. Smelting Gresik Smelter and Refinery Address Desa Roomo, Kecamatan Manyar PO. Box 555 Gresik 61151 Jawa Timur - Indonesia Telephone Number : 62-31-397-6458/59 Fax Number : 62-31-397-6460
Composition/ Information on Ingredients	Chemical formula	Cu
	Element and Content	Cu : > 99.99 %
	CAS No	07440-50-8
Hazard Identification	-	
First Aid Measures	Inhalation	-
	Eye Contact	-
	Skin Contact	-
	Ingestion	-
Fire Fighting Measures	Extinction method	None
	Fire fighting equipment	No specify
Accidental Release Measures	-	
Handling and Storage	Handling	Heavy equipment is necessary
	Storage	None
Exposure Controls / Personal Protection	Exposure Controls	-
	Personal Protection:	
	Respirator Protection	Unnecessary
	Eye Protection	Unnecessary
	Skin Protection	Unnecessary
Physical And Chemical Properties	Physical State	Copper plate
	Color	Red metal
	Odor	Odorless
	Boiling point	2,595° C
	Steam Pressure	-
	Volatile	-
	Melting point	1,083° C
	Specific gravity	8.9
	Solubility in water	-
Stability and Reactivity	General	Product is stable
	Dust explosion	None
	Ignition (reactivates of spontaneous ignition and water)	None
	Oxidize ability	the surface will be oxidized when contact with ambient air in a long time
	Combustibility	None
Toxicological Information	Skin corrosively	-
	Stimulation (skin and eyes)	-
	Acute toxicity (included : lethal dose 50)	-
	Sub-acute toxicity	No
	Chronic toxicity	No
	Cancer field	No
	Mutation field (microorganism & abnormal chromosome)	No
	Genital Toxicity	No
Ecological Information	Decomposition	No
	Accumulation	No
	Fish toxicity	No
Disposal Considerations	Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. Dispose unused content in accordance with local requirements.	
Transport Information	-	
Regulatory Information	-	
Other Information	Abbreviation CAS No	Chemical Abstract Service Number

BY PRODUCT

Product: Sulfuric Acid
Capacity: 920,000 Ton/year
Application: Fertilizer

Product: Gypsum
Capacity: 35,000 Ton/year
Application: Cement

Product: Copper Slag
Capacity: 655,000 Ton/year
Application: Cement, Concrete

Product Anode Slime
Capacity 1,800 Ton/year
Application Gold & Silver Refining

Product: Copper Telluride
Capacity: 50 Ton/year
Application: Semi Conductor, Optical Application, Coating for Solar Energy

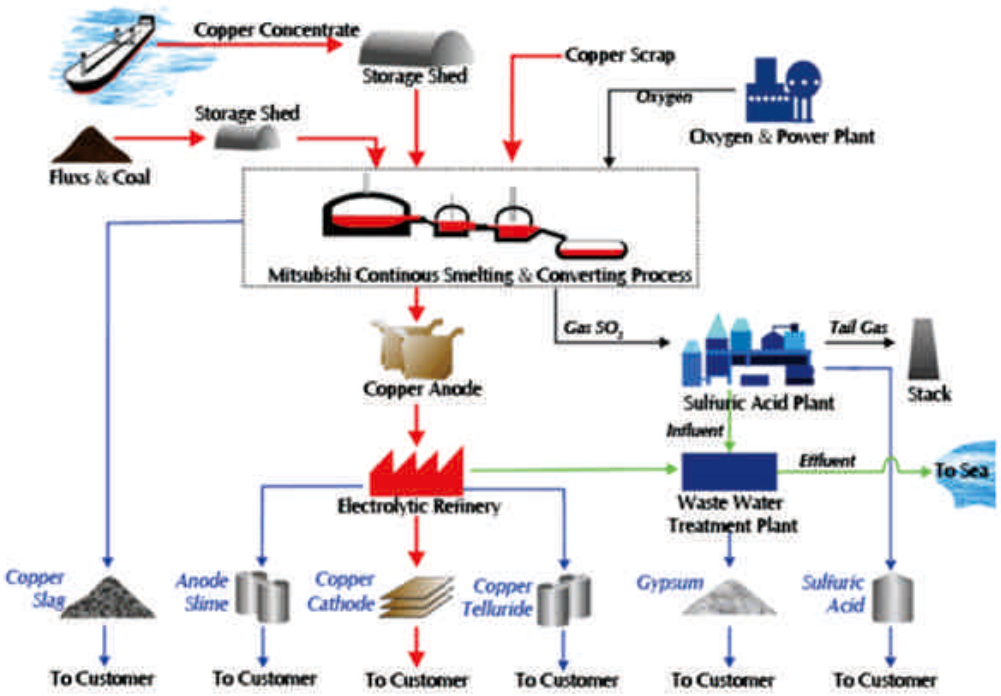
BY PRODUCT

COPPERSLAG MSDS		
Product and Company Identification	Product Name	Copper Slag
	No	GSR - SDS 005
	Manufacturer Information	Manufacturer's Name PT. Smelting Gresik Smelter and Refinery
		Address Desa Roomo, Kecamatan Manyar PO. Box 555 Gresik 61151 Jawa Timur - Indonesia Telephone Number : 62-31-397-6458/59 Fax Number : 62-31-397-6460
Composition/ Information on Ingredients	Chemical formula	$FeO-SiO_2-Al_2O_3-CaO$
	Element and Content	FeO : 45 ~ 55 % SiO_2 : 30 ~ 38 % CaO : 3 ~ 7 % Al_2O_3 : 1 ~ 5 %
	CAS No	-
Hazard Identification	Non hazardous material	
First Aid Measures	Inhalation	None
	Eye Contact	Rinse thoroughly with water. Seek medical attention for abrasion
	Skin Contact	Wash with soap and water
	Ingestion	Seek medical attention for discomfort
Fire Fighting Measures	Flash point and method	None
	Flammable Limits	Not Combustible
	Fire fighting equipment	This product is not a fire hazard

Accidental Release Measures	Land Spill	Clean up spilled material
	Water Spill	Clean up spilled material
Handling and Storage	Handling	It is safe to handle copper slag, however recommended to use personal protection
	Storage	Open stock yard
Exposure Controls / Personal Protection	Exposure Controls	-
	Personal Protection	
	Respirator Protection	Under ordinary condition no respiratory protection is required. Wear respirator/dust mask when exposed to dust above exposure limits
	Eye Protection	Wear glasses or safety goggles to prevent contact with eyes
	Skin Protection	Use gloves, shoes and protective clothing to prevent skin contact
Physical And Chemical Properties	Physical State	Solid
	Color	Grainy
	Odor	Odorless
	Boiling point	-
	Melting point	around 1200° C
	Specific gravity	
	True	3.5-3.7
	Apparent	1.0-2.1
	Solubility in Water	-

Stability and Reactivity	General	Product is stable
	Dust explosion	None
	Ignition (reactivity of spontaneous ignition and water)	None
	Oxidize ability	None
	Combustibility	None
Toxicological Information	Skin corrosiveness	No
	Stimulation (skin and eyes)	No
	Acute Toxicity (including lethal dose 50)	No
	Sub-acute toxicity	No
	Chronic toxicity	No
	Cancer field	No
	Mutation field (microorganism & abnormal chromosome)	No
	Genital Toxicity	No
Ecological Information	Decomposition	There is no problem
	Accumulation	There is no problem
	Fish toxicity	There is no problem
Disposal Considerations	Dispose in landfill in accordance with all applicable regulation. Any disposal practice must be in compliance with local regulations	
Transport Information	-	
Regulatory Information	-	
Other Information	Abbreviation CAS No	Chemical Abstract Service Number

SIMPLIFIED DIAGRAM



QUALITY ASSURANCE

LME Grade A

Brand Name: *GRESIK COPPER CATHODE*

In July 2001, the copper cathode was registered in LME (London Metal Exchange) as "Grade A" category, after comprehensive test work in European and Japanese costumers, with the brand name "Gresik Copper Cathode"

Note:
LME is one standard of the commonest non ferrous metal exchange in the world, prices in which are quoted as worldwide market prices' index.

ISO 9001:2000

Since January 2002, PT Smelting has obtained ISO 9001:2000 from Lloyd's Register.

ISO 9001 certificate is very important, to guarantee quality standard of PT. Smelting's product that makes customers more convinced about our product.

Beside, implementing ISO 9001 means that quality management system will be improved, then it will give good impact to stable operation and high-quality product.

Vale Indonesia Tbk, PT

Over half a century of operations in Indonesia, PT Vale Indonesia Tbk grew to become one of the leading mineral mining companies, with a longterm commitment to positively contributing to Indonesia's sustainable development.

COMPANY GENERAL INFORMATION

Company Name:
PT Vale Indonesia Tbk

Establishment Date:
July 25, 1968

Share Code:
INCO

Stock Exchange Listing Date:
May 16, 1990 at the Indonesia Stock Exchange (formerly Jakarta Stock Exchange)

Authorized Capital:
39,745,354,880 shares, with par value of IDR25 per share.

Issued and Fully Paid Up Capital : 9,936,338,720 shares, with par value of IDR25 per shares.

Head Office:
The Energy Building, 31st Floor
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Jakarta (12190) Indonesia

Tel.: +62 21 524 9000

Fax.: +62 21 524 9020

Representative Offices:
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Sulawesi Selatan, Indonesia

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Jl. Ternate 44, Sorowako
Nuha - Luwu Timur 92984
Sulawesi Selatan, Indonesia
Tel.: +62 21 5249100
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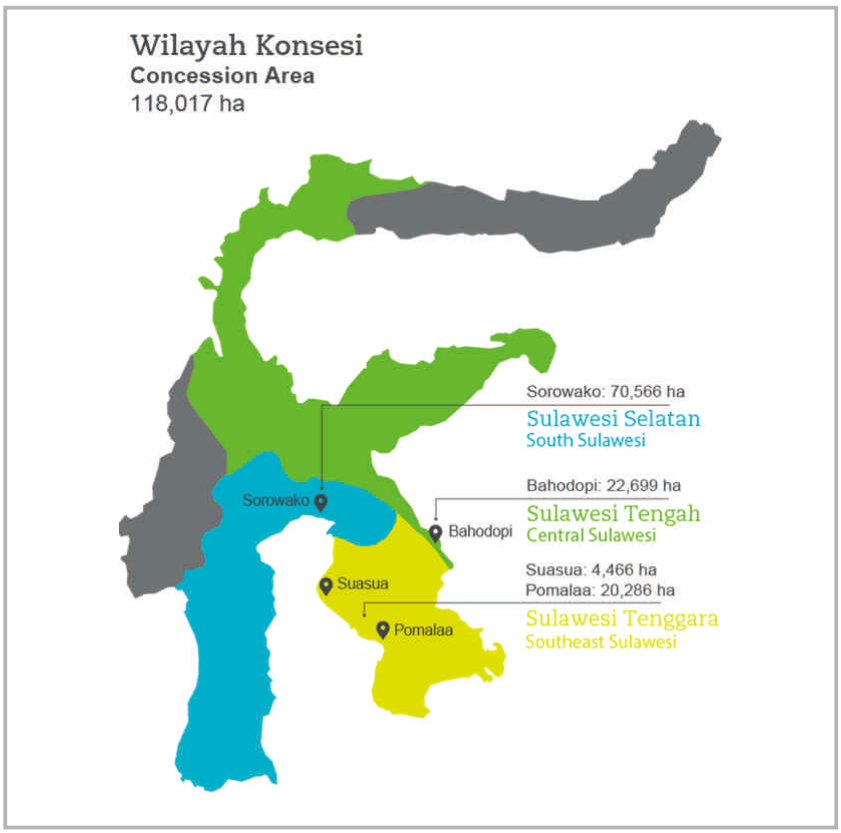
LEGAL BASIS FOR ESTABLISHMENT

PT Vale Indonesia was established by Deed No. 49 dated July 25, 1968, drawn up before Eliza Pondaag, a public notary in Jakarta. The Company's Articles of Association were approved by the Minister of Justice of the Republic of Indonesia in Decision Letter No. J.A.5/59/18 dated July 26, 1968, and published in Supplement No. 93 to State Gazette of the Republic of Indonesia No. 62 dated August 2, 1968. These Articles of Association have been amended several times with the latest amendment made by Deed No. 121, dated June 29, 2015, drawn up before Leolin Jayayanti S.H., a public notary in Jakarta, to reflect amendments to the Company's

Articles of Association as approved by the Extraordinary General Meeting of Shareholders ("Extraordinary GMS") on June 29, 2015. This amendment was approved by the Minister of Law and Human Rights of the Republic of Indonesia in Decision Letter No. AHU-0938647.AH.01.02 Year 2015 dated July 3, 2015, and obtained acceptance of notification from the Minister of Law and Human Rights of the Republic of Indonesia in Decision Letter No. AHU-AH.01.03-0948078 Year 2015 dated July 3, 2015.

CONTRACT OF WORK

We operates under the legal framework of Contract of Work which was amended on October 17, 2014 and is valid until December 28, 2025 with a concession area of 118,017 hectares covering South Sulawesi (70,566 hectares), Central Sulawesi (22,699 hectares) and Southeast Sulawesi (24,752 hectares).



PT Vale Indonesia mines laterite nickel ore and processes it into the final product of nickel in matte. The average volume of nickel production per year reaches 75,000 metric tons. In producing nickel in the Sorowako Block, we uses pyrometallurgical technology (in melting the laterite nickel ore). Our's nickel product is exported entirely to Sumitomo Metal Mining Co., Ltd. (Japan) in a long-term special contract agreed upon by the two companies.

MINING BUSINESS

From mobile phones to airplanes, from building structures to coins, minerals are substances for the production of many essential items used in our daily lives. We are the world's largest producer of iron ore and nickel, and we also operate in other mineral areas. With investments in technology and logistics, we guarantee the efficiency, growth, and sustainability of our operations.

Iron ore and pellets

Vale is the world's biggest producer of iron ore and pellets, raw materials essential to the manufacture of steel. Iron ore is found in nature in the form of rocks, mixed with other elements. By means of various industrial processes incorporating cutting-edge technology, iron ore is processed and then sold to steel companies.

The iron ore produced by Vale can be found in houses, cars and household appliances.

We are investing in technological innovations and developing initiatives to prevent and minimize the environmental impacts that mining causes. Our aim is to set the benchmark in the sustainable management and use of natural resources.

What are pellets?
Pellets are small balls of iron ore used in the production of steel. They are made with technology that uses the powder that is generated during the ore extraction process, once considered waste.

What are they used for?
The pellets are used in the production of steel which is used in the construction of bridges, cars, planes, bicycles, household appliances and much more.

But, before this, the ore goes through a blast furnace that only works when air can circulate freely. For this reason, the material needs to be big enough so that there are spaces between each piece.

On top of this, the ore needs to be strong enough not to be crushed thereby obstructing the blast furnace. Thus, the production of pellets is fundamental to the steel production process.

Where?

Our mines are concentrated in Brazil, where we also operate pelletizing plants. In addition, we have a pelletizing plant in Oman and stakes in joint ventures in China that produce pellets (small lumps of iron particles).

TECHNOLOGY AND SUSTAINABILITY

Less water

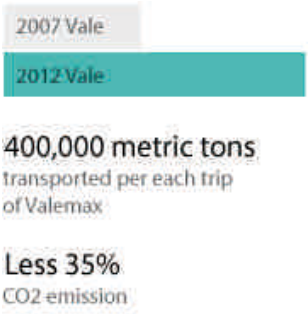
Reduce

At Sossego copper mine in Canaã dos Carajás, Pará, a series of actions aimed at increasing water recirculation resulted in a 99% reuse rate in 2012. This has reduced the amount of water pumped from the Parauapebas River by around 900,000 m3 per year, enough to supply a town of 25,000 people for six months.

More reuse

Vale's ore reuse system has so far made it possible to reprocess 5.2 million metric tonnes of ultrafine ore deposited in tailings ponds. Without this technology, this ore would have been wasted.

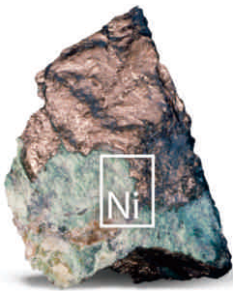
Efficient transportation



We operate 10,000 kilometres of railroad tracks and we use the world's biggest ore carriers. Valemax vessels are capable of carrying 400,000 metric tonnes each - 2.3 times more than traditional Capesize ships - and they emit 35% less CO2 per ton of ore transported.

Nickel

Vale is the world's largest producer of nickel, one of the most versatile metals in existence. Hard and malleable, nickel resists corrosion and maintains its mechanical and physical properties even when subjected to extreme



temperatures.

Our high-qualitynickelis also valued for its applications in plating and batteries. It gives your bathroom taps and shower heads their bright metallic finish. It's in everything from your coins to your car. You'll also find it in your mobile phone and the rechargeable batteries that power it while you're sending a text, checking email and staying in touch.

Where?

We have nickel mine and operations in Brazil, Canada, Indonesia, and New Caledonia as well as fully-owned and joint venture refineries in China, South Korea, Japan, the U.K. and Taiwan.

We produce a wide range of products that are able to meet the diverse needs of nickel consumers. Our regional sales offices directly serve our customers throughout the world.

Cleaner atmosphere

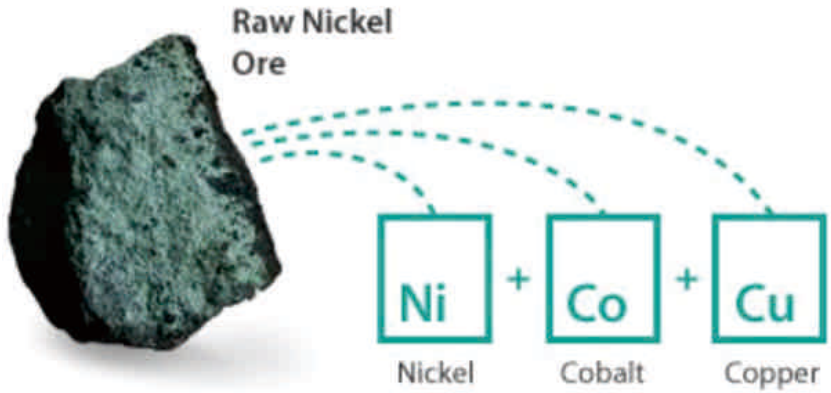
Vale is investing in the Clean AER Project (AER stands for Atmospheric Emissions Reduction') in Sudbury, Ontario, Canada. The project aims to cut sulfur dioxide emissions from the nickel melting process by 85%.

Waste reduction

At the Clydach Refinery in the U.K., employees were challenged to reduce waste. In 2011, 85% of waste generated at the Refinery, including hazardous waste, was recovered or recycled. Up next for the Refinery? To reuse, recycle and use 100% of generated waste to produce renewable energy in the next five years.

Recovery

In Indonesia, post-mining land reclamation efforts have been recognized by the local government for four consecutive



years. A revegetation program involves re-contouring mined land, restoring topsoil, and planting grasses, legumes and canopy trees to create a microclimate suitable for the reintroduction of native plant species.

Learn more about Nickel

The sulphide ores we mine contain more than just nickel. Other elements are often found and by extracting and processing nickel, our operations also produce cobalt, copper and precious metals.

Alloys

Nickel is rarely used alone; it is usually combined with other metals to form alloys. These combinations produce materials with a unique range of properties not found in pure metals.

The alloys usage

The alloys of nickel and other metals have been developed for use in jet engines and in industrial gas turbines for electricity generation. They are also found in heater elements, resistance wires, heat exchangers in power plants and furnace components.

Copper

Copper, that reddish-orange metal that has been used to benefit civilization since 8000 B.C. is one of the most important metals used by modern industry.

Prized for its ability to conduct heat and electricity, it is an element that helps facilitate the world as we know it, and is a focus of Vale's investment.

Malleable, resistant to corrosion and high temperatures, recyclable and blessed with the best electrical and thermal conductivity of any commercial metal, copper is highly valued for its application in power transmission and generation, building wiring as well as practically all electronic equipment, including mobile phones and television sets.

Where?

We produce copper in Brazil and Canada. Our operations in Brazil, located in Carajás, benefit from our pre-existing logistical infrastructure originally built to transport iron ore.

TECHNOLOGY AND SUSTAINABILITY

Reusing water

At our Sossego Plant in Pará, Brazil, practically 100% of the water we use to produce copper concentrate is recycled and reused from our tailings pond.

Technological advances in mining waste in partnership with the University of São Paulo in Brazil, we are working to identify "copper eating" bacteria and fungi capable of absorbing copper from our tailing dams. The research has the potential to significantly boost copper recovery from waste, revolutionizing the industry in the process.

Merdeka Copper Gold Tbk, PT (Merdeka)

PT Merdeka Copper Gold Tbk (Merdeka) is a holding company with operating subsidiaries engaging in mining business activities, encompassing the exploration and future production of gold, silver, copper and other related minerals, and mining services.

Merdeka today consist of five main assets which, as follows:

- Tujuh Bukit Copper
- Pani Joint Venture
- Wetar/Morowali Acid Iron Metal
- Tujuh Bukit Gold
- Wetar Copper

The Tujuh Bukit Copper Gold deposit is one of the world's top ranked undeveloped porphyry copper and gold mineral resources, containing approximately 28.3 million ounces of gold and 8.7 million tonnes of copper. Meanwhile, the operating Tujuh Bukit Mine is based on a near surface oxide gold silver deposit that as of 31 December 2019 contains a remaining Mineral Resource of 2.3 million ounces of gold and 89.8 million ounces of silver and associated ore reserves.

In June 2019, Merdeka completed acquisition of Wetar Project through 78% ownership in BTR. More importantly, it has set its sight on a promising Wetar/Morowali Acid Iron Metal Project in cooperation with a leading local off-taker.

Development of the Pani Gold Project creates an opportunity to mine gold with total measured, indicated and inferred resources up to 2,370,000 ounces of gold. MDKA has signed a joint-venture MOU with another mining company exploring an adjacent site, to jointly prospect for gold that would be greatly beneficial to both parties.

As a world-class Indonesian mining company, Merdeka is owned by prominent Indonesian shareholders including PT Saratoga Investama Sedaya Tbk., PT Provident Capital Indonesia, and Mr. Garibaldi Thohir. Merdeka's three major shareholders have exceptional track records in successfully identifying, building, and operating multiple publicly listed companies in Indonesia.

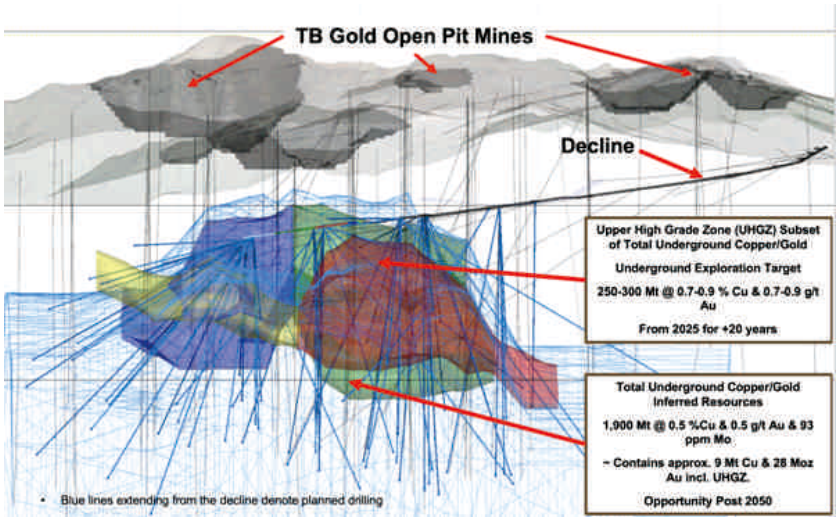
OPERATIONS

Wetar Copper is a copper mine located on Wetar Island, Maluku Barat Daya Regency, Maluku Province. Commercial production of Wetar Copper started in 2010, consists of open pit mine, associated heap leach operation and solvent extraction-electrowinning (SX-EW) plant which produces copper metal.

As of 31 December 2019, reserve of Wetar Copper Project estimated 8.3 million tonnes of ore at 1.4% Cu containing 114 thousand tonnes of copper with estimated mineral resource of 22 million tonnes of ore at 1.33% Cu containing 289 thousand tonnes of copper.

PROJECT: TUJUH BUKIT COPPER

The Tujuh Bukit porphyry deposit is the largest and most exciting discovery in Indonesia, and perhaps the world, in recent times. A total of 1.9 billion tonnes inferred global resource of ore at an average grade of 0.45% of copper and 0.45 gram per tonne of gold containing 8.7 million tonnes of



copper and 28 million ounces of gold.

In early 2018, work began on feasibility study activity for the underground development of the exploration decline and progressed encouragingly towards the development of a long life, low cost underground copper/gold mine. A pre-FS is expected to be completed in 2021. Subsequent to completion of the pre-FS, we expect a full FS should be able to be completed with moderate additional cost. The bulk of the expenditure for the feasibility activity is being spent on an exploration decline and drilling. The decline is expected to be completed in 2020 and drilling completed in 2021.

GROUP MINERAL RESOURCES

As at 31 December 2019, Group Mineral Resources are estimated to contain 33.1 million ounces of gold (2.4 million ounces of gold from Tujuh Bukit and Wetar Operation and 30.7 million ounces of gold from Tujuh Bukit Copper and Pani Project), 9 million tonnes of copper (0.3 million tonnes of copper from Wetar Operation and 8.7 million tonnes of copper from Tujuh Bukit Copper Project), and 91 million ounces of silver (91 million ounces of silver from Tujuh Bukit and Wetar Operation).

This represents an increase of approximately 158 thousand ounces of gold (~0.5%), 93 thousand tonnes of copper (~1%) and 38 million ounces of silver (~42%), compared with the estimates as at 31 December 2018.

The Group Mineral Resources as at 31 December 2019 includes changes at numerous deposits following updated notional constraining shells and/or resource models. These include:

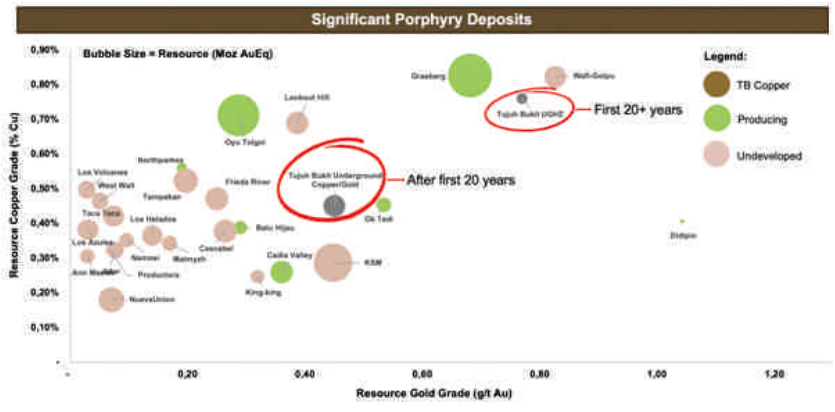
Mining depletion during 2019 was 7.3 Mt containing 262 koz of gold, 2,483 koz of silver and 69 thousand tonnes of copper.

A reduction in the cutoff grade for reporting Resources at Tujuh Bukit oxide operations from 0.3 g/t Au to 0.15 g/t Au in line with operational cutoff grades and gold price movements.

Updated resource models for Pit A and Pit C and Tujuh Bukit oxide operations. Maiden Partolang Resource estimate.

GROUP ORE RESERVES

As of 31 December 2019, Group Ore Reserves are estimated to contain 871 thousand ounces of gold (871 thousand ounces of gold from Tujuh Bukit Operation), 114 thousand tonnes of copper (114 thousand tonnes of copper from Wetar Operation) and 35.2 million ounces of



silver (35.2 million ounces of
silver from Tujuh Bukit

Freeport Indonesia, PT

Is a mineral mining company affiliate of Freeport-McMoRan (FCX) and MIND ID Indonesia's Mining Industry. PTFI mines and process ores produces concentrates containing copper, gold and silver. We market concentrates all over the world, and mainly to domestic copper smelter, PT Smelting. We operates in the remote highlands of the Sudirman Mountain Range in Mimika Regency, Papua Province, Indonesia
Our mines in Grasberg minerals district, Papua - Indonesia is one of the world's largerst copper and gold deposits. We currently mining the final phase of the Grasberg open pit, which contains high copper and gold ore grades. We have been working on several projects in the Grasberg minerals district related to the development of its large-scale, long-lived, high-grade underground mines. In aggregate, these underground mines are expected to produce large-scale quantities of copper and gold following the transition from the Grasberg open pit.

About Freeport-McMoRan

Freeport-McMoRan (FCX) is a leading international mining company with headquarters in Phoenix, Arizona, United States. FCX operates large, long-lived, geographically diverse assets with significant reserves of copper, gold and molybdenum. FCX's portfolio of assets includes the Grasberg minerals district in Papua, Indonesia, and significant mining operations in North and South America, including the large-scale Morenci minerals district in Arizona and the Cerro Verde operation in Peru. FCX is the world's largest publicly traded copper producer. FCX stock trades on the New York Stock Exchange under the ticker symbol "FCX".

About MIND ID

Is Indonesia's mining industry holding company, with PT Indonesia Asahan Aluminium (persero), PT ANTAM Tbk, PT Bukit Asam Tbk, PT Timah Tbk, and PT Freeport Indonesia as members of the holding.

How Do We Operate

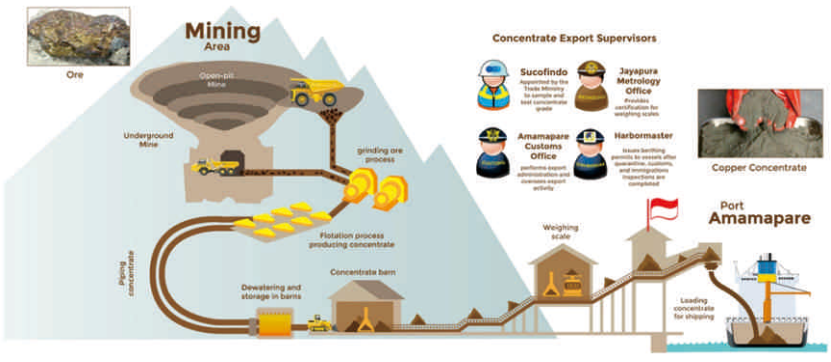
PT Freeport Indonesia (PTFI) currently employs two mining methods, the open-pit mining method in Grasberg, and underground mining. Ore extracted from the mine is hauled to the mill to be crushed and ground into very fine particles. This is followed by a flotation process using a reagent based on alcohol and lime to separate concentrate containing copper, gold and silver minerals. The residue with no economic value (tailings) is channeled by means of a river to a deposition area in the lowlands.
Concentrate in the form of slurry is channeled from the mill by means of a 110 km long pipeline to a dewatering plant in Amamapare port. After it is dewatered, the concentrate, which is PTFI's final product, is shipped to smelters in the country and abroad.

Mining and processing operations

Mining: includes drilling and blasting, loading and hauling ore, and crushing to produce copper ore.

Processing: includes grinding, flotation, and dewatering to produce copper concentrate, which buyers pay for the copper, gold, and silver content. Copper concentrate is PTFI's final product, with value added 95%.

- Refining operations in Gresik - East Java
- Refining includes smelting and refining to produce copper cathode
- Refining is carried out by PT Smelting, Gresik, which was established in 1997 and is jointly operated by PTFI & Mitsubishi.
- At this time, PT Smelting is the first and only copper smelter in Indonesia
- The smelter takes in 40-50% of PTFI's output
- In support of the industry downstreaming policy, PTFI is expanding or building an additional smelter on a site adjacent to PT Smelting



MINE TYPES

Grasberg Open-Pit Mine
The open-pit method is used in mining the Grasberg ore body, as this method is suitable for Grasberg, where the ore body occurs near the highland surface (Grasberg).
Almost the entire open-pit mining process consists of the stages of drilling, blasting, sorting, hauling, and crushing of ore. Another crucial activity is maintaining slope stability and revegetating (reclaiming) land no longer used for mining with native plants.
At the Grasberg open-pit mine the primary equipment used are drills, shovels, and large trucks to extract materials. Materials referred to are classified as ore and overburden, depending on their economic value. Shovels dig up material from different areas in the open-pit mine, and load the material onto trucks to be hauled out of the open-pit mining area.

Ore is placed into crushing machines and conveyed to an ore mill for processing. Overburden is placed in designated locations, or in OHS crushers on the HEAT road for placement in Lower Wanagon next to stackers. The main facilities located near the open-pit mine include maintenance workshops, a limestone quarry and treatment plant, and other supporting facilities and offices.

Underground Mine

Block caving is a highly resource-efficient method of underground mining, in which large underground ore blocks are

cut from beneath, allowing the ore to collapse under its own weight. After collapsing, ore is drawn through drawpoints and conveyed to a crusher.

In DOZ block caving, LHD loaders transfer ore slurry into ore passes leading to chutes. Ore slurry from chutes fill AD-55 haul trucks for removal to crushers. Crushed ore is then transported to the mill on conveyors.

DOZ Underground Mining

DOZ underground mine development (capacity 25.000 tons/day) is completed 18 months faster than the prior schedule. Not long after DOZ production reaches 25.000 tons/day, expansion to 35.000 tons/day was soon finished right on the schedule and budgets.

We have completed expansion of DOZ production capacity to 50,000 tons/day with a second crusher and additional ventilation, as well as accelerated certain developments, for a cost of approximately US $60 million. We anticipate increasing production to 80,000 tons/day. This increase would speed up recovery of high-grade ore from underground mining. Early figures indicate highly promising economic gains.

Big Gossan

We are currently developing the Big Gossan deposit, which is located in relatively close proximity to the existing mill. Due to the deposit's geometric shape, the mining method selected to be most suited for Big Gossan is open stope with paste backfill. Excavated ore is conveyed to the same processing facility as the one used for DOZ. "Stope" is the step-like excavation made during extraction of ore. Stope dimensions in Big Gossan are largely approximately: 40 m long, 15 m high, and 20 m wide.

Development from 2005 to 2009 was estimated to cost US$225 million. The mine began production in 2009 and reached peak production of 7,000 tons/day in 2011. Big Gossan is expected to yield more or less another 135 million pounds of Cu and 65,000 ounces of Au per year.

Stope open with Paste Backfill

Drifts are built at various levels. Stopes are drilled and blasted from above. Ore is extracted from beneath and dropped into ore passes leading to crushers. Cavities are backfilled to maintain stability. Stope mining follows a certain sequencing, with active stoping at various levels to maintain stability and maximize ore extraction. This is a high-cost operating method as ore extraction requires blasting and backfilling of cavities.

Oreflow and OHS (Overburden Handling System)

Oreflow and OHS (Overburden Handling System) are all about the removal of material.
The oreflow system consists of

crushers, conveyors, and ore passes to transport ore from the mine to the mill. The OHS consists of crushers, conveyors, and stackers to place overburden from the Grasberg open-pit mine in stockpiles in Lower Wanagon.

Ore Flow

One unit 63" x 114" Krupp Gyratory Crusher (#6)
One unit 60" x 113" Krupp Gyratory Crusher (#7)

OrePass
Four pieces with a diameter of 6 to 7 meters, 660 meters high.

DOZ Underground Mining

Ore Crushers
One unit 54 "x 77" Fuller Crusher (the second unit was held during the 50K Expansion Project).

Overburden Handling System

Stacker

150 meter semi-mobile Krupp Stacker.

Crusher
One unit 63 "x 114" Krupp Gyratory Crusher (# 8) One unit 60 "x 89" Fuller Gyratory Crusher (formerly used as Crusher # 5).
* Depending on the availability of various types of materials, the OHS system is projected to operate at 135,000 tons / day.

Ore Mill

The ore mill processes ore from the mine by means of the following main concentrator areas: North/South Concentrators, Concentrator #3, and Concentrator #4. Processing design capacity (nameplate capacity) is described in brief (in 000 ton metric tons per day):

Concentrator	Title
Concentrator North/South	60
Concentrator#3 (SAG #1)	60
Concentrator #4 (SAG#2)	115
Total	235

North Concentrator commenced functioning in 1972 and subsequently underwent expansion through continual minor projects. South Concentrator began functioning in 1991. Concentrator #3 was part of the 118K project expansion that was completed in 1995. Construction of Concentrator #4 was completed in 1998 as part of the latest major expansion project.

Knelson Concentrator

Crude and free gold particles do not react well in the flotation process. The Knelson concentrator, a gravity recovery system uses centrifugal force to separate and recover the crude and free gold. Gold recovery from ore is thus

enhanced overall.

High Pressure Grinding Roll

Main Equipment

Concentrator North/South
- 8 Ball Mill 15.5 ft
- WEMCO 44x1500 ft3
- Outukumpu 16x1350 ft3 sel flotasi

Concentrator #3
- SAG 34 ft
- 2 Ball Mill 20 ft
- WEMCO 36x3000 ft3 sel flotasi

Concentrator #4
- SAG 38 ft
- Ball Mill 24 ft
- WEMCO 36x4500 ft3 sel flotasi

Process Overview

The mill produces copper and gold concentrate from mined ore through a process to separate valuable minerals from the impurities covering them. The main steps in the process are crushing, grinding, flotation, and dewatering. Crushing and grinding transform ore size into fine sand in order to release particles containing copper and gold. Flotation is a separation process to produce copper-gold concentrate. Concentrate slurry consisting of finely ground ore and water mixed with reagents is introduced into a series of mixing tanks called flotation cells, where air is pumped into the slurry. The reagents used are lime, frothers and collectors. Frothers form stable bubbles that float to the surface of the flotation cell as froth. Collectors react with valuable metal sulfide mineral particle surfaces. rendering these surfaces hydrophobic.

The hydrophobic sulfide mineral particles adhere to the air bubbles rising from the slurry zone into the froth floating on the surface of the cell. The froth containing valuable minerals, resembling metallic detergent froth spills over the top of the flotation machine into launders where valuable minerals collect.

The valuable minerals collected in the launders are called concentrate. Concentrate (in the form of slurry containing 65% solids by weight) is pumped to Portsite through four 115 km-long slurry pipelines. Upon reaching Portsite, the concentrate is dewatered until only 9% moisture content remains, and is then shipped for sale.

Gangue collects at the bottom of the flotation cell and ultimately ends up as waste known as tailings. Tailings are channeled to a natural disposal system flowing from the Mill to the Modified Ajkwa Deposition Area (ModADA).

Dewatering & Shipping

Portsite is a vital part of our operations, a facility for receiving necessary materials and equipment and shipping our concentrate.

Concentrate Dewatering and Storage

Concentrate slurry is dewatered using 3 rotary vacuum disc filters and one new pressure filter. Concentrate cakes from the rotary vacuum disc filters are then dried in 3 rotary kilns. Dewatered concentrate with a 9% moisture content is stored in a concentrate barn with a total capacity of approximately 135,000 metric tons. Additional storage space is provided in pads adjacent to the dewatering plant.

Concentrate Shipment

In the final process, concentrate from the barn is loaded onto vessels on conveyors. Loading onto a concentrate vessel is partly conducted at the concentrate jetty and the vessel is then moored to the (offshore) Sea Buoy A to complete the loading process using barges. The use of barges is necessary because the water depth does not allow full loading onto the vessel. We ship our concentrate aboard more than 100 vessels every year.

Power Plant

A 195MW (3x65MW) - capacity coal-fired steam power plant (PLTU) is located in Portsite. Coal shipments are received and moved to coal barges before being unloaded at our coal jetty and stored in the coal barn. Electricity from the power plant is supplied to the mill by way of a 115 km-long 230KV distribution grid.
Cargo Dock
Materials and equipment are received and unloaded at the cargo dock for transporting to our various operating sites. The cargo dock area in Portsite functions as a goods distribution hub to all sites.

Supporting Infrastructure
Electric Power

We have approximately 385MW of power generating capacity (250MW of firm capacity), consisting of a 195MW coal-fired plant at portsite and diesel plants (primarily located at the mill). The transmission line supplies the power from the coal plant to the mill. One of our partners provides the expertise in the area of maintaining and operating our power plants.

Townsites & Camps

Our primary townsites are Tembagapura (and its "suburb" Hidden Valley) in the highlands and Kuala Kencana in the lowlands. We also have camps located at Milepost 38/39, Base Camp (near the Airport) and Ridge Camp. The townsites provide our employees with services ranging from retail stores, restaurants, residential facilities, schools, medical, libraries, banks, postal services, training facilities, and recreation. Both our towns have swimming pools, and Kuala Kencana has an 18-hole golf course.

Health Clinics & Hospitals

We have a 100-bed employee hospital in Tembagapura & numerous clinics in the surrounding area. In addition, we have funded a 74-bed hospital in near-by Waa-Banti and a 101-bed hospital in Timika. This infrastructure is key in providing services to our employees and their families and the local population as well as implementing our public health programs in this remote area.

Aviation

Our Timika airport is a hub for many flights to/from our project area. Through one of our partners, we operate our charter planes to transport employees between Papua and their homes in other parts of Indonesia. The airport also has attracted a number of commercial flights. Our partner also provides helicopter and other aviation support for our operations and exploration efforts.

Lime Plant

As part of our #4 Concentrator Expansion, we constructed a lime quarry & lime processing plant. The plant produces lime that is consumed at the mine and mill.

Workshops & Maintenance Facilities

We have a number of workshops located in the project area ranging from equipment maintenance shops to a steel fabrication shop in the lowlands. Some of our partners have also set up facilities in the lowands to support their efforts in providing services to our operation.

Logistics

As with any operation of this size, supply chain and logistics are critical to our business. We have a proven network to supply materials to our portsite - and the required fleet of equipment to transport the materials from portsite to our operation sites throughout the project area. Another one of our partners operates our on-site logistics from port to the user as well as certain maintenance activities for non-mining equipment, road maintenance, and personnel bus transportation.

Catering

With as many people as we have on-site, one of our partners provides the catering services required to keep our workforce fed as well as operates our barracks and janitorial services.

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