Mining Activities at the Pit 2 Electrification Mine Location at West Banko PT Bukit Asam, Tbk. Tanjung Enim, South Sumatera

Monica Fadhillah Afrina Wati[1] *, *Heri Prabowo*[1]

[1] Department of Mining Engineering, Faculty of Engineering, Universitas Negeri Padang

*monica.fadhillah.af@gmail.com

Abstract. *PT Bukit Asam* (*Persero*) *Tbk is a State-Owned Enterprise* (*BUMN*) *which was founded on March 2 1981 located in Tanjung Enim, South Sumatera. The purpose of production activities is to produce minerals that have a price or selling value. In coal production activities there are two productions that can be carried out, namely coal production and overburden production. PT Bukit Asam Tbk. implementing open-pit mining methods. The mining method in Pit 2 Banko Barat uses the strip mining method, because this method is used in coal deposits with a relatively small slope* (*dip*), *the slope* (*dip*) *in Pit 2 Banko Barat is N200OE/25O. Mining activities in Pit 2 Banko Barat are still being carried out are mining* (*exploitation*), *processing, marketing and post-mining activities. In coal mining activities, PT Bukit Asam Tbk. using a shovel PC 3000 earth digging tool and a Belaz transportation tool. Apart from loading and unloading excavation equipment as the main mining equipment, there is also supporting equipment such as motor graders, bulldozers, water tanks and fuel tanks to obtain optimal and maximum production results. In coal mining activities in the West Banko Mine area, PT Bukit Asam Tbk. using a Shovel PC 3000 for overburden activities, while the transportation equipment is a DT Nissan CWB 45 for coal mining activities and the HD rigid truck Belaz 75135 for overburden activities*

Keywords: *production coal, overburden, production, tools*

1. Introduction

Coal has now become one of the prima dona in overcoming the scarcity of energy sources amidst the increasing demand for world energy sources. The huge potential of coal reserves in Indonesia accompanied by rising commodity prices has provided good business opportunities for the national coal mining industry.

PT Bukit Asam, Tbk. is one of the industrial mining companies that has the largest coal reserves in Indonesia and has operational areas spread across various regions in Indonesia. One of the mining locations is located in Tanjung Enim, South Sumatera. PTBA's Tanjung Enim Mining Unit (UPTE) uses an open pit mining system (surface mining) and has a Mining Business Permit (IUP) area of 90,702 hectares (Aji Pratama Putra, 2017).

To increase knowledge about the methods used in mining, mining activities and mining activities, the most unique of the mining locations at PTBA is at the West Banko mining location, precisely at pit 2 electrification. Because electrification is the only work unit at PTBA that uses PC-3000 and HD Belaz shovels using electricity as the main fuel.

With the electrification of Banko Barat mining, it is hoped that it will increase everyone's knowledge about mining systems that use PC-3000 shovels whose main fuel is electric power. Then, with this system, production results can be increased. So that it can create environmentally friendly mining operational conditions, with low costs and mining activities running optimally.

2. Research Sites

2.1 Map of WIUP PT. Bukit Asam Tbk

Source : Geological and exploration engineering work unit PT. Bukit Asam, Tbk.

Picture 1. WIUP map of PT location. Bukit Asam Tbk.

In this mine, it is operated using *conventional* and *continuous mining.* Muara Tiga Besar is divided into two, namely Muara Tiga Besar Utara and Muara Tiga Besar Selatan, in Muara Tiga Besar Utara, the *continuous mining method is used* which is not used to produce coal but only to feed or help break up the material which will then be continued with *excavators* and *trucks* and mining systems are managed.

A company in the mining industry, PT Bukit Asam Tbk, extracts resources from coal excavation. In Palembang Province, South Sumatera, Tanjung Enim Village, Muara Enim Regency, Lawang Kidul District is the location of PT Bukit Asam Tbk. Open-pit mining is used by PT Bukit Asam Tbk. PT Bukit Asam Tbk.

2.2 Condition Geology Regional

The coal seam in the PTBA Mining Permit area of the Tanjung Enim Mining Unit occupies the western edge of the South Sumatera basin, where this basin is part of the Central and South Sumatera basins. The coal layers in this area are exposed in ten coal layers consisting of old to young layers, namely the Petai Layer, Suban Layer, Mangus Layer and seven hanging seams.

Regionally, the mining area of PT Bukit Asam, Tbk. included in the Palembang sub-basin which is part of the South Sumatera basin and was formed in the Tertiary era. Pre-tertiary rocks, consisting of metamorphic rocks and igneous rocks of Mesozoic age, are thought to be the base of the tertiary basin. This rock unit has experienced faulting, folding and intrusion.

Coal seams in the IUP area of PT Bukit Asam, Tbk. The Tanjung Enim Mining Unit occupies the western edge of the South Sumatera basin (Coster, 1974 and Harsa, 1975). This basin is part of the Central and South Sumatera basins. The PTBA mining area is included in the physiographic zone of the South Sumatera basin and is part of the Muara Enim anticlinorium of the South Sumatera basin. The main lithology found is the Muara Enim Formation as a coal carrier which is dominated by clay and silt rocks with Mio-Pliocene age.

The geological structures found in PTBA are anticlines that form domes, normal faults, minor faults with a radial pattern, and faults that do not continue until the bottom of the existing rock layers. This occurred as a result of andesite intrusion in the reserve area. Apart from the intrusion of andesite igneous rock, the structure was also influenced by tectonic forces during the Pliocene era.

The regional geology of the PTBA area is included in the Palembang sub-basin which is part of the South Sumatera basin and was formed in the Tertiary era. The South Sumatera sub-basin, which was deposited during the Cenozoic era, has a lithological sequence consisting of 2 (two) groups, namely the Telisa Group and the Palembang Group. The Telisa Group consists of the Lahat Formation, Talang Akar Formation, Baturaja Formation and Gumai Formation. The Palembang Group consists of the Air Benakat Formation, Muara Enim Formation and Kasai Formation (PT Bukit Asam, Tbk. 2018).

2.3 Statigraphy Regional

In general, the regional stratigraphy of the Tanjung area Enim is found in the stratigraphic column. Where there are several layers of coal in it, namely: the first is the Keladi Layer, the second is the Merapi Layer, the third is the Petai Layer, the fourth is the Suban Layer and the Mangus Layer. Each layer is named layer A, layer B, layer C and layer D, as well as 7 hanging layers in that area.

2.3.1 Benakat Water Formation

The Air Benakat Formation was deposited in harmony on top of the Gumai Formation and is the beginning of the regression phase. This formation consists of gray-white claystone with inserts of fine sandstone, bluish-black, gray sandstone, local glauconite containing lignite and in the upper part containing tufface while the middle part is rich in foraminifera fossils. The thickness of the Air Benakat Formation varies between 100-1300 m and is of Middle Miocene-Late Miocene age. This formation was deposited in a shallow marine environment.

2.3.2 Muara Enim Formation

The Muara Enim Formation represents the final stage of the tertiary regression phase. This formation was deposited in harmony on top of the Air Benakat Formation in shallow marine, delta plain and non- marine environments. The thickness of this formation is 500 – 1000 m, consisting of sandstone, mudstone, siltstone and coal. Sandstones in this formation can contain glauconite and volcanic debris. In this formation there is iron oxide in the form of concretions and silicification. Meanwhile, the coal found in this formation is generally lignite. The Muara Enim Formation is Late Miocene – Early Pliocene.

2.3.3 Kasai Formation

The Kasai Formation was deposited in harmony on top of the Muara Enim Formation with a thickness of 850 – 1200 m. This formation consists of tuffaan sandstone and rhyolitic tephra at the bottom. The upper part consists of quartz-rich pumice tuff, sandstone, conglomerate, sandy tuff with rudimentary lenses containing pumice and yellowish gray tuff, many plant remains and thin layers of lignite and eroded wood are found. The depositional facies are fluvial and alluvial fan. The Kasai Formation is Late Pliocene-Early Pleistocene.

2.3.4 Talang Root Formation

The Talang Akar Formation in the Jambi sub-basin consists of siltstone, sandstone and coal inserts which were deposited in shallow to transitional marine environments. According to Pulunggono, 1976, the Talang Akar Formation is late Oligocene to early Miocene and was deposited in harmony on top of the Lahat Formation. The lower part of this formation consists of coarse sandstone, shale and coal inserts. Meanwhile, in the upper part there is an alternation between sandstone and shale. The thickness of the Talang Akar Formation ranges from 400 m – 850 m.

2.3.5 Baturaja Formation

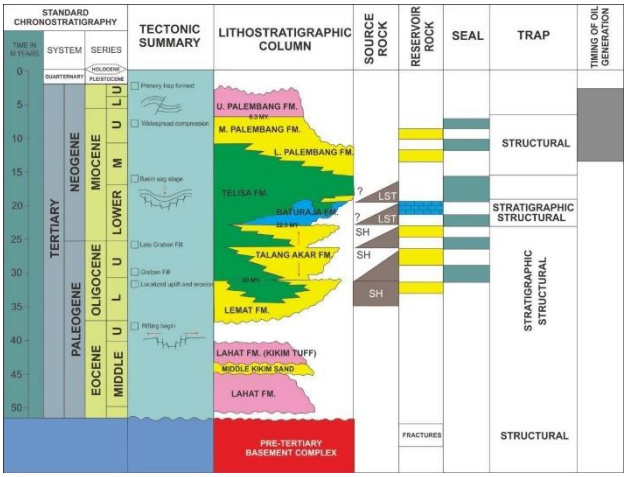
This formation was deposited in harmony on top of the Talang Akar Formation with a thickness of between 200 and 250 m. The lithology consists of limestone, reef limestone, sandy limestone, shale limestone, calcareous shale and marl rich in foraminifera, molluscs and coral. This formation was deposited in a littoral-neritic environment and is of Early Miocene age.

2.3.6 Gumai Formation

Deposited in harmony on top of the Baturaja Formation, this formation marks the maximum transgression in the South Sumatera basin. The lower part of this formation consists of calcareous shale with intercalations of limestone, marl and siltstone. Meanwhile, in the upper part there is an alternation between sandstone and shale. The thickness of this formation generally varies between 150 m-2200 m and was deposited in a deep sea environment. The Gumai Formation is Early Miocene-Middle Miocene.

7. Alluvial

Alluvial is sediment resulting from the breakdown of older rocks, consisting of mud, loose sand, gravel, gravel and boulders. These alluvial deposits cover older rock formations with erosion plane boundaries. The formation in South Sumatera, namely the Muara Enim formation, consists of clay stone, silt stone and sandstone. Stratigraphy of the South Sumatera Basin (De Coster, 1974)

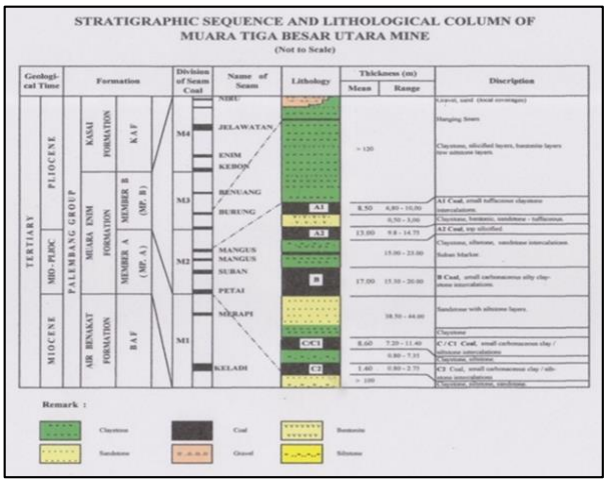


Source: Unila.

Picture 3. South Sumatera Regional Statigraphy.

2.4 Stratigraphy of the Muara Tiga Besar Utara Mine

In general, the stratigraphic column consisting of a series of formations in the Muara Enim location area from three parts of coal, namely the petai layer, mangus layer and suban layer, shows in general the layers that exist in the Muara Tiga Besar Utara (MTBU) area. Each of these layers has an inset layer, namely a sedimentary rock layer in the form of silt to sandy clay. The stratigraphic sequence is as follows: Overburden Layer, A1 Coal Layer (Upper Mangus), A1 – A2 Interburden Layer, Coal Layer A2 (Lower Mangus), Interburden Layer A2 – B, Coal Layer B (Suban), Interburden Layer B – C and Coal Layer C (Petai).



Source: PTBA Detailed Exploration Work Unit

Figure 4. Statigraphy of the North Three Great Estuaries.

3. Theoretical review

3.1 History of PT Bukit Asam, Tbk.

On March 1 1981, PN TABA then changed its status to a Limited Liability Company with the name PT Bukit Asam (Persero), hereinafter referred to as PTBA or the Company. In order to increase the development of the coal industry in Indonesia, in 1990 the Government determined the merger of Perum Tambang Batubara with the Company.

In accordance with the national energy security development program, in 1993 the Government assigned the Company to develop a coal briquette business. On December 23 2002, the Company listed itself as a public company on the Indonesia Stock Exchange with the trading code "PTBA".

In order to meet these needs, several were developed *site* in the Tanjung Enim PTBA IUP area, namely: Laya Air Mine (TAL), is The largest *site* in the PTBA IUP area which is operated using open-pit mining technology using *excavator-trucks*. Air Laya Mine has two main mining methods, namely *continuous mining* and *conventional mining* using *the BWE system* (*Bucket Wheel Excavator*) and the *shovel and truck* (using *excavator and dump truck*). The West Banko Mine, consists of Pit 1 and Pit 3 which are operated using the method *conventional mining*. Pit 2 uses an *electrification mining system.* In Pit 3, the western part is managed by PT BKPL (Bangun Karya Pratama Lestari), while the eastern part is managed by PT SMJ (Sumber Mitra Jaya). Coal from the excavation site is transported by *dump truck* to *the dump hopper*. From *the dump hopper* the coal will be distributed by *belt conveyor* to *the stockpile*. Then from *the stockpile* the coal will be sent to TLS using *a conveyor belt.* Through this TLS, coal will be loaded into wagons then transported and marketed via Tarahan port (Lampung) and Kertapati dock (Palembang). Muara Tiga Besar Utara Mine (MTBU), is a mine operated using the *excavator-truck mining method.* At the North Muara Tiga Besar *site*, the western part is used *Bucket Wheel Excavator*.

3.2 Organizational Structure

In carrying out its business PT Bukit Asam, Tbk. has a board of directors consisting of the President Director, Director of Business Development, Director of Operations/Production, Director of Finance, Director of Commerce and Director of General Human Resources. In the Production Operations section, there are four *General Manager units* that handle different sections, including: Analysis, Evaluation and Production Optimization: Tanjung Enim Mining Unit;

3.2.1 Self-Managed Mining Work Unit

The work unit has an important role in producing coal or *overburden* and *interburden*. This work unit collaborates with the contractor company PT BKPL (Bangun Karya Pratama Lestari) to rent heavy equipment belonging to PT BKPL. Swakelola carries out activities ranging from mining (*exploitation*) to transporting coal to *temporary stock* or directly to *the Stockpile*. This work unit only supervises PT BKPL (Bangun Karya Pratama Lestari) and goes directly to the field to provide direction and information related to the production being carried out. Coal from mining from several *sites* will be sent to the Tarahan port in Lampung using trains, then the coal will be sent to PLTU Suralaya and exported using ships.

3.2.2 Electrified Mining Units

The electrification work unit is one of the work units handled by self-management. Electrification itself is a new work unit at PTBA, electrification is the only work unit at PTBA that uses PC-3000 and HD Belaz *shovels* using the main fuel, electric power, which is produced from the Bukit Asam PLTU itself, this is done to save expenses.

3.2.3 Contractor's Mining Supervision Unit

Contractor mining company collaborating with PT Bukit Asam, Tbk. are PT Pama Persada Nusantara and PT SBS (Satria Bahana Sarana) PTBKPL (Bangun Karya Pratama Lestari) which are implementing mining in the Tanjung Enim Mining Unit area. Mining supervision also directs the transportation of coal from the mining area to the coal storage area (*stockpile*).

3.2.4 Operational Plan Work Unit (*Renop*)

This work unit is tasked with planning mining activities in the long and short term. Long-term plans are plans made to plan work operations within an annual period and short-term plans, namely quarterly. In the long-term operations planning process, it is usually handed over to the POHA (Daily Operations Planning) work unit to make daily plans for the work units to be assigned.

3.2.5 POHA Work Unit (*Daily Operations Planning and Administration*)

It is a work unit whose task is to make daily plans for the annual plans set by the Renop work unit and also monitor the condition of the field to see whether it is in accordance with what was planned.

3.2.6 PAB Work Unit (*Coal Transportation Handling*)

The PAB work unit has the task of organizing and monitoring equipment and processes for handling railroad coal to be transported to the temporary *Stockpile* at Tarahan Port (Lampung) and Kertapati Pier (Palembang) for delivery and then sales to domestic or overseas markets. using a barge and transferred to the main shipping vessel.

3.2.7 Keloling Work Unit (*Environmental Management*)

The Keloling Work Unit is tasked with monitoring and handling environmental problems that may occur during the ongoing mining activity process

3.3 Coal Resources and Reserves

3.3.1. Coal Resources

The aim of classifying coal is to identify names and create class boundaries according to *the fixed carbon* that the coal has. The coal classification that is commonly used is the classification according to ASTM (*American Standard for Testing Materials*). This classification is based on proximate analysis of coal, namely based on the degree of change during the coal process starting from lignite to anthracite. For this, data is needed on fixed carbon, volatile *matter* and calorific value of coal product *brands* at PT Bukit Asam, Tbk.

Coal quality classification aims to determine variations in coal quality. Coal classification commonly used by PT Bukit Asam, Tbk. is based on proximate analysis of coal and coal calories with *mine brand* being the name of the product resulting from unmined mining undergoes a processing process and *the market brand* is the name of the product that is ready to be marketed. PTBA (UPTE) coal classification data generally includes *sub-bituminous* to *anthracite classes.*

3.3.2 Coal Reserves

The amount of coal resources found at PTBA-UPTE locations varies in each region with total measured resources of 1.99 billion tons, and mined resources of 1.59 billion tons. The total measured resources (*measured reserves*) of the West Banko Mine are 560 million tons of coal.

3.4 Mining Activities

Mining is some or all stages of activities in the context of research, management and exploitation of coal which includes general investigations, exploration, feasibility studies, construction, mining, processing, transportation and sales, as well as post-mining activities.

3.4.1 General Investigation

General investigation is an investigative activity, a search to find valuable mineral deposits. This investigation can be carried out in the form of geological mapping and geophysical investigations (on land and aerial photography) to interpret the presence of excavated materials and sampling (*traching float / stream sediment; grab sampling / chip sampling*) the results of which will determine the distribution of excavated materials which have economic significance.

The mining authority (KP) is a coal mine in Tanjung Enim with an area of 66,414 hectares covering Muara Enim Regency and Lahat Regency, South Sumatera and an exploration IUP of 5,640 hectares.

3.4.2. Exploration

Exploration is one of the mining activities to determine the effects, distribution, form, grade and reserves of a mineral deposit. Based on the examples obtained, exploration is divided into two, namely direct exploration and indirect exploration. Direct exploration is the activity of directly obtaining samples such as drilling activities, test wells, test trenches, making openings, while indirect exploration is the activity of not directly obtaining samples such as geophysical investigations.

Apart from that, to obtain the distribution and thickness of excavated materials, this activity also carried out samples of excavated materials and overburden. This exploration stage also plays a very important role in the reclamation stage later, through this exploration we can find out and recognize all components of the ecosystem that existed previously. has coal resources of 292 million tons and *mineable reserves* of 109 million tons.

3.4.3 Feasibility Study

A feasibility study is an activity carried out to assess the feasibility of a mine based on exploration (technical) results and accompanied by economic and environmental considerations (Amdal or UKL/UPL). mining business permits (IUP) for operations and production covering an area of 3,145 hectares with an average stripping ratio (SR) of 4.16. With AMDAL with AMDAL Decree Development of UPT South Sumatera Governor Decree No. 574/KPTS/Bapedalda/2004 Dated 30 October 2004 concerning Environmental Feasibility of Development of the Tanjung Enim Mining Unit of PT Tambang Bukit Asam, Tbk. In Muara Enim Regency and Lahat Regency, South Sumatera.

3.4.4 Development

Before exploitation work is carried out, preparation (*development*) is carried out for the procurement of facilities and infrastructure that can support exploitation activities, for example: mining offices, *workshops* or main workshops, construction of mining roads, construction of production levels, mosques, sports fields, parks, housing and other facilities. so that mining activities can run well.

3.4.5 Exploitation

Exploitation is a work activity carried out to release mineral deposits such as *alluvial*, coal and others. Then take it to the surface of the earth or somewhere to be used. Exploitation/mining activities are carried out after evaluation of exploration results, showing that the excavated material is suitable for mining from a technical, economic and environmental perspective. In stages *In this* exploitation, the general activity is demolition/excavation, which is an activity aimed at freeing excavated material from its parent rock. Loading, namely an activity aimed at lifting material (excavated material) onto a conveyance using loading equipment such as a *loader*. Transportation, namely activities aimed at lifting excavated materials from the mining *front* to the stockpile *or* processing location.

3.4.6 Processing

Processing is a job to improve the quality of minerals according to consumer demand. The processing process can be carried out using a dry process (without using water) or a wet process, namely using water as a separating medium. From the concentration (separation) process, valuable minerals called concentrate will be obtained and worthless minerals called tailings, the stages of which include size reduction, sieving, and separation.

Another advantage of this activity is that it reduces the volume and weight, the volume and weight in question are the impurities or associated minerals attached to the coal so that it can reduce transportation costs and increase the selling price. Coal processing at PT Bukit Asam, Tbk. including: PLTU, Briquettes, *Blending*, *Crusher*, Coal Liquefaction (Coke) and others.

3.4.7 Marketing

Activities to trade or sell mining results. Marketing purposes are used for power generation, also used for cement products and other general industries. Most of the domestic sales are in order to fulfill the Domestic Market Obligation (DMO), through long-term contracts to supply Steam Power Plants (PLTU), namely PLTU Suralaya, PLTU Bukit Asam, PLTU Tarahan and PLTU Percepatan 10,000 MW. Meanwhile, the Company's export destination countries are still focused on countries in the Asia Pacific region such as India, Taiwan, Malaysia, China, Japan, Sri Lanka, Korea, Cambodia and Vietnam.

If the excavated materials have been processed, they are marketed to consumers. Between mining companies and consumers, there is a long-term contract buying and selling relationship, and *spot* or temporary sellers (PT Bukit Asam, Tbk. 2018)

3.4.8 Post-Mining

PTBA is committed to developing areas that have been mined to be managed responsibly, through reclamation, revegetation and post-mining activities. The Company carries out this mandate in accordance with statutory regulations and involves stakeholders in its implementation.

The post-mining goal is to create benefits from ex-mining land for various purposes for stakeholders

4. Methods Study

4.1 Literature Study

Literature studies include reading books, research reports and publications about the efficiency of loading and transporting digging equipment in order to understand ideas related to the issues that will be discussed in the field.

4.2 Field Observations

Observations in the field were carried out directly for several days, field observations included orientation activities with supervisors and employees in the field. Field observations were carried out at the West Banko electrification site

4.3 Data collection

4.3.1 Primary field data

Primary data is data obtained directly in the field by recording, measuring and asking questions directly in the field with supervisors or workers in the field. Where the data needed includes:

1) Tool documentation
2) Location documentation
3) Cycle time

4.3.2 Secondary Data

Secondary data is data taken from several literature studies from companies, reports and results of previous publications that are related to research conducted or have the same references. There are several secondary data required, namely:

4) Production data. coal
5) Rainfall data
6) Work efficiency data
7) Slippery clock data

4.4 Data Processing Stages

Data processing is contained in the general overview and specific overview chapters regarding mining activities, main and supporting mining activities.

4.5 Data Analysis and Conclusions

A conclusion is an arrangement (sentence delivered) taken from several ideas with inference rules (applicable) or it could be said to be an idea reached at the end of the discussion. To clarify the writing framework for making this fieldwork practice report, you can see the writing flowchart

5. Results and Discussion

5.1 Mining Methods in Pit 2 West Banko

Mining method used in *pit* 2 Banko West PTBA uses the *strip mining method. Strip mining* is a strip or row mining method which is specifically an open pit or surface mining system for coal. This method is used in coal deposits that are quite thick and have a relatively small *dip* or in fairly flat layers, with a dip *of* N200 $^{O\,E}$ / 25 $^{O.}$ The process of extracting coal (*coal getting*) *is carried out using the conventional mining* method using a combination of loading digging equipment and transportation equipment used in *pit* 2 Banko Barat, namely loading digging equipment in the form of a Komatsu PC3000E-6 *shovel and HD Rigid Truck Belaz 75135* transportation equipment.

5.2 Main Mining Activities in Pit 2 West Banko

Mining activities at *Pit* 2 West Banko consist of: *land* clearing, stripping *top soil*, excavating and loading *overburden*, transporting overburden, digging and loading coal, and transporting coal.

5.2.1 Land Clearing

Land clearing is carried out to separate trees from the land where the trees grow. The tools used in this activity are a Komatsu D375A *bulldozer and a* Komatsu PC200 excavator for *land clearing activities*. and uses 3 workers including supervisors, and in 1 day there are 2 work *shifts*. This land clearing activity is only carried out on land that will actually be mined soon, while land that has not yet been mined must retain the trees growing on that land.

5.2.2 Top Soil Stripping

Topsoil handling activities include digging, loading, transporting and stockpiling topsoil in the form of humus soil and in the *pit 2 area of West Banko using a combination of* 2 units *of Cobelco excavator* digging and loading equipment and a Komatsu D375A *bulldozer*, and CAT HD 773E transport equipment. 8 units, for equipment specifications can be seen in Appendix D, when the work requires 12 workers. The time applied in the company is divided into three *shifts* in one day or 8 hours/ *shift*. The top soil that has been peeled is then stockpiled and collected at a certain location known as a *top soil bank*. The distance from the front to the top soil bank is around 1.7 km. Then the top soil is *dumped* near the disposal area which is considered final. This top soil has a thickness of 40-60 cm, with a production target of 20,000 bcm. Later it can be reused for reclamation plans so that ex-mining land can be replanted with trees or for other uses in reclamation plans. The *top soil* stripping process was actually completed in 2016 so we did not witness this activity directly.

5.2.3 Blasting Overburden (*Blasting Overburden*)

Overburden blasting activities are carried out depending on the material that can still be excavated by the Komatsu PC3000E-6 *shovel* and the *overburden production needs*

themselves. The blasting process itself is usually carried out at 1 pm when mining activities are resting. The tool used to make the blast hole which will later be filled with explosives is the SanDvik D245S. The tool specifications can be seen in Appendix E and the blasting itself uses an MMU (*Mixing Unit Car*). The blasting activity is usually accompanied by a blasting supervisor and all activities are always stopped for a moment while the blasting is taking place. The aim of the blasting is to blow up material that is deemed necessary for blasting so that *the shovel* can dig and load smoothly.

5.2.4 Excavation and Loading of Overburden (*Overburden*)

Excavation of cover soil or *overburden* is carried out by blasting *on types of claystone* material with different thicknesses. Then the blasting material was loaded using a Komatsu PC3000E-6 shovel with a bucket capacity of *16 tons*. In accordance with the target in August 2018 of 700,000 BCM which must be achieved using a combination of Komatsu PC3000E-6 *shovels and HD rigid truck Belaz 75135* transportation equipment. For equipment specifications, the average number of fillings for transportation equipment is 4-5 times and requires an average of time. average of 2.5 minutes, in *pit* 2 west banko the tools used are 3 *shovels* and each tool consists of 1 operator and there are 20 Belaz which also contain 1 operator each so the number of workers here is 23 people.

This tool uses electric power to move *the engine* of the tool. With this, application in the field is slightly different from tools that do not use electricity as fuel. The electricity source comes from PLTU Bukit Asam 3x10 MW (Mega Watt), used as a source of electrical power to operate the engine from the Komatsu PC3000E-6 *shovel* which is used for the *overburden production process* at PT. Bukit Asam, Tbk..

5.2.5 Transportation of Overburden

Rigid truck is used for transporting materials from the work *front* to *disposal* with a stockpiling area of 16 Ha w and a transport distance of 2000 meters. For the West Banko Pit, 20 units of Belaz 75135 *rigid trucks are used* and the number of workers is 20 people with the working time at the company being 2 *shifts* a day, with the ownership status of the equipment belonging to PT. Bukit Asam, Tbk. and for its own operations in collaboration with PT. Bukit Asam Creative, where the HD *rigid truck* Belaz 75135 has a maximum *vessel capacity* of 130 tons and the standard is 110 tons.

5.2.6 Excavation and Loading of Coal

Excavation activity is the activity of breaking up or dispersing material which can be seen in Figure 3.10, which has been dismantled by *ripping* or which has not yet had a good layer of overburden *or* coal so that it can be easily loaded and transported to *the dumping area* (either to *inside dump, outside dump, temporary stockpile* or to *dump hopper*) according to needs. The coal in *the dump hopper* will later be transported using *a belt conveyor* to TLS 3 and TLS 4. The loading and digging equipment used at the Banko Barat Pit 2 Mine is 3 *fleets* and there are 3 units of loading and digging equipment, for 1 loading and digging equipment serving 6 transport equipment. Operation requires 1 worker with the applicable working hours in the company being two *shifts* in one day. In *pit* 2 Banko Barat, coal is dug in the A1, A2, B1, B2, and C coal seams with *Sub-Bituminous class* and BA-50 coal quality (4900 – 5100 kcal/kg, ar). In August 2018 the coal *seam* was dug. *Pit* 2, namely coal A1 and A2. For the mining itself, we collaborate with PT Satria Bahana Sarana (SBS).

5.2.7 Coal Transportation

The purpose of transportation is to move the coal from the excavation from the mining *front* to *the temporary stockpile* and to *the dump hopper* using 6 DT Nissan CWB 45 transport equipment. The equipment specifications can be seen in Appendix H. To operate it requires 6 workers with 2 *shifts* at a time. day. With a distance of 2.7 km to *dump hopper* 4 then it will be transported to TLS 3 or TLS 4 using *a belt conveyor* where the coal will then be loaded or transported using the Babaranjang locomotive to go to the Kertapati *stockpile* and Tarahan Pier. For the operation itself, we collaborate with PT Satria Bahana Sarana (SBS).

6. Conclusions and Recommendations

6.1 Conclusion

Based on the results of the discussion, the following conclusions can be drawn.

a. Mining activities in *Pit 2 Banko Barat that are still being carried out are mining* (*exploitation*), processing, marketing and post-mining activities
b. The mining method in *pit* 2 of West Banko uses the *strip method mining*, because this method is used in coal deposits with a relatively small slope (*dip*), *the slope* (*dip*) in *pit* 2 Banko Barat is N200 ^{O} E/25 ^{O}
c. The main mining activities in *pit 2 Banko Barat that are still being carried out are overburden* excavation activities and coal excavation activities which are going well, because they have reached the target. Meanwhile, the supporting activities that are running well are K3 activities because the applicable rules are obeyed by employees at *pit* 2 Banko Barat.

6.2 Recommendations

a. Routine road watering should be carried out on time
b. It is necessary to increase activities to support road maintenance in mining areas, so that the transport equipment will not experience problems or slippage.
c. There should be a schedule for leveling the overburden in the disposal area after dumping is carried out
d. Supervise every refueling, so that the available time is not wasted.

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