

HOW GOLD IS PRODUCED

Below is a general overview of the gold mining process in an open pit mine. It is important to note the process can vary from mine to mine.

EXPLORATION



Historically, exploration of gold involved a physical prospecting process. Geologists explored on foot, searching for visible ore deposits and inspecting rocks by hand. Today, most surface gold deposits have been discovered and mined. More sophisticated techniques have been employed to locate deeper deposits. Geologists use the character of the rocks to identify possible prospective areas and then undertake geophysical and geochemical exploration to target areas for drilling.

DRILLING



In establishing whether a prospective mine area will yield a commercial quantity of high grade gold ore, drilling is undertaken at various locations at the site. The samples are analysed to confirm the existence of gold, and the quality and quantity of the deposit. Mine engineers then decide if there is enough gold present in the area for a viable mining operation.

PREPARATION FOR MINING



Once a gold deposit has been discovered, various infrastructure needs to be built before mining can commence. An open pit mine can take 12 months to prepare. This, along with other planning, infrastructure construction and government approvals, can increase the time between discovery and mining to approximately five years.

MINING



Waste and ore are blasted to break them into sizes suitable for handling and transport to stockpiles or to the crusher. Blast holes are drilled and, before blasting, the drill cores are analysed by the laboratory to confirm the grade of ore to be mined. Heavy earth-moving equipment is used to remove waste rock from above the ore to enable mining to commence.

LGL's operations use a variety of heavy equipment in the mining process. Some of these include:

- Terex RH 90 Shovels
- Caterpillar 777F Haul Trucks
- Caterpillar 16M Grader

Stockpiles/Ore categorisation

After the ore is mined it is either transferred directly to process plant for the first stage of processing or to stockpiles for storage. Low grade ore is usually stockpiled for processing at the end of mine life, once the high grade ore has been processed.

Some gold mines (although not LGL's operations) use a heap leaching process to break down the low grade ore while it is in the stockpile. A cyanide solution is distributed across the stockpile, breaking down the gold into a solution that is collected for processing.

HOW GOLD IS PRODUCED

PROCESSING



Crushing

Ore from the mine is brought to the crusher to begin the first stage of processing. The crusher breaks down the large pieces of ore into smaller pieces. There may be multiple stages of crushing, most commonly primary and secondary crushing.

Grinding

Following crushing, the ore is transported along a conveyor to the processing plant for grinding. The ore is fed into a semi-autogenous grinding (SAG) mill or a combination of a SAG and ball mill. Mixed together with water and agitated by steel balls, this process grinds the ore into slurry. The ore is ground through a combination of the mill's rotation and the impact of the steel balls.

Ore may pass through the grinding process several times until it has reached a particle size of less than 90 microns. After each pass, the ore is sized through a large sieve-like object called a trommel screen. Finer ore particles that pass through the trommel screen are sized through cyclones again and then pumped onto the next stage of the process.

Flotation

Flotation is the process used to separate gold-bearing minerals from the ore. The slurry is aerated and chemicals are added to promote the flotation of the gold-bearing compounds. Simply, the gold floats to the top and the waste, also known as tailings, sinks to the bottom. This process is not used at Bonikro.

Leaching and Adsorption

Depending on its metallurgical characteristics, the concentrated slurry containing the gold ore can be processed in different ways.

Gravity Circuit The gravity circuit is dependent on large particles of gold separating from the slurry and sinking to the bottom. Similar to historical methods of gold panning, the gravity circuit is advantageous as it is low cost and has a minimal environmental impact. This method is used at LGL's Bonikro mine.

Refractory Ore Refractory ore containing other minerals requires treatment prior to the leaching process to free the gold. It can be pre-treated by a) roasting to burn off the sulphur, b) bio-leaching which eats the sulphur, or c) pressure leaching in an autoclave. The refined ore is then sent to the leaching circuit.

Leaching Circuit Some ore can be transferred directly to a leaching circuit from the grinding/flotation process. The leaching circuit, also referred to as Carbon-in-Leach (CIL), is where cyanide is added to dissolve the gold.

In this part of the process the gold is dissolved, then adsorbed out of the slurry solution and onto carbon molecules. Carbon has a very large surface area and therefore can adsorb large amounts of gold. The residual cyanide solution is recycled back into the process. CIL is the main concentration



method used at LGL's Bonikro mine and is also part of the refining process at Lihir Island and Mt Rawdon. Cyanide usage is carefully monitored and controlled to minimise any safety and environmental risks.

Gold Recovery

Following the leaching circuit the gold is chemically stripped from the carbon. In this process, called elution, a mixture of caustic soda and cyanide is used to extract the gold from the carbon, resulting in a concentrated gold solution. This solution is then transferred to the gold room for the final stages of processing.

Before the gold is smelted and poured into the moulds, the gold solution has an electric current applied, forcing the gold to precipitate on to steel cathodes. This process is called electrowinning.

The gold sludge is removed from the steel cathode and filtered and dried before smelting. The gold is smelted and poured into ingot moulds to produce dore (unrefined gold bars). This gold is then transferred to third-parties for further refinement. Unrefined gold from LGL Lihir Island is transported to the Perth Mint in Western Australia, and unrefined gold from LGL Bonikro is shipped to Switzerland.



WASTE AND TAILINGS

Tailings are the final, unwanted materials which remain after gold extraction. The tailings comprise of over 99% ground up sand or silt with some low levels of residual chemicals.

All tailings generated at LGL's operations are disposed of in accordance with environmental regulations and laws. We regularly report our tailings monitoring results to the relevant government authorities.