PT Newmont
Nusa Tenggara

# Fact Sheet

**What are tailings?**
Tailings are finely crushed rock from which most of the copper, gold, and silver have been removed in the form of a concentrate. The concentrate is shipped to smelters for final processing and metal recovery. Tailings are discharged from the ore processing plant in the form of slurry as they are mixed with process water.

At PTNNT, ore processing does not use mercury or cyanide. Rather, organic, alcohol-based chemical reagents are used that decompose easily and quickly.

**How are tailings produced?**
PTNNT primarily uses standard physical processes to separate valuable minerals from ore. The four main components of the mineral recovery process are crushing, grinding, and flotation for mineral separation and concentrate handling. Tailings are produced as a by-product (waste) in the flotation process.

The crushing circuit reduces the size of the ore (which is rock containing economically recoverable quantities of minerals) delivered from the open-pit mining operation to an average diameter of less than 15 centimetres. After crushing, the ore enters the grinding circuit where seawater and/or run off mine water are added to the ore. The grinding circuit uses Semi-Autogenous Grinding (SAG) Mills and Ball Mills to reduce the size of crushed rock to sand-sized granules.
The mixture of finely ground particles of ore and water that is mixed together in the grinding circuit is called "slurry." This slurry is pumped to the flotation process where organic reagents and lime are added to recover valuable minerals from the ore.

Reagents selectively react with surfaces of the finely ground ore that contain the valuable minerals to make them hydrophobic (water repellent). This mineral-rich fraction of the finely ground ore, which contains copper, gold and silver, sticks to bubbles which float to the tank surface, moving the valuable minerals from the tank base to the surface of floatation tank.

These "floated" minerals are separated from the remainder of the finely ground rock and removed as a "concentrate." The concentrate contains higher percentages of copper, gold, and silver than the ore that originally entered the processing facility. The concentrate is shipped to smelters around the world in the form of black sand for ultimate recovery of the copper, gold, and silver.

The fine-grained crushed rock particles and water (i.e. slurry) remaining in the flotation tanks after the valuable minerals are floated and removed as a concentrate are called tailings. The tailings contain small residual amounts of minerals that were not recovered in by the flotation process.

**Chemical Characteristics of Tailings**
Tailings are similar in nature and characteristics with naturally occurring sand existing in Sumbawa Island. Nature's long-term processes of erosion and weathering have created sand from the rocks of Sumbawa.

Toxicity Characteristic Leaching Procedure (TCLP) conducted on tailings and natural sediment show that, except for copper, tailings have similar non-toxic characteristics of natural sediment.

The following tables show chemical characteristics of tailings compared to riverbed sediments, and a locally made building brick.

**Comparison of leaching toxicity and characteristics of tailings in de-aeration tank, on seabed, river sediment and brick materials**

| Type of Material | | Tailing solid in | | Natural Sediment at Southern Sumbawa Coast | Sediment at Sekongkang River bed | Sediment at Sejorong River bed | Brick materials in Sekongkang Village |
|---|---|---|---|---|---|---|---|
| Chemical Elements | unit | De-aeration tank | Senunu Canyon | | | | |
| **Total Metal** | | | | | | | |
| Arsenic | mg/dry.kg | <1 - 18 | <1 - 10 | <1 - 19 | 3 - 4 | 14 | <1 - 1 |
| Barium | mg/dry.kg | - | - | - | - | - | - |
| Boron | mg/dry.kg | - | - | - | - | - | - |
| Cadmium | mg/dry.kg | <0.1 - 11.7 | <0.1 - 14.3 | <0.1 - 20.2 | <0.1 | 0.2 | <0.1 - 0.1 |
| Chromium | mg/dry.kg | <1 - 76 | <1 - 111 | 2 - 58 | 13 | 9 | 6 |
| Copper | mg/dry.kg | 245 - 3150 | 6.1 - 4080 | 1 - 58 | 62 - 64 | 127 | 39 - 48 |
| Lead | mg/dry.kg | <1 - 43 | <1 - 50 | <1 - 50 | 2 - 8 | 9 | 3 - 9 |
| Mercury | mg/dry.kg | <0.001 - 0.080 | <0.001 - 0.1 | <0.001 - 4.8 | 0.009 | 0.012 | 0.011 |
| Selenium | mg/dry.kg | <1 - 4 | <1 - 4 | <1 - 7 | <1 | <1 | <1 |
| Silver | mg/dry.kg | <0.4 - 2.1 | <0.4 - 3.6 | <0.4 - 4.7 | <0.4 | <0.4 | <0.4 |
| Zinc | mg/dry.kg | 2.9 - 481 | <1 - 133 | <1 - 402 | 76.3 -78.9 | 129 | 41.3 -64.4 |

Note: (-) Parameter is not analyzed, (<) Value below device's detection limit.

| Leaching Toxicity Metals (TCLP) | | TCLP Standard (PP85/1999) | Tailing solid in | | Natural Sediment at Southern Sumbawa Coast | Sediment at Sekongkang River bed | Sediment at Sejorong River bed | Brick materials in Sekongkang Village |
|---|---|---|---|---|---|---|---|---|
| Chemical elements | unit | | De-aeration tank | Senunu Canyon | | | | |
| **Total Metal** | | | | | | | | |
| Arsenic | mg/L | 5 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Barium | mg/L | 100 | <1 | <1 | <1 | <1 | <1 | <1 |
| Boron | mg/L | 500 | <20 | <20 | <20 | <20 | <20 | <20 |
| Cadmium | mg/L | 1 | <0.05 | <0.05 | 0.05 | <0.05 | <0.05 | <0.05 |
| Chromium | mg/L | 5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Copper | mg/L | 10 | <0.1 - 21 | 2.8 | <0.1 | <0.1 | 0.1 | <0.5 |
| Lead | mg/L | 5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| Mercury | mg/L | 0.2 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Selenium | mg/L | 1 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 | <0.05 |
| Silver | mg/L | 5 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| Zinc | mg/L | 50 | <0.05 - 1.3 | 0.25 | <0.05 | <0.05 - 0.06 | 0.11 | <0.05 |

Note: (-) Parameter is not analyzed, (<) Value below device's detection limit.

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**Tailings Toxicity Test**
Biological testing of PTNNT's tailings has been performed to determine if there are any significant toxicity affects against marine biota. This testing was done using recognized standard methods by the Research Centre for Oceanography-Indonesian Institute of Sciences (P2O-LIPI). Acute 96-hour toxicity (LC50) tests were performed on juvenile sea bass and tiger grouper. Chronic/sub lethal toxicity (IC50) tests were performed on marine diatom (plankton).

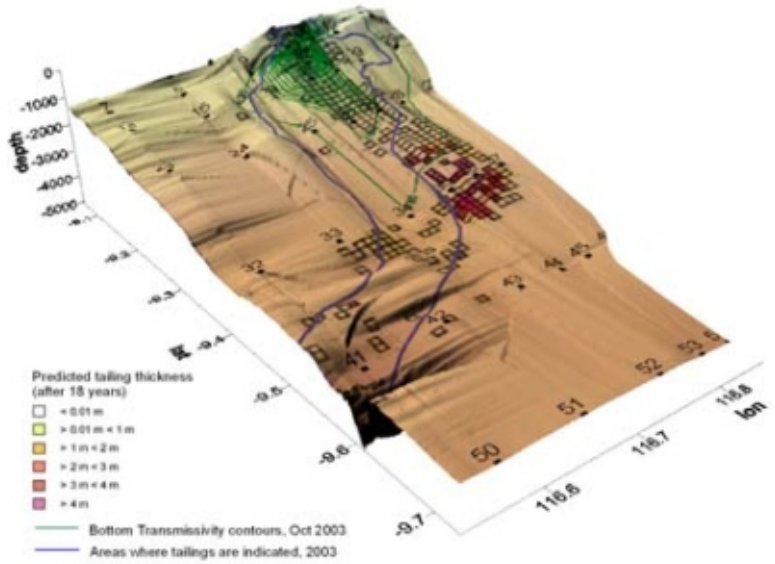
All tests were conducted using various percentages of tailings slurry concentration in seawater. The results from this testing have clearly indicated that there is no acute or chronic toxicity effect associated with the tailings, even with 100% tailings slurry concentration.

In addition, tests have been conducted to assess the ability of benthic organisms to live in the tailings deposited on the sea floor. Tests performed in 2005-2008 by consultants ENESAR together with P2O-LIPI and UNRAM show that colonization of tailings by benthos occurs in a very short period. By the 97th day of the trials, the benthos abundance in tailings was similar to that of natural sediment.

**Deep Sea Tailings Placement System**
PTNNT has a well-engineered Deep Sea Tailings Placement (DSTP) system that is continuously managed and monitored to ensure proper operation. The Government of Indonesia and PTNNT together selected DSTP as the preferred tailings management alternative during the Environmental Impact Analysis for the Batu Hijau Project that was required before operations commenced in 1999.
The major factors leading to this decision included:

1. On-land disposal would have impacted more than 2,310 hectares of productive jungle and agricultural lands;
2. Annual precipitation exceeding 2500 millimetres would have made management of water within land-based tailings impoundments extremely difficult;
3. A tailings impoundment constructed in an area prone to earthquakes was at risk of failure that could have threatened the surrounding environment, including even the safety of nearby communities;
4. Tailings placed in the sea below the biological productive photic zone minimizes impacts on the environment.

**How Does Deep Sea Tailings Placement Work?**
Tailings flow by gravity as a slurry (mixture of water and crushed rock) through a pipeline from the ore processing facility to the edge of the Senunu Submarine Canyon. The end of this pipeline lies approximately 125 meters below the sea surface and approximately 3.2 kilometres from the shoreline. The density of tailings slurry is higher than seawater so the tailings sink and flow down the steep walls of the Senunu Submarine Canyon like an underwater river. Most of the tailings will deposit at depth around 3000 m and some will continue to the bottom of Lombok basin at depth of > 4000m.



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**Monitoring Program**
PTNNT's DSTP system is monitored extensively to ensure that the system is functioning as designed to minimize any potential impacts to the environment.
In 2004 and 2009 scientists from the Centre for Contaminants Research, Commonwealth Scientific and Industrial Research Organization (CSIRO), Australia, together with an Indonesian peer-review team independently studied and reviewed PTNNT's monitoring data of the water quality, sediment, and fish around PTNNT tailings placement area and at further locations toward Lombok and Alas Strait waters.

The findings indicated that tailings did not disperse to the coastal environment of Sumbawa, nor towards the Alas Strait and Lombok, nor to surface waters.

The concentration of metals in fish tissue from Senunu Canyon were within the normal expected range, similar to the levels found in fish from control sites and markets throughout the Regency of West Sumbawa and Lombok.

The study confirmed that dissolved metal concentrations at all sites and depths were below the defined standards. These independent results confirm PTNNT's results and that the tailings are not polluting seawater in the area.

In 2003 and 2009, the Research Centre for Oceanography-Indonesian Institute of Sciences (P2O-LIPI) conducted deep sea surveys to map the tailings footprint and the impact of DSTP to marine ecosystem including water quality and benthic communities. The survey results indicate that the tailings flow down the Senunu Canyon towards the Lombok Basin as predicted in the PTNNT's ANDAL and the impact to the water quality was limited to the bottom waters of Senunu Canyon. Water quality outside the tailings mixing zone was in background concentrations level, and comply with GoI marine water quality standards.

**Tailings Spill Prevention**
Quality assurance and quality control protocols are in place for offshore and onshore pipeline integrity. On land, PTNNT has placed the tailings pipeline in a contained corridor so that in the unlikely event of a pipeline failure, tailings can be readily captured and cleaned-up.

PTNNT uses two off-shore tailings pipelines. One pipeline is used for operational purposes while the other serves as a back-up. In case the off-shore pipe would leak, the plant can be shut down immediately and the tailing slurry diverted to the back-up pipeline. However, the applied operational strategy does not wait until the first offshore pipe leaks before diverting the tailing slurry to the second offshore pipeline. Internal inspection on the onshore and offshore pipeline is conducted twice a year during scheduled total plant shutdown. If the inspection result predicts that the operational offshore pipeline will reach its minimum wall thickness before the next scheduled shutdown, the second offshore pipeline will be used as the operational pipeline while the first one will be completely replaced with the new pipe and become the backup. This strategy has minimized the possibility of offshore pipe leakage.