Kennecott Utah Copper

RioTinto

Molybdenum Autoclave Process Information Brief
August 2010

Overview

Q: What is Molybdenum?
A: Many copper mines contain molybdenum, and the Kennecott Bingham Canyon Mine is no exception. Molybdenum is considered a "by-product" of copper production at the Bingham Canyon Mine. We have recovered molybdenum since the 1930's.

Molybdenum is used in metal alloys, including stainless and low alloy steel, to enhance toughness, high-temperature strength and corrosion resistance. It is also a key component in oil refining as it is used in catalysts to remove sulfur from fuel to meet air quality regulations.

Q: How do you currently process molybdenum?
A: Following extraction and crushing, the ore which contains copper, molybdenum, gold, silver, and other impurities from Bingham Canyon is sent to our concentrator where it is mixed with an aqueous solution and ground to a powder. Minerals containing molybdenum, copper, gold and silver are separated using a process known as froth flotation.

In froth flotation, the ore is mixed with water and chemicals that cause a change to the mineral's surface. Those minerals containing sulfur (such as molybdenum, copper, etc.) float to the surface of the flotation cells when nitrogen is injected allowing separation of the valuable minerals from the non-valuable minerals (tailings). This first step is known as bulk flotation.

During the second step, molybdenum is separated from copper by adding chemicals that further alter the copper-bearing mineral surface. Molybdenum disulfide attaches to bubbles and floats to the surface of the flotation cell, separating itself from the copper. The molybdenum sulfide, or concentrate, is then filtered, dried, and packaged in large "sacks" for shipment.

Currently, the concentrate is shipped to off-site roasting facilities in Belgium and Mexico that further process the concentrate into the base finished product – molybdenum oxide.

Q: What is the Molybdenum Autoclave Process project?
A: The Molybdenum Autoclave Process, or MAP, will be a new facility constructed on our site near the Refinery. MAP will use pressure oxidation (in an autoclave), purification, and crystallization to produce final saleable molybdenum products here in Utah. The new facility will enable lower-grade concentrate to be processed, allow improved molybdenum recovery and operating flexibility and enable production of both technical and chemical grade molybdenum products.

Q: Is MAP a new smelter?
A: No. A smelter is a pyrometallurgical processing unit where concentrated ore is heated at extreme temperature producing a molten metal product and a concentrated gas stream. The MAP facility is a 'wet' or hydrometallurgical process as opposed to a smelting process. While the autoclave will operate at elevated temperature and pressure, it does not produce a molten product like a smelter. The autoclave is an enclosed system which will be vented to the atmosphere through best available pollution control technology.

We developed and patented the molybdenum autoclave process which features a number of environmental benefits compared to traditional roasting technology employed in most molybdenum production facilities globally. While the MAP facility is a newly permitted source of emissions in the Salt Lake airshed, the level of emissions of the facility is quite low compared to traditional roasting facilities.

Q: What will the capacity of the MAP facility be? Will it meet 100% of KUC's needs?
A: The initial capacity, or Phase 1, is expected to be 30 million lbs of molybdenum. Construction is expected to be completed by the end of 2012 with a one year ramp up to full production. Phase 2 will increase capacity to 60 million lbs and construction is expected to be completed by 2015.

Since 2005 our annual molybdenum production has ranged from 23 to 37 million pounds. As a by-product, molybdenum production is expected to continue to be variable over the remaining life of the mine. However, there are areas of higher grade molybdenum at the bottom of the pit. As the mine moves through these areas there may be spikes in molybdenum production during the second half of this decade. Opportunities to fill capacity with 3rd party molybdenum or process excess molybdenum externally will be considered and evaluated based on value.

Q: What is the expected increase in molybdenum recovery rates that you expect to achieve through MAP?
A: With MAP, our rate of molybdenum recovery will increase by about 7 percent. This means that we will recover more molybdenum from the same mine resource.

Q: What products will MAP produce?
A: The MAP facility is flexible to serve technical and chemical customers as market conditions warrant. Technical grade product customers are primarily steel mills. The chemical molybdenum market is driven primarily by oil refining catalyst usage and

molybdenum metal fabricators. MAP will allow us to produce two different grades of molybdenum oxide as well as rhenium[1] onsite.

Environmental Aspects

Q: Is the MAP process more energy efficient than traditional roasting?
A: When completed, MAP will produce molybdenum using less energy with less environmental impact than producing it at traditional roasting plants. By its very design, the autoclave process is more efficient than traditional processing methods. We developed and patented the MAP process. In addition, MAP's design includes a number of energy efficiency features:

- Heat recovery system: A heat recovery system will be installed in the facility to recover waste heat to convert to steam which will supply 40 percent of the facility's thermal requirements. This reduces the amount of virgin steam that would need to be generated otherwise.

- Combined Heat and Power System: A combined heat and power (CHP) system, powered by natural gas, has been sized to meet the process steam needs of the MAP facility while also co-producing approximately 6 megawatts of electricity to meet most of the facility's electricity needs. It will displace 6 megawatts of electricity that would otherwise be purchased from the grid and produced using more conventional processes (like coal). It also offsets the electricity it would take to produce the amount of process steam needed for MAP. Co-generating electricity and steam through CHP is more efficient and therefore more environmentally friendly than traditional options. In sum, CHP provides distributed onsite steam and electricity production at individual facilities, meets short-term rising demand for energy with highly-efficient technologies, and diversifies our energy generation portfolio and reduces the risk of power shortages.

- Reduction in transportation emissions: Because we will be producing a salable molybdenum product onsite, the need to transport molybdenum concentrate to another country and facility for processing will be eliminated.

- Improvement in environmental footprint[2]: Because the autoclave process is more energy efficient and cleaner than traditional roasting, processing will occur onsite, and additional energy efficiency features are integrated into the facility's design, the following improvements in the environmental footprint of the product may be realized (per ton of product produced) compared to processing the molybdenum at traditional roasters:

[1] Rhenium is a metal used as an alloy in jet engines. This alloy enables the engines to be operated at higher temperatures which allow greater power and fuel efficiency.
[2] This information is based on a study completed by Five Winds International to compare the environmental impacts to process molybdenum at traditional roasters vs. MAP from a product life cycle perspective, from cradle-to-gate.

- Energy use will be reduced by 10-15%
- Greenhouse gas emissions will be reduced by 20-30%.
- Sulfur dioxide emissions will be reduced by 50-60%.

Q: What are the environmental aspects of adding a new processing facility at Kennecott?
A: Even though producing molybdenum at MAP is anticipated to be a more energy efficient and cleaner than processing molybdenum using traditional roasters, we do expect a slight increase in our overall emissions at the local level due to moving some of the processing steps on-site. The following is a summary of anticipated environmental aspects as a result of MAP.

Air: MAP will lead to an increase in emissions to the local airshed as indicated in the table below. However, it is important to note that we are offsetting PM10, SO2 and NOx emissions from emissions that were previously eliminated and banked. Once the facility is operational, actual air emissions will be reported annually to UDAQ.

Emission Type	Amount (tons per year)	Amount of offsets provided (tons per year)
$PM_{10/2.5}$	14.34	15.77
SO_2	1.23	1.35
NO_x	27.99	30.79
CO	29.25	NA
VOC	5.82	NA
HAPs	0.35	NA

Water Quality: MAP will not adversely impact surface water quality or groundwater quality.

Land: The MAP facilities will be constructed on about 26 acres of existing Brownfield property we own and manage. No other land will be impacted or disturbed outside this footprint.

Climate (GHG Emissions): As noted above, global GHG emissions from a life cycle perspective associated with the recovery of our molybdenum will be reduced by 20-30% as a result of this project. Locally, we expect that MAP will generate 61,500 metric tonnes of CO2-equivalent per year. This equals about a 3% increase in our overall carbon footprint. Once the facility is operational, actual GHG emissions will be reported annually under the new federal GHG reporting rule.

Q: What environmental regulations apply to MAP and what primary environmental permits are required for MAP?
A: Working with the various agencies that permit us across our operation, a thorough permit review was completed. The following is a summary of the outcome:

Air permits:
According to state and federal regulations, we are required to obtain two types of air permits regulated by the Utah Division of Air Quality (UDAQ):

1. Approval Order permit: A facility must apply for an Approval Order before starting construction or operation of any emitting equipment.
2. Operating or "Title V" permit.

An Approval Order permit was issued by UDAQ in September 2008 and was modified in August 2010 to accommodate the addition of a CHP unit replacing the original boilers and several other process refinements.

We will eventually seek the required Title V Operating permit prior to MAP operation.

Water Permits:
The Utah Department of Environmental Quality, Division of Water Quality has been consulted pursuant to the applicability of surface water and ground water quality programs.

Specific to existing KUC Utah Pollutant Discharge Elimination System (UPDES) permit requirements to incorporate MAP, it has been concluded that the existing UPDES permit will accommodate the MAP facility.

Specific to existing KUC Ground Water Protection permit requirements, it has been concluded that a specific Ground Water Discharge Permit for MAP will not be required.

A Storm Water Pollution Prevention Plan (SWPPP) has been developed and implemented for the construction phase. Post construction storm water management will be outlined in a modified KUC wide operational SWPPP.

Waste:
Projected MAP facility process and general waste streams were carefully evaluated. These waste streams included tailings, general refuse and maintenance waste. Some of these wastes will be non-hazardous and some will be hazardous wastes. Each waste will be managed in compliance with authorized Utah Department of Environmental Quality, Division of Solid and Hazardous Waste and United States Environmental Protection Agency Resource Conservation and Recovery Act (RCRA) regulations.

Other:
The environmental aspects of MAP will be managed in accordance with KUC's ISO14001 certified Environmental Management System.

Utah Department of Natural Resources, Division of Oil, Gas, and Mining (UDOGM) jurisdiction does not apply to the MAP facility as the MAP process would not be characterized as "primary processing".

Under the Federal Oil Pollution Prevention Act guidelines a Spill Prevention, Control and Countermeasures (SPCC) Plan will be developed and implemented.

Emergency Planning and Community Right-to-Know Act (EPCRA)

- Sections 311 and 312. Community Right-to-Know Requirements MAP will manufacture chemicals that will require the development of Material Safety Data Sheets (MSDSs) describing the properties and health effects of these chemicals. The Facility will also prepare inventories of all on-site chemicals for which MSDSs exist. All of this information will be reported or made available to state and local officials and local fire departments.

- Section 313. Toxics Release Inventory MAP will complete and submit a Toxic Chemical Release Inventory Form annually for each of the present Toxic Release Inventory (TRI) chemicals that are manufactured or otherwise used above the applicable threshold quantities. TRI reports detail environmental releases to air, water and land.