

Project Profile – North Americas Largest Copper Mine

Overview

Gold prospectors came to Morenci, in Greenlee County, Arizona, in the 1860's but instead of gold found extensive copper deposits. Underground copper mining began in 1872 by the Detroit Copper Company, a venture financed by Phelps Dodge Corporation. In 1921 the assets of the Detroit Copper Company and nearby Arizona Copper Company were purchased by Phelps Dodge and consolidated under the Phelps Dodge name. In 1939 the underground mining operations were replaced with open-cut mining. The operation nearly doubled its production capacity during World War II at the urging of the U.S. government to meet wartime needs. Phelps Dodge developed the property for nearly 90 years, then agreed to be purchased by a smaller rival, Freeport McMoRan Copper & Gold, Inc. (FMI) in 2007.

The mine property at Morenci covers approximately 60,000 acres and has five pits, three of which are currently active. It is the largest copper mine in North America and one of the largest in the world. The mine has a workforce of approximately 2000, processing up to 700,000 tons of rock per day, producing up to 840 million pounds of copper per year. FMI is second only to Chilean company Codelco in world copper production.



Copper is extracted at Morenci using the SX-EW, or solution extraction-electrowinning, process. The process involves leaching the ore with a weak sulfuric acid solution, concentrating the solution (SX process) and then collecting the copper from the solution by electrowinning (EW process). In the EW process the copper is reduced electrochemically from copper sulfate in solution to a metallic copper cathode. Electrowon copper cathodes are as pure, or purer, than more conventional electrorefined cathodes from a smelting process.

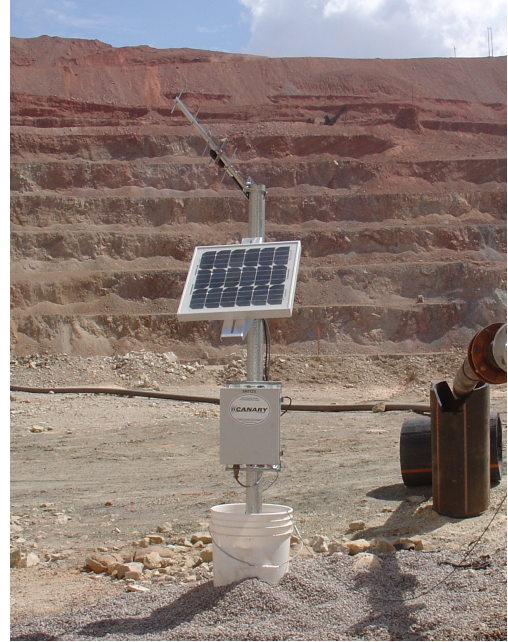
This process also allows recycling of the leaching solution which greatly reduces environmental impact, as the SX process returns the solution to its original acidity thereby allowing it to be recycled for leaching. The SX-EW process also makes it possible to extract copper from low-grade sulfides. There are four solution extraction facilities and three electrowinning tankhouses at Morenci. By-products are silver, gold and molybdenum.

Morenci operations also pioneered the use of wireless networking technologies including GPS to manage equipment and production.

What We Did

We have worked with Phelps-Dodge, now Freeport-McMoRan, for several years developing their mine safety monitoring system. Prior to our involvement with the project the monitoring consisted of several disconnected systems for different types of instruments with no centralized dispatch of alarms to the operations group. Our involvement has facilitated combining all of the automated monitoring into a single database using our MLDB software, MLWeb is also utilized to present the alarm monitoring interface to dispatch and other operations personnel.

We have worked with them to integrate their Leica Total Stations (TPS), dewatering well monitoring, slope monitoring using wire extensometers, MFL leaching levels, flow monitoring and two Campbell Scientific weather stations. All mine-wide communications are facilitated using a high-bandwidth Mesh wireless TCP/IP network, we are also monitoring the power supplies for the remote IAP platforms which extend the network. This work has included developing and supplying hardware solutions to integrate all these measurements for access over the Mesh wireless network. Example de-watering well solution is shown at right.



With all measurements (approximately 1500 data elements in total, with equal number of calculated elements) integrated in a single database/interface monitoring of the project is much simpler and much more effective. The MLWeb main page (shown below) shows monitoring locations throughout the property and status. If any alarms are generated the interface allows the operations personnel to quickly find the location and details of the alarm.

Project Views - Microsoft Internet Explorer
 Address: http://localhost:2116/web/ImageWindow.aspx

Project: **Prisms_Alarm** | Window: **Overview2** | Output: **Highwall to Piece WGOR**

FREEPORT-McMoRAN COPPER & GOLD

Icon	Instrument	Count
	Piezometer	24
	Piezometer Temperature	0
	Lake Elevation	1
	Basin Drain	2
	Wind Speed	2
	Temp	3
	24HR Rain	6
	Monthly Rain	3
	Entensometer	9
	PRISM	245
	Humidity	0

Project	Interval	Last Updated
	TOWER402HR	2 Hours 9/16/2008 12:00:00 PM
	TOWNSSETHR	2 Hours 9/16/2008 12:00:00 PM
	CADILLAC	2 Hours 9/16/2008 8:45:00 AM
	NWUpper	2 Hours 9/16/2008 12:15:00 PM
	P2P3_BalInlv	2 Hours 9/16/2008 12:30:00 PM
	Prisms	2 Hours 9/16/2008 12:14:57 PM
	PRODUCER	2 Hours 9/16/2008 12:30:00 PM
	MFL	2 Hours 9/16/2008 12:30:00 PM

MONITORING LOCATIONS: CORONADO, UCC DAM, GARFIELD, SHANNON, AMERICAN MT, NORTHWEST, METCALF, WESTERN COPPER, DISPATCH, MFL, LCC, HYDROLOGICAL DATA.

CURRENT 402 TOWER TEMP | Max Wind Speed | **FOR CANARY ALARM ON DISPATCH SCREEN**
 24HR RAINFALL | Average Wind Speed | 1. DOUBLE CLICK ON RED CIRCLE ABOVE
 MTD RAINFALL | Humidity | 2. LOCATE FLASHING ICON ON NEXT SCREEN AND DOUBLE CLICK
 YTD RAINFALL | ON BLUE WRITING OF ALARMING ICON
 3. FOLLOW INSTRUCTIONS THAT COME UP

Who to Contact

Project reference contact supplied on request.