



## **CONTACT INFORMATION**

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PRINTED: 06/24/2002

ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES AZMILS DATA

PRIMARY NAME: SAN MANUEL OPEN PIT OXIDE MINE

ALTERNATE NAMES:

PINAL COUNTY MILS NUMBER: 744

LOCATION: TOWNSHIP 8 S RANGE 16 E SECTION 35 QUARTER --  
LATITUDE: N 32DEG 41MIN 37SEC LONGITUDE: W 110DEG 40MIN 49SEC  
TOPO MAP NAME: MAMMOTH - 7.5 MIN

CURRENT STATUS: PRODUCER

COMMODITY:  
COPPER OXIDE

BIBLIOGRAPHY:  
ADMMR SAN MANUEL OPEN PIT OXIDE MINE FILE



SAN MANUEL OPEN PIT OXIDE MINE

NJN WR 6/6/86: In the company of Dick Beard, attended an A.I.M.E. field trip. We visited an exposure of diatomite and gypsum just south of the Whitecliffs Mine (f) Pinal County. A separate field visit report has been written and a hand out on diatomite has been added to the diatomite commodity file.

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Date Printed: 01/30/98

ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES

INFORMATION SUMMARY

Information from: **Field Visit by Ken Phillips,**

Company: Nyal Niemuth, and H. Mason Coggin

Address:

City, State ZIP:

Phone:

MINE: San Manuel Open Pit

ADMMR Mine File: San Manuel Open Pit Oxide Mine file

County: Pinal

AzMILS Number: 744

SUMMARY

Together with State Legislators, Officials of the State Mine Inspector's Office and Nyal Niemuth, Mason Coggin, and Eric Nordhausen toured the 2615 level of the San Manuel Copper Mine, the San Manuel Open Pit Oxide Mine, the San Manuel SX-EW plant and the San Manuel production shafts hoist house. Applicable Pinal AZMILS numbers are 577A and 744

The following are some notes from the visit:

1. BHP is the worlds largest non government producer of copper
2. BHP produces 11 % of the world's copper.
3. BHP controls 40 % of the world's copper concentrate.
4. The San Manuel Mine is north America's largest underground mine.
5. Current average sulfide ore grade of the two ore bodies is 0.611 % Cu.
6. Current average oxide ore grade is 0.589 % Cu.
7. Current mine cash cost of production for the combined sulfide and oxide ores is \$0.91 per pound of copper.
8. Current San Manuel employment is 2300.
9. BHP's Arizona operations spend \$616,000,000 on supplies, power, etc. in Arizona which is 75-80 % of their expenditures.
10. The expenditures are divided as follows:

San Manuel Operations	\$243,000,000
Corporate Operations	70,000,000
Pinto Valley Operations	132,000,000
Superior Operations	16,000,000
Smelter, refinery, rod plant	156,000,000
11. Current San Manuel production is 20,000,000 pounds of copper per month.
12. Plan 23,500,000 pounds of copper per month by May 1998 by increasing oxide and Kalamazoo production.
13. Ton of ore per day is planned at 60,000 by May 1998.
14. Costs are targeted to be \$0.78 per pound by May 1998. First

Date Printed: 01/30/98

ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES

INFORMATION SUMMARY

operation.

Ken A. Phillips, Chief Engineer      Date: November 17, 1997

## ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES

VERBAL INFORMATION SUMMARY

1. Mine file: SAN MANUEL OPEN PIT OXIDE MINE
2. Mine name if different from above:
3. County: Pinal
4. Information from: H. Smith

Company: Magma Copper Corp.

Address: P.O. Box M

San Manuel, AZ 85631

Phone: 385-3100

5. Summary of information received, comments, etc.:

Talk presented to AIME State Conference, December 4, 1988 in Tucson

"San Manuel overview of the oxide mining operation"

The open pit mining operation began in 1985. The mineralization is principally chrysocolla and minor chalcocite with an ore body containing 61 million tons grading .376% Cu. Currently the open pit measures 4800' by 2400', bench heights are 30', 40-45 degree slope results in a stripping ratio 1.05:1.0. Ore density varies from 13.5 - 17.5 cubic feet per ton. Production rate is about 21,000 tons of ore daily.

Pit blasting pattern varies but consists of 9" holes 37', drill bit life averages 12,000'. A combination of hydraulic excavators and loaders keeps a fleet of fourteen 100 ton trucks busy. Waste is disposed of in a deeper portion of the subsidence area, while ore is hauled to a 108 acre heap. Heaps are constructed by contouring the surface, placing the liner and 18" of sand as a base, and then end dumping and ripping the ore up to a height of 80'.

Date: December 4, 1988

Nyal J. Niemuth, Mining Engineer

ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES

INFORMATION SUMMARY

quarter 1998, \$0.88; second quarter 1998, \$0.91; third quarter 1998, \$0.84; and fourth quarter 1998, \$0.78 for a 1998 average of \$0.85.

15. The Arizona Industrial Commission's "8 hour law" limits the total amount of time a worker can work underground to 8 hours portal-to-portal (or collar-to-collar) in 24 hours. Underground transportation time to the work face, set up time, lunch time, etc. limits the actual underground working time to between 4.5 and 5 hours. BHP claims that both management and labor desire to have the law changed to allow 10 hour days.

If such a work day/week were allowed there would no additional cost to the company and the workers, a majority of whom drive over one hour each way to and from work, would not get any increase in pay. The workers would have one less round trip commute per week. However, the average production per hour would increase. The current union contract allows such a change if the law can be changed. There is some question as to if the union business office is in favor of a change that would allow the same number of workers to produce more and thus eliminate the need to hire more workers.

In 1991 the company and the union signed a 15 year labor agreement guaranteeing no strikes, but agreeing to re-negotiate in 1997. That agreement was just signed. Wages went from \$13.66 to 16.54 per hour. Cost of labor went from 23.94¢ to 28.16¢ per pound of copper. The agreement provides for 10.5 hour per day underground and 12 hour per day surface work schedules.

A 2/3 vote of workers is needed to change the schedule if the statute is changed. If the vote approves a change, it can be changed back to the old schedule by a worker vote after 6 months.

During the same trip the San Manuel open pit mine (currently an in-situ leach injection well field) and the solvent extraction and electrowinning plant were toured. When open pit mining operations stopped in February of 1995, 93,000,000 tons of oxide ore had been mined. The San Manuel pit now has 1,000 injection wells on the eastern portion of the deposit. The resultant pregnant leach solution is recovered in old underground workings.

When the open pit operation started it was decided production cost would not exceed \$0.50 per pound of copper produced and there would be no recapitalization of the truck and shovel fleet.

There is current consideration to restart the open pit but if done it will impact the underground portion of the mine. Currently they are determining what modifications to their aquifer protection permit and environmental impact statement would be required to start oxide ore production again. They could reopen the pit in 3 years. Open pit resources could be as much as 200,000,000 tons at 0.5% total copper and 0.41% acid soluble copper.

The plant is running at 50 percent capacity on leach solution from the insitu leaching operations under the south and east side of the idle open pit. The SX-EW plant has produced over 600 million pounds of copper at a guaranteed purity of 99.999%. Even insitu leaching is currently limited so as to protect portions of the underground

SAN MANUEL OPEN PIT OXIDE (F) PINAL

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# ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

FIFE SYMINGTON, GOVERNOR  
RANDOLPH WOOD, P.E., DIRECTOR

## PUBLIC NOTICE

### NOTICE OF INTENT TO ISSUE AN AQUIFER PROTECTION PERMIT

Pursuant to Arizona Administrative Code, Title 18, Chapter 9, Article 1, the Director of the Arizona Department of Environmental Quality intends to issue an Aquifer Protection Permit subject to certain specific and general conditions.

Public Notice No. 21-91AZAP

San Manuel Mine

Oxide Leach Pad/ Solvent Extraction- Electrowinning  
Facility

On or about  
April 22,  
1991

Magma Copper Company - San Manuel Division

P.O. Box M

San Manuel, Arizona 85631

Aquifer Protection Permit No. P-100421

The facility is located approximately seven miles northeast of San Manuel, Arizona and two miles southwest of Mammoth, Arizona, in Pinal County, in Township 8 South, Range 16 East, Sections 22, 25, 26, 27, 33, 34, 35 and 36 and Township 9 South, Range 16 East, Sections 2, 3, 4, 9, 10, 15, 16 of the Gila and Salt River Baseline and Meridian, over groundwater of the Lower San Pedro Basin.

The facility is a hydrometallurgical base metal (copper) recovery facility comprised of heap leaching pads using sulfuric acid solutions as the leachate; a solvent extraction-electrowinning (SXEW) facility; and associated pregnant leaching solution (PLS) pond, plant feed pond, raffinate pond, solution ditches and pipelines. The existing heap leaching facility is permitted under Groundwater Protection Permit Number G-0058-11. The proposed Aquifer Protection Permit (APP) will regulate the existing heap leaching and SXEW facilities and a 35.5 acre expansion of the heap leaching pads. Processed materials shall include oxide ore from the San Manuel Mine, solutions extracted from in-situ leaching of oxide ore at the San Manuel Mine, and loaded copper solutions and materials generated on- and off-site for copper recycling. All recycling shall be conducted according to A.A.C. R18-8-261.A., (40 CFR 261.2 and 40 CFR 261.6).

All pads, ponds and solution ditches are constructed with flexible geomembrane liners installed over a compacted, prepared subgrade. The heap expansions shall be constructed with 80 mil High Density Polyethylene (HDPE) liners and an 18 inch layer of protective gravel shall cover the pad liners. Geotextile shall be installed above the liner in internal drainage areas and underneath the toe berms at the edge of the outer collection ditches. All discharge control components shall be protected from runoff occurring from the 100-year, 24-hour storm event and shall be capable of containing precipitation resulting from the 100-year,

*The Department of Environmental Quality is An Equal Opportunity Affirmative Action Employer.*

24 hour storm event that falls within the discharge control components. Hydrologic controls will prevent any accidental discharge from moving off the mine property.

Two vadose zone monitoring wells shall be monitored for potential leakage from the PLS pond. Groundwater shall be monitored in a deep groundwater well located approximately 300 feet northeast of the leach pad. Leach solutions shall be monitored in the PLS and raffinate ponds. Magma will perform any necessary pre-qualification testing of recyclable materials to ensure that only eligible materials are accepted for recycling at the facility.

The permit and related materials are available for public review Monday through Friday, 8:00 a.m. to 5:00 p.m. at the Arizona Department of Environmental Quality, Water Permits Unit, 2005 North Central Avenue, Phoenix, Arizona 85004.

Persons may submit comments or request a public hearing on the proposed action, in writing, to ADEQ at the above address within 30 days from the date of this notice. Public hearing requests must include the reason for such request.

## **Abstract from SME Annual Meeting 2002**

### **Seguin, J.M., 2002, The benefits of interdisciplinary team work at the San Manuel mine, Arizona**

The San Manuel mine has been in production since early 1956. Between 1985 and 1995 the open pit oxide operation produced 580 million pounds of cathode copper. Today in-situ mining within the original open pit is the sole mining method. In 1987 BHP commissioned an interdisciplinary team to perform a feasibility study which evaluated resumption of open pit mining at a level necessary to provide value to the entire San Manuel operation. The foundation of this study was the mineral resource model that stands as the most comprehensive evaluation of the San Manuel ore body to date.

### **Notes from talk on February 27, 2002 taken by Keith R. Long, Economist, Geologist, USGS – Tucson**

The San Manuel mine was placed on care-and-maintenance in June, 1999. On January 15, 2002, BHP-Bilteon announced the official closure of the San Manuel mine. A proposal to resume mining the oxide ore pit was not taken up due to low copper prices and the commitment of company development funding to the Escondida Phase IV expansion in Chile.

From January, 1956 to June, 1999, more than 700 million tons of sulfide ore was mine, mostly underground. Oxide ore mining began in 1977 with an in situ leach operation which continues to this day. Open-pit mining of oxide ore from 1985 to 1995 yielded 580 million pounds of cathode copper. Open-pit operations were limited by proximity to the underground mine. Oxide ore mined was leached at a 242 acre facility north of the pit. Since the pit was closed in February, 1995, all oxide copper has been mined by in situ leach. Since then, 23 million pounds of copper have been recovered by this method. Current operations include 6 million pounds of copper per year from residual leach of underground workings.

In January, 1997, a reserve inventory identified 3 billion pounds of copper in oxide ores along with considerable additional resources. The San Manuel Oxide Open Pit Project conducted drill exploration from February, 1997 to July, 1997. To January, 1998, \$9 million was spent on exploring oxide reserves. A new pit was designed, based on data from 1,974 drill holes. Besides waste and a block-caved zone, the proposed pit includes an oxide zone of mainly chrysocolla with grades up to more than 0.8 percent copper, irregular peripheral pods of high-grade chalcocite, and a sulfide zone consisting of chalcopyrite. Resources at various cut-off grades are:

Note that, of the 14 billion pounds of copper at a 0.2 percent total copper cut-off grade, only 3 billion pounds is in oxide copper ore.

Alternative open-pits were designed at assumed prices of \$0.80, \$0.90, and \$1.00 per pound for copper. No pit design was economic at \$0.65 per pound copper. The project would have a 14-year life with a peak production of 100 million pounds per year cathode copper.

BHP also examined other projects, including expansion of in situ leach operations, in-pit heap leaching, mining shaft pillars, and rubblizing ore in pit.

<b>Cut-off Grade percent total copper</b>	<b>Resource billion pounds copper</b>
<b>0.0</b>	<b>19</b>
<b>0.2</b>	<b>14</b>
<b>0.5</b>	<b>5</b>

SAN MANUEL OPEN PIT 0x102 (P)

COMPLETE AND MAIL TO:

STATE MINE INSPECTOR  
705 WEST WING, CAPITOL TOWER  
PHOENIX, ARIZONA 85007-2859

STATE MINE INSPECTOR

SEP 16 1986

OFFICE USE ONLY

START-UP NUMBER 64016143

STATE NUMBER \_\_\_\_\_

MSHA NUMBER \_\_\_\_\_

*J. Taylor*

### NOTICE TO ARIZONA STATE MINE INSPECTOR

In compliance with the Arizona Revised Statute Section 27-303, we are submitting this written notice to the Arizona State Mine Inspector of our intent to start ~~XXXXX~~ stop \_\_\_\_\_ move \_\_\_\_\_ (Please check one) a mining operation.

If this is a move, please show last location: \_\_\_\_\_  
If you have not operated a mine previously in Arizona, please check here: \_\_\_\_\_ If you want the Education and Training Division to assist with your mine safety training, please check here: \_\_\_\_\_  
If this operation will use Cyanide for leaching, please check here: \_\_\_\_\_

COMPANY NAME: SOUTHWEST ENERGY, INC.

DIVISION: \_\_\_\_\_

MINE OR PLANT NAME: SAN MANUEL OPEN PIT TELEPHONE: (602) 385-3100x504

CHIEF OFFICER: J.D. TOOLE, PRESIDENT

COMPANY ADDRESS: 2040 W. GARDNER LANE

CITY: TUCSON STATE: ARIZONA ZIP CODE: 85705

MINE OR PLANT LOCATION: ( Include county and nearest town, as well as directions for locating property by vehicle: MAGMA COPPER COMPANY, SAN MANUEL OPEN PIT IN  
PINAL COUNTY, ARIZONA NEAR SAN MANUEL, ARIZONA

TYPE OF OPERATION: Start hole loading, OPEN PIT COPPER PRINCIPAL PRODUCT: COPPER

STARTING DATE: 1/1/86 CLOSING DATE: \_\_\_\_\_ DURATION: 15 YEARS

PERSON COMPLETING NOTICE: ROBERT G. SMITH TITLE: EXECUTIVE V.P.

DATE NOTICE MAILED TO STATE MINE INSPECTOR: 9/11/86