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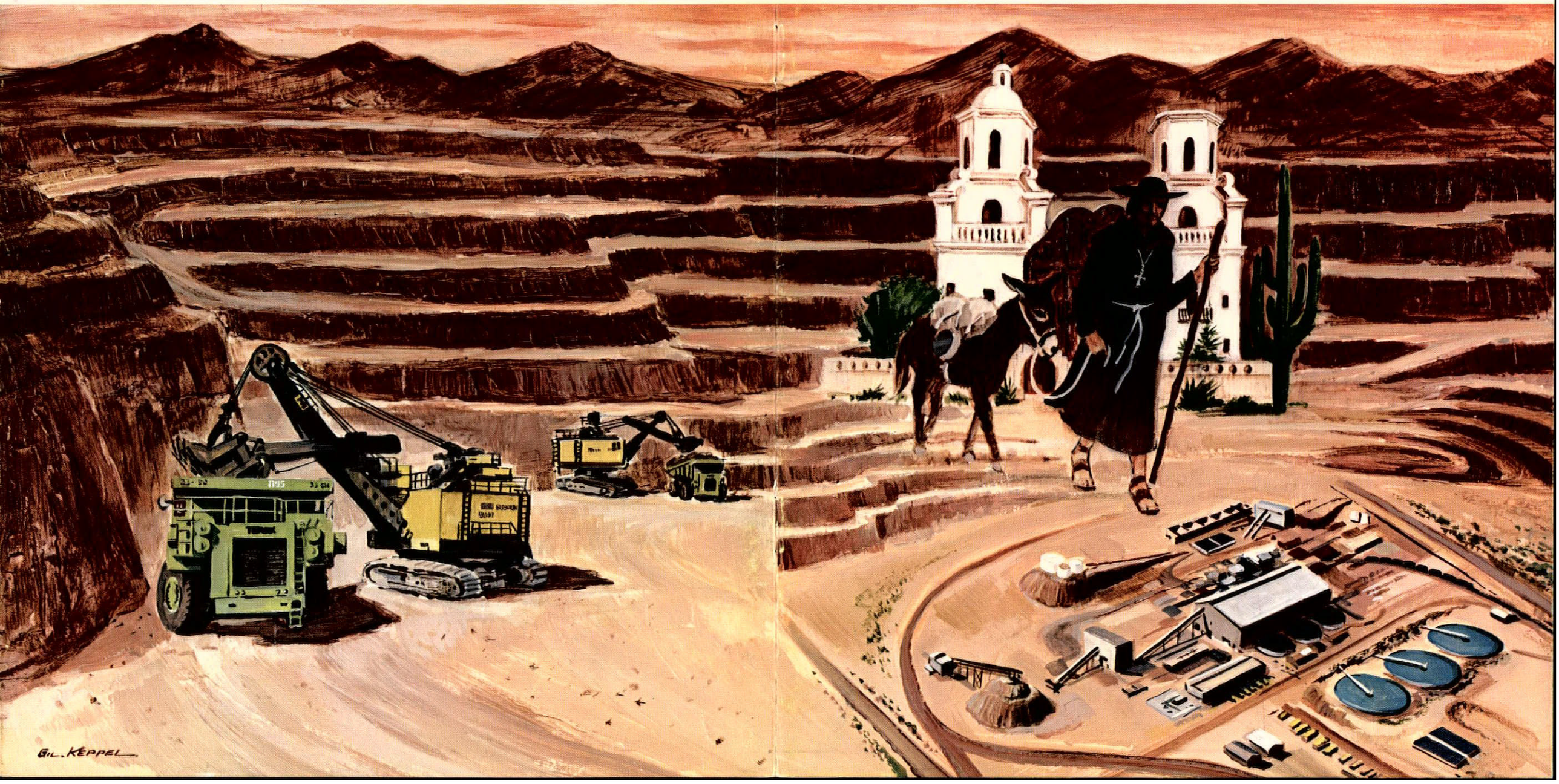
ASARCO

ASARCO

Southern Arizona Mines

Mission Mine • Eisenhower Mine • San Xavier Mine



In the Beginning...

Mission San Xavier del Bac, founded in 1783 by Padre Kino.

The Mission Mine

It was 250 years after Father Kino founded the historic Mission San Xavier del Bac, the "white dove of the desert," that Asarco took an option on some desert land 15 miles southwest of Tucson, Arizona. Since the land lay in the shadow of the mission, it was christened the Mission mine.

That was in 1953. Today the Mission mine is like a giant bowl, 7,000 feet wide and 700 feet deep. The sides consist of a series of benches that serve as ramps for the 85- and 170-ton trucks that carry valuable copper ore out of this "open pit."

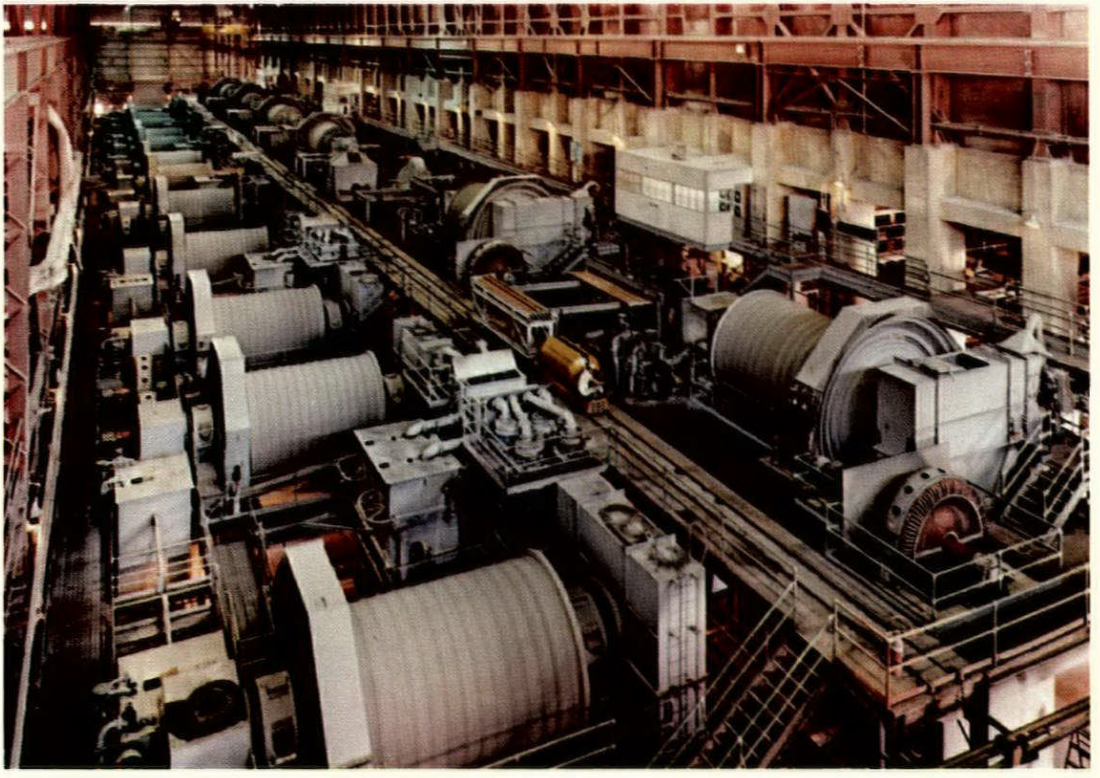
Since the mine site was first cleared of brush, more than 500 million tons of alluvium (a mixture of clay, sand, gravel and rock) has been excavated—in all, enough material to make a mountain more than a mile long, over half a mile wide and as high as the Washington Monument.

ASARCO

Box 111, West Pima Mine Road, Sahuarita, Arizona 85629

Milling

The purpose of milling is to separate the copper-bearing mineral from the waste rock. Milling consists principally of three steps: crushing, grinding and flotation.



Ball mills inside the grinding bay where ore is reduced to powder.

Crushing

At Asarco's southern Arizona operation, ore from the Mission and San Xavier mines is delivered to the crushing plant at the Mission mill.

The primary crusher is a 54-inch gyratory which reduces the ore to less than eight-inch size. Further crushing is done in two stages with two seven-foot Symons standard cone crushers and three seven-foot Symons shorthead crushers. The final product from the crushers is less than 3/4-inch. All material must pass through screens before being conveyed to bins for the grinding process.

Grinding

The wet grinding process consists of six rod mills followed by twelve ball mills. These mills are large, rotating cylindrical vessels containing heavy steel rods or balls which grind the ore to the consistency of powder.

This reduction of huge rocks to powder is the most expensive part of the milling process.

The Mining Process...
it starts with blasting and digging.

Blasting at the Mission mine loosens ore.

The terrain of Asarco's southern Arizona mines was fairly flat and composed of bedrock covered with several hundred feet of alluvium (gravel). A study of the area revealed the best method for removal was with shovels and trucks. This method offered maximum flexibility for placing waste in disposal areas and promised full-life use of all major equipment.

Blasting frees the gravel and ore which is then loaded by shovel onto huge trucks. Each truck carries between 75 and 130 tons of material every trip out of the pit.

Dirt and gravel are dumped as waste and ore is transported to the concentrator for processing.

At the three mines there are a total of 61 trucks, nine drills and six shovels.

Thirteen 170-ton trucks, each more than 18½ feet high, and costing more than $600,000 apiece.

Open Pit Mining

An electric shovel loads overburden onto a truck which carries 130 tons of material each trip out of the pit.

Simply stated, open-pit mining, as the name implies, is removing ore from a large, open pit. This method differs from underground mining, in which workers go deep inside the earth through shafts or tunnels to extract the ore.

The open pits of the Mission, San Xavier, and Eisenhower mines are similar in design but different in dimension.

At both the Mission and Eisenhower mines the pits have 40-foot benches in gravel and 40-foot benches in rock. At the San Xavier pits the gravel benches are 40 feet and the ore benches 20 feet. Main haulage roads in all the pits are at a maximum 9% grade. The ultimate working slope at these mines will be 45° in rock.

As of December 1978, eight million tons of ore had been extracted from San Xavier North and South, and 118 million tons from Mission.

Exploration of the property began in 1954. By 1957 more than 346 holes, totalling 200,000 feet in length, had been drilled. In 1958 sinking of a shaft in the ore zone commenced. Approximately 2,300 feet of underground work was done to check interpretation of diamond drilling and to obtain bulk samples for pilot mill tests. The tests were conducted at the University of Arizona to gather data for mill design.

In 1959 brush was cleared and earthmoving began. Also, office buildings were completed. In 1960 the first major mining equipment arrived: a nine-yard electric shovel and a fleet of 55-ton trucks. A special route had to be prepared for transporting the equipment because it was too heavy for the Santa Cruz River bridges.

During 1960 negotiations for railroad facilities were concluded with the Southern Pacific Railroad and work proceeded on the mill and related buildings, the crushing facilities, and an assay and metallurgical laboratory.

In January 1961 Tucson Gas & Electric Company began installation of a 138,000-volt power line to the Mission Unit. That same month, having removed 33 million tons of overburden, Asarco reached the first copper ore. Later that year electric power lines were ready and mining operations began.

From the first clearing of the desert to the start of operations, less than two years was required to make the Mission mine a reality.

The Eisenhower Mining Company

Before Asarco began excavating the Mission mine, the Banner Mining Co. had acquired land in the Mineral Hill/Twin Buttes area bordering the Mission operation.

Drill results at the Banner property indicated a large ore body. Banner proceeded to sink a five-compartment shaft 1,000 feet underground and to mine several million tons of ore. Banner named the new mine the Palo Verde after the all-green desert trees growing in the area.

By 1960 Banner had positively identified a major ore body extending across the eastern section of its Twin Buttes property. With such large reserves to develop, Banner took The Anaconda Company as a partner. In 1973 The Anaconda Company and AMAX Inc. formed a partnership called Anamax Mining Company to acquire, develop and operate the former Banner holdings in Pima County.

In 1976 Asarco and Anamax Mining Company formed a general partnership called Eisenhower Mining Company to develop the Palo Verde mine. Asarco is mine operator for the partnership.

The San Xavier Mine

The San Xavier mine, like its namesake, Mission San Xavier del Bac, is located on the Papago Indian Reservation. At about the time Asarco acquired the Mission property, it set about negotiating leases for land on the Reservation.

In 1967 Asarco started open-pit operations at the San Xavier North mine, producing flux, a silica used in the process of smelting copper, and copper sulfide ore. Two years later, excavation started at the San Xavier South mine, and copper oxide ore was reached in 1972.

The two ores are different in color (oxide is blue and sulfide is gold) and require different methods of processing to separate the copper. Today, only sulfide ore is extracted from both of the San Xavier mines.

Fine-powder ore is agitated in a solution; copper-bearing particles float to the surface where they are skimmed off.

Flotation

The fine powder from the ball mills is agitated in water solution in a tank called a flotation cell. This agitation, plus the addition of chemicals, creates bubbles similar to those produced in a kitchen mixmaster. These bubbles collect particles of copper mineral and float to the top where they are skimmed off. From each ton of ore, flotation separates about 42 pounds of concentrate containing approximately 33% copper.

Molybdenum

The copper concentrate from the flotation section is then chemically retreated, roasted, reground and refloated to extract a molybenite concentrate. This concentrate is dried and sold for recovery of the contained molybdenum, an alloying element for steel. The copper concentrate, which also contains about three ounces of silver per ton, is filtered, loaded in 100-ton railroad cars and shipped to Asarco smelters in Hayden, Arizona, and El Paso, Texas.

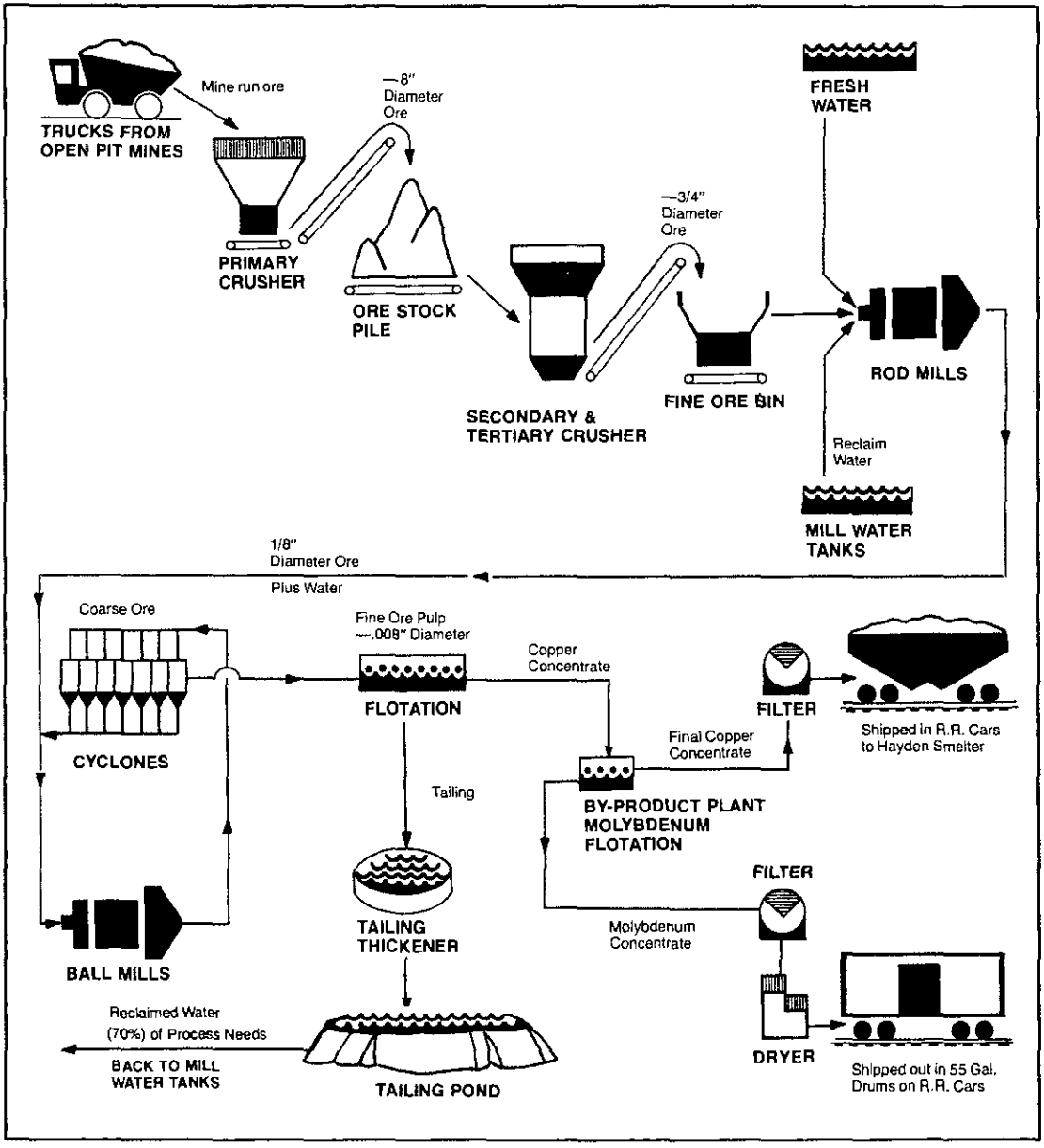
Asarco's Southern Arizona Mines

The photo on the left, taken in 1976, shows the location of Asarco's mines.

The photo at the right, taken in December 1978, shows progress at the Eisenhower mine (center). Overburden is deposited west of the mine.

These pits will eventually become one mine 1½ miles long and 7,000 feet wide. The final pit limit is shown on the photo to the left.

How it works


TRUCKS FROM OPEN PIT MINES
Mine run ore
PRIMARY CRUSHER
—8" Diameter Ore
ORE STOCK PILE
SECONDARY & TERTIARY CRUSHER
—3/4" Diameter Ore
FINE ORE BIN
FRESH WATER
ROD MILLS
Reclaim Water
MILL WATER TANKS
1/8" Diameter Ore
Plus Water
Coarse Ore
CYCLONES
Fine Ore Pulp —.008" Diameter
FLOTATION
Copper Concentrate
FILTER
Shipped in R.R. Cars to Hayden Smelter
Final Copper Concentrate
BY-PRODUCT PLANT MOLYBDENUM FLOTATION
Tailing
TAILING THICKENER
BALL MILLS
FILTER
Molybdenum Concentrate
DRYER
Shipped out in 55 Gal. Drums on R.R. Cars
Reclaimed Water (70%) of Process Needs
BACK TO MILL WATER TANKS
TAILING POND

Asarco and Arizona – a Winning Team!

Preserving Arizona's desert environment takes high priority at Asarco.

A Word about the Environment

Long before protecting the environment, conserving natural resources and fighting pollution became popular, Asarco instituted measures to lessen the impact of mining on the desert.

Water

It takes approximately 240 gallons of water to process ore containing a ton of copper. Asarco recycles and reclaims 70% of the water used. As mining progresses deeper into the pit, underground water begins seeping to the surface. Asarco pumps this water out of the pit and uses it over and over again.

Dust Control

Airborne dust is a common occurrence in arid Arizona. To control dust at Asarco's southern Arizona mines, a water sprinkler system is used in the pits and a series of both wet and dry dust collectors are placed in strategic areas in the mill. Water trucks spray the benches and ramps, and automatic sprinklers spray material being shoveled into trucks.

Reclamation and Revegetation Plan

"What grows best in the desert ought to grow best at disturbed mining sites and mineral waste deposits in the arid environment." This was the conclusion of Asarco's agronomist for the Southwestern Mining Department in 1973 when he was assigned the responsibility for developing a total reclamation and revegetation plan for Asarco facilities in southern Arizona.

That theory seems to be proving true as the desert's eco-cycle is reestablishing itself in previously revegetated areas.

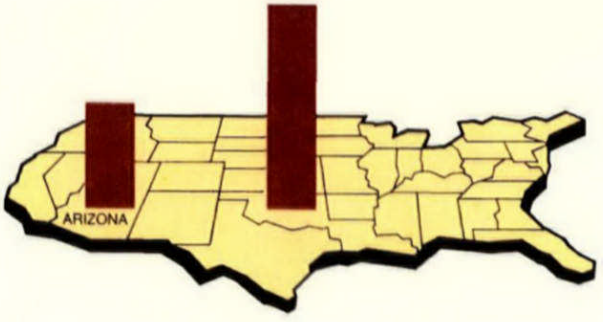
Asarco in Arizona

Asarco has been part of Arizona's growth and prosperity since 1911, when construction began on the Hayden copper smelter at Hayden, Arizona. In 1912, the year Arizona became the forty-eighth state, the first copper from the Hayden smelter was poured. Since then, the plant has been enlarged repeatedly.

Asarco's first important Arizona copper mine was developed on a small scale at Silver Bell in 1915. After years of inactivity Silver Bell was developed as an open pit mine in the early '50's and has been in continuous production since 1954. In 1974 production started at the Sacaton mine and mill near Casa Grande.

Today, Asarco's southern Arizona mines constitute the Company's largest wholly owned mining property.

Location of Asarco's mining operations in Arizona.



Copper mines in Arizona produce 50% of the copper in the United States.

Although a new mine is being prepared for production in Montana, Asarco's present U.S. copper mines are concentrated in Arizona, "the copper state." It alone accounts for more than half of the total annual U.S. copper mine output.

Arizona's mining industry, principally copper, pays a large share of the state's taxes, employs more than five percent of all workers, and contributes significantly to the state's growth and prosperity.

Arizona has been good for Asarco
Asarco has been good for Arizona

Asarco around the World

Metal must be mined where it is found. Almost since its inception in 1899, Asarco has been involved in mining ventures, not just in the United States, but outside its boundaries as well. Asarco has a significant interest in three of the world's great mining companies: Mexico Desarrollo Industrial Minero, S.A.; Southern Peru Copper Corporation; and M.I.M. Holdings Limited in Australia. Additionally, it has interests in other mines in Canada, Nicaragua, Peru and Bolivia. In the United States Asarco operates lead, zinc, silver, coal, limestone, and ilmenite mines in Colorado, Idaho, Illinois, New Jersey, New Mexico and Tennessee.

Asarco is a company which extracts vital raw materials from the earth and converts them along with those extracted by others into metals and minerals useful to mankind.

Profile

Location:	Approximately 15 miles south and west of Tucson, Arizona.
Mines:	Mission, San Xavier North and South, and the Eisenhower. Except for San Xavier North, these mines are adjacent and will eventually become one large open pit.
Plant:	Mill with crushing, grinding and flotation facilities. Truck lubrication center, tire shop, warehouse, maintenance shop, salvage building, and management office.
Employment:	870
Production Capacity:	Copper concentrate: 178,000 tons per year.