

PROCESS DESCRIPTION

The Asarco facility in El Paso, Texas, is over 100 years old and includes the following five metal processing facilities: copper, lead, zinc, antimony, and cadmium. Of these facilities, only the copper smelter and cadmium roasting operations are still in operation.

As shown in Figures 1 and 2, the copper smelting process is quite complex. The unloading and bedding facilities were designed to handle both copper and lead ores. Lead ores are not being processed.

At the rail unloading station, various ore concentrates are unloaded with bottom dump and open hopper cars. Bottom dump cars discharge into a below grade conveying system. Open cars are unloaded with an overhead clamshell crane that deposits ore into the same below-grade conveying system used for the bottom dump cars. The conveying system transfers the ore to one of 14 bedding bins (storage) in the adjacent bedding building. Conveyor transfer points have water sprays for dust suppression. The bins are used to feed a series of eight reclaim hoppers. The reclaim hoppers feed the copper smelter. The amount of ore taken from each reclaim hopper is dependent upon the type of mixture fed to the copper smelter.

Dust in the unloading operation is captured by a ventilation system consisting of 5 baghouses. All ore dust from this system is captured by a ventilation system using a jet pulse fabric filter.

Two 35,000 acfm wall mounted air sweep fans introduce fresh outside air to ventilate the cleanup hopper area for each side of the unloading building. Housekeeping in the unloading building is aided by a water washdown system. Washdown water is pumped to the water treatment plant where solids are recovered as a sludge.

Continuous ventilation is provided for transfer points of the copper delivery and shuttle conveyors and reclaim belt feeders. Each reclaim hopper is ventilated. All bedding plant ventilation air passes through a dust dropout box and plenum, then is cleaned in two parallel fabric filters and discharged through induced draft fans and 66 foot high steel stacks. The recovered baghouse dust is slurried and transferred to the water treatment plant for solids recovery.

ROASTING

Four seven-hearth gas or oil fired wedge roasters are used for roasting reverberatory charge material. Each roaster is capable of producing 400 tons of calcine per day. Calcine is hauled to the single reverb furnace in seven-ton enclosed larry cars.

Roaster gases pass through high velocity flues to a hot gas fan, then through a spray chamber and a plate and wire cottrell. From here, the gases are routed to the 800 ton per day Monsanto double-contact acid plant.

SMEETING

The reverberatory furnace is gas or oil-fired and has a sprung arch. The crucible is entirely jacketed with cast copper. Deep bath smelting is practiced with calcine charging to the reverb. Charging is accomplished through four retractable Wagstaff feed guns.

The molten bath in the reverb furnace consists of matte and slag. Matte is periodically tapped from either side of the furnace into ladles. Matte ladles are conveyed by overhead crane to the copper converters.

Slag is periodically skimmed from the reverb and allowed to sit in a holding furnace. This operation allows additional time for separating any remaining matte (refined copper ore) from slag. The cleaned slag is transferred to the dump by Kress slag haulers.

The off-gases from the reverb pass through a waste heat boiler, a hot gas fan, a spray chamber, and a plate and wire cottrell, and are emitted through the 828 foot stack. Copper dust from the cottrells is returned to the bedding building.

CONVERTING

Converting is done in three 13' x 30' Pierce-Smith converters, two of which are normally in operation. The reverberatory matte is charged to the copper converter. In the converter, air is blown into the molten bath to oxidize the sulfur and iron. The product from the converter is blister copper which is transported by ladle to the anode furnaces for further refining.

Converter gases pass to a settling chamber where coarse dust is collected. Two waste heat boilers are downstream from the converters.

The gases then pass to a hot gas fan, through a spray chamber, and a plate and wire cottrell. From the cottrell, the gases can go to a 500 ton per day double-contact acid plant. There is also the capability to send a portion of the converter gases to the 800 ton per day double-contact acid plant.

FIRE REFINING OF BLISTER COPPER

The anode furnace removes oxygen from the blister copper. From this operation slag is returned to the Pierce-Smith converter. Seven hundred and twenty pound anodes are cast and shipped via open rail to Asarco's copper refinery in Amarillo, Texas.

CADMIUM PLANT

All dust with the proper cadmium content from the blast furnace in East Helena, Montana, is roasted in a 25-ft. Godfrey roaster. The roaster charge contains approximately 65 percent flue dust, 15 percent crushed limerock, and 20 percent coal. The Godfrey roaster generates a fume that is 65 percent Cd, which is recovered in a baghouse, packaged in special impermeable bags, and shipped to the Globe Plant in Denver.

ACID PLANTS

In December, 1972, Asarco in El Paso started its first acid plant designed to handle SO_2 from the converters. This plant is a Lurgi-500 TPD double-absorption plant with a design volume of 58,500 scfm, built by Davy Power Gas.

Hot converter gases are ducted by high velocity flues to a plate and wire cottrell. Converter gases leave the cottrell at 285°F , and enter the venturi scrubber. The venturi scrubber cleans particulates from the gases and reduces the gas temperature to 105°F .

Gases leave the venturi and the stream splits before entering the packed scrubbers. Here, gases are cooled to 75°F by plate coolers.

The gases then enter the mist precipitators at 75°F , where water and acid mist are removed. All blowdown from these three systems is fed back to neutralizer tanks where acidity is neutralized and particulates are removed with flocculents before the water is returned to the spray chambers for reuse.

After the precipitators, the gas streams rejoin to one stream before entering the 93 percent H_2SO_4 drying tower. The drying tower removes any moisture remaining in the gases.

The acid blowers move the gases through the remainder of the acid plant. The gases leave the blowers and must be reheated by either heat exchangers or preheaters. Once the gases are heated to 750°F , they enter the first two catalyst beds for conversion.

Next in the venturi absorber, gases enter the top with a counter-current flow of 98 percent sulfuric acid that is sprayed into the throat of the venturi. Gases enter the bottom of the entrainment separator which is a conventional packed tower where acid mist is removed before gases re-enter the heat exchangers. Gases are reheated to the conversion temperature of the third and fourth beds and returned to the final absorption tower for further absorption.

The final absorber is a conventional packed tower with a counter-current flow of 98 percent sulfuric acid. Gases leave the circulation area and mist pads remove droplets of acid before the gases ultimately leave the acid plant stack.

In October, 1978, Asarco in El Paso started its second double-absorption acid plant. The 750 TPD Monsanto unit has a design volume of 90,000 scfm. This plant accepts gas from the converters.

Gases leave the scrubbers at 90°F and are split again to enter the mist precipitators.

The mist precipitators are of Asarco design and are for the removal of water, acid mist, and particulates. Gases leave the mist precipitators and form one stream again. At this point, any excess converter gas enters from a bypass duct to join the roaster gases.

Gases then enter the drying tower of the Monsanto acid plant. This tower is a conventional packed tower with 93 percent sulfuric acid flowing counter-current to the gas stream. The drying tower acid removes any moisture from the gas before entering the compressors. The gases are compressed and move into a mist eliminator for the removal of acid mist before the gas enters the heat exchanger or preheater. Gases are heated for the entry into the first bed for conversion. The converter is a three-pass system with double-absorption.

The interpass and final absorption towers are conventional packed towers with counter-current flow of 98 percent sulfuric acid. SO_3 is absorbed in the towers and the gas passes through mist eliminators for droplet removal prior to discharge from the acid plant stack.

The plant has a decolorizer facility to treat 93 percent black sulfuric acid with hydrogen peroxide before storage. This system consists of peroxide storage tanks and a mixing tank, where peroxide is added until clarity is obtained before the acid is sent to the 93 percent storage tanks.