PRELIMINARY CONTROL TECHNOLOGY ASSESSMENT

OF

Cominco American, Inc.
Bixby, Missouri

SURVEY CONDUCTED BY:
Frank W. Godbey
Thomas C. Cooper

REPORT WRITTEN BY:
Frank W. Godbey

SURVEY DATE:
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ECTB 111-12a

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
Division of Physical Sciences and Engineering
Engineering Control Technology Branch
4676 Columbia Parkway
Cincinnati, Ohio 45226

PLACE VISITED:	Cominco American, Inc., Bixby, Missouri
DATE OF VISIT:	August 3, 1981
PERSONS CONDUCTING SURVEY:	Frank W. Godbey Thomas C. Cooper
Company Representatives Contacted:	Les J. Koon, Plant Manager Leo Bradshaw, Safety Manager Art Schweiger, Mill Superintendent
PURPOSE OF SURVEY:	To investigate Cominco's methods of controlling potential health hazards in the beneficiation of lead ore and to dertermine the advisability of conducting an indepth survey of this plant.

INTRODUCTION

The Engineering Control Technology Branch of the Division of Physical Sciences and Engineering, NIOSH, is conducting a research study to assess and document control methods for minimizing worker exposure to harmful substances, operations, and processes in the beneficiation of galena and cerussite (lead) ore industry. Exposure to a number of substances used in the beneficiation of lead ore may lead to a variety of health problems. These substances include lead, silica, nuisance dusts, and flotation reagents.

This preliminary survey was conducted to obtain information on control technology used in the industry including engineering controls, monitoring devices, work practices and protective equipment, and to determine the advisability of conducting an indepth survey of this plant.

PLANT DESCRIPTION

Lead ore beneficiation operations started in 1968 at the Cominco Magmont operation. An average of 4600 tons of ore, averaging seven percent lead, is processed per day. The mill operates five days per week, 24 hours per day, to produce lead, copper, and zinc concentrates. Of the total 200 employees at the Magmont operation, 26 are employed in the mill, 30 of the 60 maintenance employee crew work on the surface, with the remaining employees being underground, office and staff personnel. The mill or beneficiation operations and supporting functions are housed in a four-story sheet metal building containing approximately 80,000 square feet of floor space.

PROCESS DESCRIPTION

Once the ore is skipped to the surface it is dumped from the skip into the coarse-ore bin. The coarse-ore bin is located above the crusher building (Figure 1).

There are two stages of crushing on the surface. A variable speed apron feeder controls the ore flow from the coarse-ore bin to a 5 1/2 foot standard cone secondary crusher set at about 2 1/2 inch. The ore then passes to a 7-foot short-head tertiary crusher set at 3/4 inch.

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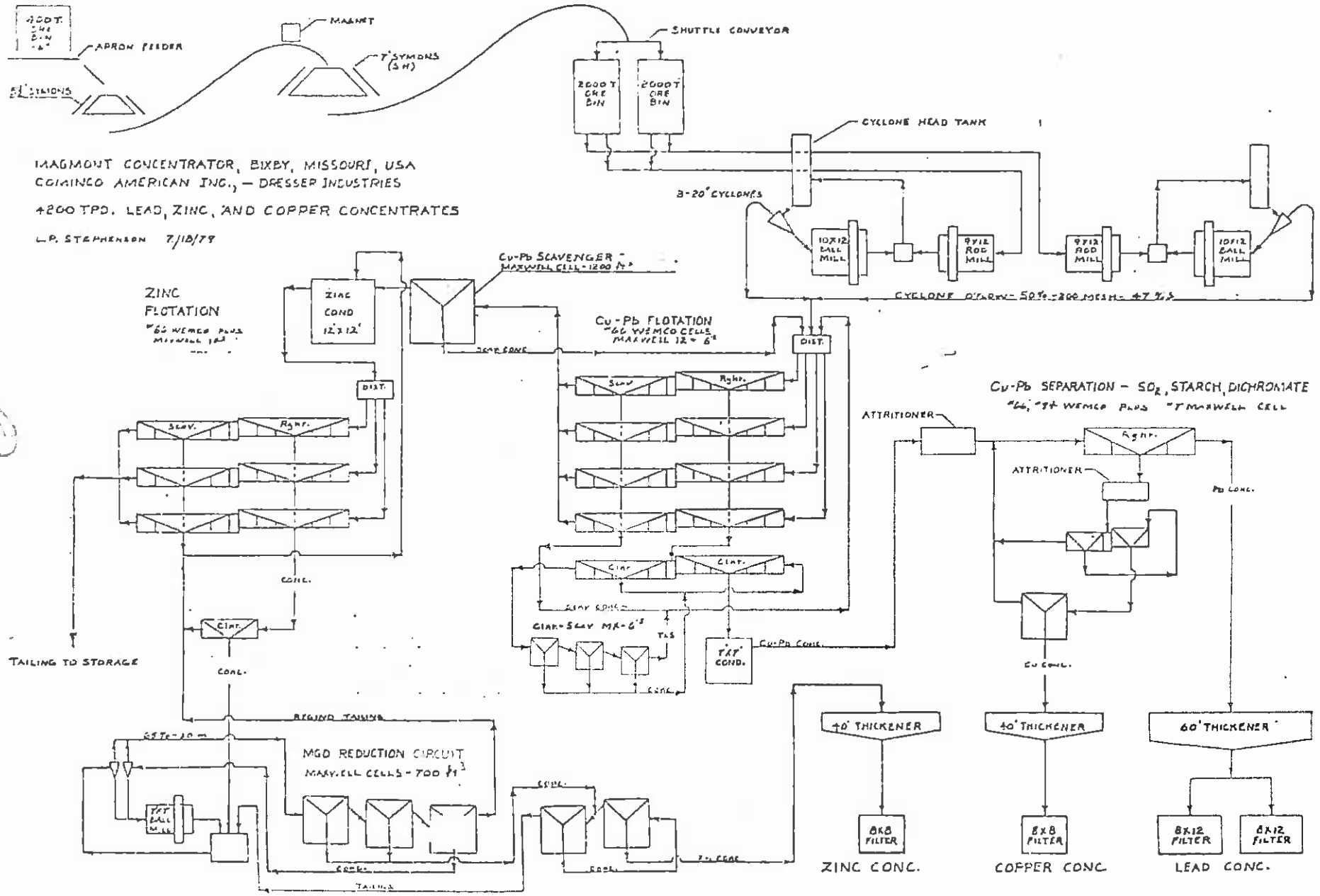


Figure 1 - Mill Flowsheet

Discharge from this crusher is conveyed to two 2000-ton fine-ore bins fed by a reversible shuttle belt. The shuttle belt is wheel-mounted on rails so that it can be moved to a forward position to discharge crushed waste, or stockpile ore, outside the plant.

Because of fluctuations in ore composition and as protection against production stoppages, two grinding circuits are installed. Each circuit consists of a 9 1/2 by 12 foot rod mill and a 10 1/2 by 12 foot ball mill. The rod mills are in open circuit while the ball mills are in closed circuit with 20-inch cyclone classifiers. Mill steel consumption is 0.153 pounds of 3-inch rods and 0.234 pounds of 2-inch balls per ton of mill feed.

Each fine-ore bin has two slot feeders, one to each grinding circuit. One of the feeder belts to each circuit is adjusted manually while the other is static controlled from the belt scales. In practice, one belt feeds at a constant speed while the other floats to maintain the preset tonnage.

There are three cyclones for each grinding circuit with two normally in use and the third as a stand-by. The cyclones are mounted 30 degrees from horizontal and are pressurized at about 4 1/2 psi from a steady-head tank. The steady-head tank compensates for feed variations as well as assuring deaeration without requiring precise pump-speed control. The cyclone overflows are pumped to the flotation circuit through vertical pipes equipped with radiation density gauges.

The slurries from the two grinding circuits are combined and then distributed into four rows, each row containing 11 flotation machines. The galena and chalcopyrite are floated together in a bulk concentrate. The eleven 61 cubic foot cells in each row are divided into six roughers and five scavengers. Concentrate is then pumped to an 11-cell cleaner circuit. The bulk concentrate is cleaned once or twice, depending on the throughput quantity. The cleaner tails and scavenger concentrates are returned to the distributor ahead of the rougher circuits.

The cleaned bulk concentrates are then fed to the copper separation circuit. They are treated with sulfur dioxide and starch to depress the galena, and the chalcopyrite is floated in four 150 cubic foot cells. The tailings from these cells is the final lead concentrate and is pumped to the lead thickener. The copper-bearing froth is cleaned four times to produce the final copper concentrate. The cleaner tailings are returned to the copper circuit feed.

The tailings from all four rows of copper-lead scavenger machines go to a 1200 cubic foot final scavenger flotation machine. The tailings from the scavenger cell go to the zinc conditioner and then are distributed to three rows of 61 cubic foot flotation machines. The froth from the six roughers in each row goes to one stage of cleaning then to a zinc regrind circuit to produce the final zinc concentrate. The feed consumption in the regrind mill is 0.015 pounds of 1-inch balls per ton of mill feed. The concentrate from the scavengers returns to the zinc conditioner.

Lead concentrate is thickened in a 60-foot diameter thickener. Copper and zinc concentrates are thickened in 35-foot diameter thickeners. The rakes rise automatically when thrust exceeds the set amount, but must be lowered manually by the reversible motors on the lifting mechanisms. The thickener tanks are supported on concrete columns and located outside of the mill building.

Lead concentrate is filtered on two 8-foot diameter by 12-foot long drum filters. Zinc and copper concentrates are filtered on 8 by 8 foot drum filters.

Cake moistures are satisfactory in both zinc and copper concentrates, usually 8 to 10 percent. The lead concentrate is sticky unless a filter aid is used. Aerodri 104, a surface tension modifier, is used in the lead filters at the rate of 0.8 to 0.9 pound per ton of concentrate. This lowers the cake moisture by 2 to 3 percent which gives a final moisture of 6.5 to 8.5 percent.

Concentrates are conveyed by belts to a concentrate-storage building that is partitioned for the three concentrates. A combination truck and railroad scale is in front of the loading dock, and trucks or rail cars are loaded by a front-end loader to the desired weight as shown by a digital display.

Most of the lead concentrates are hauled to a smelter one-half mile away by truck. Other concentrates are shipped in open gondola rail cars.

The Magmont Mine uses a variety of reagents in the flotation process to recover the valuable minerals. These reagents have varying degrees of hazard potential. They are stored in the mill. The following is a list of these reagents with their functions and approximate usage:

Potassium Amyl Xanthate - Promoter for copper, lead and zinc sulfide minerals. Approximate usage: 150,000 lbs./yr. Storage container: 300 lb./bbl.

Frothers (MIBC and Dowfroth 250) - Frothing agents used to create stable bubbles capable of carrying the sulfide mineral to the surface. Approximate usage: 20,000 lbs./yr. Storage container: MIBC 371 lbs/bbl. Dowfroth 250 450 lbs./bbl.

Sodium Cyanide - Depressant for iron sulfide minerals. Approximate usage: 20,000 lbs./yr. Storage container: 200 lbs./bbl.

Zinc Sulfate - Depressant for sphalerite. Approximate usage: 65,000 lbs./yr. Storage container: Bulk tank 20 tons.

Starch - A depressant used to control slime lead in the copper-lead separation. Approximate usage: 150,000 lbs./yr. Storage container: 100 lbs./bag.

Sulfur Dioxide - Used in copper-lead separation. Copper activator and lead depressant. Approximate usage: 1,000,000 lbs./yr. Storage container: Bulk tank 80 tons.

Sodium Bichromate - A depressant of lead used in the copper cleaners. Approximate usage: 70,000 lbs./yr. Storage container: 100 lbs./bag.

Caustic Soda - A dispersant used for preparation of the starch in the copper-lead separation. Approximate usage: 50,000 lbs./yr. Storage container: 500 lbs./bbl.

Sulfuric Acid - A leaching agent to remove dolomite from the copper-lead concentrate. Approximate usage: 900,000 lbs./yr. Storage container: Bulk tank 25 tons.

Lime - pH regulator used in the copper-lead circuit and zinc circuit. Approximate usage: 350,000 lbs./yr. Storage container: Bulk tank 30 tons.

Copper Sulfate - Activator of sphalerite used in the zinc circuit. Approximate usage: 250,000 lbs./yr. Storage container: Bulk tank 20 tons.

Alkyl Sulfonate (Aerodri 104) - A drying aid used to control the moisture content of the concentrates. Approximate usage: 90,000 lbs./yr. Storage container: 450 lbs./bbl.

Sodium Aerofloat - Secondary promoter for sphalerite in zinc circuit. Approximate usage: 4,000 lbs./yr. Storage container: 525 lbs./bbl.

CONTROLS

Some of the state of the art health and safety controls at Cominco's Magmont operation are:

1. Use of isolated control booths for crushing, grinding, and flotation.

2. Good housekeeping program including an effort to remove dust on roadways and dock area (wetting, sweeping, and vacuum cleaning truck, also installation of sprinkler system to wet sweep).

3. Use of binders sprayed over the lead concentrate pile stored in the open to prevent air erosion and contamination and oxidation of the lead sulfide.

4. Testing a new binder "Nalco-326" on zinc concentrate shipped on gondola car. Binder is a vinyl latex emulsion that is supposed to retain its elasticity.

5. In the reagent handling area, the use of a "water spike" to empty drums of cyanide and xanthate (Figure 2).

6. Lining of the truck bed hauling lead concentrate, chutes to transport concentrates to the concentrate building, and chutes in the reagent room to empty starch with polypropyline to prevent caking.

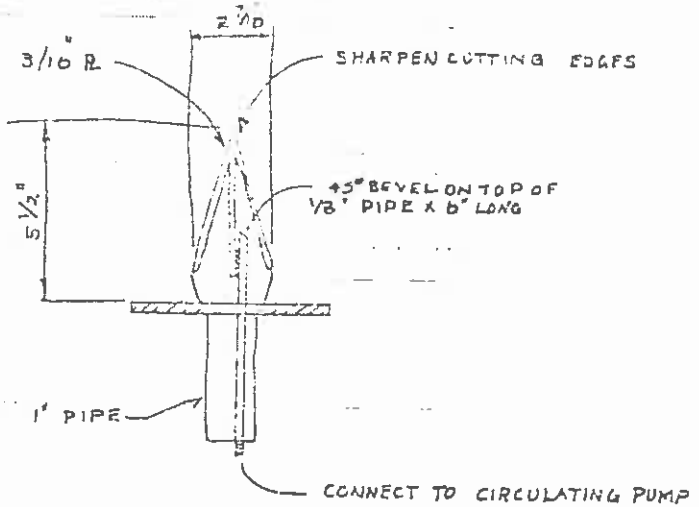
1. FORCE XANTHATE BARREL ON SPIKE
2. START CIRCULATING PUMP.
3. START DILUTION WATER
4. OPERATE CIRCULATING PUMP ½ HOUR

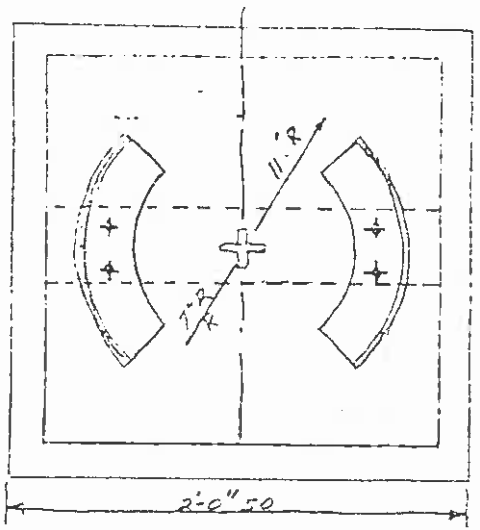
NOTE. ADEQUATE ROOM IS NEEDED AROUND SPIKE SO PELLETS CAN DISCHARGE FROM THE BARREL.

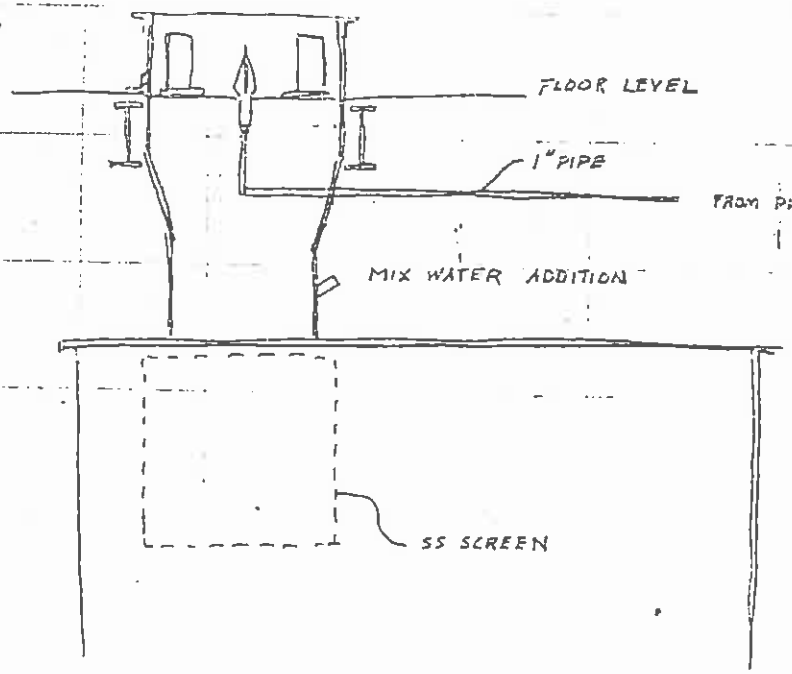
LEAVE EMPTY BARREL ON SPIKE FOR SAFETY WHEN DISSOLVER IS NOT IN USE.

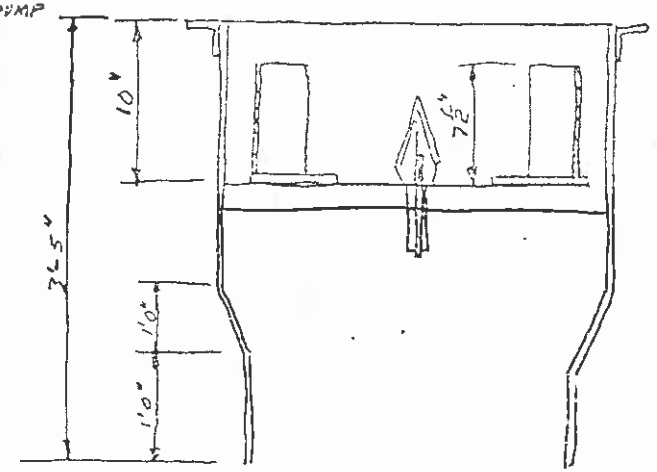
MAY BE USED FOR OLD + LUMPY OR STICKY XANTHATE (1355.)

L. P. Stephenson









XANTHATE DISSOLVER – DUST FREE

L. P. STEPHENSON JULY 1972

COMINCO AMERICAN INC. – MAGMONT MINE

INSTALL SS BASKET BELOW

Figure 6 - Reagent Barrel Spike

7. Use of an aspirator type vacuum system in the reagent room for dumping bags of starch to reduce dust.

8. Use of wall insulation (cellulose fibre) for temperature and noise control.

9. Use of enclosed conveyor system.

HEALTH AND SAFETY PROGRAM

The health and safety program is conducted by the Safety Manager who conducts periodic inspections of the facilities. A good housekeeping program includes an effort to remove dust from roadways and dock areas by the use of a wet sweep and vacuum cleaning truck. A formal MSHA required health and safety training program is conducted by company personnel and the Missouri Department of Mine Inspection.

CONCLUSIONS/RECOMMENDATIONS

The beneficiation operation at Cominco Magmont is recommended for an indepth survey. There are a number of locations within the operation with the potential for causing worker exposure to lead, dusts and flotation reagents. Some of these potential exposure locations are equipped with controls designed to control the hazard. An indepth survey will provide an opportunity to evaluate these controls by determining the concentration of hazardous contaminants in the general work area air.