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ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES AZMILS DATA

PRIMARY NAME: LAVENDER PIT

ALTERNATE NAMES:

COCHISE COUNTY MILS NUMBER: 279

LOCATION: TOWNSHIP 23 S RANGE 24 E SECTION 15 QUARTER NW
LATITUDE: N 31DEG 25MIN 27SEC LONGITUDE: W 109DEG 53MIN 57SEC
TOPO MAP NAME: BISBEE - 7.5 MIN

CURRENT STATUS: PAST PRODUCER

COMMODITY:
COPPER SULFIDE
COPPER OXIDE
GOLD
SILVER

BIBLIOGRAPHY:
USBM PROD TABULATIONS
OWN/OP: PHELPS DODGE CORP.
MINERALOGICAL RECORD, "BISBEE" ISSUE
ARIZONA III, P. 268, 276, SEPT.-OCT. 1981
ADMMR LAVENDER PIT FILE
TITLEY & HICKS, GEO OF PORPHYRY CU DEPOSITS
U OF A PRESS, 1966,
ANTHONY, J.W, ET AL MINERALOGY OF AZ P 17,69

LAVENDER PIT

ABM Bulletin 125
" " 129
" " 180, p. 122, 137, 140, 143, 144
" " 187, p. 14

See: Mineralogical Record, "Bisbee" issue, ARIZONA-III, Pg. 268, 276, Sept.-Oct.1981

COPPER MINING AT BISBEE, ARIZONA: History of the Discovery & Development, by R.B. Brinsmade. M&M, Vol. 27, p. 289, 9½ columns. I.

THE BISBEE, ARIZONA, COPPER CAMP, by George A. Newett. T.L.S.M.I., Vol. 10, p. 127, 18 pages

NOTES ON THE BISBEE DISTRICT, ARIZONA, E/MJ, Vol. 78, p. 545, 52/3 columns.

Mining World, December, 1958, p. 58
" " December, 1961, p. 16

Metal Mining & Processing, April, 1964, p. 25

World Mining, July, 1965, p. 76

LAVENDER PIT

Economic Geology, December, 1966, No. 8, p. 1429

Mining Engineering, April, 1973, p. 47
" " January, 1975, p. 10 (closure)

Skillings Mining Review, July 1, 1967, p. 12
" " " September 1, 1973, p. 21
" " " December 14, 1974, p. 4 (closure)
" " " Jan. 4, 1975, p. 6, 7 (ground movement & slope stability problems)

Mining Annual Review, July, 1973, p. 297
" " " 1974, p. 307 (gen. info.)

Mining Journal, January 24, 1975, p. 57 (closure)

Mining Magazine, March, 1973, p. 201

Metals Week, November 12, 1973, p. 2
" " November 19, 1973, p. 2
" " Dec. 2, 1974, p. 1 (closure)
" " Jan. 13, 1975, p. 1 (closure)

Mining Congress Journal, February, 1973, p. 30
" " " January, 1975, p. 6 (closure)

Mining Annual Review, July, 1973, p. 292

Mineralogy of Arizona p. 16, 17

E/MJ = March, 1974, p. 211
" January, 1975, p. 138 (closure)

LAVENDER PIT

COCHISE COUNTY
BISBEE DIST.

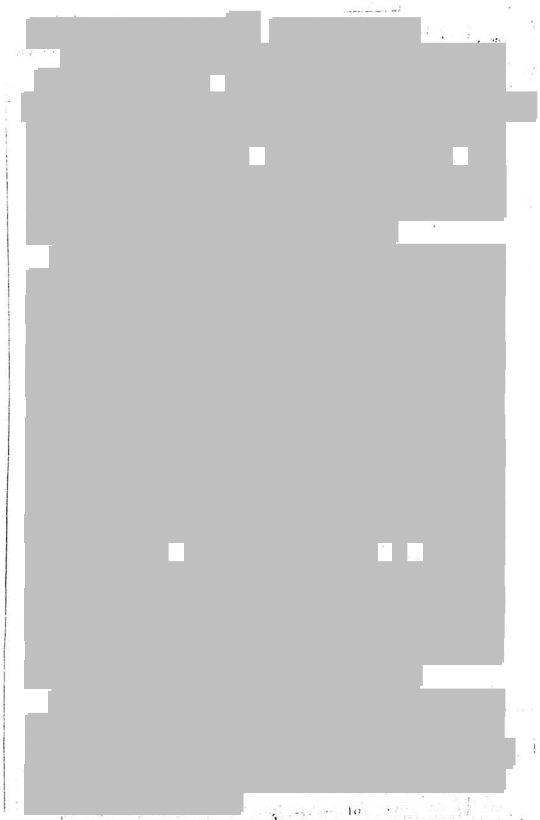
W. W. Little, Mgr., Copper Queen Branch, Phelps Dodge Corp., Bisbee.
(COPPER QUEEN, LAVENDER PIT & MILL, SMELTER AT DOUGLAS)

2,475 men working

Feb. 1962

PHELPS DODGE CORPORATION has announced the completion of a 25-ton-per day sponge iron plant at its Douglas smelter, Douglas, Arizona. The plant makes sponge iron from iron oxides produced in the smelting process. The sponge iron is expected to be a more economical precipitant for copper in the leaching operations at Bisbee than the detinned cans used previously.

Taken from MINING WORLD, June, 1962, p 44.



PAY DIRT for APRIL 22, 1960

LAVENDER PIT COCHISE COUNTY

Mr. A. E. Himebaugh has been appointed superintendent of the Lavender Pit, replacing Glen Simmons, who recently retired.
Mr. William Gidley has been named supervisor of employment and safety. He replaces W. J. Hunt, who has been transferred to the Phelps Dodge Tyrone, N. M. branch.
Brewery Gulch Gazette 1-5-67

Visited the Lavender Pit - mine closed for the Holidays or vacations. Management busy with labor relations. GWI WR 7-8-67

Active Mine List Nov. 1967 - 2500 men
Active Mine List April 1968

The possible closing of its Lavender Pit in Bisbee, in about six years is being studied by Phelps Dodge Corporation. Walter C. Lawson, vice pres. and gen. mgr. of Western Operations, is quoted as saying that the present reserves will last about that long at the present rate of production. World Mining Nov. 1968 p. 50

Fred M. Winkler smelter supt. of Morenci Branch of Phelps Dodge Corp., will be transferred to Douglas as plant superintendent of the Douglas smelter tomorrow. News Clip 4-30-69

Active Mine List April 1969 - 1825 men - H. D. Clark, Supt.
Active Mine List Oct. 1969 - 1750 men - H.D. Clark Jr., Supt.
Active Mine List May 1970 - 1690 men - " " " "
Active Mine List Oct. 1970 - 1710 men - " " " "

According to an article in one of the Tucson Newspapers the owners of the claims adjoining the Lavender Pit have been trying to sell them to a large mining company with the Inspiration Co. being mentioned as interested. GWI QR 12-31-70

The Bisbee operations continue with production from U.G. and the Lavender Pit. GWI 4 ¼ /72

PHELPS DODGE CORPORATION

BISBEE, ARIZONA

NOTES ON LAVENDER PIT CONCENTRATOR

Note: Data presented herein are NOT FOR PUBLICATION

Phelps Dodge Corporation
Copper Queen Branch

CONCENTRATOR DATA

YEAR 1956

OPERATING TIME:

Available Operating Days	321

ORE MILLED:

Dry Tons Pit Ore Milled	5,068,987
Dry Tons Cole-Dallas Ore Milled	145,163
Total Dry Tons Ore Milled	5,214,150

	Primary	Secondary
CRUSHING:		
Unit Hours Operated	5,406	6,353
Percent of Available Time	70.17	41.23
Tons Crushed per Unit Hour	965	821

GRINDING: (Primary Mills)	
Percent of Available Time Operated	95.40
Dry Tons Milled per Operating Day	16,243
Dry Tons per Mill per 24 Hours	2,128
Ball Consumption - Pounds per Ton of Ore Milled	1.676
Grinding Circuit Feed - Percent Plus 65 Mesh	83.10
Grinding Circuit Product - Percent Plus 65 Mesh	6.03
Grinding Circuit Product - Percent Minus 200 Mesh	61.24

	Monthly		
	High	Low	Year
ASSAYS:			
Heads - % Total Copper	1.192	1.003	1.091
- % Oxide Copper	0.060	0.043	0.051
- % Chalcocite	1.42	1.20	1.30
Concentrate - % Total Copper	14.28	12.09	13.12
- % Chalcocite	17.62	14.84	16.17
- % Insol	5.40	3.96	4.39
Tailing - % Total Copper	0.263	0.209	0.240
- % Oxide Copper	0.049	0.032	0.040
RECOVERIES:			
% of Total Copper	80.85	78.23	79.44
% of Total Chalcocite	83.90	80.50	82.00
% of Total Gold	85.44	41.16	62.33
% of Total Silver	87.42	69.78	78.05
RATIO OF CONCENTRATION:			
Tons into One	16.377	14.225	15.143

CONCENTRATE PRODUCED:

Dry Tons	344,332
Dry Tons per Operating Day	1,073

TAILINGS:

Dry Tons Rejected	4,869,818
M Gallons Water to Tailing Pond	1,405,653
Percent Solids	45.4
Percent Water Reclaimed from Pond	20.35

REAGENTS:

Collectors	- Minerec "A" - Pounds per Ton Ore	0.0052
	- Aerofloat - Pounds per Ton Ore	0.0284
	- Xanthate Z-11 - Pounds per Ton Ore	0.0018
Frothers	- Dowfroth - Pounds per Ton Ore	0.0276
	- Pine Oil - Pounds per Ton Ore	0.0028
Lime	- Pounds per Ton Ore	3.6332

WATER:

	Fresh	Reclaimed	Naco
Total M Gallons Used	1,095,397	286,015	84,650
Gallons per Ton Ore Treated	210	55	16

POWER:

Total K.W.H. per Year 1956	70,428,100
K.W.H. per Ton Ore - Primary Crushing	0.43
K.W.H. per Ton Ore - Secondary Crushing	0.88
Total K.W.H. - Crushing and Conveying	1.31
K.W.H. per Ton Ore - Grinding	6.77
K.W.H. per Ton Ore - Flotation	2.51
K.W.H. per Ton Ore - Concentrate Retreatment	1.16
K.W.H. per Ton Ore - Concentrate Handling	0.51
K.W.H. per Ton Ore - Mill Water	1.12
K.W.H. per Ton Ore - Tailings Disposal	0.13
K.W.H. per Ton Ore - Grand Total	13.51

LABOR:

Total Man Shifts Worked, 1956	46,882.25
Average Daily Total Concentrator Employees	146.05
Total Tons Milled per Man Shift Worked	111.22
Labor Turnover - Percent	1.20

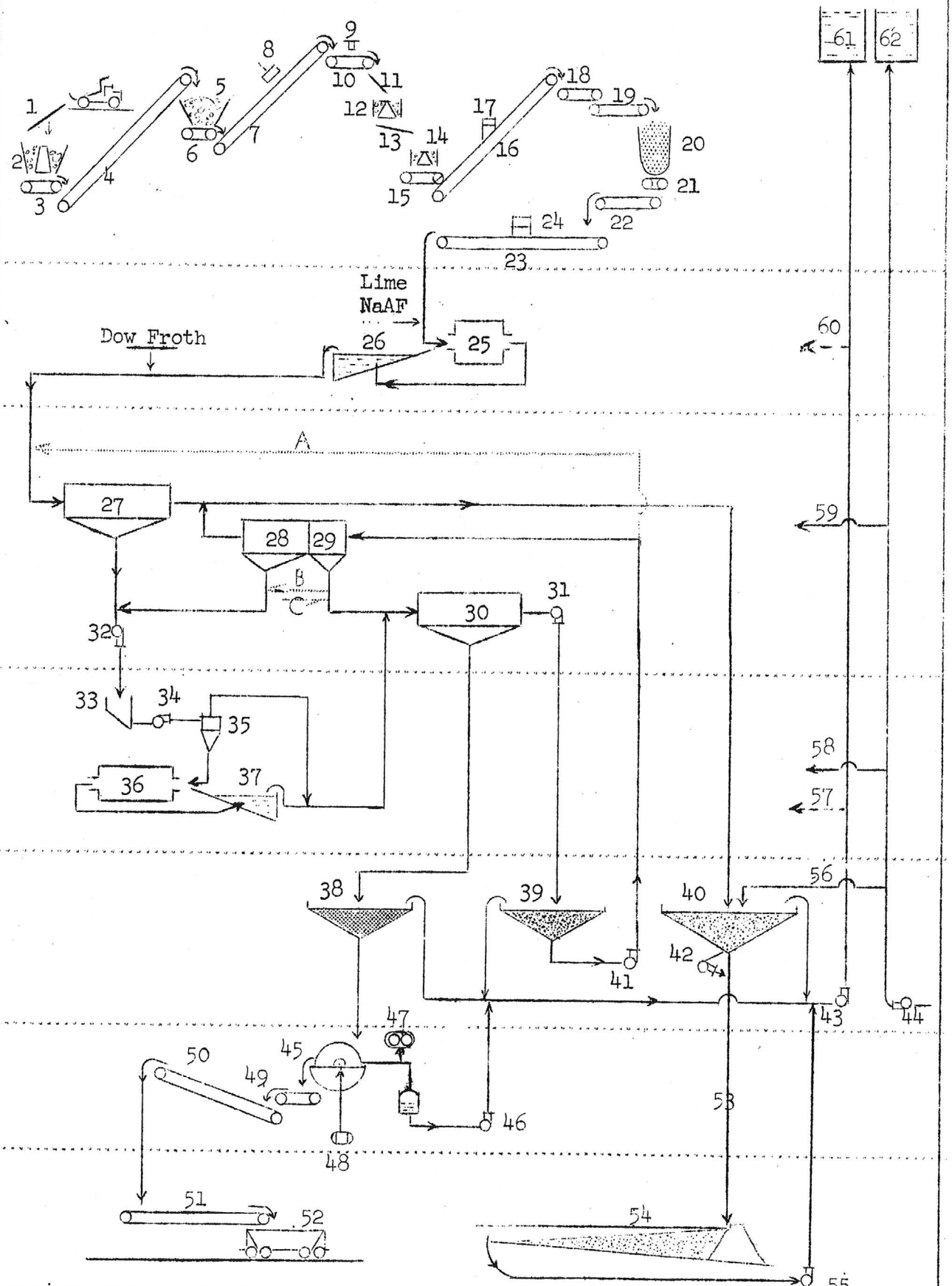
SAFETY:

"Lost Time" Accidents	0.0
"No Lost Time" Accidents	21

Note: The data presented in the Summary of Operations for the Year, 1956, are NOT FOR PUBLICATION.

LAVENDER PIT CONCENTRATOR FLOWSHEET

CRUSHING · GRIND · FLOTATION · REGRIND · THICKEN · FILT · PROD ·



NOTES

PRESENT FLOWSHEET - No. 5 - SOLID LINES - SCAV. CONC. DIVIDED.
A - FLOWSHEET NO. 2 - CLEANER TAILS TO RO. HEADS - NO SCAVENGERS.
B - FLOWSHEET NO. 3 - ALL SCAV. CONC. TO REGRIND FEED.
C - FLOWSHEET NO. 4 - ALL SCAV. CONC. TO CLEANER HEADS.

2/57

Phelps Dodge Corporation
Copper Queen Branch

LAVENDER PIT CONCENTRATOR

EQUIPMENT

Flowsheet No.	Item
1	2 Grizzlies - 5-1/2" Openings - 40° Slope.
2	1 Gyratory Primary Crusher, 48" - 5-1/2" Opening - 1500 T.P.H. Max. 200 H.P. Drive.
3	2 Pan Feeders - 48" x 19'6" Each 750 T.P.H. Max 25 F.P.M. - 15 H.P. Drives.
4	1 Belt Conveyor - 48" x 950' Hor.-219' Rise 400 F.P.M. - 1500 T.P.H. Max., Three 150 H.P. Drives.
5	1 Coarse Ore Bin 10,000 Tons. (3,000 Tons Available)
6	2 Pan Feeders - 48" x 13' - 8 to 24 F.P.M. - 250 to 750 T.P.H. - 7.5 to 10 H.P. - D.C. Drives.
7	1 Belt Conveyor - 42" x 600' Hor.-129.5' Rise - 400 F.P.M. - 1200 T.P.H. Max. - Three 75 H.P. Drives.
8	1 Suspended Magnet - 30" x 42".
9	1 Metal Detector and Marking Device with Automatic Stop.
10	2 Belt Conveyors - (A) 54" x 36' - 200 F.P.M. - 30 H.P. (B) 42" x 41' - 200 F.P.M. - 15 H.P. Drive.
11	2 Grizzlies - 1-1/2" Openings - Morenci Type Bars - 35° Slope.
12	2 Standard Cone Crushers, Symons 7' - 1-1/2" Opening - 300 H.P. Drives.
13	8 Rod Deck Screens, Symons - 4' x 8' - 5/16" Openings - 7.5 H.P. Drives.
14	4 Shorthead Cone Crushers, Symons 7' - 1/4" Opening - 300 H.P. Drives.
15	1 Belt Conveyor - 42" x 96' - 325 F.P.M. - 20 H.P. Drive.
16	1 Belt Conveyor - 36" x 301' Hor. - 94 Rise - 471 F.P.M. - 150 H.P. Drive.
17	1 Transportometer.
18	1 Belt Conveyor - 36" x 13'6" Hor. - 4' Rise - 450 F.P.M. - 20 H.P. Drive.
19	1 Belt Conveyor - 36" x 284' - 450 F.P.M. - 50 H.P. Drive and Tripper Car - 3 H.P. Drive.
20	1 Fine Ore Bin, 9,000 Tons. (7,000 Tons Available)
21	27 Belt Feeders - 16" x 3' D.C. Variable Speed Drives, Transportometer Controlled.
22	8 Belt Conveyors - 18" x 25' - 225 F.P.M. - 3 H.P. Drives.
23	8 Belt Conveyors - 18" x 56' - 228 F.P.M. - 3 H.P. Drives.
24	8 Transportometers.
25	8 Primary Ball Mills - 10' x 10' Marcy Grate Type - 18 R.P.M. 89 D.T.P.H. Actual - 800 H.P. Drives.
26	16 Primary Classifiers - 54" Akins Duplex - 6 R.P.M. - 15 H.P. Drives.
27	100 Rougher Flotation Cells, 66" Fagergren - 420 R.P.M. - 15 H.P. Drives.
28	14 Secondary Scavenger Flotation Cells, 66" Fagergren - 420 R.P.M. 15 H.P. Drives.
29	6 Primary Scavenger Flotation Cells, 66" Fagergren - 420 R.P.M. 15 H.P. Drives.

CONCENTRATOR EQUIPMENT (CONT'D)

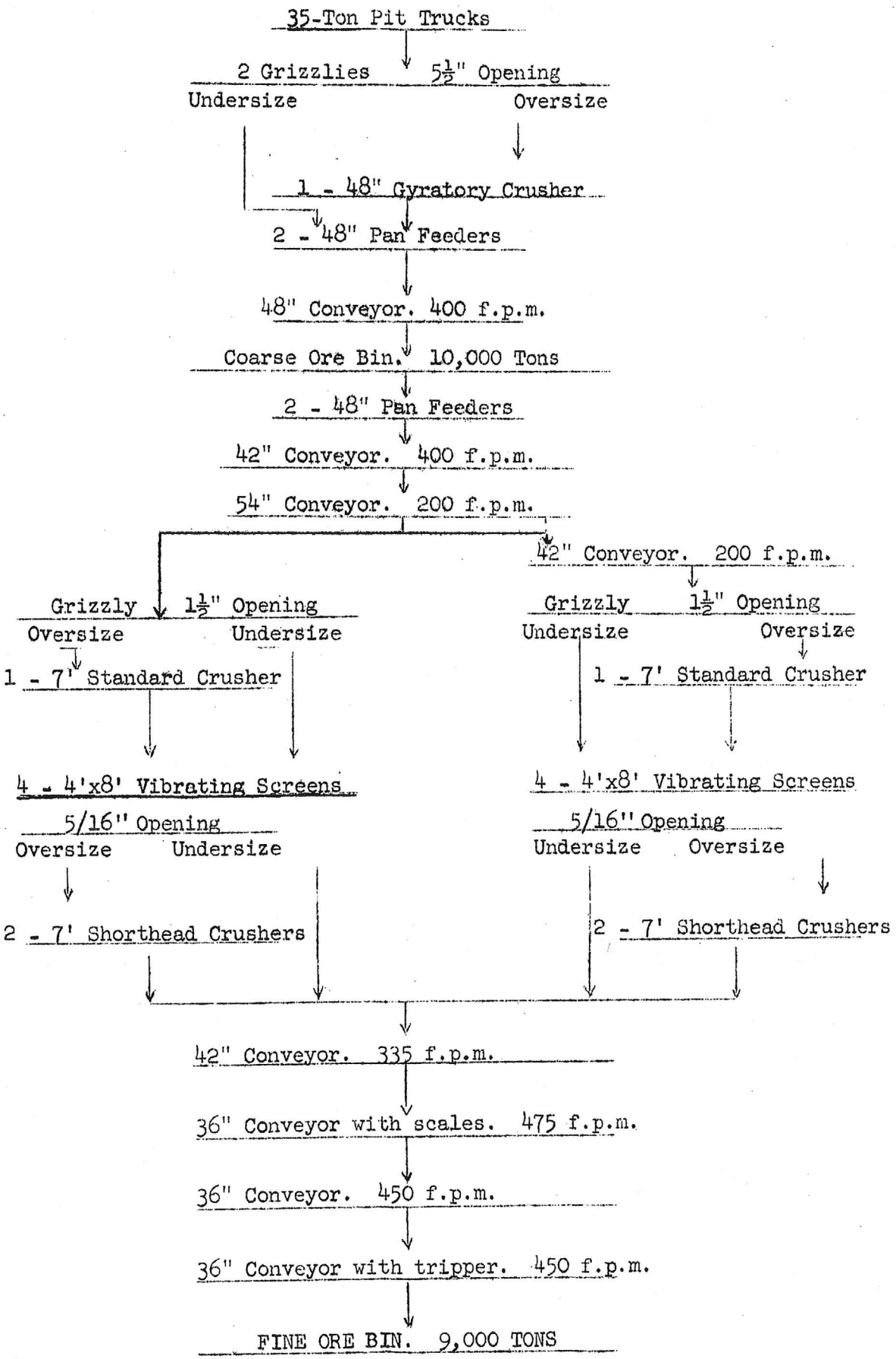
Flowsheet No.	Item
30	36 Cleaner Flotation Cells, 66" Fagergren - 385 R.P.M. - 15 H.P. Drives.
31	2 Cleaner Tail Pumps, Hydroseal D-41-5, 50 H.P. Drives.
32	3 Regrind Pumps, 8 x 6 SRL-C, Rated 1100 G.P.M. Each @ 80' - 50 H.P. Drives.
33	4 Cyclone Sumps - 42" x 45" x 9' Deep.
34	4 Cyclone Pumps, Hydroseal 6 x 4 - 20 H.P., 8 x 6 NRL-C - 30 H.P., Centriseal 6 x 4 - 40 H.P. and Hydroseal 8 x 6 CD - 30 H.P.
35	4 Dorrclones, 12" Dia. x 20° Cone - 12 to 16 P.S.I.
36	4 Regrind Ball Mills, 8' x 12' Llewellyn Iron Works - 20.3 R.P.M. 2,400 H.P. Drives and 2,350 H.P. Drives.
37	4 Regrind Classifiers, 54" Akins Duplex - 4.3 R.P.M. - 15 H.P. Drives.
38	2 Concentrate Thickeners, Dorr Torque - 125' Dia. - 5 H.P. Drives. (One Operating)
39	1 Middling Thickener, Dorr Torque - 125' Dia. - 5 H.P. Drive.
40	2 Tailing Thickeners, Dorr Traction - 300' Dia. - Tandem Drives, 5 H.P. Each.
41	3 Middling Pumps, 5 x 4 SRL-C, Rated 500 G.P.M. Each @ 85' - 30 H.P. Drives.
42	3 Tailing Booster Pumps, Wilfley 8" - 100 H.P. Drives. (Emergency use only)
43	5 Reclaimed Water Pumps, Gardner-Denver Centrifugal - Rated 3,000 G.P.M. Each @ 215' - 200 H.P. Drives.
44	4 New Water Pumps, Peerless Vertical Turbine - Rated 900 G.P.M. Each @ 225' - 75 H.P. Drives.
45	5 Drum Filters, Oliver 11'6" x 18' Var. Speed - 0.56 R.P.M. to 0.29 R.P.M. - 20" Vacuum.
46	2 Filtrate Pumps, Worthington - Rated 150 G.P.M. Each @ 80' - 50 H.P. Drives.
47	3 Rotary Vacuum Pumps, Allis-Chalmers - Rated 2,300 C.F.M. @ 20.7" Each - 100 H.P. Drives. Barometric Leg on Vacuum System.
48	2 Rotary Blowers, Sutorbuilt No. 6-L - Rated 400 C.F.M. @ 16 oz. Pressure, Each - 7.5 H.P. Drives.
49	2 Belt Conveyors (No. 9) 24" x 26'4" - 10 F.P.M. - 5 H.P. (No. 10) 24" x 55' - 10 F.P.M. - 5 H.P.
50	1 Belt Conveyor - 24" x 224' Hor. - 20' Rise - 150 F.P.M. - 7.5 H.P. Drive.
51	1 Belt Conveyor - 24" x 460' - 150 F.P.M. - 7.5 H.P. Drive and Tripper Car - 3 H.P. Drive.
52	Concentrate Cars T.C.&G. Weatherproof, Bottom Dump, 50 Tons Net Capacity.
53	Tailings Line - 225' - 16" Steel Pipe, 10,400'- 18" Concrete Pipe and 5,835' - 18" Transite Pipe to Wye at Pond. Average Slope of Line, Minus 1.26%.
54	Tailings Dam - 350 Acres Impounding Area, Berm Enclosed.
55	4 Return Water Pumps, Johnson Vertical Turbine - Rated 360 G.P.M. Each @ 420' - 50 H.P. Drives.
56	New Water Makeup to Tailing Thickeners.
57	Alternative Reclaimed Water to Regrind Section.
58	New Water to Regrind Section.

CONCENTRATOR EQUIPMENT (CONT'D)

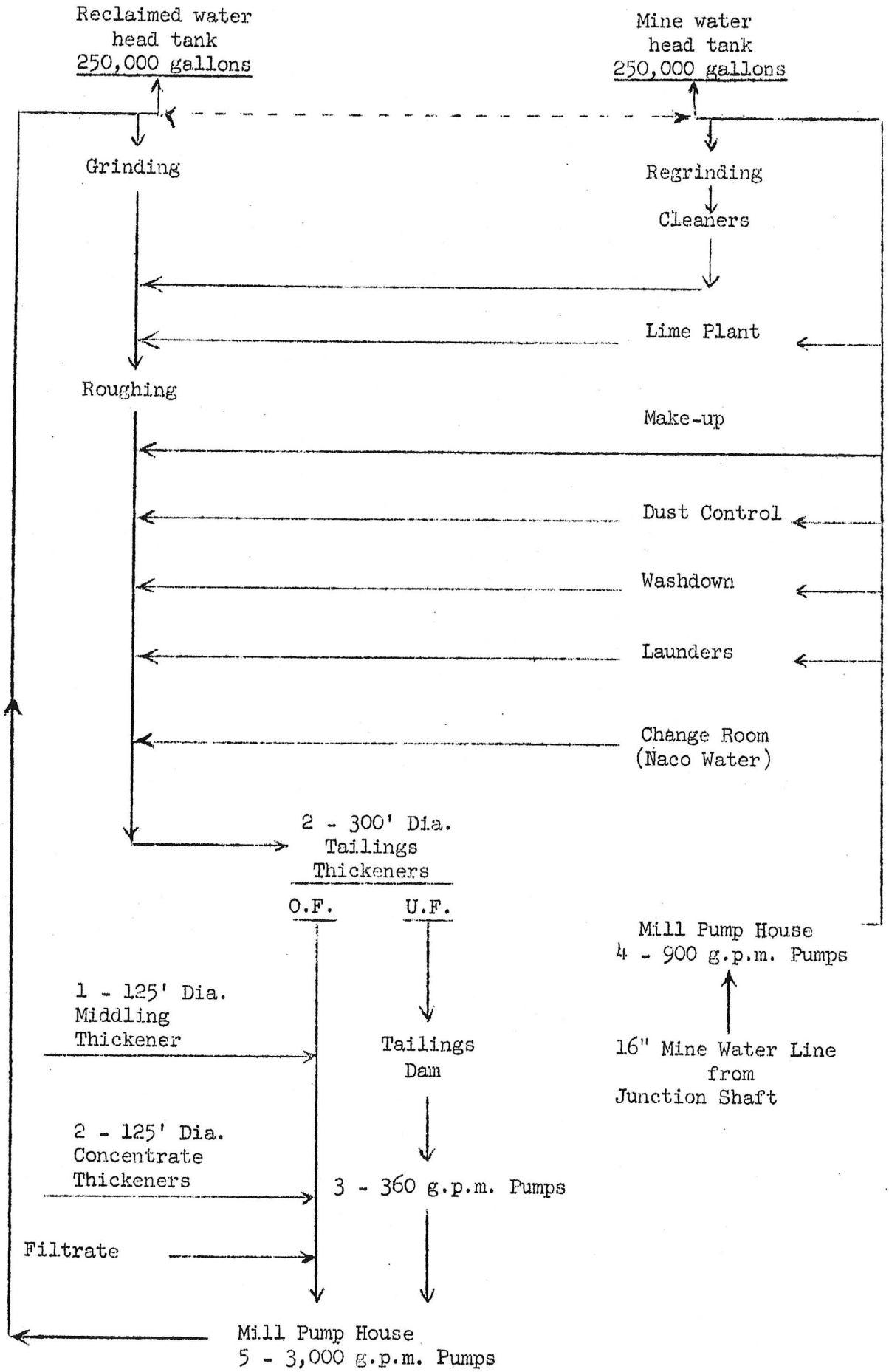
Flowsheet No.	Item
59	New Water to Flotation Launders, Wash-down, Sinks, etc.
60	Reclaimed Water to Primary Grinding Section.
61	Reclaimed Water Head Tank - 35' x 35' Dia. - 250,000 Gallons.
62	New Water Head Tank - 35' x 35' Dia. - 250,000 Gallons.

Bisbee, Arizona
March 1, 1957
mm

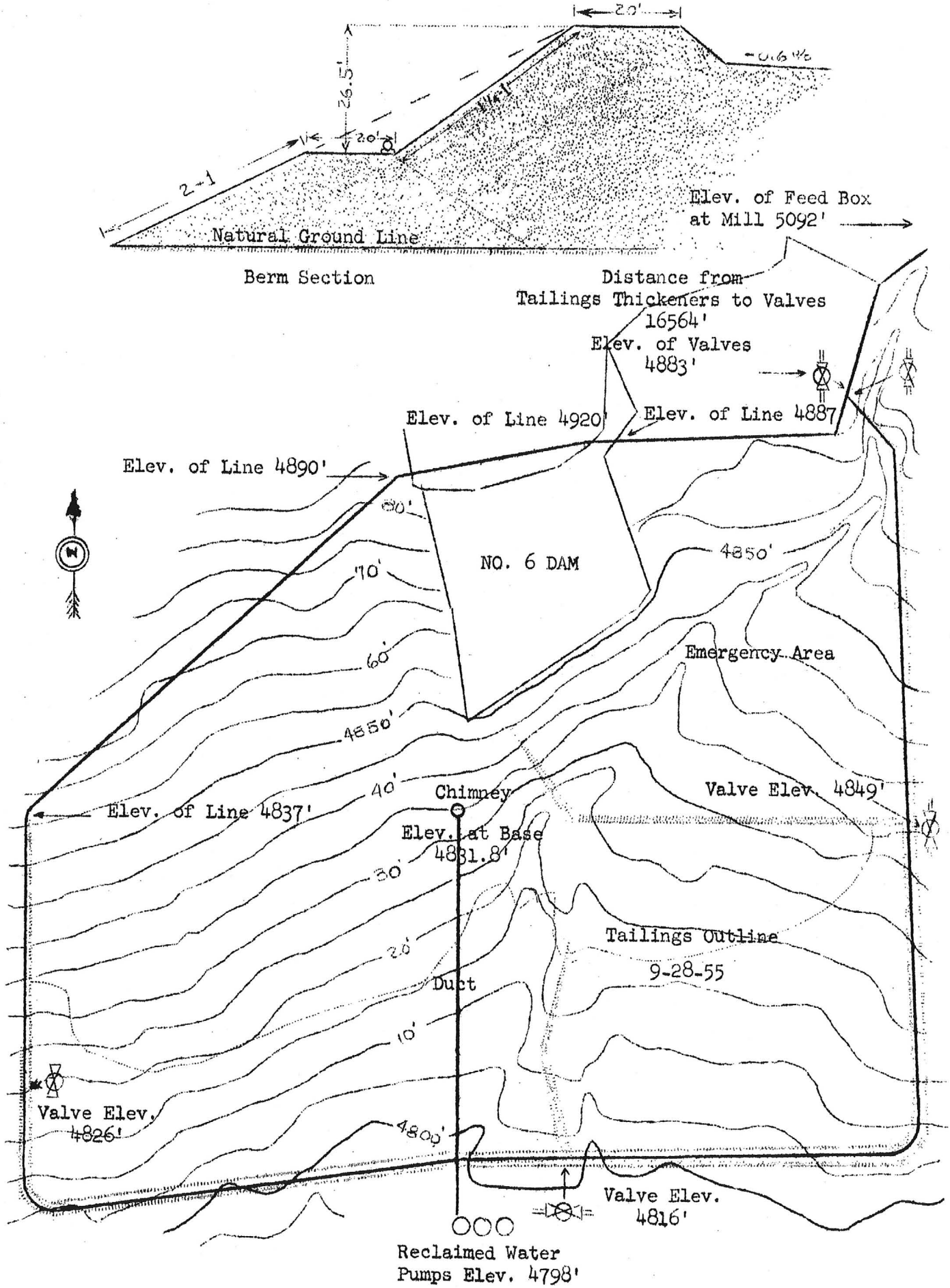
CRUSHING FLOW SHEET



WATER SUPPLY



TAILINGS DISPOSAL AREA AND SECTION OF BERM



THE LAVENDER PIT

Another Arizona Copper Mine - the Lavender Pit of Phelps Dodge Corporation - was formally dedicated on August 7th of the year 1954. A celebration marked the opening of the huge open-pit operation which required the expenditure of more than 25 million dollars to bring the mine to production.

The following statement by Robert G. Page, President of the Phelps Dodge Corporation, gives a good clear picture of the project:

Faith Can Move Mountains

The Lavender Pit - the new open-pit copper mine of Phelps Dodge Corporation at Bisbee - was officially opened on August 7. The Lavender Pit is an excellent example of the saying that large mines are made, not found. The presence of copper in the area which is now the Lavender Pit mine was known for many years. But during that long period it was not ore because it could not be mined profitably.

Mineralized rock is ore only when it can be mined and processed at a profit. The Lavender Pit material became ore only after gradual but continuous improvements in the arts of mining, milling and smelting and in the size as well as perfection of modern tools and machinery. It became ore also only when more than $25 million was invested in stripping the mountainous overburden and building the huge industrial facilities.

The nature of the ore deposits in the Bisbee district has required for the most part mining by underground methods for the past 75 years. The underground ore deposits are small, scattered and at considerable depth. Under such conditions only high-grade deposits can be mined commercially.

Once before, in the '20s at Sacramento Hill, Phelps Dodge Corporation undertook to mine a low-grade ore body in the Bisbee district by open-pit methods.

That small ore body was near the surface and its comparatively high-grade ore made the project feasible but only slightly profitable because the highly efficient open-pit practices now used had not then been devised.

In developing the Lavender Pit, Phelps Dodge has again tackled the problem of successfully mining a lower grade deposit. For an open-pit mine operation, the deposit is also small, though considerably larger than the Sacramento Hill project. About 3.5 tons of mined rock will produce only one ton of ore yielding metal valued at $3 to $5 depending on the variation in market price. That yield will have to pay for all expenses of mining, milling, smelting, refining, transportation, taxes, so forth; and it is also out of that low gross value that the funds must come to repay the initial cost of the project of over $25 million before a profit can be realized.

Perhaps it is not too much to say that the same kind of courage and vision, and the willingness to take risks, which characterized the Arizona pioneers - whether cattlemen, mining men or farmers - find expression today in this Lavender Pit project. Risk, of course, there is; but, most important, having calculated the risk, we have faith that the risk is worth taking in Bisbee and that another mine - even though mountains have to be moved - may be successfully created in Arizona.

Highlights Of The Project

Source: Pay Dirt For August 20, 1954

The project cost more than $25 million before a pound of copper was recovered.

It was entirely financed by Phelps Dodge Corporation without one cent of Federal financial aid.

The pit embraces an area of 155 acres.

The ore is low-grade and requires fine grinding.

Ore eventually will be mined from 16 benches 50 feet in height.

The lowest point in the pit will be 1,005 feet below the highest original ground contour.

The first blast to clear the waste material was set off in March, 1951.

First ore was delivered to the concentrator June 24, 1954.

During the preparatory period, 46,000,000 tons of overburden was mined and delivered to waste dumps.

During the life of the pit, 2.62 tons of waste and leach material must be mined to recover one ton of ore that will produce less than 16 pounds of copper.

The 50-foot benches are mined by drilling a series of 7-3/8-inch holes about 60 feet deep and spaced at 14-foot intervals, 15 feet from the edge of the bank.

The holes are loaded with approximately 450 pounds of explosives per hole and shot simultaneously to break about 2,100 tons of rock for each hole.

The broken muck is loaded into 25-ton diesel trucks by five and six-yard electric shovels with six-cubic yard dippers.

At the loading dock, the muck is dumped into 43-cubic yard side-dump railroad cars and transported to a dump by 1,250-horse-power diesel electric locomotives.

In 17 trips to the dump in one eight-hour shift, the locomotive, pulling a 10-car train, will transport 12,000 tons of rock for a distance of 1.25 miles.

Since the ore body was located in the heart of a populated area, it was necessary to remove many business/es and residences, abandon the railroad into Bisbee, relocate U. S. Highway 80 and all utilities.

The construction work included a large crushing plant, concentrator and allied facilities, plus 75 new residences.

An additional 600 jobs have been created.

The Lavender Pit is expected to produce about 76,000,000 pounds of copper annually for a period of 12 years.

Processing The Copper From the Lavender Pit

(From Arizona Days and Ways, Aug. 8, 1954)

A man presses a dynamite exploder and the earth trembles. A cloud of dust drifts away in the wind and there, among tons of fractured rock, is the set of copper kitchen ware you will give your wife next Christmas. There, too, is the precious copper for wire to carry the messages of the world; copper to make the motor in your car run; copper for ammunition; copper for the thousands of intricate instruments of the atomic age.

The man at the blast control launches the fascinating series of steps that win copper from ore, but it all started countless geologic ages ago when nature laid down a low-grade copper ore deposit in a mountainside.

Today, the mountainside has been gouged into a pit embracing 155 acres. Dynamite and giant shovels will eat into the rock until the pit has reached a point 1,005 feet below the highest original ground level.

This is the great Lavender Pit Project of the Phelps Dodge Corporation, named for the late Harrison M. Lavender, whose vision and engineering skill on a Bisbee mountainside made possible a $25 million project - and all without benefit of Federal financial aid.

Almost four years have passed since the first homes and other buildings were relocated to make way for the new Phelps Dodge project. During the preparatory period, 46 million tons of waste rock were removed to expose benches of copper ore. During the life of the pit, 2 1/3 tons of worthless rock must be removed to reach each ton of ore.

That ton of ore will yield less than 16 pounds of copper by the most advanced technological treatment known in the mining world. Only a short time ago, the low-grade ore such as is found in the Lavender Pit would have been considered commercially worthless.

From the first dynamite blast in the pit to the copper refining, the ore passes through a busy new life on the way to becoming a useful product.

Scooped up in the dippers of 6-cubic-yard shovels, the ore is then trucked, crushed, concentrated and smelted. The chain of operation in the new Phelps Dodge pit mine must run smoothly and efficiently to keep the costs low - for this is low-grade ore.

The ore, with its tiny amount of copper-bearing mineral, is dumped from 25-ton trucks into a large gyratory crusher capable of crushing 3-foot cubes of solid rock, located on the wall of the pit. The product is coarse, broken "muck" which falls from the giant crusher to a conveyor belt. Crossing U. S. Highway 80 for a distance of 975 feet, the belt lifts the roughly crushed ore from the bottom of the pit to a storage bin high on an adjoining mountainside, from which it may be withdrawn as needed for the concentrating operation.

The concentrating operation is one of getting rid of as much waste material as possible without losing too much of the valuable metals in the ore. The valuable minerals are so minutely distributed through the ore that they must be ground extremely fine in order to make the separation in the concentrator. To do this requires more dry crushing in the concentrator, followed by grinding and re-grinding with water in the ball mills until a pulp of mixed ore and water, fine enough so that most of it will pass through a silk handkerchief, is produced. It is now ready for chemical treatment and more mechanical pushing around.

Additives and re-agents transform the pulp into a soapy froth in flotation cells which act much like an egg beater. This froth attracts to it the tiny copper-bearing particles and carries them over the lip of the cell. This is because chemistry has been busy in this process, and each particle is coated with a substance that makes the copper minerals adhere to the froth bubbles. The waste materials sink to the bottom of the cells and are discharged to large settling basins known as "thickeners" where most of the valuable water is recovered

and the solids are conveyed through a pipe line to the tailings disposal area.

The concentrate produced by the froth from the flotation machines also goes to a thickener where much of the water it contains is recovered, and where the concentrate is drawn off as a heavy pulp to filters that further dry it. From the filters, it drops into railroad cars all ready for the trip to the smelter.

The concentrate product travels by railroad to the Phelps Dodge smelter at Douglas, 25 miles from the pit and mill. In the smelting process, which transforms the concentrates into a large amount of slag and a small amount of almost pure copper, large quantities of heat are required.

Here the concentrate, after being mixed with lime and silica, is first passed through roasters at red heat to remove excess sulphur. One thousand tons per day of the roaster product are fed into a reverberatory furnace, the second smelting step required in the process of becoming pure copper.

The copper, combined chemically with iron and sulphur in a substance known as "matte", sinks to the bottom of the furnace where it is drained off. The top layer of the white-hot molten mixture is slag which is drained off, too, and disposed of so colorfully as waste on the slag dump.

From the reverberatory furnaces, the molten matte is transported in huge ladles and poured into a "converter" for more metallurgical treatment, including blowing with air. The product from the converter is "blister" copper which is ladled from the converters to the anode furnace.

Green oak logs at this point are used to stir the molten copper. The excess oxygen in the copper unites with the carbon in the log, forming carbon dioxide gas which passes off. Without the log treatment, excess oxygen would remain in the blister copper as an impurity.

The final product, from the anode furnaces, contains 99.5 per cent copper with minute amounts of gold and silver. The molten copper at this point is

poured into revolving molds and then cooled in a water bath.

Each bar of anode copper is about 3 feet square, about 2 inches thick and weighs approximately 700 pounds. The bars are loaded neatly on railroad flat cars for shipment to the refinery at El Paso, Tex. The business of the refinery is to purify these bars by electro-metallurgical treatment to the highest possible degree and to cast into shapes suitable for fabrication. Here too, the small amounts of gold and silver metals are recovered.

From the refinery, the copper goes to various plants throughout the country for fabrication into useful products.

Production Record to January 1, 1957

In 1954 the open-pit mine produced 1,671,753 tons of ore from which were recovered 17,056,589 pounds of copper.

In 1955 the mine produced 4,433,218 tons of ore from which were recovered 59,862,955 pounds of copper. The tons per day rate was 14-15,000 compared with 12,000 tons projected. The ratio of waste and leach material to ore was 1.81.

In 1956, the mine produced 5,069,049 tons of ore, from which were recovered 80,305,962 pounds of copper. The tons per day rate was 15,700 compared with 12,000 tons projected. The ratio of waste and leach material to ore was 1.29.

At the presently scheduled rate of mining, and on the basis of presently known minable ore, the estimated remaining life of the mine is about seven years. To the first of January, 1957, the mine has produced 11,174,020 tons of ore from which 157,225,506 pounds of copper have been recovered; or only 14.07 pounds of copper per ton of ore.

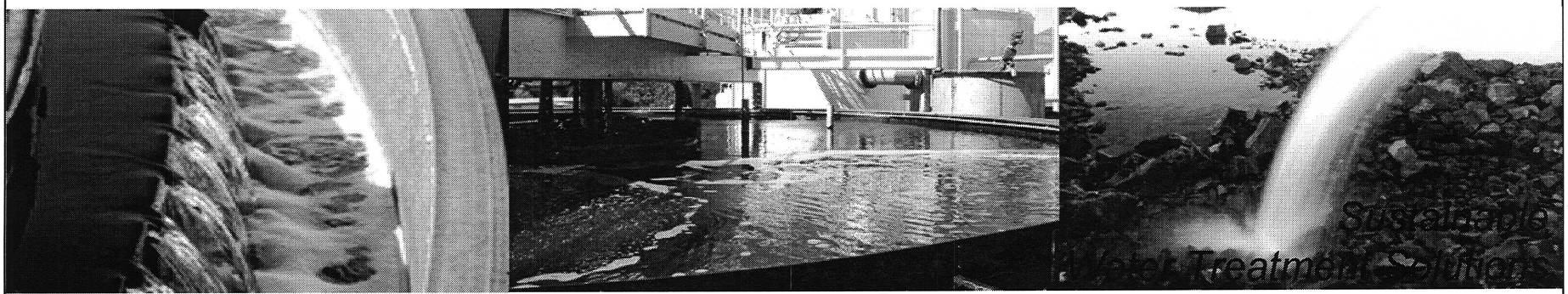
The successful exploitation of an orebody containing only 14 pounds of recoverable copper in 2,000 pounds of rock, is an achievement of which the Company's executives, engineers, miners and all of its employees can well be proud. It is an amazing spectacle to witness the many operations needed to be performed to recover the metal from a mass of apparently worthless rock. The State has acquired rather than been depleted of taxable wealth, and thousands of its citizens have benefitted tremendously from the high wages they have received.

BIOTEQ

ENVIRONMENTAL TECHNOLOGIES INC.

Lower Life Cycle Costs for Water Treatment

Applying experience from the Copreco Plant, Bisbee AZ



2009 WINNER CANADA EXPORT ACHIEVEMENT AWARDS

Canada Export Achievement Award

JANTZI RESEARCH
Social investment analysis

MACLEAN'S

Canada's Top 50 Most Socially Responsible Corporations

PDAC2009

Environmental and Social Responsibility Award

CHINA MINING 中国国际矿业大会

Environmental Protection Award

GLOBE FOUNDATION

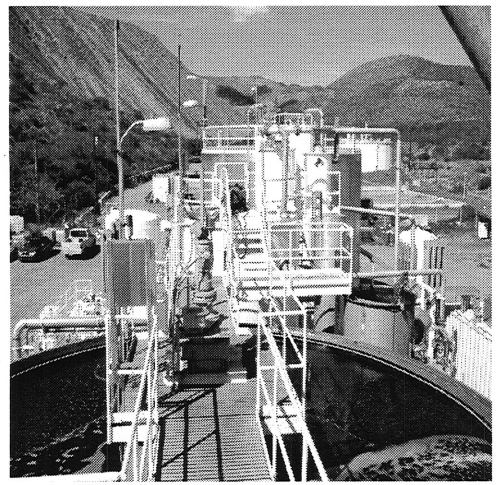
THE GLOBE AND MAIL

Environmental Excellence Award

BC EXPORT AWARDS
The 2009 Top 25
FINALIST

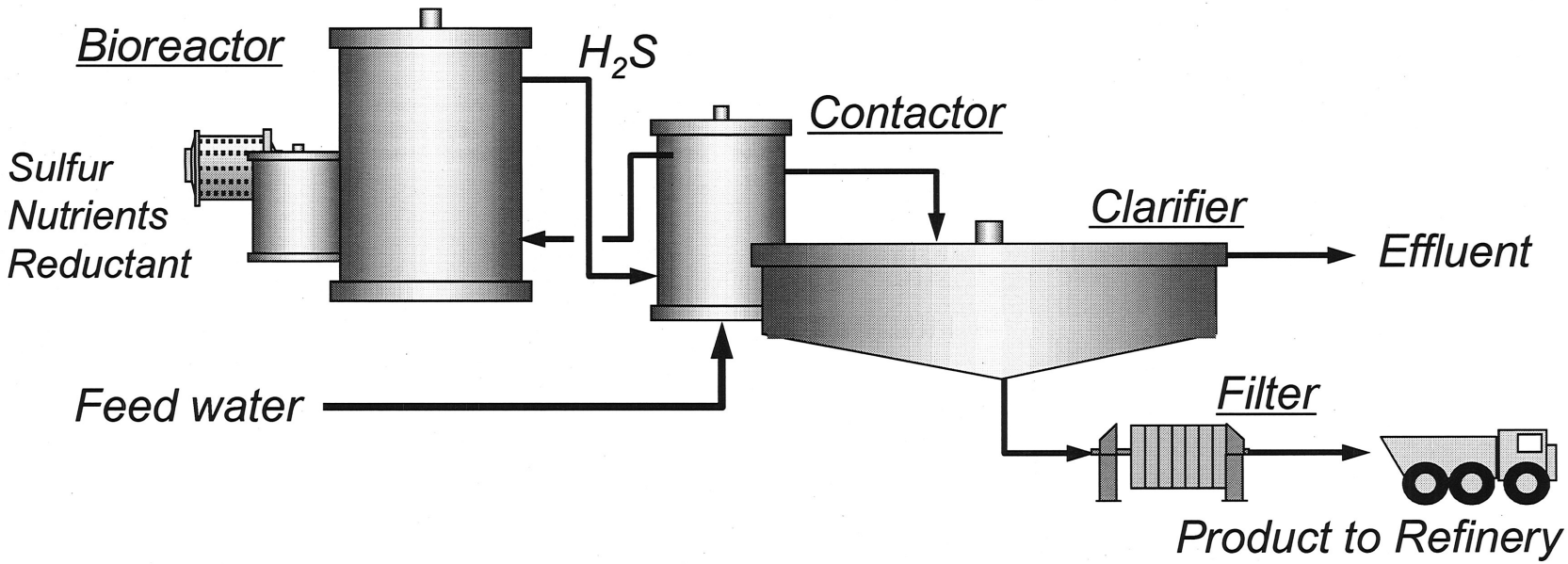
Top 25 Exporters in British Columbia

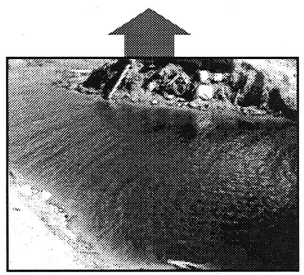
Copreco's BioSulphide® Plant

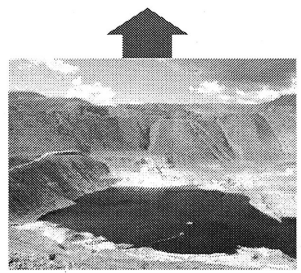


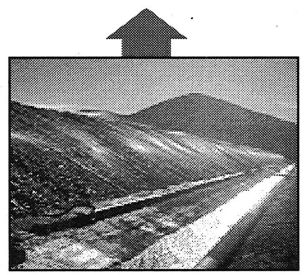
- 50/50 joint venture between BioteQ and Freeport-McMoRan Copper & Gold
- Plant commissioned in 2004
- Capital cost = $3.2 million (2004)
- 500 m^3/hr (2,200 usgpm) capacity
- Recovers copper from wastewater run-off from low-grade stockpile at inactive mine site
- Furlough initiated in April 2009; re-start in progress now

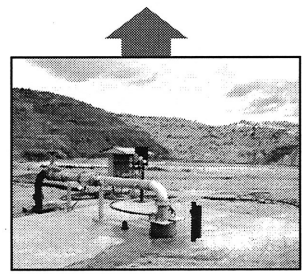
Sulfide process for metal recovery

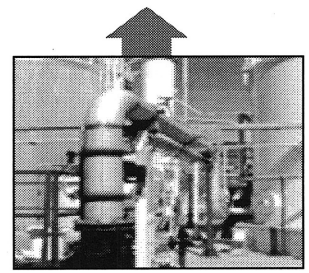



Acid drainage

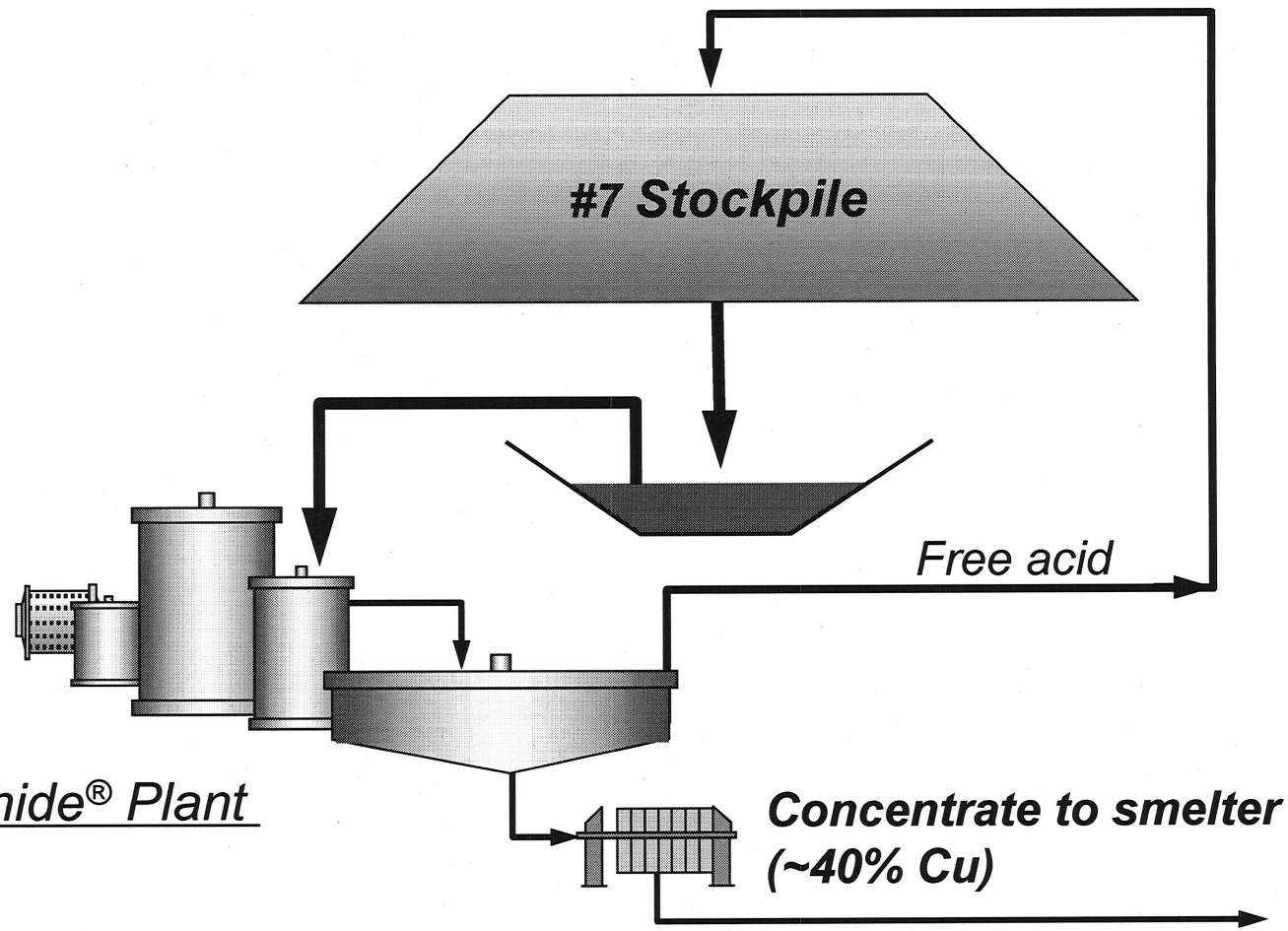

Mine water


Leach solutions

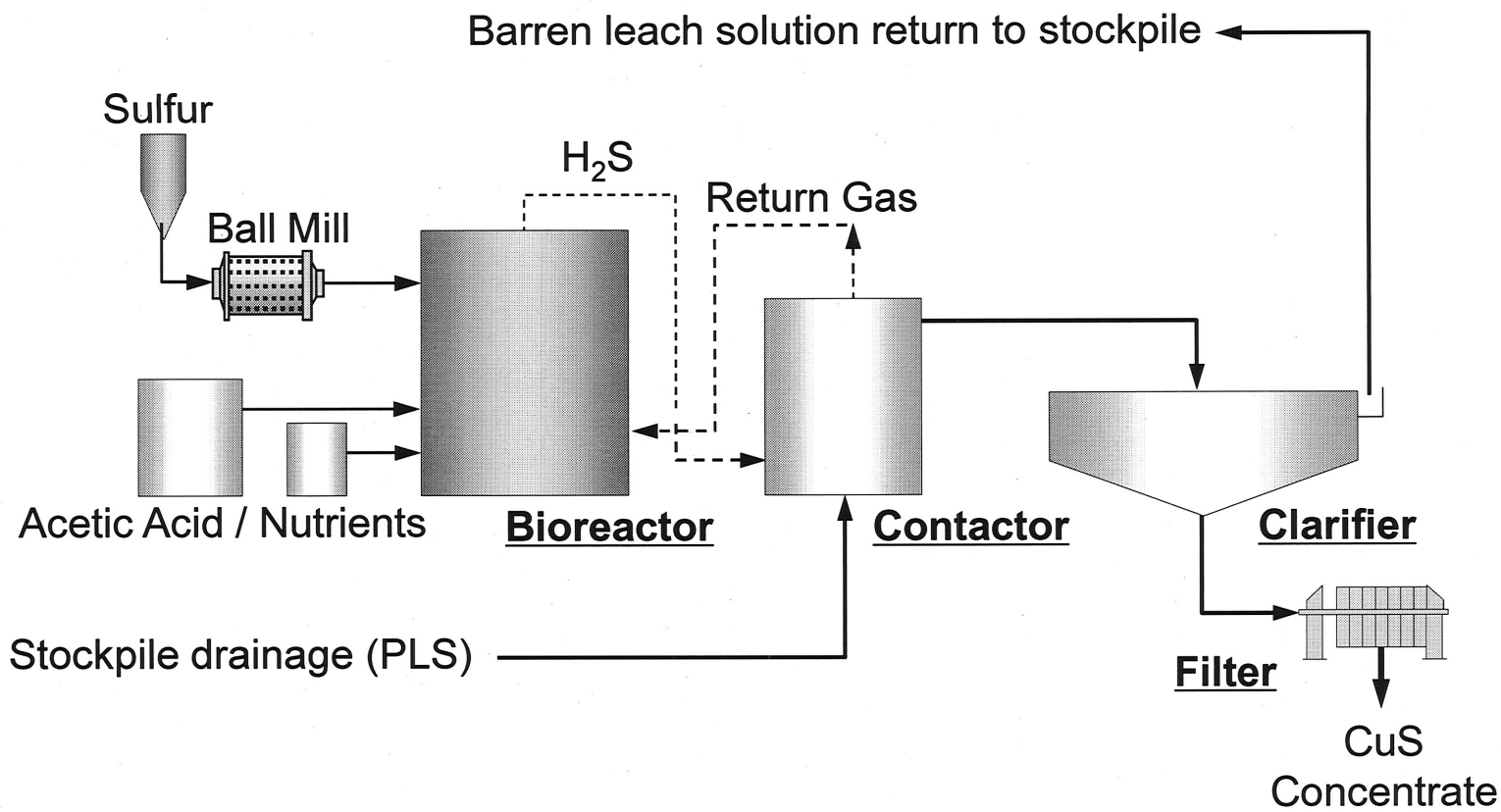

Ground-water


Bleed streams

Bisbee Overall Flowsheet

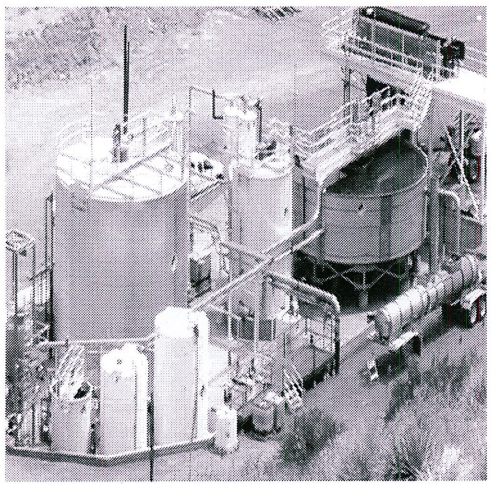


Process flowsheet at Bisbee




Copreco Plant,
Bisbee Arizona

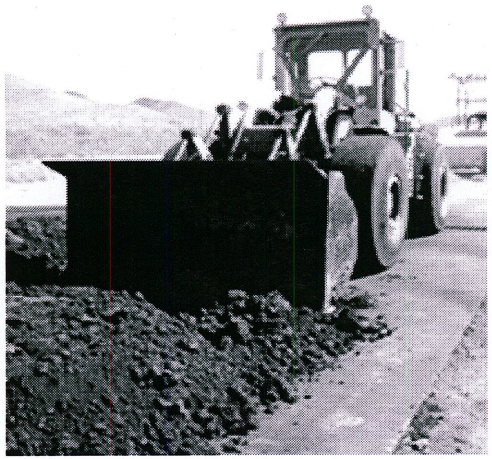
Design Criteria – Feed to Plant



PLS Composition (average, mg/L):

Copper	340
Total Iron	2,500
Total Ferric	700
Zinc	930
Manganese	1,620
Aluminum	3,950
Magnesium	2,890
Calcium	500
pH	2.2 to 2.4

Copreco Operating Results



- Water treated & recycled:
  - 765 million US gallons/year
- Copper recovered:
  - 1.3 million lbs/year 2008
- Mechanical availability = 98%

Copreco Compared to Case Study

	Copreco	Case Study
Copper grade	0.35% TCu	0.16% TCu
Tonnage	135 million Tons	30 million Tons
Solution Permeability	Less than 0.0004 gpm/ft^2	0.0015 gpm/ft^2
Recoverable Cu Estimate	165 million lbs at 17.5% recovery	53 million lbs at 50% recovery
Cu recovery	• Design capacity = 2.9 million lbs/year • Actual production = 1.3 million lbs/year • Less than 12 million lbs over 15 years - projection	• 6.3 million lbs in year 1, declining to 0.88 million lbs in year 15; • 37.3 million lbs recovered over 15 years – sol'n grade and flow decline same as in Bisbee
Solution composition	• 250 mg/L Cu, 550 mg/l Fe3+	• Same as Copreco

Life Cycle Cost Comparison
for Site Reclamation & Remediation

	Option 1: Capping	Option 2: Leach then Cap
Initial Capital Cost, Year 1	$ 0	Est. $10.5 million
Cumulative Net Cash Flow from Operations * (15 yrs @ 7% discount factor)	$ 0	$50 million
Est. Cap & Reclamation Cost	($35 million)	($35 million)
Net Profit / Loss	($35 million)	$15 million

Sale of the copper recovered from the heap leach can generate funds to pay for eventual capping costs

* Assumes Cu price of $3.20/lb, opex based on Q2 2010 costs