FOR IMMEDIATE RELEASE
July 26, 1988

SAN MANUEL, ARIZONA -- Magma Copper Company (NASDAQ-MGCP) announced today a second quarter, 1988 net income of $11.7 million or $0.31 per common share. Net income for the second quarter, 1987, which contained a pension settlement gain of $9.8 million, was $7.5 million.

Total revenue for the second quarter of 1988 was $136.2 million, compared to $97.8 million for the same period in 1987. Copper sales, including rod conversion premiums, contributed $116.3 million or 85% of total revenue for the second quarter of 1988, compared to $82.5 million or 84% of total revenue for the second quarter of 1987.

Net income for the first six months of 1988 was $28.5 million, or $0.33 per common share after accounting for preferred dividends of $16 million in the first quarter. During the same period in 1987, net income was $1.7 million. Total revenue for the first six months of 1988 was $269.1 million, compared to $199.2 million for the same period in 1987.

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NEWS FROM MAGMA
MAGMA COPPER COMPANY
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Magma sold 114.4 million pounds of refined copper during the second quarter, compared to 114.1 million pounds in the second quarter of 1987. The average revenue per pound of copper sold during the second quarter of 1988, including rod conversion premiums, was $1.017. During the same period in 1987 the average revenue per pound of copper sold was $0.723.

The production cost per pound of copper during the quarter was higher than the comparable period in 1987 due primarily to price related bonuses payable to employees and other costs linked to copper prices.

Refined copper production during the second quarter of 1988 was 106.4 million pounds, excluding third party tolling.

After an extensive test of a mechanized production system in two underground panels of the San Manuel orebody, the Company has concluded that it will limit mechanized production to these areas because of ground support and ore recovery problems. As a result, conventional block caving methods will be used in the remaining undeveloped areas of the San Manuel mine.

Start-up of the Company's new flash furnace at the San Manuel smelter began on schedule July 7 and has progressed smoothly, according to plan, with only minor

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technical delays. The retrofitted smelter is expected to operate at its fully rated capacity of 3,000 tons per day of concentrates by October 1, when a three month commissioning period will end. By that time, costs for sulfide copper smelting should decrease significantly.

Magma operates mines near San Manuel and Miami, Arizona; a smelter, refinery, and rod plant in San Manuel and a rod plant in Chicago.

MAGMA COPPER COMPANY
Summary of Consolidated Income
(In Thousands Except Per Share Amounts)
(Unaudited)

	Three Months Ended June 30,		Six Months Ended June 30,	
	1988	1987	1988	1987
Revenue	$136,213	$97,827	$269,059	$199,244
Net Income	11,745	7,467	28,524	1,684
Preferred Stock Dividends	---	(7,467)	(16,000)	(1,684)
Net Income Available For Common Stock	11,745	---	12,524	---
Net Income Per Common Share	$0.31	---	$0.33	---
Average Number of Common Shares Outstanding	38,114	38,091	38,106	38,091

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MAGMA COPPER COMPANY
Consolidated Balance Sheet
(in thousands)

ASSETS	June 30, 1988 (unaudited)	December 31, 1987
Current Assets:		
Cash and short-term investments	$ 1,529	$ 9,148
Accounts receivable	54,523	51,447
Inventories:		
Metals	68,201	71,947
Materials and supplies	26,807	24,640
Prepaid expenses	5,034	16,658
Total Current Assets	156,094	173,840
Property, Plant and Mine Development, (net):		
Mining claims and land	30,628	30,705
Equipment and buildings	470,716	425,766
Deferred mine development	157,419	136,655
Net property, plant and mine development	658,763	593,126
Funds Held by Trustee	---	906
Other assets	12,082	10,202
	$826,939	$778,074
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current Liabilities:		
Accounts payable	$ 19,483	$ 23,160
Accrued liabilities	46,810	48,399
Due to Newmont Mining Corporation	351	1,336
Income taxes payable	96	---
Total Current Liabilities	66,740	72,895
Accrued Pension, Retirement and Facility Abandonment Costs	27,750	28,855
Deferred Income Taxes	465	---
Long Term Debt	244,182	218,182
Series A Convertible, Exchangeable Preferred Stock	200,000	200,000
Stockholders' Equity:		
Class B Common Stock	381	381
Capital in Excess of Par Value	331,490	327,381
Retained Earnings (Deficit)	(39,923)	(68,447)
Unearned Stock Grant Compensation	(4,146)	(1,173)
	$826,939	$778,074

MAGMA COPPER COMPANY
AND CONSOLIDATED SUBSIDIARIES
STATEMENT OF OPERATIONS
(in thousands except per share amounts)
(unaudited)

	Three Months Ended June 30		Six Months Ended June 30	
	1988	1987	1988	1987
Sales	$136,213	$ 97,827	$269,059	$199,244
Cost of sales:				
Cost of products sold	(110,780)	(85,647)	(212,996)	(180,276)
Depreciation, depletion and amortization	(5,562)	(5,804)	(10,904)	(11,444)
General and administrative	(4,147)	(3,907)	(8,599)	(7,502)
Marketing and delivery	(3,606)	(4,548)	(7,253)	(7,601)
Income (loss) from operations	12,118	(2,079)	29,307	(7,579)
Interest expense	(53)	(288)	(72)	(571)
Pension settlement gain	---	9,834	---	9,834
Income before income taxes and extra-ordinary credit	12,065	7,467	29,235	1,684
Provision for income taxes	(5,439)	(2,893)	(12,080)	(2,893)
Income (loss) before extraordinary credit	6,626	4,574	17,155	(1,209)
Extraordinary credit - utilization of net operating loss carryforward	5,119	2,893	11,369	2,893
Net income	$ 11,745	$ 7,467	$ 28,524	$ 1,684
Preferred stock dividends	$ ---	$ (7,467)	$(16,000)	$ (1,684)
Net income available for common stock	$ 11,745	$ ---	$ 12,524	$ ---
Earnings Per Share:				
Income (loss) before extraordinary credit and preferred stock dividends	$ .17	$ .12	$ .45	$(.04)
Extraordinary credit - utilization of net operating loss carryforward	.14	.08	.30	.08
Preferred stock dividends	---	(.20)	(.42)	(.04)
Earnings Per Share of Common Stock	$ .31	$ ---	$ .33	$ ---
Average common shares outstanding	38,114	38,091	38,106	38,091

MAGMA COPPER COMPANY
Consolidated Statement of Cash Flows
(in thousands)
(unaudited)

	Six Months Ended June 30, 1988	Six Months Ended June 30, 1987
Net income	$28,524	$ 1,684
Adjustments to reconcile net income to net cash provided by operating activities:		
Depreciation, depletion and amortization	10,904	11,444
Gain on sale of assets	(2,893)	---
Other	1,070	---
Pension settlement gain	---	(9,834)
Change in assets and liabilities:		
(Increase) decrease in:		
Accounts receivable	(3,076)	(4,783)
Inventories	1,579	12,383
Prepaid expenses	11,624	(4,746)
Increase (decrease) in:		
Accounts payable and accrued expenses	(5,266)	7,666
Due to Newmont Mining Corporation	(985)	14
Income taxes payable	96	---
Accrued pension and facility abandonment costs	(1,105)	65
Deferred income taxes	465	---
Total adjustments	12,413	12,209
Net cash provided by operating activities	40,937	13,893
Cash flows from investing activities:		
Proceeds from sale of assets	4,089	---
Capital expenditures	(77,723)	(46,486)
Other	(1,828)	(4,633)
Proceeds from pension settlement net of excise tax	---	18,653
Net cash used in investing activities	(75,462)	(32,466)
Cash flows from financing activities:		
Drawdown of IDA loans held by trustee	906	4,714
Increase in long-term debt	26,000	53,000
Newmont short-term borrowing	---	11,116
Repayment of Newmont short-term borrowing	---	(29,757)
Net cash provided by financing activities	26,906	39,073
Net increase (decrease) in cash	(7,619)	20,500
Cash at the beginning of the period	9,148	235
Cash at the end of the period	$ 1,529	$20,735

PUBLIC HEARING

SENATOR ULM FILES CHARGES AGAINST MAGMA

John Scott Ulm, Arizona State Senator and TV newscaster, recently filed charges against Magma Copper Co., for putting concern for production ahead of the safety of its employees.

The whole affair is shaping up into a battle between the Company and Mine Inspector Verne McCutchan on one side and the Unions along with Senator Ulm on the other side.

The Unity Council, consisting of all the different Unions at Magma is issuing this leaflet in order to make the Unions' position clear to the membership and to the Company.

Wild-Cat STRIKE OVER SAFETY

The safety issue came to a head, a few weeks ago, when more than 150 employees of Magma took part in a wild-cat strike because the Company fired a man who refused, on grounds of safety, to cut into an electrical junction box unless the power was cut off.

There is something deeper here than just the technical question of whether the procedure proposed by the Company in this instance was or was not safe.

The refusal of a good worker to perform that particular job and the strike that followed his dismissal, constitute a resounding vote of NO CONFIDENCE in the Company and it's safety practices in general.

WE DON'T TRUST YOU

These men are in effect saying to the Company: "we don't care how many experts you use to tell us that this job is safe-we don't trust you! We have seen too many of your short cuts, tricks and just plain petty policies. We know by our own every day experience that you DO put concern for production and profit ahead of concern for our safety and health."

THE "RANK AND FILE" BRINGS A VISITOR

As a result of the strike, some of the men, too long frustrated by the Company's unyielding policies, contacted Senator John scott Ulm. One of the men, a Rank and File leader, proposed that Ulm make an inspection tour of the Smelter in order to learn first hand about some of the conditions that are causing concern. The Senator accepted, then got a visitor's pass in his own name, without the Company noticing that they were about to receive an influential outsider into their inner-sanctum of fumes; otherwise known as the Smelter.

Ulm, inspected the Smelter for three hours, while some of the management watched from behind posts. This was an inspection that was really an inspection...and most important was the fact that the Company was'nt given advance warning, so that it might hide it's sins.

The Company was caught with it's pants down. Senator Ulm filed a seven page report with the so called Mine inspector, detailing many safety violations and questionable practices at the Smelter.

EVEN CHARLIE McCARTHY WOULD MAKE A BETTER MINE INSPECTOR

Senator Ulm, along with the Mine "Inspector", Verne McCutchan, revisited the Smelter a week later. The "Inspector" made sure the Company was warned of the visit. The Company, accustomed to the methods of their "Inspector", did its stuff. Production was cut and the place was all spruced up, just waiting for the admiring glances of the "Inspector". Sure enough, the "Inspector was true to his cause; he complimented warmly and generously, what he called Magma's fine job regarding the safety of its employees.

Then, in a gesture, making even Charlie McCarthy, the wooden dummy look like a true independent...and with the Company's well oiled ventriloquist lips scarcely moving...the "Inspector" swinging around on his strings, charged the Senator with illegal entry into the Smelter. Criminal charges might be pressed, said the Company, thru its puppet.

Of course, this duet between the puppet and the puppeteer is a big sham and the Company is'nt fooling anyone except people like mine inspectors,who make a living by getting "fooled".

THERE WILL BE A PUBLIC HEARING THAT IS REALLY GOING TO BE A HEARING

The Unity Council, consisting of Local 937 USWA and Locals of IBEW, IAM&AW, BOILERMAKERS, UTU, RAILROAD and TEAMSTERS, along with Senator Ulm and others is holding a Public Hearing into the charges against Magma. This is in order to give all workers at Magma, a chance to present their views on questions regarding safety and other matters of concern.

Special attention will also be directed at Magma's hospital facility, which Senator Ulm branded a disgrace to medicine.

Brothers, this is our chance to make some changes. Remember, that the Company, like a vampire,thrives in darkness. Let's put on the lights! The Hearing will take place on Monday, June 25, 6pm at the Union Hall,Oracle.

The Mine
GENERAL INFORMATION

MAGMA COPPER COMPANY

A Subsidiary of
Newmont Mining Corporation
San Manuel Division
San Manuel, Arizona

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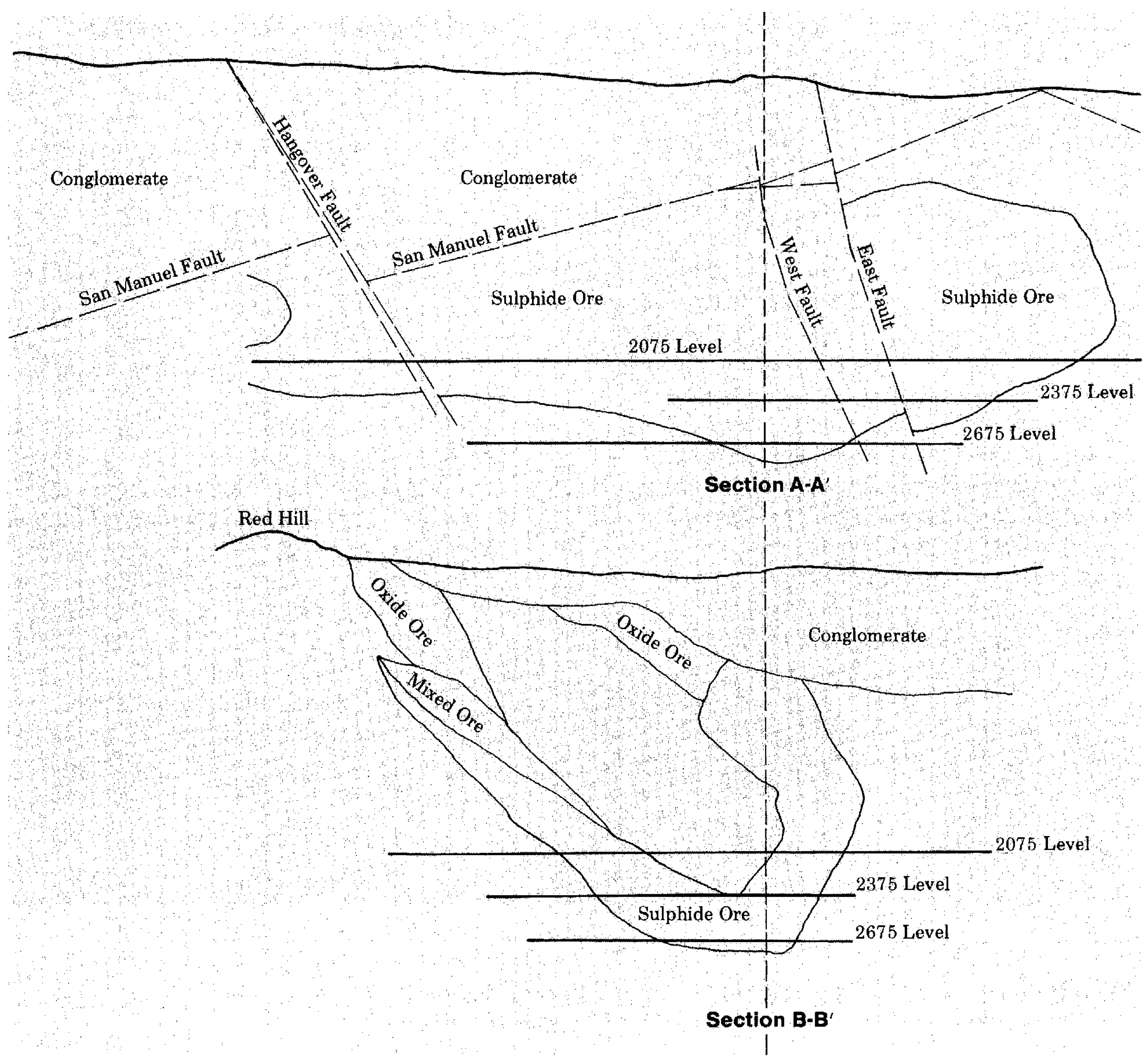
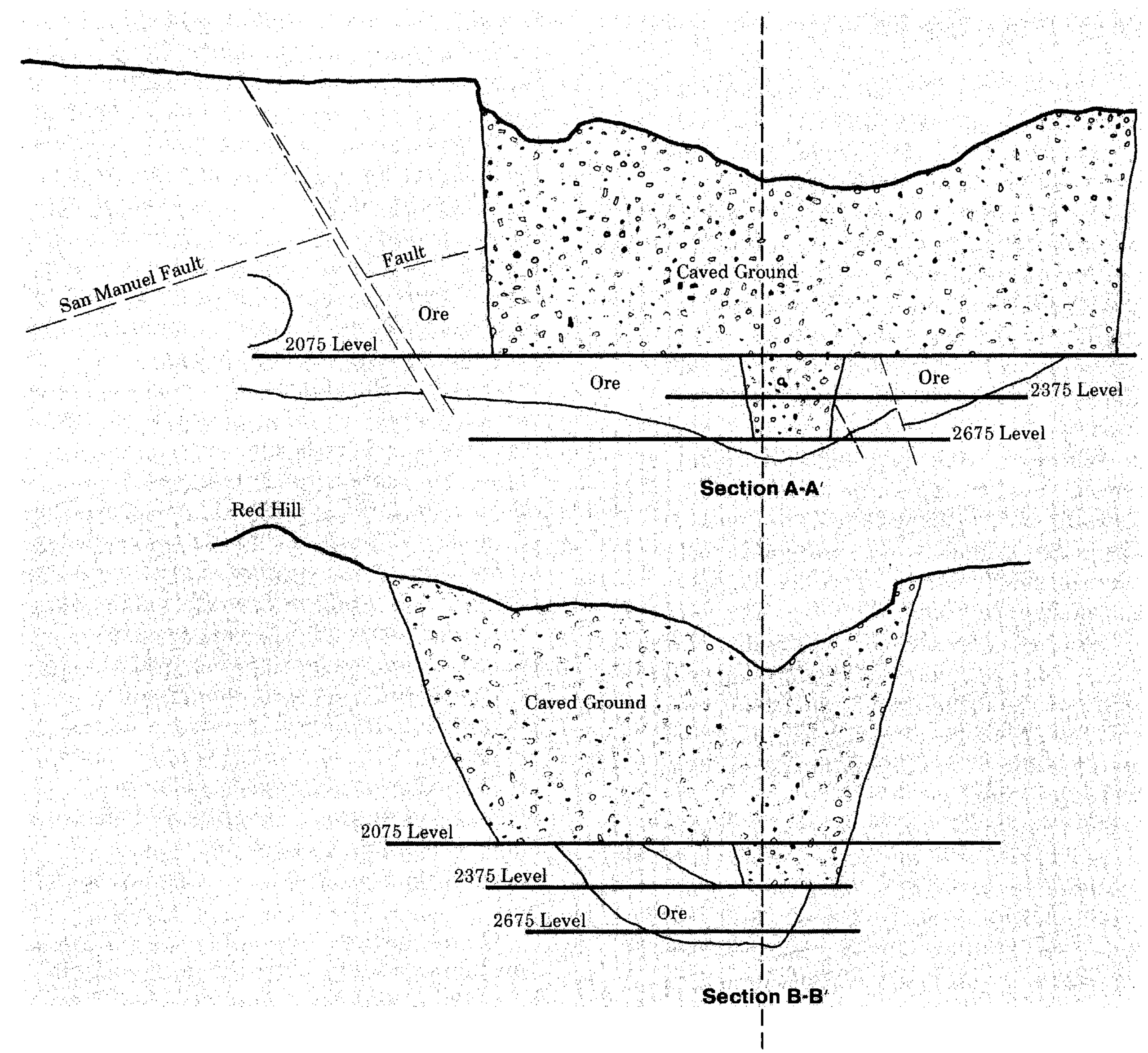


Sections Before Caving

1″ = 1200′



Sections After Caving

1″ = 1200′

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Mining System

The San Manuel mine operates with a full gravity block caving system. The orebody is divided into panels 140 ft. wide. These panels are further divided into blocks of varying sizes. The initial block undercut in any panel is at least 210 ft. by 140 ft. to ensure sufficient area to induce proper caving action. Subsequent blocks vary in size according to production requirements. Undercuts are generally taken in sequence from the initial undercut toward the outer edges of the orebody.

Where the orebody is high and essentially vertical, the lift or slice being mined is normally 600 ft. high. However, in areas where the orebody has considerable dip or rake, sublevels 300 ft. apart are used to maximize extraction.

Mining is accomplished through a pair of levels. The upper level is the mining or grizzly level and the lower level is the haulage level. Level placement and design are based on a preselected undercut elevation dependent on orebody geometry.

The sill of the grizzly level is currently placed 15 ft. below the undercut elevation and the haulage level is 75 ft. below the undercut. The levels are parallel and are sloped to provide a downhill haul for loaded trains at 0.4% grade to the shafts for hoisting.

Primary development starts with shaft sinking or deepening to a depth sufficient to allow loading facilities, spill handling facilities and sumps. Both types of levels require peripheral drifts surrounding the orebody. These are called fringe drifts on the grizzly level and haulage drifts on the haulage level. While these are being driven, support facilities are developed around the shafts.

When the haulage level development reaches an appropriate stage, panel drifts are started. These cross the ore body on 70 ft. centers and are centered below each half of each panel. Some of these are pull-through panels and some are back-in panels that are dead ended. Panel drifts are connected with vent crossovers at various places to facilitate ventilation and emergency access.

Concurrently with haulage panel development, panel drifts are driven on the grizzly level. These are driven across the orebody on 290 ft. centers to serve pairs of panels. A 10 ft. pillar is allowed over the drift.

All drifts through the orebody are concrete lined for maximum support. Most peripheral drifts have timber support. Ground support is varied to meet special conditions.

Secondary development, or block preparation, begins as soon as a sufficient amount of primary development is accomplished to allow access to the mining area.

On the haulage level, secondary development starts after the excavation of raise stations and installation of pony sets. These are spaced every 35 ft. along the drift, in conjunction with the grizzly drift spacing above. When the raise stations are completed, preparation is made for the drawing of ore by the installation of chutes and installation of trolley power for 20-ton haulage locomotives. Transfer raises are then driven and lined with armored cribbing. They are normally four-ft. square and are driven blind with a bell at the top.

When the raises are in, secondary development can begin on the mining level. Grizzly drifts are driven on 35 ft. centers at right angles to the panel drifts over the tops of the raises. Most of the broken rock falls down the raise, so very little mucking is required. Raise tops and grizzlies are installed as the drift proceeds. The drift is temporarily supported with wire mesh and rock bolts.

Next, the raise tops are formed and concreted. Permanent ground support of the drift is accomplished by placing forms in the drift starting from the far end and retreating outward to the panel drift. Windows are boxed in for a draw raise on each side of each grizzly. Grizzlies are spaced on 17.5 ft. centers. Concrete is placed behind the forms pneumatically and the forms are removed for reuse.

When several grizzly lines are driven, an access drift is driven parallel to the panel drift at the far end of the block. Rubber tired muckers are used to remove excavated rock. The access is formed and poured grizzly drift size. This drift provides ventilation connections and emergency access.

The next step is to drive the draw or finger raises. These are driven blind up to the undercut elevation, the muck dropping through the grizzly rails into the transfer raise. The grizzly drift is equipped with air, water and blasting lines, and guide rods for muck control boards. Sprays are installed under each grizzly for dust control.

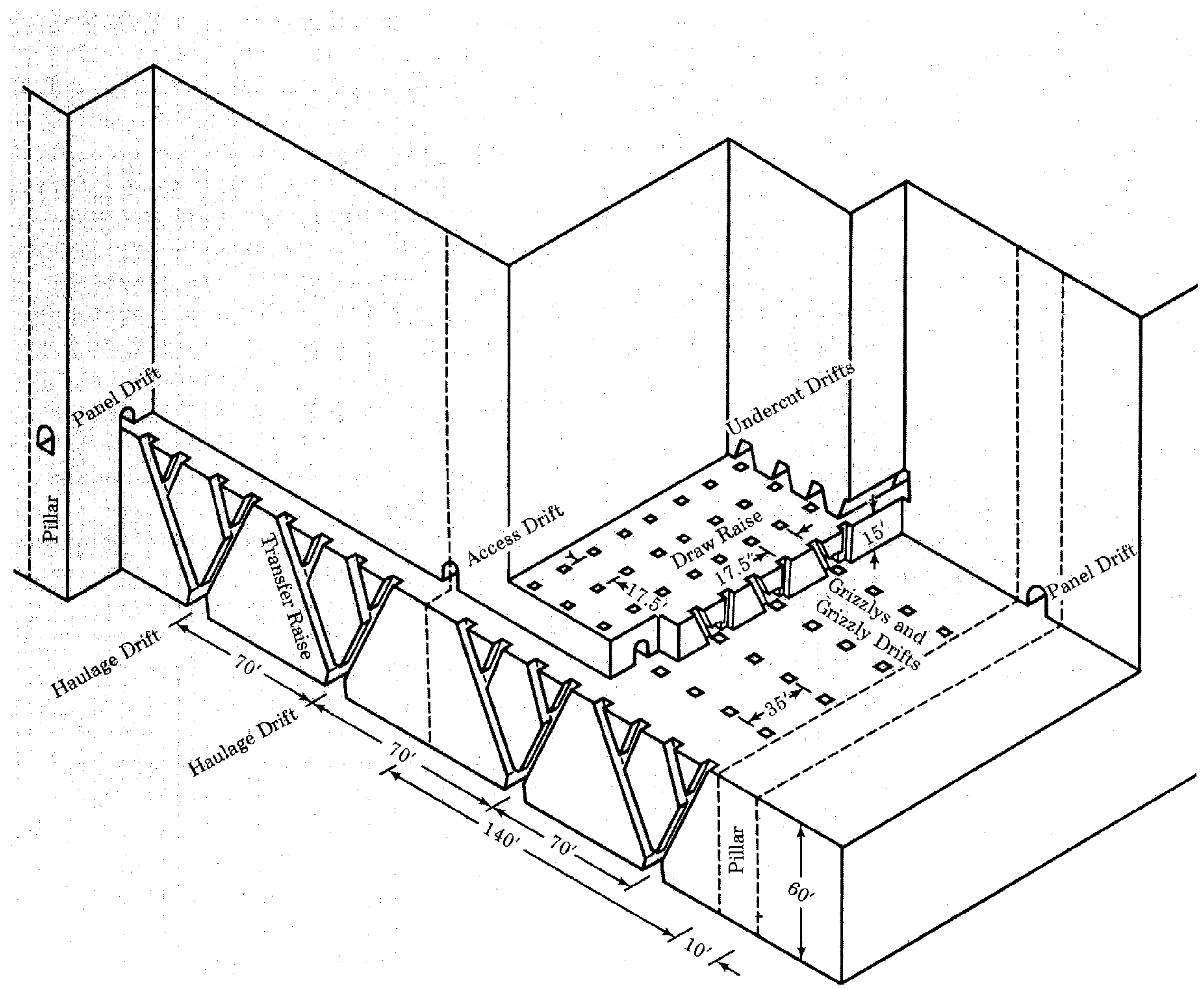
Two draw raises in every third line are equipped with ladders to provide access to the undercut. Please refer to page 21.

When undercutting above a draw point has been completed, production can begin. Muck is pulled from grizzly level draw points by means of several tools: bars, hooks and double jacks. The flow of rock is regulated by the control board, which is raised and lowered in front of the draw point. Boulders too large to fit between the grizzly rails (90# salvaged rail spaced at 14") must be sized with the double jack hammer before they will fall into the transfer raise.

When boulders in draw points hang up and stop the flow of muck, secondary blasting is required. Scheduled lunchtime and quitting time blasts are used to fragment boulders on the grizzly that are too large to be broken with a double jack.

Once the ore is in the transfer raise, it can be loaded into ore trains by car loaders on the haulage level. Car loaders, standing in pony sets above the panel drifts, load a train as it passes below. Chute doors are air-operated guillotine type undercut gates. Signal lights operated by pull bottles located in all pony sets provide a means of communication between car loaders and the motorman.

Once a train has been loaded, the muck is hauled to the #3 Shaft area, where it is dumped by either an ASEA or a rotary dump. Four production shafts hoist the ore to the surface. It is then run through a primary crusher and stored in bins, ready for transportation to the mill for processing.



Isometric Diagram of a Block

1″ = 80′

Production Control

Before secondary development is begun, cross sections through the orebody are diamond drilled by contract drillers under the direction of the Geology Department. Core is logged and assayed. This information, as well as drift sampling, mapping, experience factors, etc., are utilized to predict grade, production efficiency, extraction and weight problems.

Production Engineers, using this information, production requirements, and stope availability, assign quotas to the operating crews. These quotas are designed to maintain the desired production and grade for the mine and an optimum rate of draw from each area and draw point.

Various factors are involved in determining the desirable rate of draw. If not pulled fast enough, a draw point or area may take weight and cave. If pulled too fast, a draw point may pipe through to waste prematurely. Some areas contain too much oxide or too little recoverable copper and production may be curtailed here to maintain a relatively uniform grade for the mine output.

Quality control is effected by a sampling program which is basically computer-controlled and is another function of the Production Engineers.

Tonnage drawn from each draw point is tabulated daily by computers in the Data Processing Section. When the computer determines that sufficient tonnage, usually 200 tons, has been extracted from a given draw point since the last sample, it issues a sample card for that draw point.

When production records and assays indicate a stope is approaching depletion, regular sampling procedures are normally suspended. At this time, the production engineer initiates procedures which include close visual inspection of ore drawn and special sampling. The engineer manually orders samples on a much more frequent basis, perhaps daily, according to production pressures and the characteristics of each area.

Development drift samples are taken by the Geology Department while mapping the headings. Production area samples are taken by four full time samplers working a 5-day week, who are capable of taking more than 300 samples a day.

Samples are assayed at the plant site under the direction of the Quality Control Department.

Assaying is by atomic absorption and X-Ray fluorescence equipment which transmits results directly to the computer. The computer processes the data and can transmit results via teletype directly to those portions of the operation needing rapid analysis.

No. 1 Shaft

Depth: 2,829 ft. (for the Third Lift.)
Dimensions: 25′-5⅞″ x 6′ inside concrete.
Four compartments:
2 Hoisting, 6′-5½″ x 6′-0″.
1 Manway, 5′-0⅛″ x 6′-0″.
1 Service Cage, 5′-0″ x 6′-0″.
Ventilation downcast.
Structural steel sets in reinforced concrete.
Headframe: 100′-6″ to ℄ sheaves.
Two 12′ diameter steel sheaves with wear liners.
Skips: Two, 4-ton capacity each, in counterbalance, Kimberly type.
Hoists: Main Hoist, two 200-hp motors, double drum.
Rope speed = 800 fpm, with Lebus wind.
Rope size = 1⅛″.
Service Hoist: single drum, 200-hp.
Rope speed = 545 fpm.
Rope size = 1″.
This shaft is used to hoist rock from the development headings. The manway compartment contains pump discharge columns and power transmission lines. The service compartment has one pump line and three 8-in. heavy-duty pipes for passing concrete from the automated concrete batching plant at the collar of the shaft to the underground mining levels.

3A-3B Shafts

Twin ore hoist shafts.
Depth 3A: 3,680′ by Dec., 1985
Depth 3B: 2,950′ by Dec., 1981 (for third lift)
Dimensions: 29′ x 7′ inside concrete.
Four compartments, each 6′-6″ x 7′-0″.
Ventilation exhaust shafts, 195′ apart.
Structural steel sets in reinforced concrete for smooth lining. Reinforced concrete curtain walls between each compartment, with 3′-7½″ x 4′ windows in each set.
In each of the two hoisting compartments, structural tubing guides are of Corten steel. These guides are supported every 6 ft.
Timber guides in service compartment are supported every 6 ft.
Headframe: 181′ to ℄ sheaves.
14′ diameter cast steel sheaves.
Coarse Ore Bins:
Diameter: 60′
Height: 66′-6″; top of bin 92′ above collar.
Capacity: 750 tons total.
Loading Gates: 2 on each track per bin, air operated. 2 loading tracks.

3A-3B Shafts, continued

Fine Ore Bins:
Diameter: 65′
Height: 81′-6″; top of bin 107′ above collar.
Capacity: 10,000 tons total.
Loading Gates: 6 on each track per bin, air operated. On same two tracks as coarse ore bins.
Loading Pockets: Two in 3A, one below 2075 Level; one below 2675 Level, capacity = 1,500 tons. One in 3B below 2075 Level, capacity = 1,500 tons.
Skips: Bottom-dump Corten steel skips, with alloy steel liners and impact railmat, running on solid rubber tires.
Capacity: 23 tons with ± 4.0% moisture.
Dimensions: 35′-5″ long, 6′-1″ wide, 6′-3″ deep.
Weight: 30,000 lbs. (Approximate)
Automation: Skip loading and hoisting are fully automated. Skip loading and dumping are viewed on closed circuit television, and the car dumping and hoisting systems are monitored on a control panel.

Hoists: Double drum with Lebus wind; automatic or manual operation; 15′ diameter drums having a 109″ face, spooling 4,700 ft. of 2¼″ rope in two layers.
Drum Shaft: 27″ diameter through drums.
Hoisting Speed: 2,800 fpm.
Two 3,000-hp DC motors equipped with MG set consisting of one 4,000-hp motor and two 2,500 KW DC generators. Steel plate flywheel, 44 tons (approximate) for 80% power peak equalization.
Service hoists are equipped with an 18-passenger cage and 45 cubic ft. skip combination with solid rubber tires running on timber guides. Hoisting ropes are 1″ at 3A and 1⅛″ at 3B. The cage and skip are counterbalanced by an 8,400-lb. counterweight in the shaft manway.
Primary Crusher: The 460′ x 50′ crusher building houses four 42-65 gyratory crushers. There are four 96″ x 62′-0″ pan feeders, with a capacity of 1,500 tons per hour; one fed from the 3A, one from the 3B, one from the 3C and the other from the 3D coarse ore bins. At 3A and 3B, 48″ conveyor belts transfer the crushed ore from the crusher building to transfer towers (222′) and back to the fine ore bins (421′).

3C-3D Shafts

Identical ore hoisting shafts, 3C is 195 ft. north of 3A; 3D is 195 ft. south of 3B. Height of the headframes is 200 feet.

Depth: 3C = 2,890 ft. The sinking and furnishing of this shaft was completed April 12, 1971. Hoisting from 3C started in August, 1971.
3D = 3,740 ft. Shaft sinking is complete.

Dimensions: 22′-0″ inside diameter, circular, concreted.
Two ore hoisting compartments, service cage, manway and pipe compartments.

Ventilation exhaust shafts.

Steel box-section Corten guides supported every 12 ft. in hoisting compartment.

Douglas fir timber guides in service compartment supported every 6 ft.

Headframe: Structural box members of Corten steel.
15′ diameter fabricated steel sheaves.

Loading Pockets: Two in 3C: one below 2375 level with 800-ton capacity, one below 2675 level with 1,500-ton capacity, both for ASEA trains.
One in 3D below 2375 level, capacity = 1,500 tons.

Skips: Bottom-dump Corten steel skips, impact railmat alloy steel liners, with solid rubber tires running on Corten steel box-section guides.
Capacity: 29 tons.
Dimensions: Length, 37′-4½″; Width, 6′-8″; Depth 6′-3½″; Weight, 30,860 lbs.

Automation: Same as 3A-3B.

Hoists: Double drum with Lebus wind; automatic or manual operation, 15′ diameter drums having a 109″ face, spooling 2¼″ wire rope.
Hoisting Speed: 2,800 fpm.
Each hoist has two 3,500-hp DC motors powered from a MG set consisting of one 6,000-hp 514 rpm synchronous motor driving two 2,800 KW generators. MG set has no flywheel.

3C Service Hoist: Single drum, manually operated, powered by a 250-hp DC motor capable of handling an 8,000-lb. load at a depth of 3,600 ft. Adjustable DC voltage for driving the hoist motor will be supplied by silicomatic I-power conversion equipment converting AC to DC power through silicon control rectifier cells. Speed is 800 fpm. Rope size is 1″.

3C-3D Shafts, continued

Primary Crusher: At 3C and 3D, 48″ conveyor belts transfer the crushed ore from the crusher building to transfer towers (169′) and back to the fine ore bins (365′). Skip dumping, fine ore bin capacity and transfer belts are viewed on closed circuit television. The entire automated crusher is monitored from control panels at each crusher location.

No. 4 Shaft

Depth: 2,729 ft.

Dimensions: 26′-6″ x 14′. Structural steel sets are poured in concrete for smooth lining.

Two cage compartments, each 14′ x 8′; two rounded end compartments for manway, pipes, electric cables and ventilation. Manway compartment also contains the main compressed air line supplying the mine.

Man and supply shaft, and downcast ventilation.

Cages: 2 decks, 50 men per deck.
Inside dimensions: 6′-9½″ x 13′-6″.
Rated Capacities: 20,000 lbs. supplies per deck.
12,000 lbs. men per deck.
Cage Weight: 24,000 lbs. (approximate).

Headframe: 109′ to ℄ sheaves.
Two 14′ cast steel sheaves.

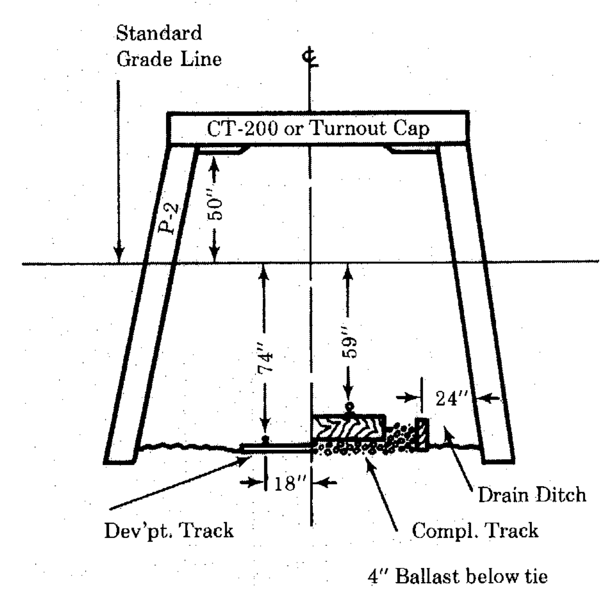
Hoist: Double drum.
15′ diameter, 90″ face drums.
2¼″ hoisting rope.
Maximum hoisting speed: 1,500 fpm.
Single reduction drive, two 700-hp DC motors equipped with MG set consisting of one 1,750-hp AC motor and two 600-KW DC generators. Hoisthouse equipped with 30-ton crane, with 5-ton auxiliary.

No. 5 Shaft

Lining: 24" thick reinforced concrete lining.
Depth: 4,123 ft.
Dimensions: 25 ft. diameter inside the concrete line.
Of the four hoisting compartments, two are used for handling men and supplies, and two are used for hoisting waste rock. The shaft has compartments for manway, pipe lines, electric cables, and concrete transportation lines.
Man and supply shaft, downcast ventilation.
Hoists: Double drum production hoist powered by one 1,000-hp DC motor.
9' diameter, 103.5" face.
1⅜" hoisting rope.
Hoist speed: 1,925 fpm.
Skip capacity: 5.5 tons.
A static rectifier rated at 1,000 KW supplies power to the production hoist motor.

Service Hoist: Double drum service hoist (for men and materials), powered by two DC motors, each having 1,000-hp.
15' diameter, 105" face.
2⅛" rope.
Hoist speed: 1,856 fpm.
Man cage: Similar to that at No. 4 Shaft.
Headframe: 157 ft.

Haulage Level Primary Development Drifts



Timber

Posts: 12" x 12" x 10'-4"
Caps: 12" x 12" x 11'.
Sets on 5' centers.
Crews: Single Heading—2 men.
Two Headings—4 men.
64 holes drilled per set.
75 lbs. ± Aquagel 1¼" x 12" sticks. Initiated by electric blasting caps 0 to 12 delay.
Inside Cross Section Area: 87.5 sq. ft.

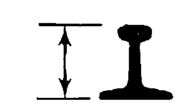
Main lines running from the orebody to the dumps are generally timbered. Ladder drifts are turnouts connecting panel drifts to the main haulage lines.

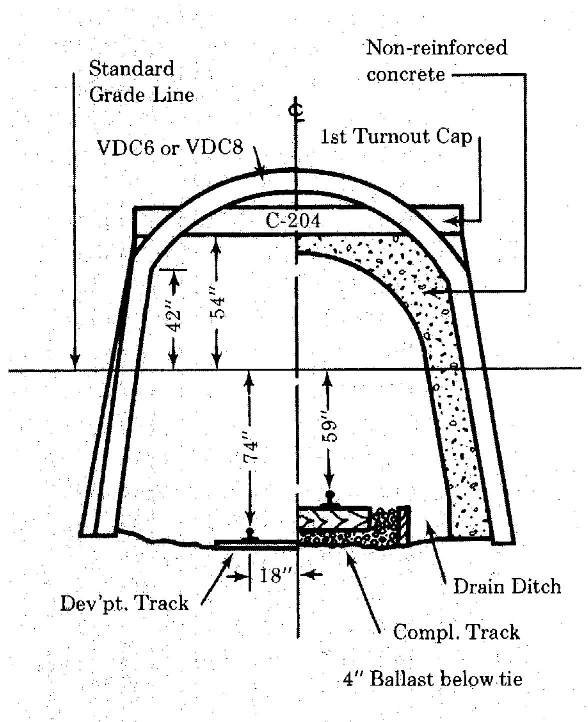
TRACK

Haulage Drift:
45# rail for Development.
90# rail finished track.

Ladder Drift:
If 75# rail is used, 65" is the grade.
45# rail for Development.
75# rail finished track.

Rail Measurements:
3¾" for 45# rail.
4-13/16" for 75# rail.
5⅝" for 90# rail.





Concrete

4" or 6" W.F. arch caps and 9'-6" posts for initial ground support.
Sets on 5' centers.
Crews same as Timber Haulage Drift.
Initial Ground Support: 6" Steel Set VDC-6 or 8" Steel Set VDC-8

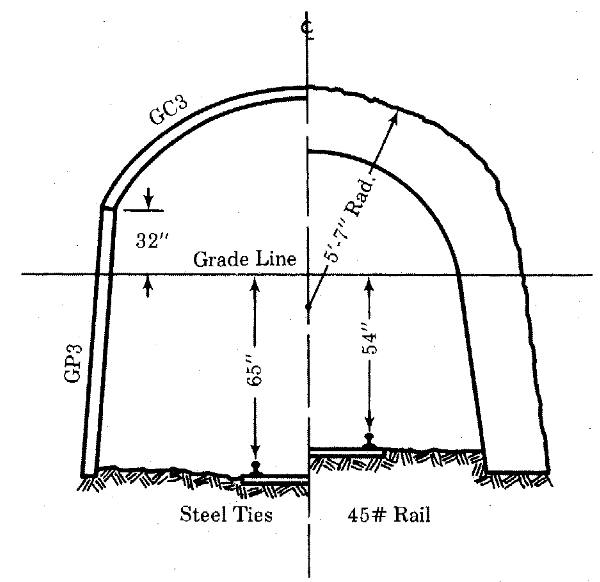
Cross Section Area
Inside Concrete: 84 sq. ft.

Drifts through less competent ground are concreted for additional support. Panel drifts, which run through the orebody, are concreted.

TRACK

Same as for timber drifts.

Grizzly Level Primary Development Drifts

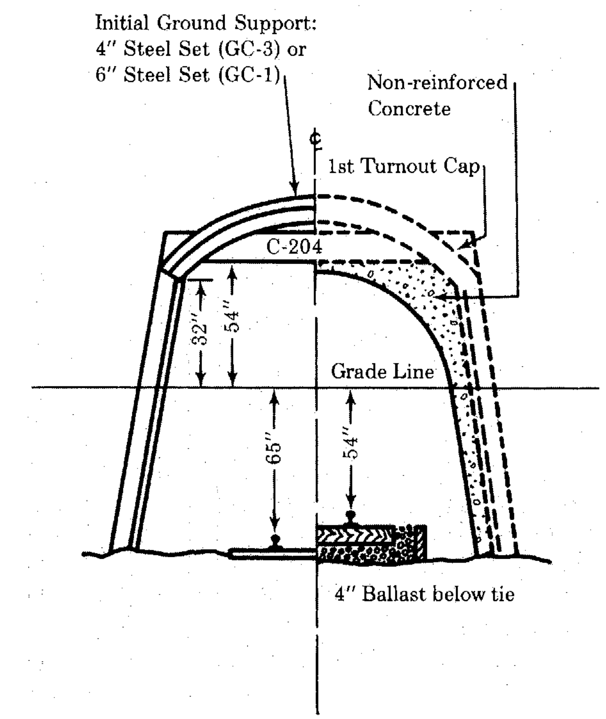


Concrete Panel Drift

Excavation only:
Rock bolts and steel straps GC-3, GP-3 are used as pre-concrete support.
Size: 10'-3" x 9'-1".
Each round marked on face by Boss.

Cross Section Area
Inside Concrete: 62 sq. ft.

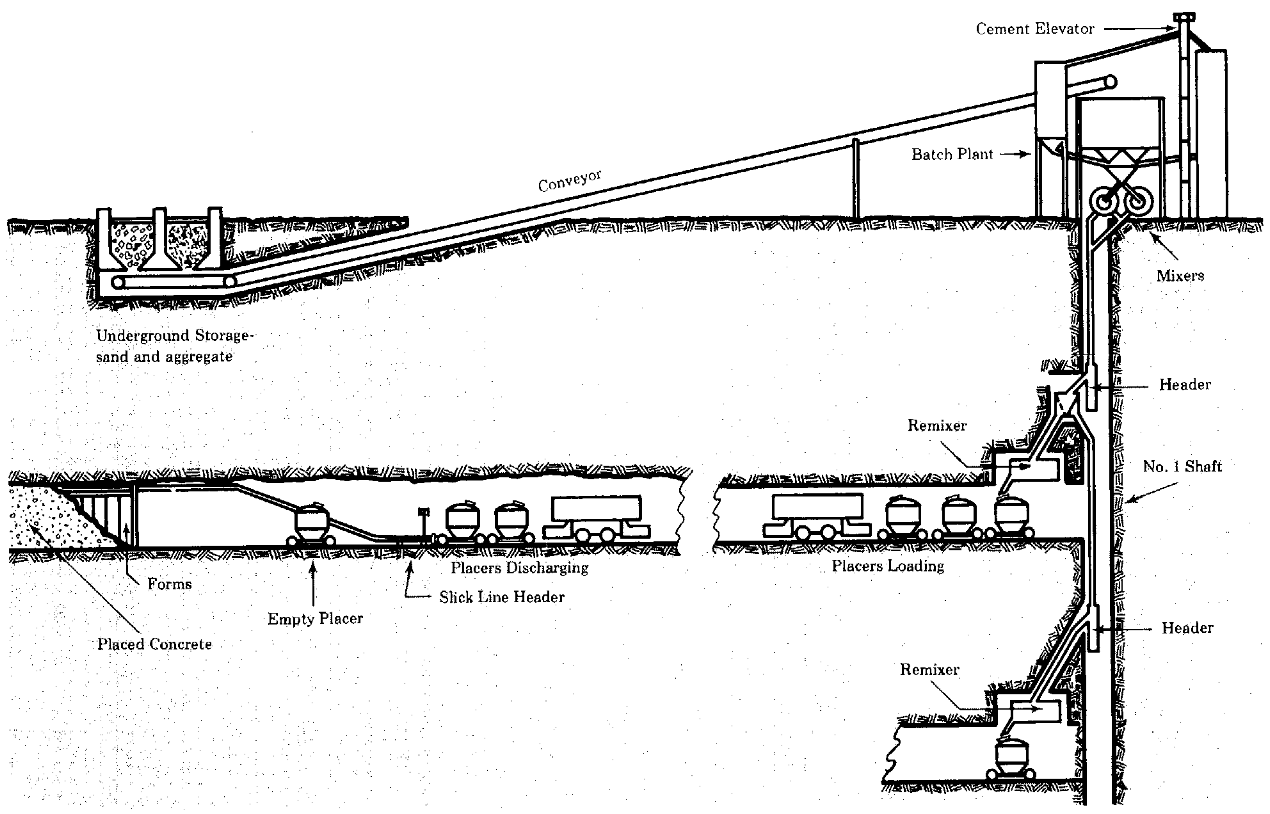
Two-Man crews, or 4 men in two headings.
44-48 holes drilled 6' deep.
50 lbs. Aquagel per round. Initiated by electric blasting caps 0 to 12 delay.
Ventilation with fans and tubing.



Concrete Fringe Drift

45# rail and steel ties for Development and Finished Track.

Cross Section Area
Inside Concrete: 72.5 sq. ft.



Concrete

In November, 1964, the surface mixing and underground distribution operations were automated. The operation of the batch plant, including the diversion of the concrete to the various levels, is entirely controlled by one man located in a central monitoring station on the surface. The aggregate is moved from underground storage bins to the batch plant by conveyor belt. Truck-delivered bulk air-entraining cement is transferred from the truck by pneumatic elevator into either the 500-bbl. or 800-bbl. cement silo. Mixers are 1¼ cubic yard double compartment. Mixwater is chilled to 48°-55° by a refrigeration plant in the summer. Dispersing and retarding agents are added with the mix water. Mixers discharge through a screened hopper into 8″ heavy-duty pipes suspended in No. 1 Shaft. Concrete discharges through a header into remixers on the various levels, which fill 2.5-cubic yard portable placers. The placers discharge pneumatically through a header and 6″ slick line behind plywood or steel forms.

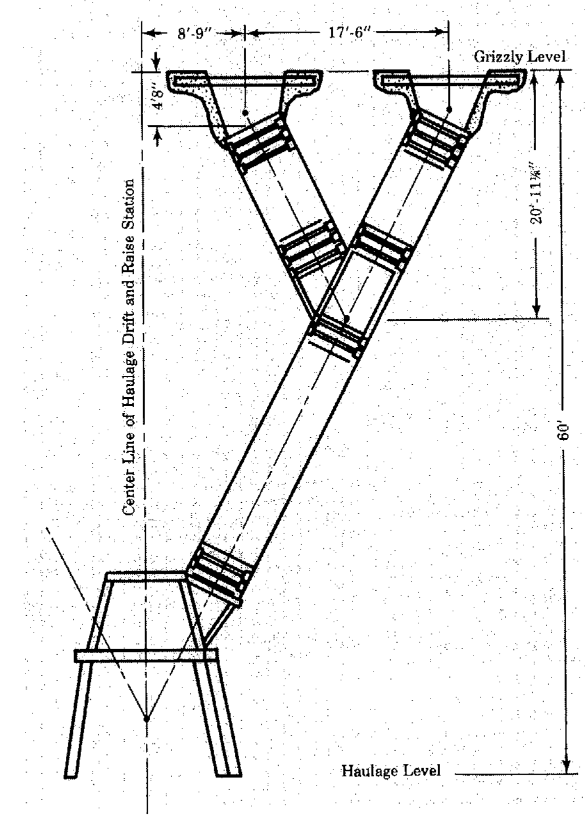
From 6,000 to 8,000 cubic yards of concrete per month are poured on a three-shift-per-day, seven-day-per-week basis. Forming is also done on three shifts, seven days per week.

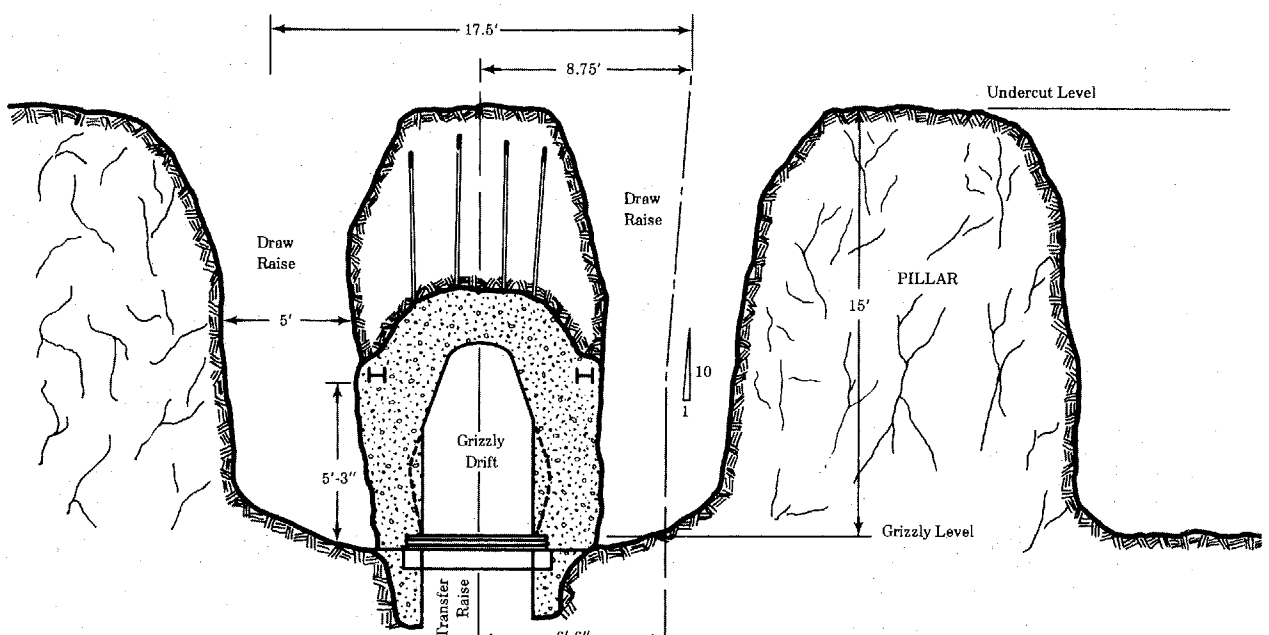
Transfer Raises

4′ x 4′ inside.
Lining: 6″ x 8″ cribbing, armored with 3″ x 4″ x 3/16″ steel angles and "T"-irons.
Inclination: 63°
Length: 48′
Crews: 2-man crews advance two raises at once, using 3″ stopers. 14 holes drilled 5′ deep; 25 lbs. 1¼″ x 12″ sticks of Aquagel, detonated with electric caps. Ventilation with compressed air.

Transfer raise stations are cut by a special raise station crew using the same equipment listed for primary development headings.

Raise stations are steel pony sets on top of special drift sets. They are installed after the drift is concreted.





Grizzly Drifts

Excavation only; 8'-4" x 8'-0" between draw points: 9'-6" x 8'-0" at draw points.
Rock bolts and wire mesh used for pre-concrete support.
Size: 5' wide, 6¾' high finished drift with concrete reinforced at the draw points only.
2-man crews used. 13 to 21 holes drilled 6' deep. 50 lbs. 1" x 12" Amogel per round; electric primer blasted. Drilling is done with Jackleg. Ventilation with air mover.

Draw Raises

Size: 5' minimum diameter, unlined.
Length: 15'-0" above grizzly. Driven after grizzly drift is concreted.
Crews: 2-man crew drives several raises at once. 11 to 24 holes drilled 4' to 6' deep. 50 lbs. explosive; electric caps; electrically blasted.

Undercut Procedure

Undercut drifts are 5' x 7' timbered with 6" round posts and 6" x 8" caps. These drifts are driven over the tops of all the draw raises, 15 ft. above the grizzly drift floor at right angles to the grizzly drifts. Access undercut drifts are driven parallel to the grizzly drifts over the tops of the northernmost and southernmost draw raises. Undercut pillar work usually begins before the drifts are all completed to prevent excessive drift repair and maintenance.

Undercutting can start at any position in the block, but usually is begun against an older caved block and retreats to a solid corner or corners.

Undercut pillar crews start the cave by drilling and blasting out a pillar between drifts or at a boundary of the block. The pillar crews retreat away from this initial cave, breaking the ground into the caved area. Before each pillar is blasted, the drift is widened on one side about four ft. and timbered if necessary. The remaining pillar, about 8 ft. thick, is drilled out to a height of 13 ft. above the floor of the undercut, and the pillar and widened drift are shot.

The timber is drilled with wood augers and shot with the undercut round. Generally, a 15 ft. section along the drift length is taken with each blast (from one draw raise to the next). Care is taken to insure that the pillar is completely broken by drawing off sufficient broken muck to observe the effect of the blast before the next adjoining pillar is shot. Millisecond delay electric caps are used in pillar blasting, and are wired in series—parallel, with not more than 25 primers in any one series. Circuits are tested with a galvanometer before being connected to the power source. All blasting lines go through an interrupter switch and from this switch to the main pillar blasting switch, which is a completely independent circuit.

Timber:
- Round posts and 6" x 8" caps with 6" x 8" stringers or sills over raise tops.
- 2" x 12" side and back lagging.
- Raise tops temporarily covered with 2" lagging.

Crews:
- 2-man crews drill 10 to 18 jackleg holes, and 20 to 30 stoper holes per shift, depending on draw raise spacing and ground condition. Undercutting proceeds on a 3-shift, 6-day per week basis.
- In blasting 60% Amogel Explosive in 1" x 12" stick is used with millisecond electric blasting.

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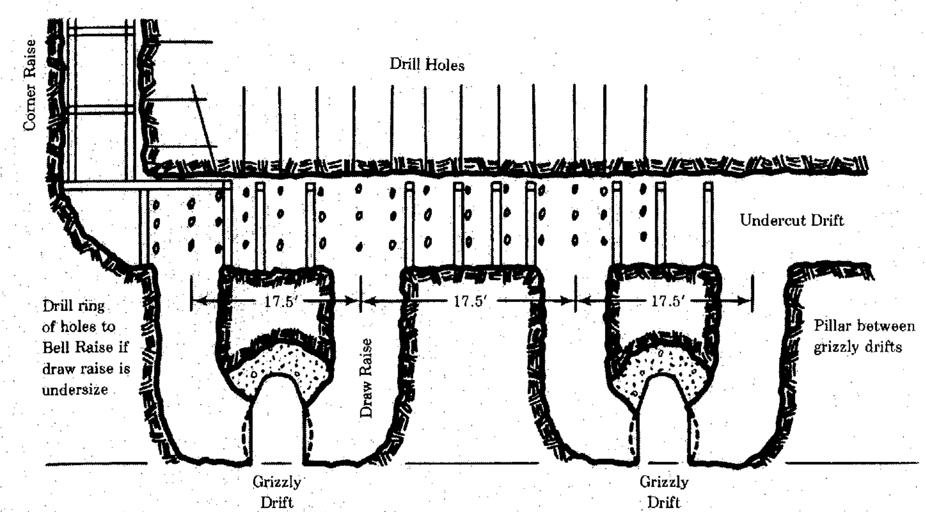
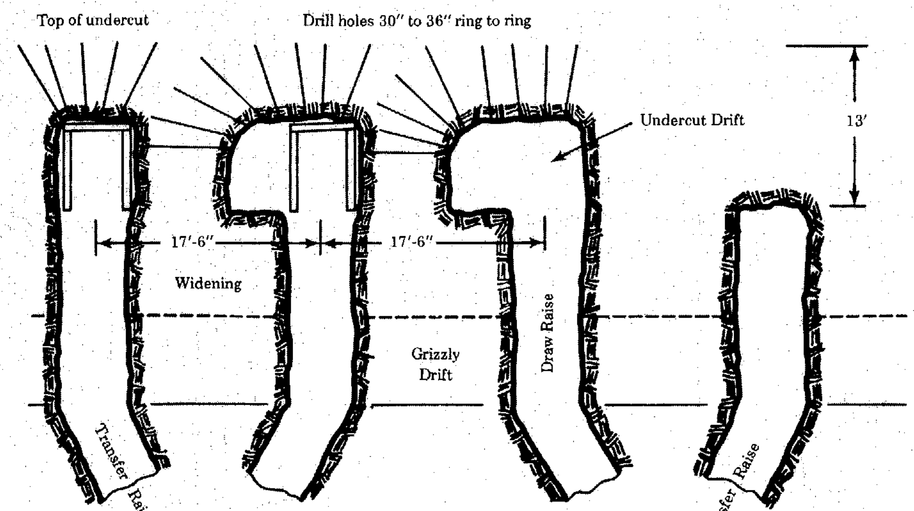
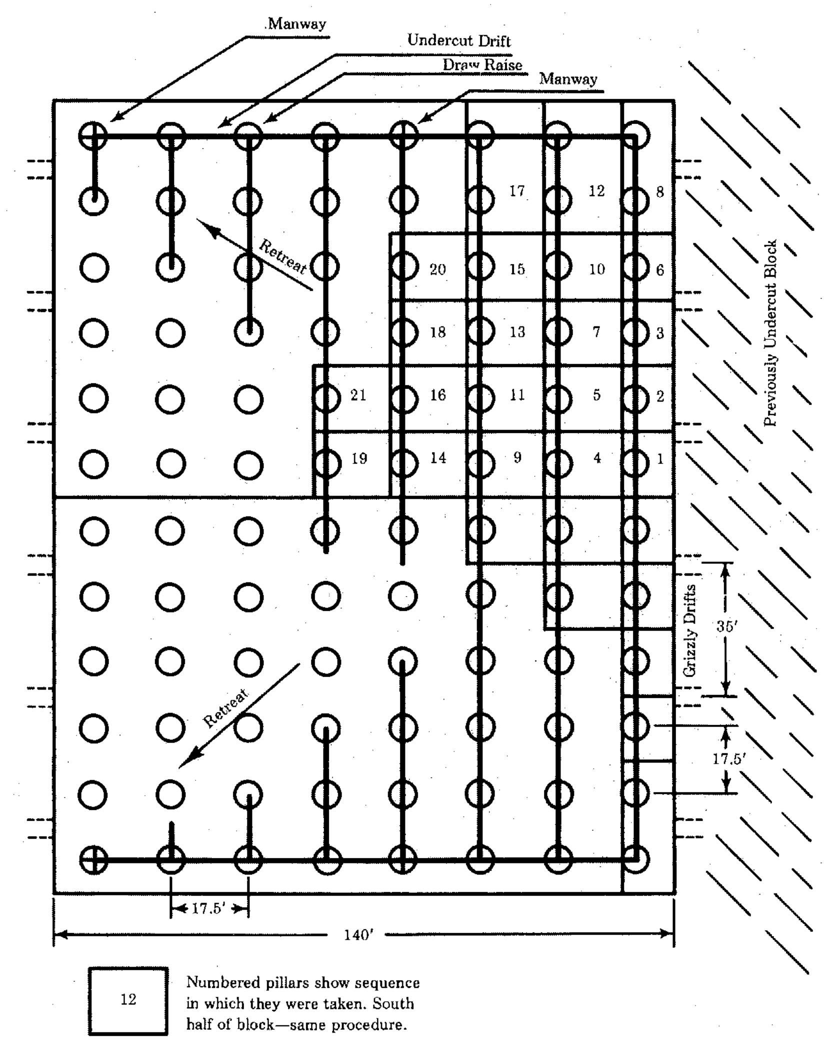


North-South Section (Alongside boundary)



East-West Section (Across any intermediate line of draw raises)

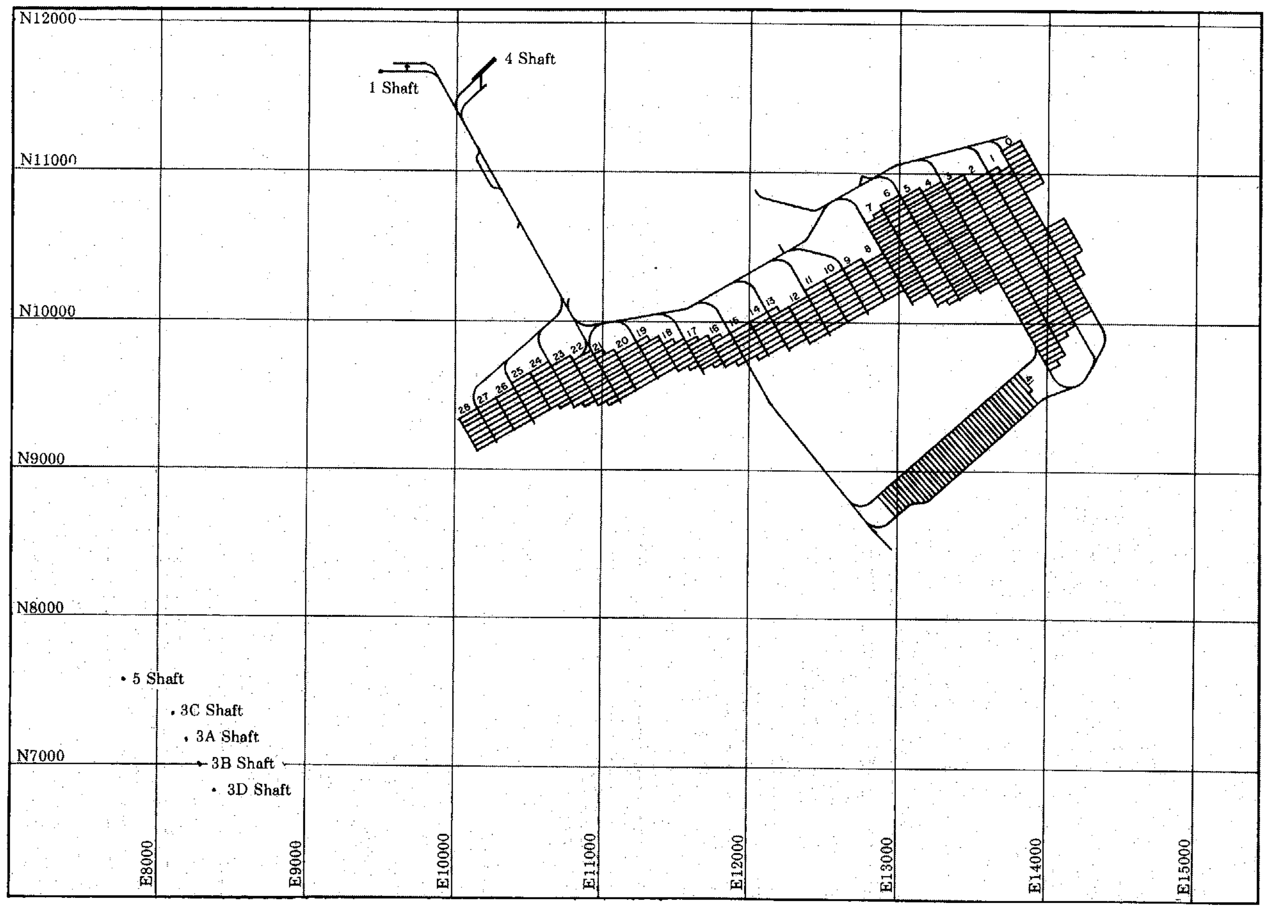
Undercut Procedure



Progression of Undercutting

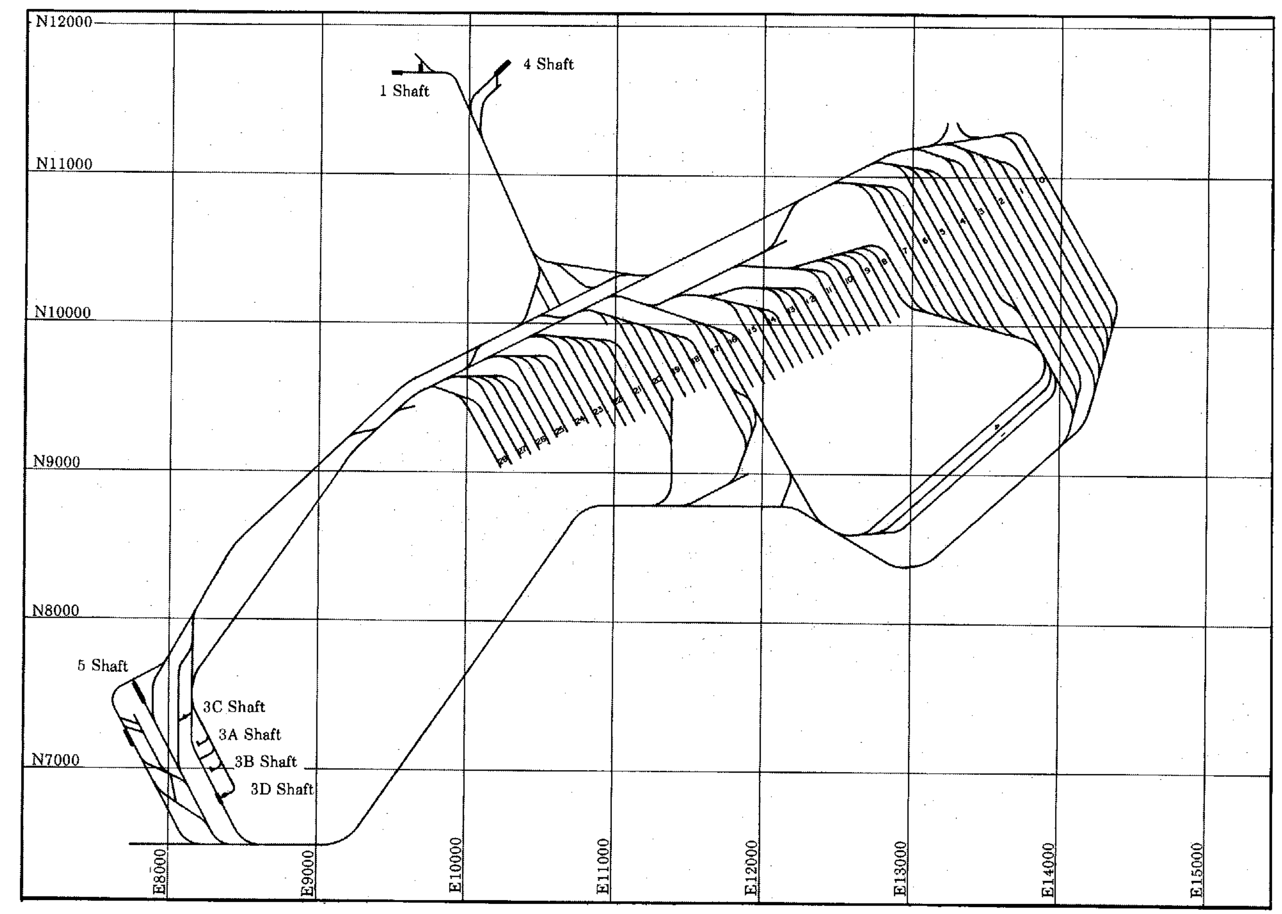
Typical Block

23



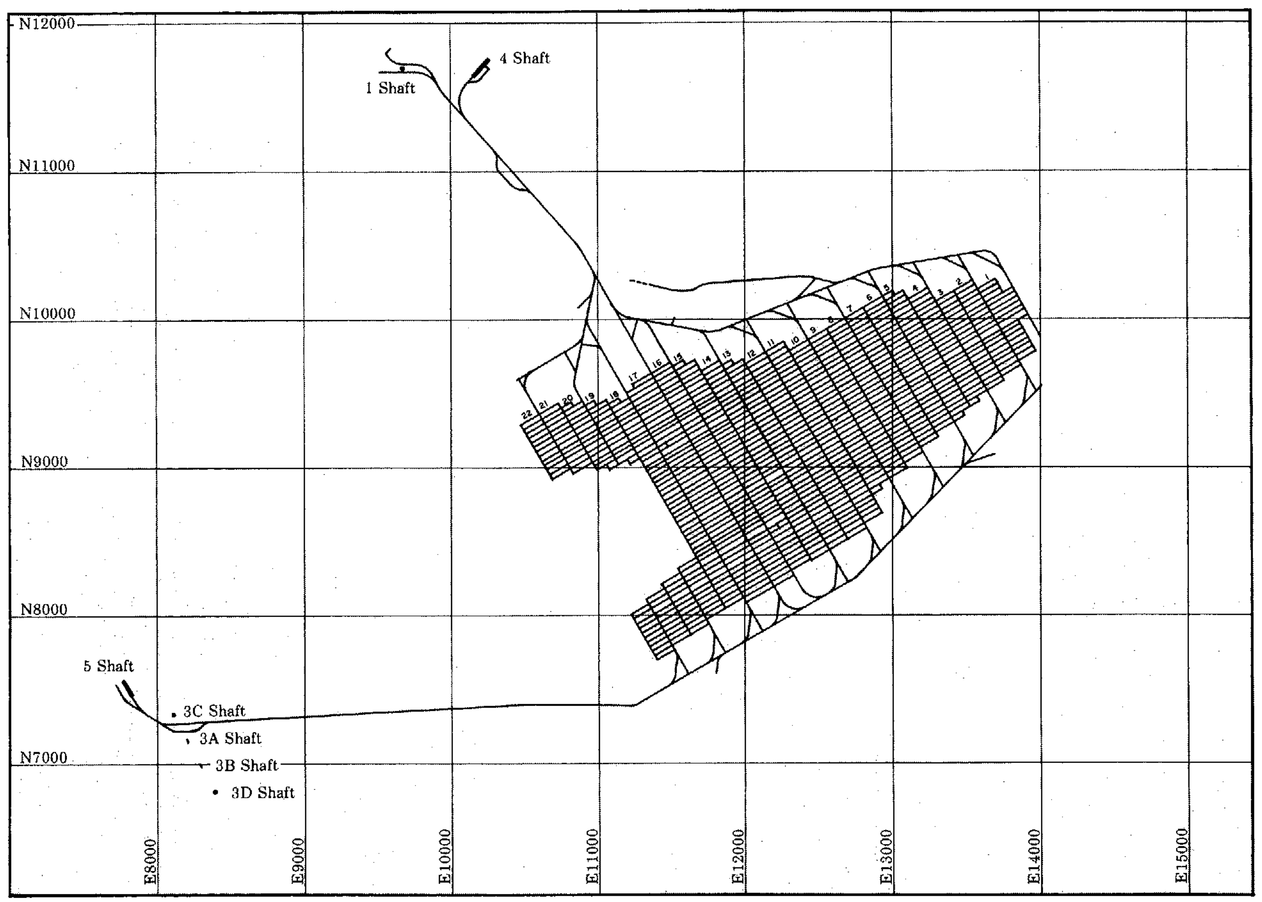
Plan-2315 Grizzly Level

1″ = 1200′



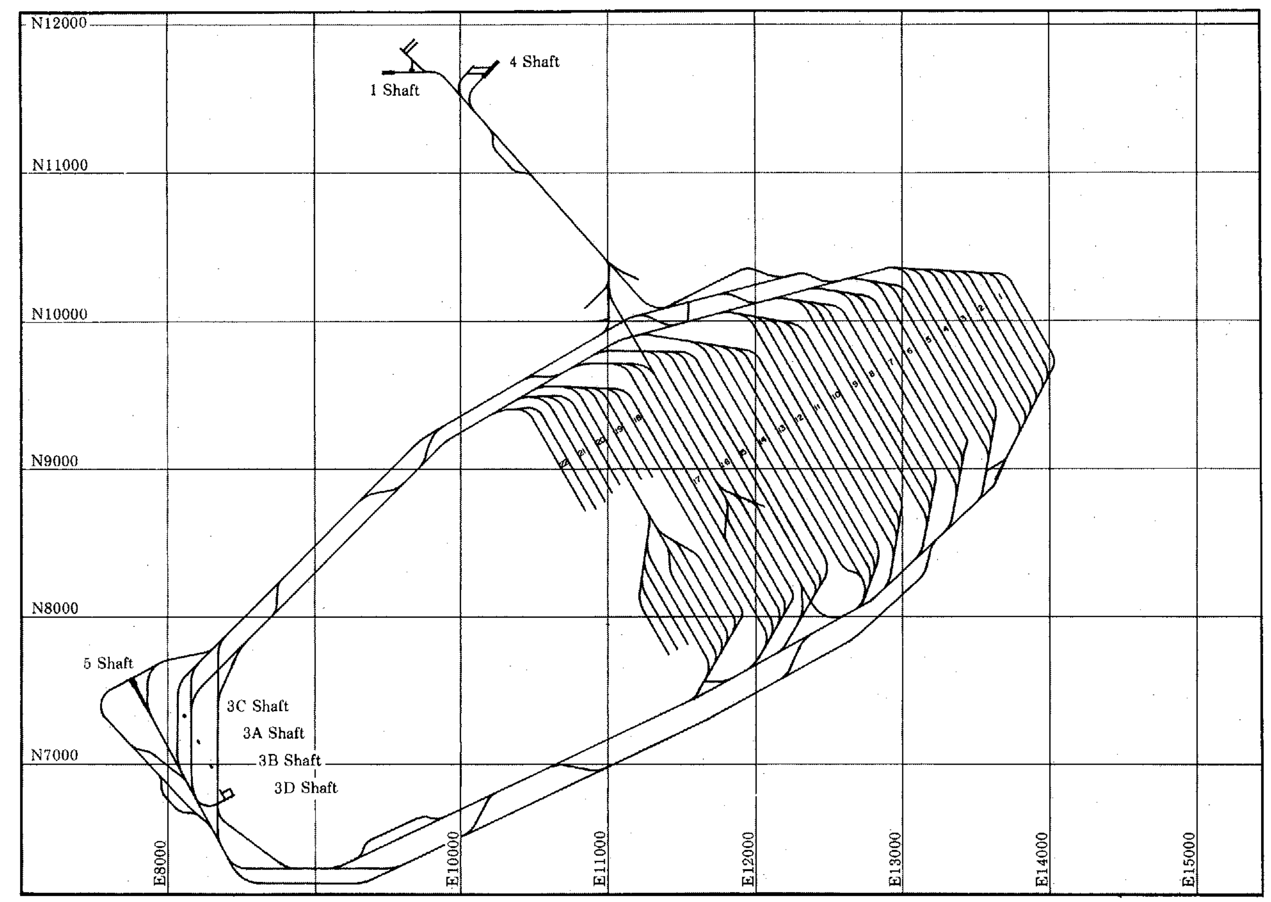
Plan-2375 Haulage Level

1″ = 1200′



Plan-2615 Grizzly Level

1″ = 1200′



Plan-2675 Haulage Level

1″ = 1200′

General Mine Operating Data

Operating Shifts per Day	3
Operating Days per Week	7
Operating Days per Year (9 holidays)	356
Production per Day, Tons	64,000
Production per Year, Tons	22,784,000
Active Undercut Area, Sq. Ft.	446,000
Draw Point Spacing: 17.5′ East-West x 17.5′ North-South	
Block Dimensional Data:	
Block Width	140′ or 210′
Block Length	105′-385′
Present Average Block	140′ wide x 210′ long
Ore Height above Undercut Floor	100′-700′
Draw Points (Average per Month):	
Active	1,775
High Pack	50
Held for Repair	150
Held for Grade	70
Total Draw Points	2,045

Mining Equipment

Big drifts utilize 2 and 3-boom remote control jumbos. The jumbos are outfitted with 8′ booms and 3′ pneumatically powered drifters with 6′ feed shells. The booms are hydraulically operated and are powered by two 1¾ gpm, 11,000 psi hydro-pumps that feed into a hydraulic manifold.

Mucking is done by an overshot rocker shovel with a steel flight conveyor dumping into 10-ton development cars. The cars are trammed to and from the work area by 8-ton, 40-hp (or 9-ton, 40-hp) storage battery locomotives.

Smaller headings use muffled feedleg drills mounted on 2′ or 4′ telescopic air legs. Vertical and inclined raise excavations utilize stoper drills. Mucking in smaller headings is done by a rubber tired 1-yd. hopper type pneumatically powered mucker.

Explosives Used

Primary Blasting (Development)

Carbamite P: For dry headings, blown in hole. One stick of powder in hole bottom or booster on electric blasting cap ensures detonation, 0-12 delay.

Aquagel: 1¼″ x 12″ with primer initiated by electric blasting caps 0-12 delay. Used in dry headings.

Amogel: For hard ground, wet headings. Stick form, initiated by e.b.c. 0-12 delay.

Detagel: Stick form, used in transfer raises. Less gas produced. Initiated by e.b.c.

Blasting in large headings is unscheduled. All other development blasting is done at the middle and end of each shift.

Secondary Blasting (Production)

On the draw level ½-lb. bags of Kinepac or Nipack are initiated with zero delay blasting caps. These are connected by a trunk line to a central underground location where blasting switches are located. Blasting is done at the middle and end of each shift.

Transfer raise hangups are blasted with stick powder during the shift. Detonating cord, laced through the powder, is placed up the raise and initiated with a safety fuse.

Rotary Car Dumps

In the dumping cycle the motorman pulls through the dump and spots three cars in the dumper without uncoupling. Car stops raise and lock the train in position. The motorman activates the dumper which rotates 180° and returns to the upright position. Three cars are dumped in about one minute, or five minutes per train of 15 cars. Development cars are designed to fit the dumper, but because of their length and type of coupling, they must be uncoupled to dump. Traffic can flow in both directions through a rotary dump, but dumping is done in one direction only.

ASEA Car Dumps

ASEA cars dump while in motion over the ore pocket. The locomotive and cars are designed to ride along the rollers of the unloading station while the opening of the car bottoms is controlled by a stationary guide bar. ASEA trains can be dumped in either direction in the time it takes to ride through the dump (approximately one minute).

General Mine Operating Data continued

Development Car Dumps

Two types of development car dumps are presently in use at the mine: (1) Welkom cars dump automatically while in motion by means of an inverted camel-back which tips the cars, allowing rock to be discharged; (2) bottom dump cars are parked over the dump and emptied by a tripper mechanism which opens the doors.

Underground Haulage Data

Haulage locomotives are 23-ton, 4-wheel trolley type, powered by two 125-hp, 275-volt DC motors. ASEA locos haul ten 15-17 ton working load cars while rotary dump locos haul fifteen 12-13 ton working load cars.

Rotary ore cars are 300 cu. ft., 15-ton box-type with one stationary and one rotating coupling.

ASEA cars are 350 cu. ft. 18-ton box-type. A fifth wheel on the car rides along the guide bar during dumping. Lips of adjacent cars are designed to overlap. This helps prevent spillage during loading.

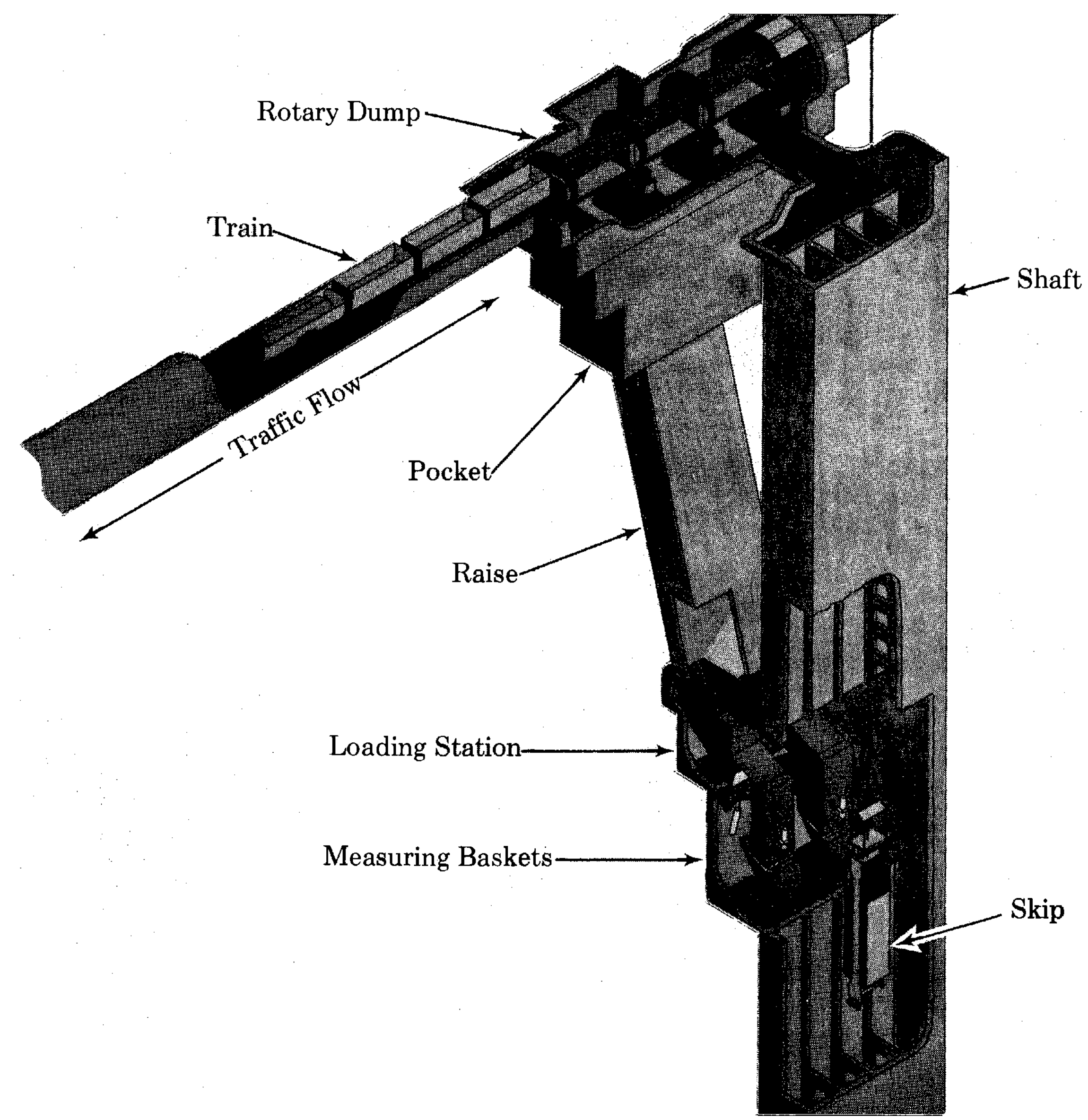
Length center to center of coupling:
- Rotary—17′-6″
- ASEA—17′-9″

Width, overall:
- Rotary—6′0″
- ASEA—6′7″

Height above track:
- Rotary—5′6″
- ASEA—6′2″

Couplers:
- Rotary—rotary and non-rotary coupler equipped with rubber cushioned draft gear.
- ASEA—couplers are self-centering spherical horn type, rubber cushioned.

Track gauge: 36″



Car Dumps

Monitoring System

Because of the extent of the underground operation, vital remote equipment which cannot be effectively tended are monitored from one central location. This will allow developing problems to be detected quickly so that corrective action can be taken.

The system displays the continuing status of all major switchgear, rectifiers, pumps and ventilation fans. Underground air flows and gas level monitoring provides information for fire prevention. Data on compressed air pressures and water flows helps in regulation and efficient use of these systems.

The monitoring system is computerized. Equipment status is displayed by indicating lights on a 288 ft.^{2} graphic panel.

Ventilation and Cooling

In general, air is brought in on grizzly levels, drawn down transfer raises and exhausted from haulage levels.

Intakes:	#1 Shaft	165,000 cfm
	#4 Shaft	425,000 cfm
	#5 Shaft	625,000 cfm
	Compressed Air	40,000 cfm
Exhausts:	#3A Shaft	265,000 cfm
	#3B Shaft	110,000 cfm
	#3C Shaft	470,000 cfm
	#3D Shaft	410,000 cfm
Level Intakes:	2015-2075	410,000 cfm
	2315-2375	350,000 cfm
	2615-2675	260,000 cfm
	Sublevels and Compressed Air	135,000 cfm
Main Fans:	2015-450 hp, Vent Crosscut supplying 2315; 1-450 hp at 5 Shaft; 2-60 hp, Main Crosscut (MXC)	
	2315-200 hp, MXC	
	2615-200 hp, MXC	
	2675-450 hp, MXC supplying 2615.200-hp fans are 60", 1,160 rpm. 450 hp fans are 72", 1,160 rpm.	

Auxiliary Ventilation

Block ventilation is handled by 20-hp, large-volume, low-pressure, low-speed fans. Individual working places and development headings are supplied with 10 hp and 20 hp high-pressure, high-speed fans. Individual ventilation is provided by venturi type air movers. 60 hp fans are used to supplement the main fans in problem areas.

Cooling for specific development headings is provided by 50-ton spot coolers. The production areas on the 2615 level are cooled by a refrigeration system in which chilled water is circulated to a coil drift. There, air is pushed through coils and cooled before being sent into the working areas.

Drainage

Newly opened areas show an appreciable flow of water which is carried out of the working area by air-operated sump pumps, with a capacity of 150 gpm at 100′ head. Mine underground was planned so that water drains either to No. 1 Shaft or to 3A and 3B Shafts.

Mine Water = 7,000 gpm, principally from the shaft bottoms and the third lift.

Mine water is pumped approximately eight miles to the Plant site for use as Mill water.

Potable water is pumped from San Pedro wells to the Mine for domestic use.

Mine Power

Power is supplied to the Mine No. 3 Hoist Area Substation at 115 Kv from the Plant Substation over a feeder approximately 6.5 miles long. The Mine feeder conductors are 795 MCM ACSR with a current carrying capacity of 900 amps.

The No. 3 Hoist Area Substation Main Transformer is rated at 50/66.5 MVA, 115/46 Kv, 3-phase. This transformer supplies the 46 Kv bus at the Substation and the feeder to the No. 1 and No. 4 Shaft Area located approximately one mile away. The 46 Kv bus at the No. 3 Hoist Area Substation supplies several banks of single phase 46/2.4 Kv., 2,500 Kva and 7,500 Kva transformers for all surface and underground power requirements in this area.

The 46 Kv feeder to the No. 1 and 4 Shaft Area feeds three secondary substations supplying all surface and underground requirements. These include No. 1 and No. 4 hoists, compressor building and all service requirements.

Compressed Air

Delivering 110 lbs. air pressure for approximately 100 psi mine working pressure.

No. 4 Compressor House:
- Five 3,500 cfm compressors, delivering at 100 lbs. air pressure, each equipped with 600-hp synchronous motor.
- One 1,936 cfm—350-hp synchronous motor.
- One 1,596 cfm—300-hp synchronous motor.
- Total—21,032 cfm, delivering at 110 lbs. air pressure for approximately 100 lbs. mine working pressure.

Three natural gas powered compressors each having a 3,200 cfm capacity. "Outdoor" type.

No. 3 Shaft Hoist House:
- Three 7,000-cfm centrifugal compressors, each equipped with 1,500-hp motor, delivering at 110 lbs. air pressure.

Chiller/Compressor Building:
- Two 3,500 cfm centrifugal compressors, each equipped with a 700-hp motor, delivering at 110 lbs. air pressure.

Total compressed air—58,632 cfm.

Communications

A dispatcher, located on the surface, coordinates draw and haulage operations by means of an audio paging system.

Radio phones, on a different circuit from the audios, allow communication between haulage level ore and supply trains and the dispatcher. Trains move only on direct order of the dispatcher.

Each shaft has its own paging system for coordination of shaft operations.

A dial telephone system aids in communication between hoisting, maintenance and service facilities between the surface and the mine underground.

Surface Ore Transportation

Cars: 100 tons capacity, 35 to 40 per train.

Locomotive: 125-ton, 1,600-hp, diesel-electric.

Trackage: 132-lb. rail, 7-mile haul to receiving bin at reduction plant, level track.

No. 1 and No. 4 Yards

Surface installations in this area include a machine shop (including car repairs), electric shop, drill repair shop, a blacksmith shop, truck maintenance shop, framing shed, carpenter shop, warehouse facilities, timber-treating plant, salvage area, pipe shop, cylinder repair shed, sand-blasting shed, paint shed, fire marshal shed, mine rescue training center, fuse and cap storage tunnel, batch plant (including mix water cooling plant and additive storage tanks), compressor house, No. 1 and No. 4 hoisthouses, potable water treating plant, and changerooms.

There are storage areas for all material used in the mining operation.

Steel: Variety of structural shapes for shop fabrication jobs and mine ground support.

Timber: 12" x 12" drift timber.
- 2" and 3" lagging, various lengths.
- 6" and 8" cribbing, pre-framed.
- Pole posts—Texas pine for undercut timber.

A large explosives magazine is maintained to supply the mining operation.

A planned maintenance and lubrication schedule is followed for all surface and underground operating equipment.

Change Room No. 4

Accommodates 1,900 employees with lockers, showers, and toilet facilities. Heated with gas space heaters.

In the same building are the foreman's office, time office, mine survey office, industrial hygiene office, dispensary, lamp room, and incentive bonus office.

Change Room No. 3

Accommodates 1,000 employees and has office facilities similar to #4 change room. This change room is located in the #3 Shaft Area near #5 Shaft.

Training Center

The Minesite Training Department conducts classes in safety and first aid for all Mine Division surface and underground employees. Training is required for newly hired employees and those changing job assignments. Employees also spend one day per year in annual refresher training.

The department conducts an electrical helpers' training program and the miner trainee school. New hire and refresher training is also provided for other mine and plant employees.

Miscellaneous

1979—12 months of operation:	
Average Daily Mine Production, Dry Tons	61,005
Tons of Ore Mined	21,828,705
Copper Contained in Concentrates Produced, Tons	120,862
1980—8 months of operation:	
Average Daily Mine Production, Dry Tons	62,177
Tons of Ore Mined	13,803,276
Copper Contained in Concentrates Produced, Tons	79,231
Number of Mine Employees, 12/31/80	2,476

Magma Copper Company
A Subsidiary of Newmont Mining Corporation
San Manuel Division
P.O. Box M
San Manuel, AZ 85631

The Plant
GENERAL INFORMATION

MAGMA COPPER COMPANY

A Subsidiary of
Newmont Mining Corporation
San Manuel Division
San Manuel, Arizona 85631

THE HISTORY AND DEVELOPMENT OF THE SAN MANUEL DIVISION MAGMA COPPER COMPANY

Magma Copper Company's San Manuel Division is located in the south-east part of Pinal County, Arizona, about forty-five miles northeast of Tucson. Seven head-frames and the dome-shaped Red Hill serve as land-marks for the mine area.

The concentrator, smelter, sulfuric acid plant, electro-lytic refinery, administration building, and other plant facilities are located seven miles southeast of the mine area adjacent to the community of San Manuel.

The district was prospected prior to the Civil War, but there was little or no ore production until 1881. The chief producers were the Mammoth and Mohawk mines. Gold, lead, zinc, and some vanadium and molybdenum were the main recoverable metals at these properties. At least two exploratory churn drill holes were drilled in or near the San Manuel ore zone in 1917. The copper con-tent indicated by these holes was not sufficient to en-courage further exploration at that time.

In 1942, through the efforts of the property owners, James M. Douglas, R. B. Giffin, Victor Erickson, and Henry W. Nichols, all of Superior, Arizona, the Recon-struction Finance Corporation and War Production Board authorized the United States Geological Survey to investi-gate the property.

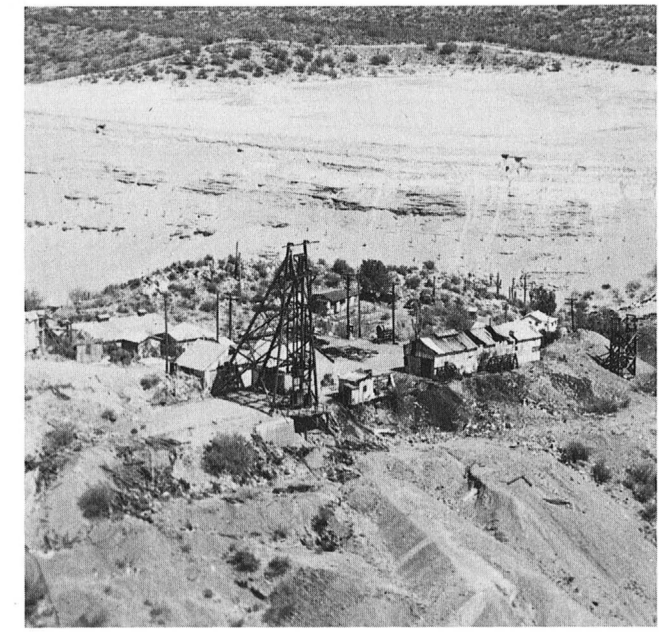
The survey confirmed the owners' original conception of the probable existence of important copper mineraliza-tion and, by its recommendation, the Bureau of Mines was authorized to put down a limited number of churn drill holes. This test drilling started in November, 1943, and was continued until February, 1945, when seventeen holes had been drilled for a total of 15,844 feet.

Magma Copper Company obtained an option to purchase the property in 1944. In September, 1944, Magma exercised its purchase option. Adjoining claims held by the Apex Lead Vanadium Mining Corporation and the Quarelli family were purchased. Additional claims were located and in December of that same year, Magma undertook exploration by churn drilling.

The San Manuel Copper Corporation was incorpo-rated in August, 1945, and all of the property acquired by Magma Copper Company in the district was deeded to San Manuel. The corporate structure was changed in 1962 to include the San Manuel property as a Division of Magma Copper Company, rather than a wholly-owned subsidiary corporation. In 1969 Magma was merged with Newmont Mining Corporation and operates today as a wholly owned subsidiary of Newmont.

Exploratory churn drilling essentially was completed in early 1948, and underground exploration and devel-opment was started in March of that year.

On July 10, 1952, the Reconstruction Finance Corpo-ration authorized a loan of $94,000,000 to San Manuel for mine development and plant construction.



TIGER MINE IN THE 1940'S

In early 1953 Utah Construction Company and the Stearns-Roger Manufacturing Company, a Joint Venture, were awarded a contract for the design and construction of the entire surface plant, including the concentrator, smelter, and railroads.

The concentrator was completed in September, 1955, and began trial runs on stockpiled and mine development ores. Smelter and remaining plant construction was com-pleted in late 1955, except for minor cleanup work. The smelting of copper concentrates was started January 8, 1956. Five shafts had been sunk and over twenty miles of drifting had been completed to prepare the first lift for production. On January 23, 1956, the Mine was in production with the first undercut completed. Ore was first hoisted on November 21, 1955.

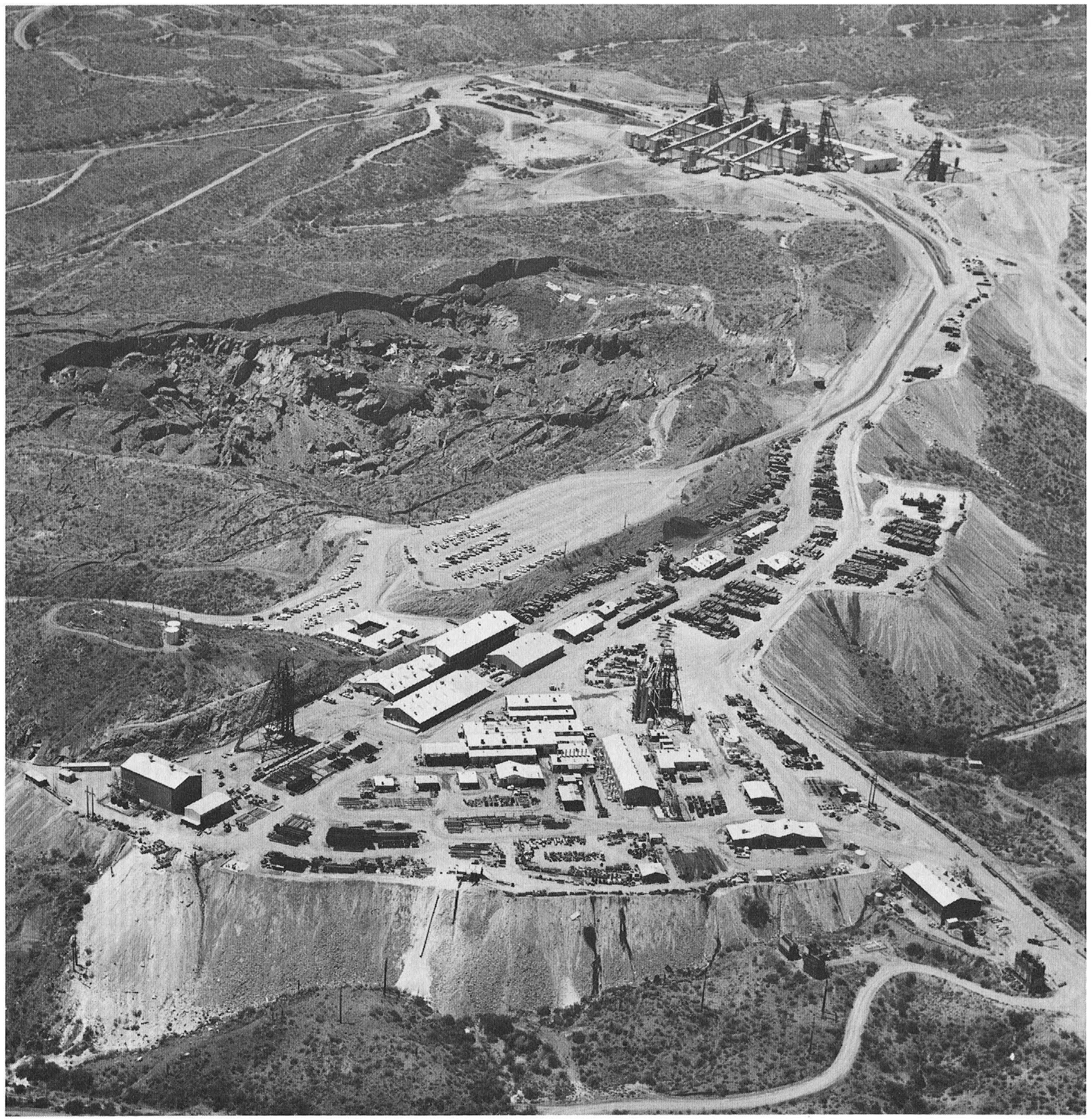
The 1475 level, was mined to completion early in 1965. The 2075 level, along with the 2375 level and the 2675 level are now being mined.

In 1968, Magma purchased nearby mining claims to an orebody of similar size and grade to San Manuel. The top of this second orebody lies 2,500 feet deep and mining will start on the 2950 level.

Since production started in 1956, the mine and plant have undergone two expansions. The first in 1965 boosted production from 30,000 to 40,000 tons of ore per day. In 1971, an expansion was completed which increased production to 62,500 tons of ore per day and included a new refining division as well as expanded mill and smelter facilities.

THE SAN MANUEL MINE

The San Manuel orebody is the recumbent lower half of an ore shell which was originally an elliptical (in cross-section) cylinder some 8000 feet long, and with major and minor axes of 5000 and 2500 feet. In its present location, its curved limbs lie 700 feet below the surface and its keel some 3000 feet deep. The economic ore shell occupies the regional contact zone between a central plug of intrusive granodiorite porphyry rock of Laramide age and the intruded porphyritic quartz monzonite of Precambrian age. The granodiorite porphyry core within the ore shell is marginally mineralized and the quartz monzonite surrounding the shell is strongly pyritized but with very low copper content. Post-ore faulting concealed most of the original San Manuel orebody under a wedge-shaped sequence of tertiary conglomerate.



1975 AERIAL VIEW OF SAN MANUEL MINE

The 700′ thickness of the overburden and shape and size of the orebody combine to make open pit mining impractical. For these reasons the underground block caving method of mining was selected. The host rocks in which the ore occurs are well fractured, cave readily and crush to a size that is easy to transport.

Block caving entails the undercutting or removal of a horizontal slice of ore of sufficient area (stope block) so that the unbroken ore above will not support itself, but will cave and slough into the undercut. As the broken ore is drawn, removing support from the ore above, caving extends to the surface with the overburden or waste rock following the ore down. When the waste rock reaches the undercut horizon, drawing is stopped and the block is finished.

The caved ore from the undercut horizon is drawn on the grizzly level through a series of closely spaced draw raises. The grizzly level which is the control level, is 18 feet below the undercut. On the grizzly level the ore passes through the grizzlies which consist of rails spaced 14 inches apart over the top of each transfer raise.

Two transfer raises funnel the ore from eight draw raises to one common loading station on the haulage level which is 60 feet below the grizzly level. A raise station serves two transfer raises, each of which, when full of ore, holds 55 tons. The ore stored in the raises is transported by an underground electric railroad system to the ore hoisting shafts.

Loading operations from the transfer raises to the ore cars are controlled through steel chutes and air operated chute gates. Two types of ore cars are used. One is a 12-ton rotary dump car which is used in a 15-car train with a total haulage capacity of 180 tons. The second type of ore car is a bottom dump, 18 ton capacity car which is used in a 10-car train with a total haulage capacity of 180 tons. In both cases ore trains are pulled by a 23-ton, 250 horsepower trolley locomotive. The trolley power system is 275 volt DC with rectifier stations situated to maintain full voltage throughout the haulage routes.

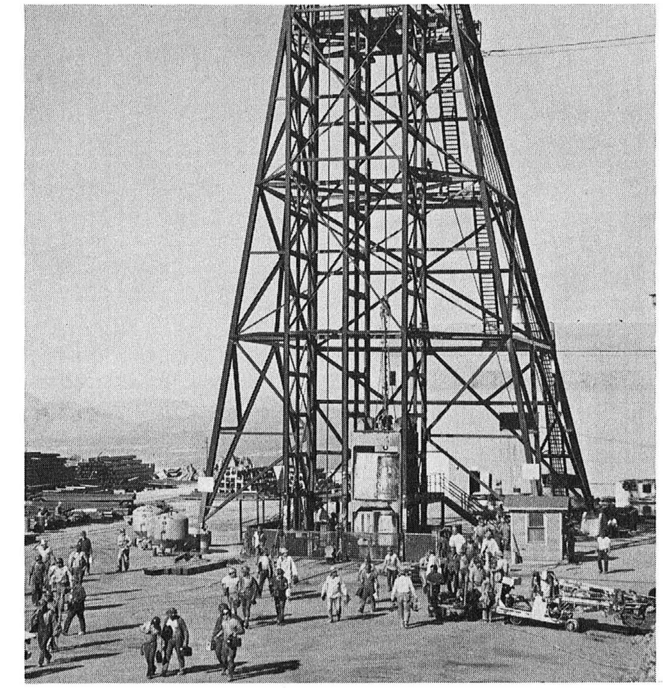
The underground track for the haulage system is 36-inch gauge with 70-pound rail through the panels. On the main lines between the mining area and the hoisting shaft, 90 and 119-pound rail is used to accommodate the heavy traffic and higher speeds.

Three of the four ore hoisting shafts, 3-A, B, & D, accommodate rotary dump type ore cars, the trains of which pass through a rotary tipple on the haulage level and dump three cars at a time. The cars are equipped with rotary couplings and are not disconnected as they are turned 180° to dump the ore into a 1500 ton underground storage bin adjacent to each hoist.

The 3-C shaft accommodates the bottom dump type ore car which passes over the ore dump on a rail while a mechanism opens the car bottom for dumping while the train is in motion.

The ore is drawn from the bottom of the pocket into a measuring pocket hopper which in turn discharges into skips for hoisting to the surface. The bottom dump ore skips, which hold from 21 to 29 tons of ore, are hoisted to the surface and discharged into four 5,000-ton surface storage bins, which in turn discharge onto pan feeders that carry the ore to the four gyratory crushers located nearby. Discharge from the crushers is moved by conveyor belts to four 10,000-ton surface storage bins awaiting transportation to the Plant.

Two ore hoisting shafts, 3-A and 3-B, are equipped with 6,000-hp hoists with 15-foot diameter drums. The operating hoisting speed is from 2500 to 3000 feet per minute. The 3-C and 3-D ore hoisting shafts are equipped with 7,000-hp hoists having 15-ft. diameter drums, hoisting at 2,850 feet per minute. All four ore hoists can be manually or automatically controlled. The hoisting cables are 2¼ inches in diameter. The hoisting shafts also serve for ventilation up-cast.



SHIFT CHANGE AT #4 SHAFT

Nos. 1 and 2 shafts were sunk early in the program, and from these shafts the first mining lift was developed. No. 1 shaft, steel and reinforced concrete lined, now serves for concrete supply, pumping, and as a service shaft for men and supplies, and downcast ventilation. No. 2 shaft, sunk for exploration and quick development, has been abandoned.

No. 4 shaft, steel and concrete lined, serves as a downcast ventilation shaft and as a service shaft with a double deck cage for men and supplies. Men are lowered and hoisted at the rate of 100 men per trip; and timber, powder, and other supplies necessary for the mining operation are lowered to grizzly and haulage levels through this shaft.

No. 5 shaft is equipped for service and development hoisting. The double drum service and supply hoist is powered by two 1000-hp DC motors and is capable of carrying 100 men per trip in its double deck cages. The double drum rock hoist is powered by one 1000-hp DC motor with power supplied through a 1000 KW static Thrystor. The rock skip capacity is 5.5 tons. It is a downcast ventilation shaft.

Other facilities at the mine include mechanical and electrical shops, modern timber framing shed, timber treating plant, warehouse, and change rooms. Mine air compressors, with a capacity of 61,400 cubic feet per minute provide compressed air for rock drills and other air-driven tools underground and on the surface.

Limestone and high grade silica for metallurgical use is mined from two separate quarries. Limestone is mined from a quarry site 6 miles south of the plant and hauled by truck. Silica is mined at a site 17 miles north of the plant and is hauled by the San Manuel Arizona Railroad to the flux crushing plant.

THE CONCENTRATOR

The primary crushing circuit located at the mine site is equipped with 4 gyratory crushers. A panel board located for each crusher and an intercommunication system provide control. Iron detectors are installed on conveyors for the removal of tramp iron. The final product of the mine crushing plant is conveyed to four 10,000-ton receiving bins for loading into ore transportation cars.

Ore transportation from the Mine to the Plant is by rail shuttle service in 100-ton capacity bottom-dump railroad cars. The 48-car train is pulled by two tandem 1600-horsepower, 120-ton diesel-electric locomotives. The six mile ore transportation track is standard gauge, 132-pound rail and was constructed with liberal curves and no grade.

At the 20,000 ton coarse ore receiving bin at the Plant, the train pulls over the bin and four cars are dumped at a time through bottom-dump air-operated gates with compressed air furnished by the locomotives.

From beneath the receiving bins, ore is fed by 48" manganese steel pan feeders and belt conveyors into four, seven-ft. standard cone crushers at the rate of 1000 tons per hr. to each crusher. Magnets are suspended at the head of the conveyor to remove tramp iron. Crusher feed passes over double deck grizzly screens where undersize material is bypassed directly to fine ore bins. Screen oversize is conveyed to a series of secondary crushers. The crushed ore from the secondary crushers is conveyed and distributed to seven tertiary seven-ft. cone crushers, each preceded by mechanical screens to bypass the undersize material to fine ore bins.

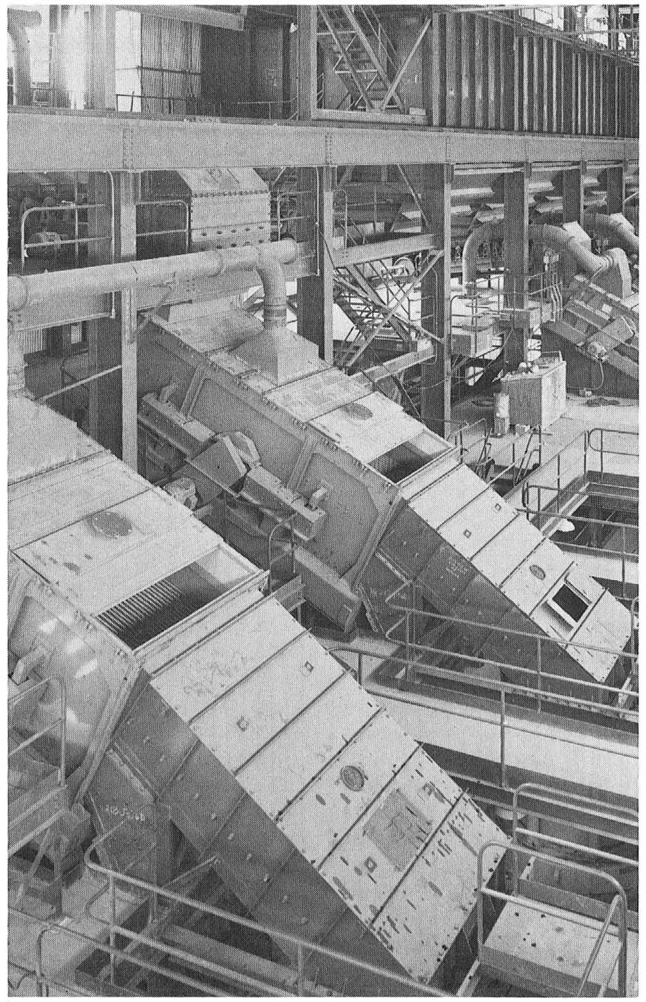
The crushing plant is designed with all crushers on the same level. A panelboard, with computer control, on the operating floor and an intercommunication system provide complete control from one point. A 30-ton overhead crane with a 5-ton auxiliary hook services the crusher floor.

The final product from the crushing plant, all less than ¾", is delivered by belt conveyor at the rate of 3,500 tons per hour to two 54-inch wide tripper conveyors. The tripper conveyors run across the top of the 70,500-ton capacity fine ore bin in the concentrator building and travel the length of the bin distributing the ore at an even rate. Seal belts cover the slots through which the ore is discharged and provide dust control.

The ore is drawn from the bottom of the fine ore bin by a system of belt conveyors onto gathering conveyors which feed the rod mill sections at the rate of 62,500 tons per day. A weightometer both registers and controls tonnage to each grinding section.

The concentrator is divided into thirteen grinding sections, ten sections each consisting of one 10′ x 13′ rod mill, and two 10′ x 10′ ball mills, and three sections each consisting of one 12′6″ x 16′ rod mill and two 12′6″ x 14′ ball mills. Ball mills are operated in closed circuit with 20″ and 26″ cyclone classifiers. Oversize material from classification is returned to the ball mills for additional grinding.

All grinding sections are operated from a central control room equipped for remote control and an intercommunication system and radio circuit help provide control. The grinding bay is serviced by a 175-ton crane and a 275-ton crane which are capable of taking out a fully charged rod or ball mill for repairs. Two 10-ton cranes serve for lighter and faster service.

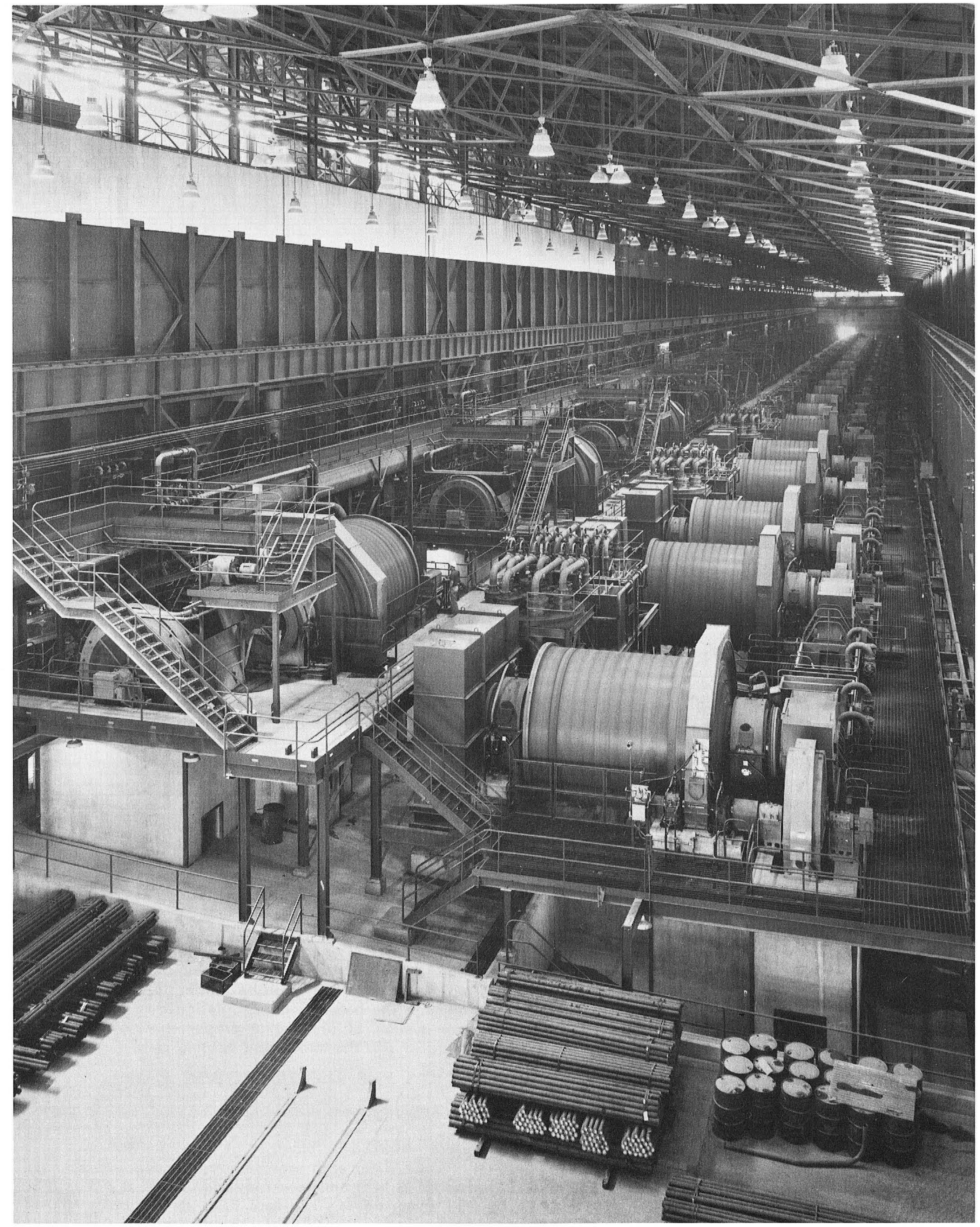


SECONDARY CRUSHING PLANT AT SAN MANUEL

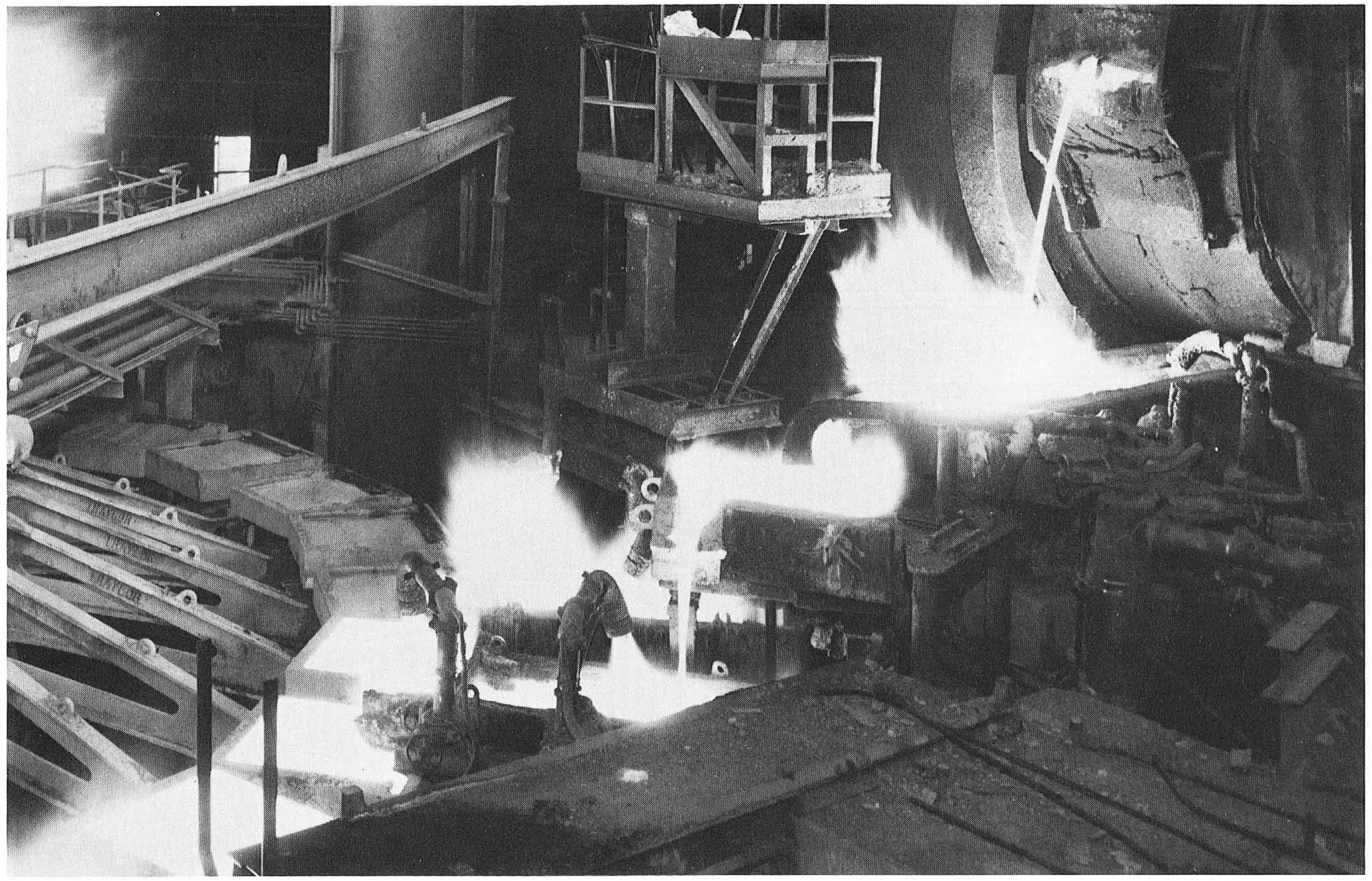
The classifier overflow goes to distribution boxes where, with reagents added, it is distributed to 40 cubic foot rougher flotation cells, and to 300 cubic foot rougher flotation cells, with a retention time of nine minutes. The copper-molybdenum minerals float to the surface of the pulp in each cell and are gathered in froth launders. The material not floated in these cells is called tailings, and is piped by gravity to the tailings thickeners where approximately 24,000 g.p.m. of reclaimed overflow water is returned to the mill for reuse. The thickened underflow is discharged to the tailings pond where the excess water is decanted and returned to the mill for reuse.

The mineral concentrate is pumped from the rougher flotation cell launders through cyclone classifiers in closed circuit with eight 8′ x 12′ regrind ball mills, then distributed to 276 forty cubic foot cleaner flotation cells. The tailings from this flotation are returned to the ball mill circuit or back to the primary cleaner cells. The final copper-molybdenum concentrate is pumped to two thickeners. The thickened concentrate goes to the molybdenum recovery plant.

Molybdenum disulfide is recovered by flotation in another series of flotation cells, after which the concentrate is filtered, dried, and conveyed to drum storage. Tailings from the Molybdenum flotation process is the copper sulfide concentrate. It is thickened, filtered, dried, and conveyed to the concentrate storage bins at the smelter. Overflow water from the thickeners joins the recycled water to the mill circuit.



GRINDING MILLS AT SAN MANUEL CONCENTRATOR



PRECISION ANODE CASTING AT SAN MANUEL SMELTER

THE SMELTER

Copper concentrate, averaging about 29.5% copper and about 10% moisture, is drawn from storage bins by conveyor belts and is fed to each of three 102-feet long, brick, suspended-arch reverbatory furnaces through hoppers located along the sidewalls.

The concentrate is smelted at temperatures of approximately 2700°F using coal, natural gas or light oil for fuel interchangeably. Combustion air is preheated for higher efficiency and fuel conservation.

Slag is skimmed from the reverberatory bath into railroad slag pots of 380 cubic foot capacity for hauling to the slag dump.

Matte, composed of copper, iron, and sulfur is tapped into 300 cubic foot ladles and transferred by 60-ton overhead cranes to one of six Peirce-Smith type converters. Three converters are 13' x 35' and three are 15' x 35'.

A silica flux is added to the converter bath where it combines with iron oxide to form a slag which is returned to the reverberatory furnaces. Low pressure air is blown through the bath, oxidizing the sulfur to sulfur dioxide and leaving metallic blister copper. Several charges, slag skims, and blowing cycles over an 18-hour period are required to finish a batch of 115 - 130 tons of blister copper in each converter.

Molten copper from the converters is transferred by ladle to one of four holding furnaces where finish blowing and slagging is performed. Final excess oxygen is removed by injection of natural gas or propane in the reduction or "poling" stage.

The finished or "fire refined" copper, about 99.7% pure, is poured by an automatic, computer controlled, system which delivers a precise weight of molten copper into anode molds on one of two revolving casting wheels. The molds are copper castings weighing approximately 5,700 pounds and are poured as needed. A releasing agent prevents the anodes from adhering to the molds.

Single anodes are poured on the smaller wheel and removed by an operator controlled mechanism to a quench tank for cooling. On the larger wheel, two anodes are automatically poured and removed and quenched in pairs with an automatic take off device. Each commercial anode weighs 820 pounds.

The anodes are removed by fork lift to the yard where they are inspected and loaded into bolsters for transport by 20-ton straddle carrier to the electrolytic refinery. The bolster racks are designed to hold the correct number of anodes, at proper spacing, for direct charging into the tank house refining cells.

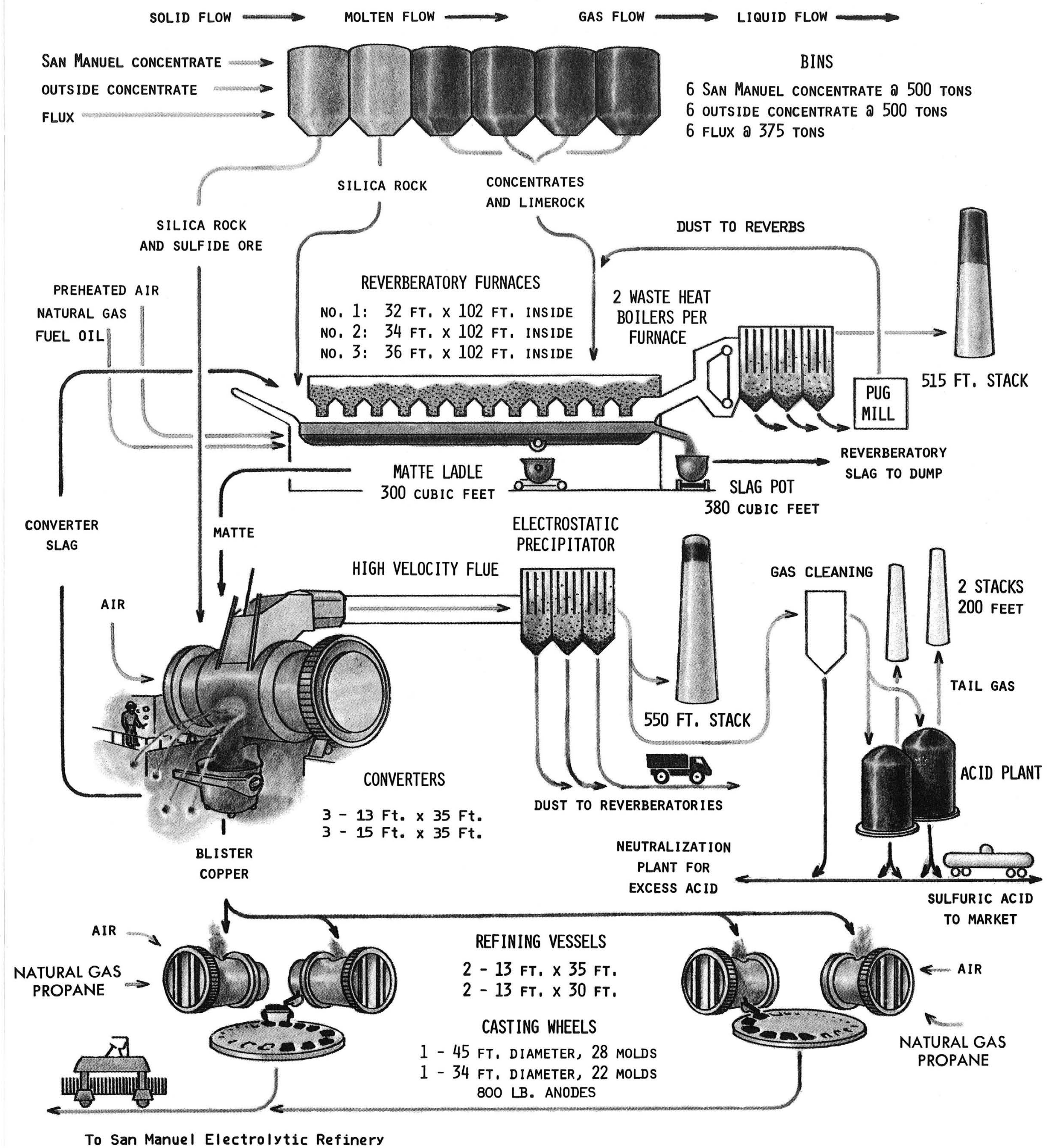
THE SMELTER POWER PLANT

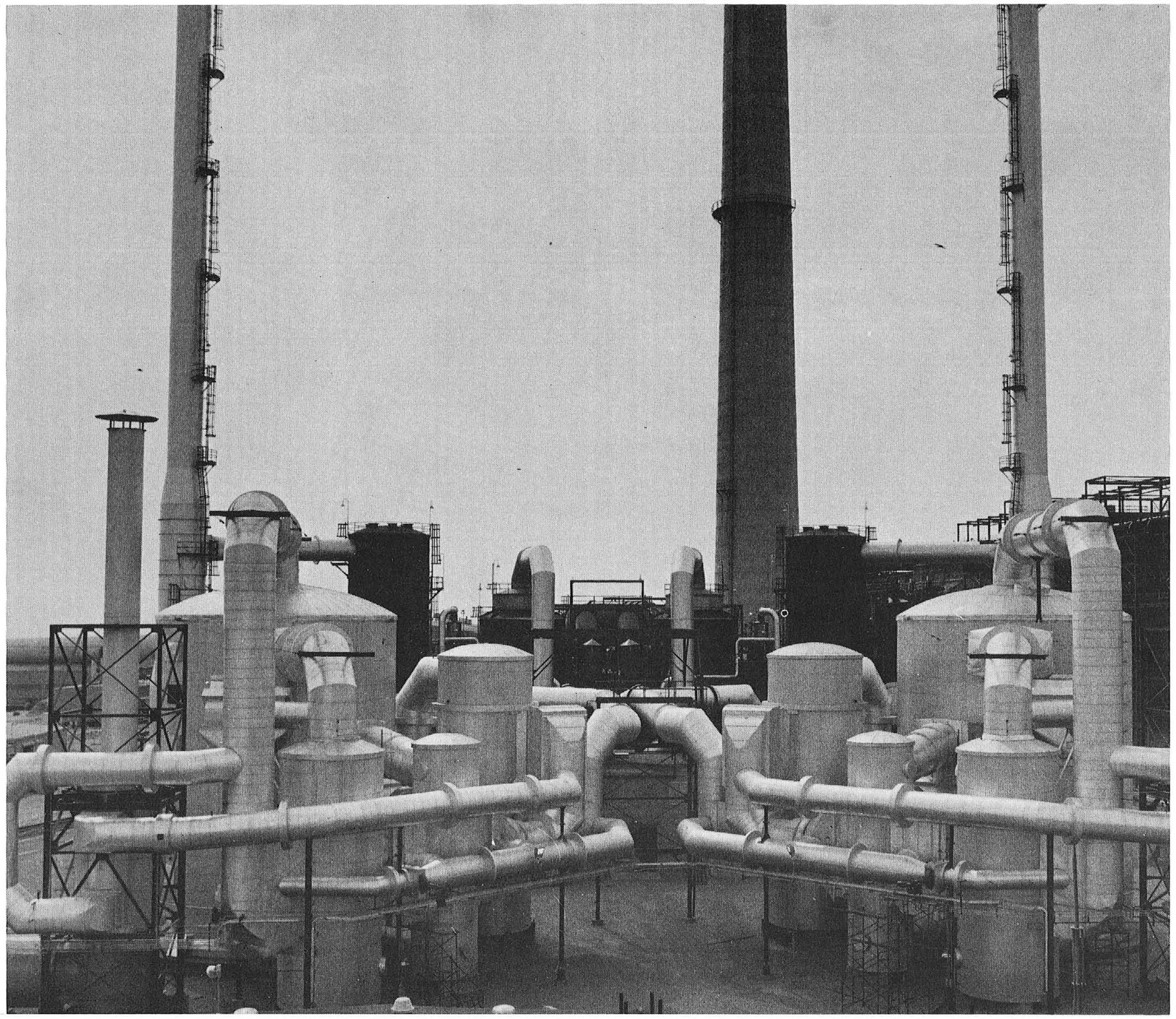
Approximately 20% of the Division electric power requirements can be generated at the smelter power plant which has a capacity of 32,975 KW.

Gases from each reverberatory furnace pass through two waste heat boilers which furnish steam at 475 psig to the power house. There are three steam turbine generators rated a 10,000 KW, 13,600 KW and 9,375 KW. In addition there are five turbine compressed air blowers, three rated 30,000 cfm and two 45,000 cfm. The electricity feeds into the nearby utility substation and can be routed to the mine or plant facilities.

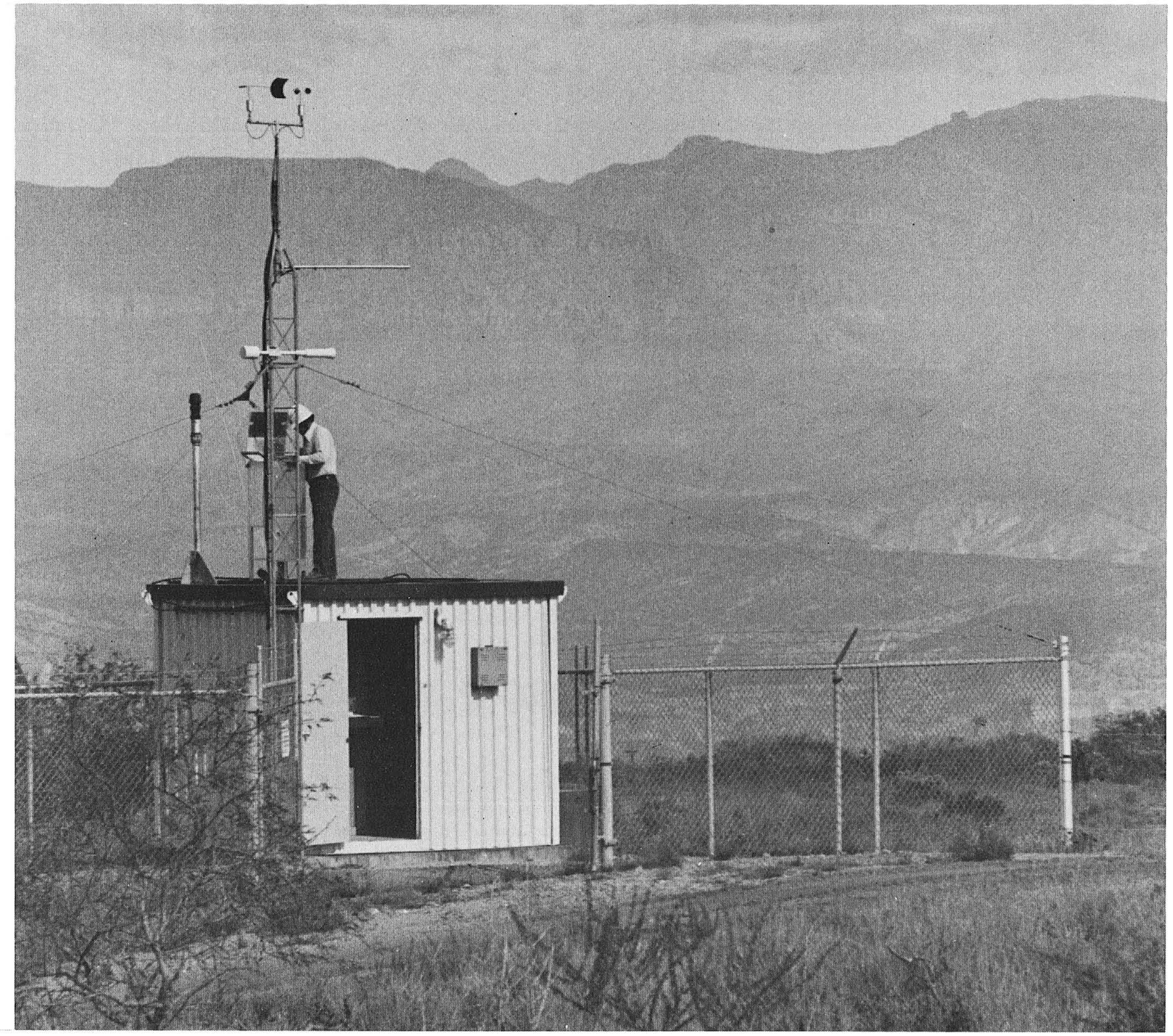
MAGMA

San Manuel Division Smelter Flow Sheet





SAN MANUEL SULFURIC ACID PLANT



REMOTE AIR MONITORING STATION NEAR SAN MANUEL

SMELTER EMISSION CONTROL SYSTEMS

The two independent sources of gas emissions from the smelter are the reverberatory furnaces and the converters. Each source produces a unique emission and must utilize a unique control system.

REVERB EMISSIONS

The emission gases from the reverberatory furnaces contain large amounts of particulates, and water vapor and small amounts of sulfur dioxide (less than 1% SO2 by volume). For control of the particulates the gases pass through a four-module electrostatic precipitator. Approximately 96% of the particulate matter is removed and returned to the furnaces. The normal plume from the 515' western smelter stack is composed of approximately 1% sulfur dioxide, 15% water vapor, and 84% inert natural air components.

CONVERTER EMISSIONS

Emission gases from the six converters contain above 4% of sulfur dioxide and lesser amounts of moisture and dust. All converter emissions are passed to the sulfuric acid plant which is capable of recovering approximately 96% of this sulfur.

The gas collection system in the smelter includes water cooled converter hoods, balloon settling flues, and high velocity flues. Converter operations are scheduled to provide reasonably continuous flows of relatively strong sulfur dioxide to feed the acid plant.

An electrostatic precipitator removes dust before the gas is passed through cooling and humidifying towers and then through a bank of 6 mist precipitators to remove all remaining solids and acid mist.

The resulting clean and dry sulfur dioxide gas is split into two trains, or modules, where it is passed through beds of a catalyst, vanadium pentoxide, which converts it to sulfur trioxide.

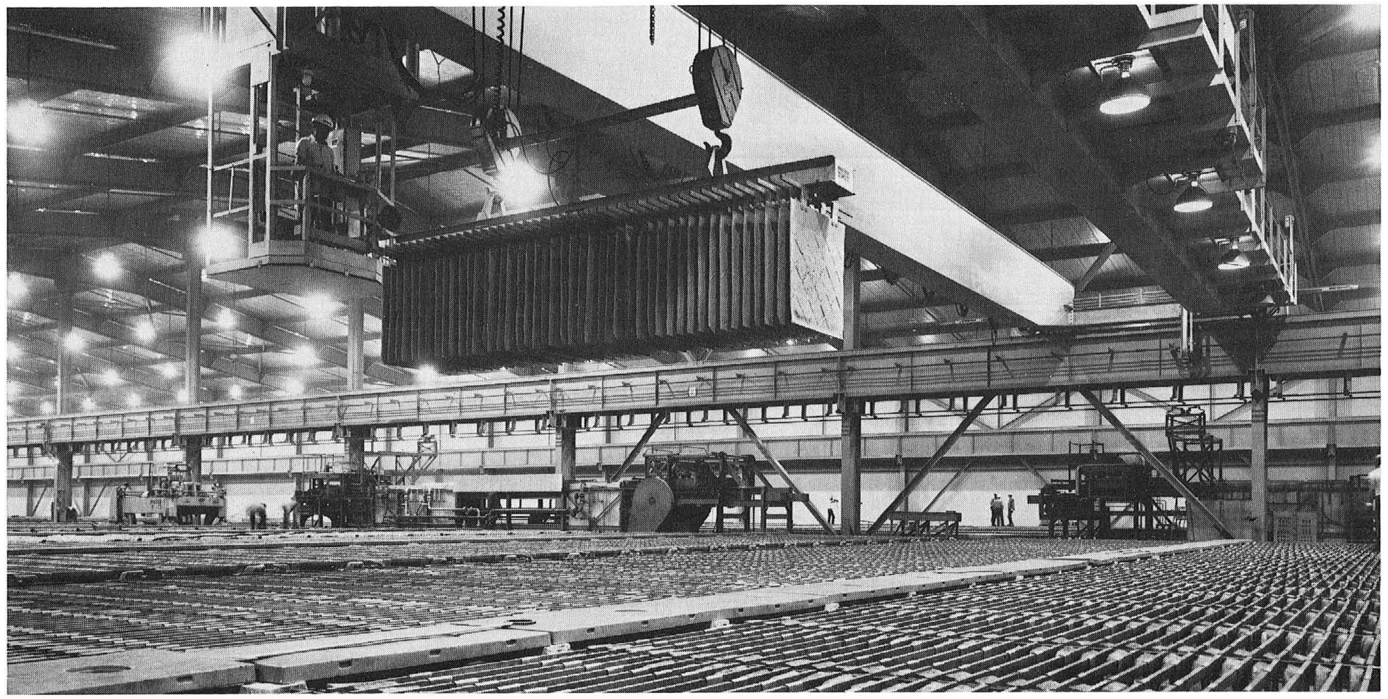
The sulfur trioxide passes to towers where it is absorbed into circulating sulfuric acid. The resulting saturated acid is then diluted to 93.4% or greater commercial grade for storage and transport to market.

The plant has a production capacity of approximately 2,000 tons per day of sulfuric acid. Storage is provided at the loading docks for 20,000 tons. Neutralizing facilities are provided for any amounts of acid, including, if necessary, the entire production. A limestone slurry is mixed with the acid and the resulting gypsum slurry is introduced into the on-line tailings disposal stream from the concentrator.

When the sulfuric acid plant is in operation there are no emissions from the eastern 550-foot high smelter stack. Minor tail gases from the two stainless steel acid plant stacks are invisible.

AIR MONITORING

Regulations require that ambient air standards will not be violated during adverse weather conditions so extensive system of eight continuous air monitors measures and records air quality conditions throughout the area of the smelter's influence. Special computer programs produce guidance information about potential air pollution episodes. The data is monitored in the Environmental Control Center and Smelter Controller Center, and standing operating procedures provide for reduction or curtailment of emission producing operations if necessary to maintain ambient air standards.



OVEHEAD CRANE TRANSPORTING CATHODES IN TANK HOUSE

THE ELECTROLYTIC COPPER REFINERY

The San Manuel Refinery with an annual design capacity of 215,000 tons of electrolytic copper, was completed in October, 1971.

The rod plant has a capacity of 160,000 tons of continuous cast copper rod per year in 5/16", 0.400", 9/16", and ¾" diameters. The balance of the production is in the form of cathode copper. The continuous cast rod is shipped in coils of from 6,000 lbs. to 16,000 lbs. in gross weight by rail or truck. Cathodes are shipped in bundles of appropriate size and weight to facilitate materials handling and loading.

Process and Facilities

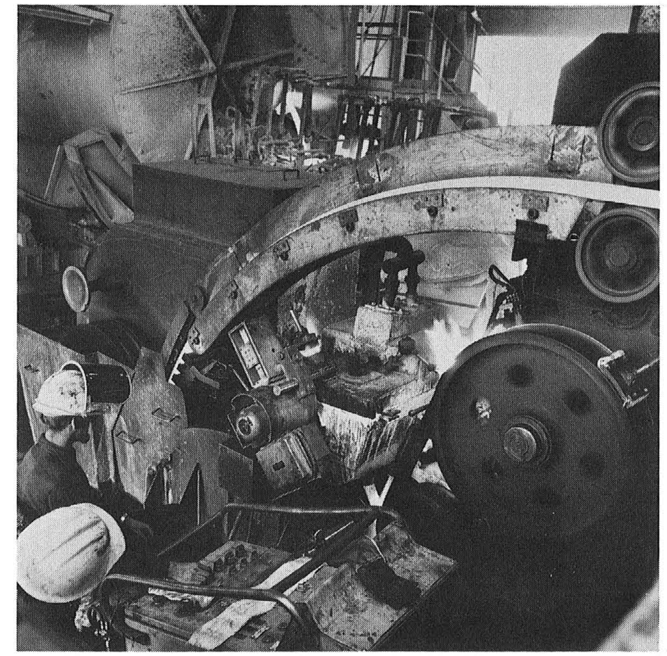
Refining takes place in the tankhouse. Smelter anodes are loaded in refining cells with 4" spacing with copper starting sheets suspended between the anodes. Electrolyte containing 50 grams per liter copper and 200 grams per liter sulfuric acid, with solution temperature controlled at 150°F, is circulated through each cell at the rate of 4 to 5 gpm.

Electric current is applied in a series-paralleled system to provide 20,600 amperes per cell. The DC voltage per cell is nominally 0.25. This provides a current density of slightly over 24 amperes per square foot of cathode surface. In the electro-refining process, copper ions go into solution at the surface of the anode. At the same time, copper ions are deposited from the electrolyte on the surface of the cathode. As the anode is depleted, the cathode grows in thickness and weight. Anodes are replaced after 28 days in circuit. Each anode charge produces two pulls of cathodes. Under normal operating conditions, an anode weighing 820 pounds produces two cathodes weighing 350 lbs. each. Approximately 100 lbs. of anode remain after 28 days exposure and is washed and returned to the smelter converters for recycling. Cathodes are washed and transferred to the rod casting plant or shipping docks.

Soluble impurities and copper which tend to concentrate in the electrolyte are controlled within strict concentration limits in the electrolyte purification (Liberator) section. The process of purifying the electrolyte is a modification of the commercial electrolytic refining process. Insoluble lead anodes are used with copper starting sheets as the cathode. Copper ions deposit on the cathode thereby depleting copper in the electrolyte. Partially decopperized cathodes are sent to the rod plant shaft furnace for melting.

Copper starting sheets, interspaced between the anodes at the start of the 14-day cathode cycle, are produced in the stripper (or starting sheet) section of the tankhouse. In the stripper section, rolled copper blanks with prepared surfaces are interspaced between copper anodes. Electrodeposition occurs in the same manner as the commercial sections. Blanks are pulled after 22½ hours of deposition and the thin, copper deposits are stripped from the blanks. Each day, 5,400 starting sheets weighing approximately 12 pounds each are produced. Two loops cut from starting sheet stock are automatically attached to each of the starting sheets and copper suspension bars inserted to complete the starting sheet assembly.

Impurities in anode copper either go into solution in the electrolyte or settle to the bottom of the electrolytic cell as slime. The slime, which contains various impurities including precious metals, is washed from the cells at the end of each 28-day anode cycle. It is collected and transferred to an acid leaching, filtering, and drying section. The dry slime is sampled and packed in plastic lined drums for shipment to a precious metals refinery for recovery of gold, silver, and selenium metals values.



CASTING WHEEL AT ROD PLANT

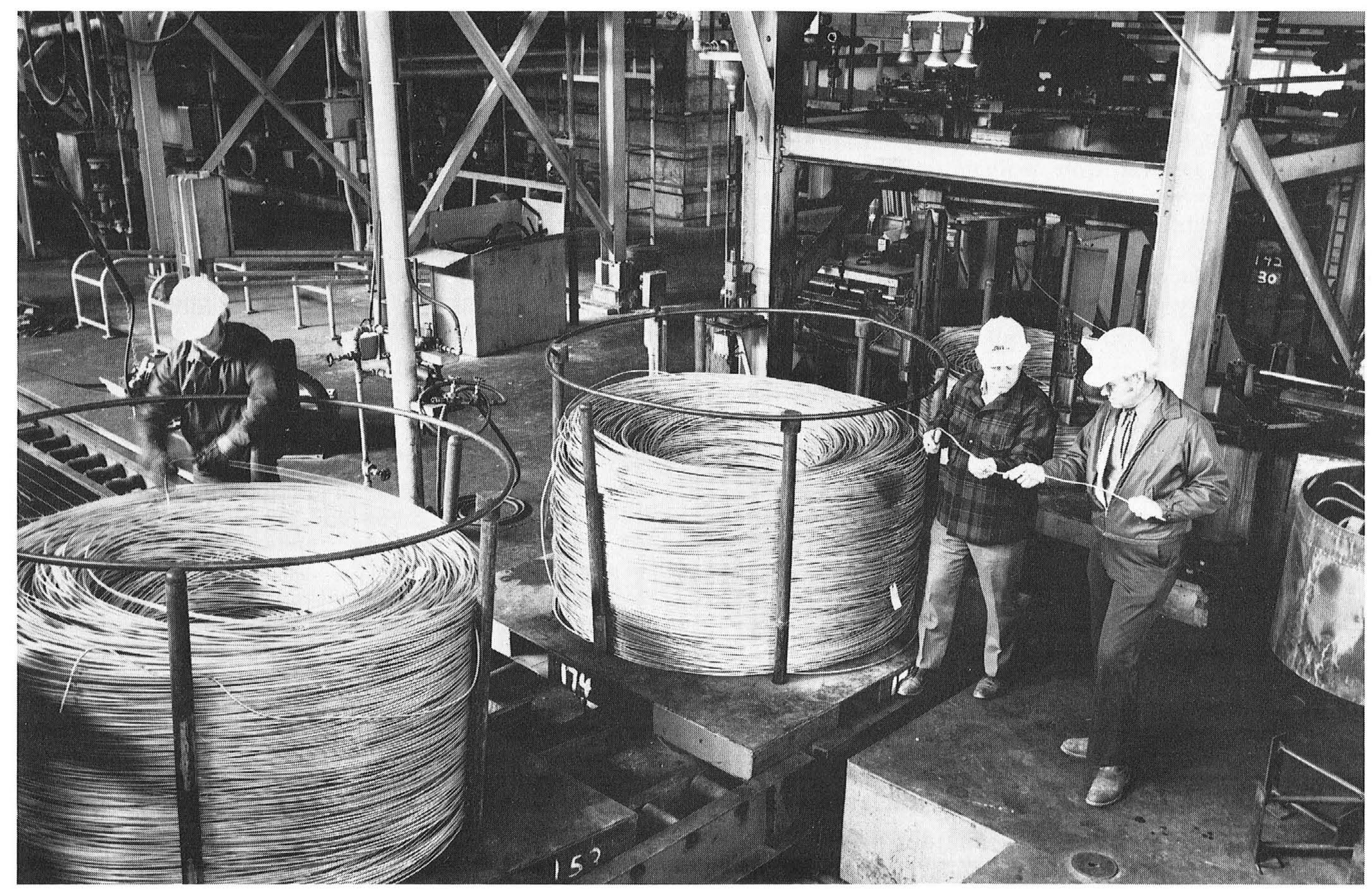
Continuous Rod Casting

Refined copper, in the form of cathodes, with dimensions approximately 38" x 38" and weighing approximately 350 pounds are transferred to the rod plant. Approximately 160,000 tons per year are melted and cast into 5/16", .406", 9/16" or ¾" diameter rod.

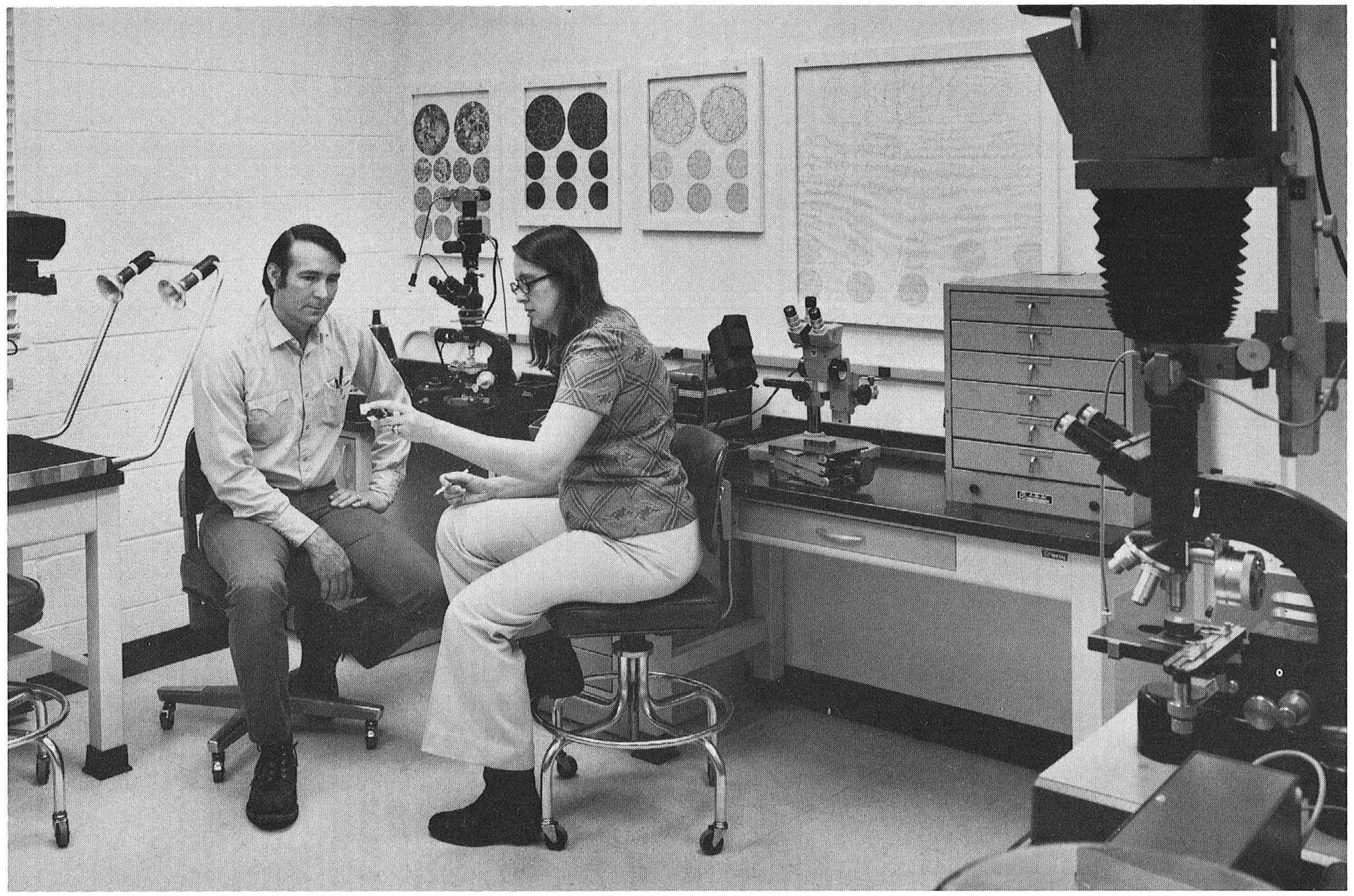
Cathode melting takes place in a gas-fired shaft furnace. Molten copper flows through a heated launder system to a 10-ton capacity gas fired, holding furnace.

Molten copper is fed to the rod casting machine at a controlled rate of up to 40 tons per hour by rotating the holding furnace. The molten copper flows into a casting ladle which directs the flow into the cavity of the casting wheel. The copper casting wheel is 96" in diameter with a rim cavity specifically designed and machined to produce a casting with 6 square inches of cross-sectional area. The entire casting assembly is water cooled and lubricated to produce a smooth casting.

The copper casting formed on the casting wheel is continuously withdrawn and fed to a large multiple stand rolling mill which reduces the original casting in 12 step reductions to 5/16" continuous rod or 10 steps for 13/32" rod. After leaving the rolling mill, the rod is pickled in a dilute sulfuric acid solution, washed and coated enroute to the coiling mechanism. Equipment is provided to coil, compress and package the rod in various weight coils required by the customers. Packaged coils of finished rod are weighed and loaded directly into boxcars or upon trucks for shipment.



FINISHED 7-TON LAY COILS OF 5/16" CONTINUOUS CAST MAGMA ROD



QUALITY CONTROL IS ESSENTIAL IN PRODUCTION OF MAGMA COPPER

METALLURGY

The Division Metallurgy Department maintains service for assay, quality control, testing, and research for all operating divisions. Laboratory equipment and methods include x-ray fluorescent spectrometer, atomic absorption, optical emission spectrometer, gas chromatograph, and wet chemical non-destructive testing, microscopy and physical metallurgy.

Four modern, fully equipped laboratories serve the Division, one of which is a quality control unit located at the continuous rod casting plant for production testing of finished product.

The metallurgical department operations include ore assay, process materials assay, product quality determination, stack gas analysis, weight and measure standards, process efficiency analysis, equipment wear and failure analysis, lubricant controls, combustion analysis, and research on new processes and products.

Extensive use of electronic data processing is utilized for metallurgical determinations and a computer network gives prompt information at operational control points throughout the Division.

OTHER PLANT FACILITIES

The flux preparation plant is located between the smelter and concentrator buildings and includes receiving bins and crushers for handling limestone and silica flux. A lime kiln for calcining limestone, and a slaker provide metallurgical lime for the concentrator.

Other plant facilities include a machine shop with locomotive service and repair pits, electric shops, carpenter, and truck shops, warehouses, time offices, and change houses.

The San Manuel Arizona Railroad Company, a wholly owned subsidiary of Magma Copper Company, operates on thirty miles of standard gauge railroad from San Manuel to connect with the Southern Pacific Railroad at Hayden, Arizona. The depot is just north of the smelter-refinery gate. SMARRCO is a licensed interstate carrier.

SAN MANUEL, ARIZONA

THE TOWNSITE

To provide adequate permanent housing facilities for the construction period, as well as the future productive life of the mine, an agreement was made with the Del E. Webb Construction Company and M.O.W. Homes, Inc., under which they were to finance and build a community suitable for the accommodation of San Manuel's employes.

Active construction was started in mid-1953, and by late 1954, the community of San Manuel, consisting of 1,000 homes, shopping facilities, and hospital, was completed. Magma Copper Company acquired the property early in 1955. Additional houses were built in 1957 and in 1971 bringing the total to 1,276.

The community at San Manuel, Arizona, contains modern homes, shops, and surfaced streets, on the sloping west side of the San Pedro Valley. To the east are the Galiuro Mountains, while to the west are the Santa Catalina Mountains.

San Manuel was conceived and built for those who work for Magma Copper Company, as well as for those in related activities — merchants, police officers, clergymen, and others.

The main shopping center covers 32 landscaped acres off McNab Parkway. The shops located there offer San Manuel a wide variety of merchandise and services. This is supplemented by a second shopping center located in the lower part of the town.

The townsite properties are managed from the San Manuel Townsite Office of the San Manuel Division of Magma Copper Company.

The San Manuel Division Hospital, a half-million dollar institution, maintains the very latest equipment, and a complete medical staff services the needs of San Manuel and vicinity.

Within the hospital there is a completely equipped surgery, nursery, two obstetrical rooms, emergency room, x-ray room, x-ray developing room, a patients' wing of 30 beds, doctors' offices, laboratories, therapy rooms, reception room, waiting room, offices, kitchen facilities, and dining rooms.

In this same area is located the Administration Building which houses the various management, accounting, purchasing, and personnel offices.

San Manuel elementary schools, Mammoth elementary school and San Manuel High School and Junior High School serve the Mammoth Public School District.

Five schools were completed at a cost of more than than $5,000,000 for buildings and equipment. The School Board is elected by the registered electorate without regard to property ownership.

A 10,000-book library serves the town of San Manuel and supplements the school libraries. The library has gradually expanded from a small one-room area in the Community Center building to its own quarters with over 1,500 square feet of floor space.

Parks, playgrounds, community center, and swimming pool facilities are provided by the Townsite for the residents of San Manuel.

STATISTICAL DATA

ORE DEPOSIT

Type	Disseminated copper
Gangue rock	Quartz monzonite porphyry
Metallic minerals	Pyrite, chalcopyrite, chalcocite, molybdenite, silver and gold
Copper content	About 0.75%
Molybdenum sulfide content	About 0.025%
Gold and silver contents	Trace amounts

OREBODY

Orebody	The control as to size and shape of the orebody is an economic cutoff based on copper content of the mineralized rock. Therefore, that portion considered economically feasible to mine appears in the more northerly portion as a tabular mass up to 400 feet thick with its long dimension bearing northeast and dipping at an angle of 55° from horizontal to the southeast. This attitude persists down dip for about 2,400 feet where it flattens and then rolls upward to form a cross-sectional fishhook shape.
Fracture pattern	Intricate, three-dimensional network
Mineral occurrence	Disseminated through the gangue rock

OVERBURDEN OR CAPPING

Description	Gila conglomerate and weakly mineralized monzonite porphyry
Thickness	Averages 670 feet

MINE OPENINGS

Support	All ground requires support, either timber, steel or concrete
Water	Newly-opened areas may show appreciable flow. Orebody drains rapidly
Temperatures	Moderate

MINE PRODUCTION

Capacity	62,500 tons daily
Mining method	Block caving
Underground haulage	Electric trolley locomotives; ore car capacity: 12.5 ton rotary dump cars, 15 cars per train, and 15.5 ton bottom dump cars, 10 cars per train
Hoisting	Hoisted through four vertical shafts First level 1475 feet (now completely mined out) Intermediate level, 1775 ft., now depleted Second level, 2075 feet Intermediate level, 2375 feet Third level, 2675 feet Hoists: 2 - 6000-hp, double drum 2 - 7000-hp, double drum Hoisting speed: 2500 to 3000 fpm Capacity of skip: 21 to 29 tons Run-of-mine ore: up to 14 inches

ORE CRUSHING

Bin capacity	Four ore receiving bins hold 5,000 tons each
Primary crushers	Four gyratory crushers 1,000 tons per hour each

ORE TRANSPORTATION — MINE TO CONCENTRATOR

Storage	At mine loading point — four 10,000 ton bins
Ore moved	Rail shuttle service, 13 round trips daily
Railway construction	Six mile, standard gauge, 132-pound rail, level, minimum curves with liberal radius
Type of Cars	Bottom-dump, air-operated
Capacity of car	100 tons or 72 cubic yards
Cars per train	48
Locomotives	4 ALCO 1600-hp Electric Diesels

ORE CRUSHING (PLANT)

Coarse ore bin	20,000 tons capacity
Secondary crushing	Four 7-foot standard cone crushers, 600 tph each
Tertiary crushing	Seven 7-foot short-head cone crushers, 360 tph each
Fine ore bin	702,500 tons capacity

CONCENTRATION OF ORE

Concentrator	62,500 tons per day capacity
Rod mills	Ten 10' x 13' rod mills and three 12'6" x 16' rod mills; primary grind in open circuit
Secondary Grind	In closed circuit with 20' and 26" cyclone classifiers; twenty 10' x 10' and six 12'6" x 14' ball mills with twenty-six sets (122) 20-inch cyclone classifiers
Flotation	1056-40 C.F. and 63-300 C.F. mechanical cells
Concentrate regrind	Eight 8' x 12" ball mills
Cleaner concentrate	1300 to 1500 tons of concentrate to molybdenum plant for recovery of molybdenum
Molybdenum plant	Products — 90% + MoS2 concentrate ready to market and 29/30% copper concentrate to smelter storage bins

SMELTING OF COPPER CONCENTRATE

Copper concentrate	29/30% final copper concentrate to one of three coal, natural-gas, or oil fired, side feed, reverberatory furnaces, 32' x 102', 34' x 102' and 36' x 102'.
Reverberatory products	Matte at 30% to 36% copper. Slag to slag dump. Waste gases — about 50% of contained heat recovered by two waste-heat boilers on each furnace. Flue dust recovered from gases by a three compartment electrostatic precipitator before entering 20' x 515' stack.
Matte to converters	Three 13' x 35' and three 15' x 35' Peirce-Smith type converters.
Converter products	Slag, return to reverberatory furnace. Waste gases to electrostatic precipitator and contact acid plant. Blister copper, delivered to 4 anode holding furnaces where it is fire refined prior to casting into 820 pound anodes.

REFINERY PRODUCTION

Anodes charged per day	775 Tons
Cathodes pulled per day	690 Tons
Anode scrap pulled per day	97 Tons
Average weight — Anodes	
Commercial Sections	820 Pounds
Starting sheet section	783 Pounds
Starting sheets per day	5400
Starting sheet blanks in cells	2700
Average weight — starting sheets	12 Pounds
Anodes per cell	46
Cathodes per cell	45
Cathodes pulled per day	3357

MISCELLANEOUS

1983 Employees	3,614
1983 Payroll	$ 81,566,000
1983 Fringe Benefits	$ 29,869,000
1983 Arizona Purchases	$ 64,523,000
1983 Arizona Taxes	$ 7,861,000
1983 Refined Copper Produced	109,249 Tons

STRING OF SULFURIC ACID TANK CARS START TO MARKET VIA SMARRCO

San Manuel Arizona Railroad Company

WHOLLY OWNED SUBSIDIARY OF MAGMA COPPER COMPANY

Incorporated	September 1953
Track mileage	San Manuel-Hayden, Southern Pacific Junction, 29.42 miles
Freight carried 1983	395,950 Tons
Locomotives	4 ALCO 1600hp electric diesel road switchers
	2 EMD 2000hp electric diesel road switchers

— Edition of 1/1/85.