CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
1520 West Adams St.
Phoenix, AZ 85007
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

The following file is part of the

Arizona Department of Mines and Mineral Resources Mining Collection

ACCESS STATEMENT

These digitized collections are accessible for purposes of education and research. We have indicated what we know about copyright and rights of privacy, publicity, or trademark. Due to the nature of archival collections, we are not always able to identify this information. We are eager to hear from any rights owners, so that we may obtain accurate information. Upon request, we will remove material from public view while we address a rights issue.

CONSTRAINTS STATEMENT

The Arizona Geological Survey does not claim to control all rights for all materials in its collection. These rights include, but are not limited to: copyright, privacy rights, and cultural protection rights. The User hereby assumes all responsibility for obtaining any rights to use the material in excess of "fair use."

The Survey makes no intellectual property claims to the products created by individual authors in the manuscript collections, except when the author deeded those rights to the Survey or when those authors were employed by the State of Arizona and created intellectual products as a function of their official duties. The Survey does maintain property rights to the physical and digital representations of the works.

QUALITY STATEMENT

The Arizona Geological Survey is not responsible for the accuracy of the records, information, or opinions that may be contained in the files. The Survey collects, catalogs, and archives data on mineral properties regardless of its views of the veracity or accuracy of those data.

SAFETY AT SILVER BELL

By: Ellis A. Robinson

Safety Engineer, Silver Bell Unit

American Smelting and Refining Company

D45

SAFETY AT SILVER BELL

"Safety is Everybody's Business here". The Superintendent, the Department Heads, the Line Supervisors, the Workmen as well as the Safety Engineer. However, it is the responsibility of the line supervisor to carry out the safety program. It has long been recognized that he is the key man so far as the safety of the man on the job is concerned. It is his responsibility to sell safety to his men. Therefore, he must be alert at all times to be sure that sound practices are being observed.

Once each month, each foreman holds a safety meeting with his men. Injuries during the previous month are discussed. Unsafe acts or practices are discussed and suggestions from the men received. The safety engineer acts as secretary and also presents the program. This may be a safety movie, a quiz, or a buzz session. All have been quite effective in stimulating interest in the safety program. Minutes of the meetings are distributed to Management, Department Heads, and Foremen.

Once each month a supervisor's safety meeting is held. Prior to the meeting an inspection committee is appointed by the Superintendent. One man from each department teams up with the safety engineer to make plant inspections. The men do not inspect their own departments. For example the man selected from the milling department will inspect the mine or mechanical departments. These men make their reports on unsafe practices and conditions at the general meeting. Suggestions are discussed and once approved they become work orders for the department involved. The inspectors also check on old suggestions and make a progress report.

The previous months injuries are reviewed and disabling accidents at other ASARCO plants are discussed and preventive measures applied to out Unit where necessary. Equipment damage reports and near miss incidents are also carefully considered in this meeting. Safety films as well as general interest movies are shown frequently.

Being a unit of a large organization, we receive bulletins and other literature from the Department of Safety and Technical Employment, relative to new equipment or safer job methods. Our plant is inspected annually by an engineer from the Department of Safety. The Industrial Hygiene Department and the Medical Department is also available to us for assistance as well as making periodic inspections.

Periodicals distributed to department heads and foremen are: The Industrial Supervisor and Family Safety. The foremen are encouraged to share with their men the many timely articles in Family Safety.

Supervisory training in recent years has included the National Safety Council "Safety Management Training Series" and we are now in a monthly session of Supervisory Training being conducted by Mr. William H. Poe, of the College Supervisory Development Program, Texas A. & M. University.

The Safety Engineer, who is a qualified Bureau of Mines first aid instructor, holds classes in first aid for the employees on a bi-ennial basis or yearly if the need is indicated. Aproximately 25% of all the Unit employees have at least one Bureau of Mines First Aid Certificate. Attendance at classes is voluntary. Injury cases requiring medical treatment are normally directed to the Tucson Clinic or St. Mary's Hospital where they are treated by the Tucson Clinic Doctors. An ambulance is maintained on a standby basis, with at lease one driver on each operating shift, and a number of others on call.

When a new man is hired, he is indoctrinated by the safety engineer and given a book on general plant safety rules. This booklet also contains the department safety rules of all departments. The safety engineer sees that he secures necessary protective equipment. The wearing of hard hats, safety shoes and safety spectacles is mandatory for all production and maintenance employees. Staff or Office personnel in these areas must wear the same protection. Respirators, both dust and fume, are furnished where needed.

Department Heads meet with the line supervisors daily. In addition to mining, metallurgical and other problems, ground work is laid for general safety procedures. This includes housekeeping and fire prevention.

It might be interesting to see whether or not a program as outlined has been effective. In 1955 our first full year of operations we had 17 disabling and 28 non-disabling injures for a frequency rate of 40.26 and a severity rate of 611. In 1966 we had 4 disabling injuries and 41 non-disabling injuries for a frequency rate of 5.34 and severity rate of 291. We were awarded the State Mine Inspectors Safety Award for the best overall safety record for 1960, when our Frequency was 3.58 and Severity of 300. On April 21, 1964 we were awarded a Certificate of Honor by the Joseph A. Holmes Safety Association for completing 5,581,517 man hours without a fatality or permanent total disability from January 1, 1954 thru December 31, 1963.

Although our Frequency rate has been below the national average for open pit mines for several years the 1966 Frequency of 5.34 leaves room for improvement, as a safety goal must ever be the elimination of all injuries and a Frequency of zero.

As of January 31, 1967 days worked by the various groups since last disabling injury are:

Crushing	111
Concentrating	1691
Concentrate Handling	1907
Test Laboratory	1289
Assay Laboratory	4965
Precipitation Plant	1098

Our safety program is based on the personal approach by the supervisor. He is trying to sell the idea that safety is not entirely a matter of Company interest in saving money. It is also concerned with elimination of human suffering, and preventing loss of time. As he leaves his men after a personal contact on some aspect of safety, he hopes he has instilled the thought "that it won't kill them to be careful".

- - - - -

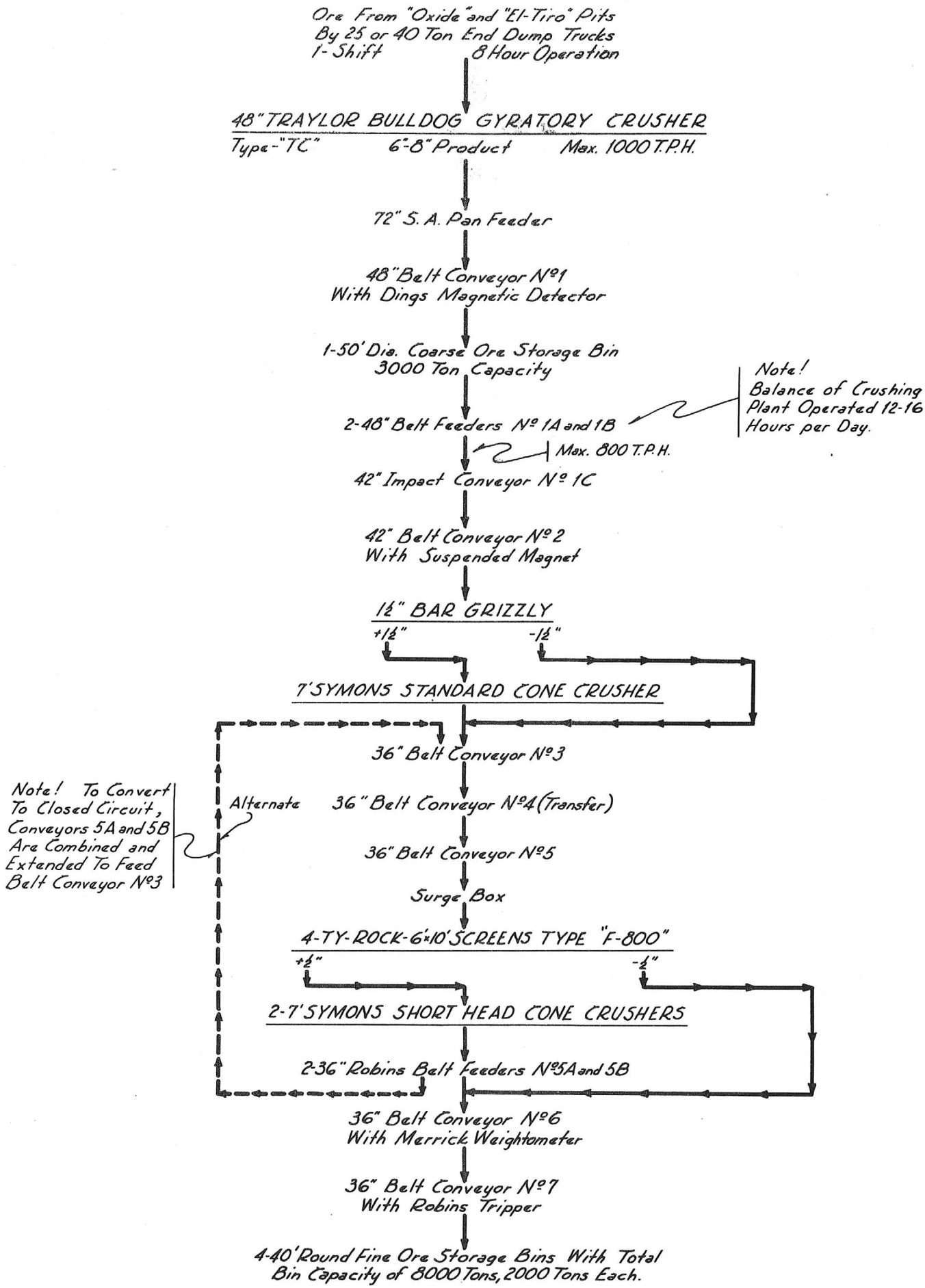

Ore From "Oxide" and "El-Tiro" Pits
By 25 or 40 Ton End Dump Trucks
1-Shift 8 Hour Operation
48" TRAYLOR BULLDOG GYRATORY CRUSHER
Type-"TC" 6"-8" Product Max. 1000 T.P.H.
72" S. A. Pan Feeder
48" Belt Conveyor No 1
With Dings Magnetic Detector
1-50' Dia. Coarse Ore Storage Bin
3000 Ton Capacity
2-48" Belt Feeders No 1A and 1B
Note!
Balance of Crushing
Plant Operated 12-16
Hours per Day.
Max. 800 T.P.H.
42" Impact Conveyor No 1C
42" Belt Conveyor No 2
With Suspended Magnet
1½" BAR GRIZZLY
+1½"
-1½"
7' SYMONS STANDARD CONE CRUSHER
36" Belt Conveyor No 3
Note! To Convert
To Closed Circuit,
Conveyors 5A and 5B
Are Combined and
Extended To Feed
Belt Conveyor No 3
Alternate
36" Belt Conveyor No 4 (Transfer)
36" Belt Conveyor No 5
Surge Box
4-TY-ROCK-6'x10' SCREENS TYPE "F-800"
+½"
-½"
2-7' SYMONS SHORT HEAD CONE CRUSHERS
2-36" Robins Belt Feeders No 5A and 5B
36" Belt Conveyor No 6
With Merrick Weightometer
36" Belt Conveyor No 7
With Robins Tripper
4-40' Round Fine Ore Storage Bins With Total
Bin Capacity of 8000 Tons, 2000 Tons Each.

Plate I

D410

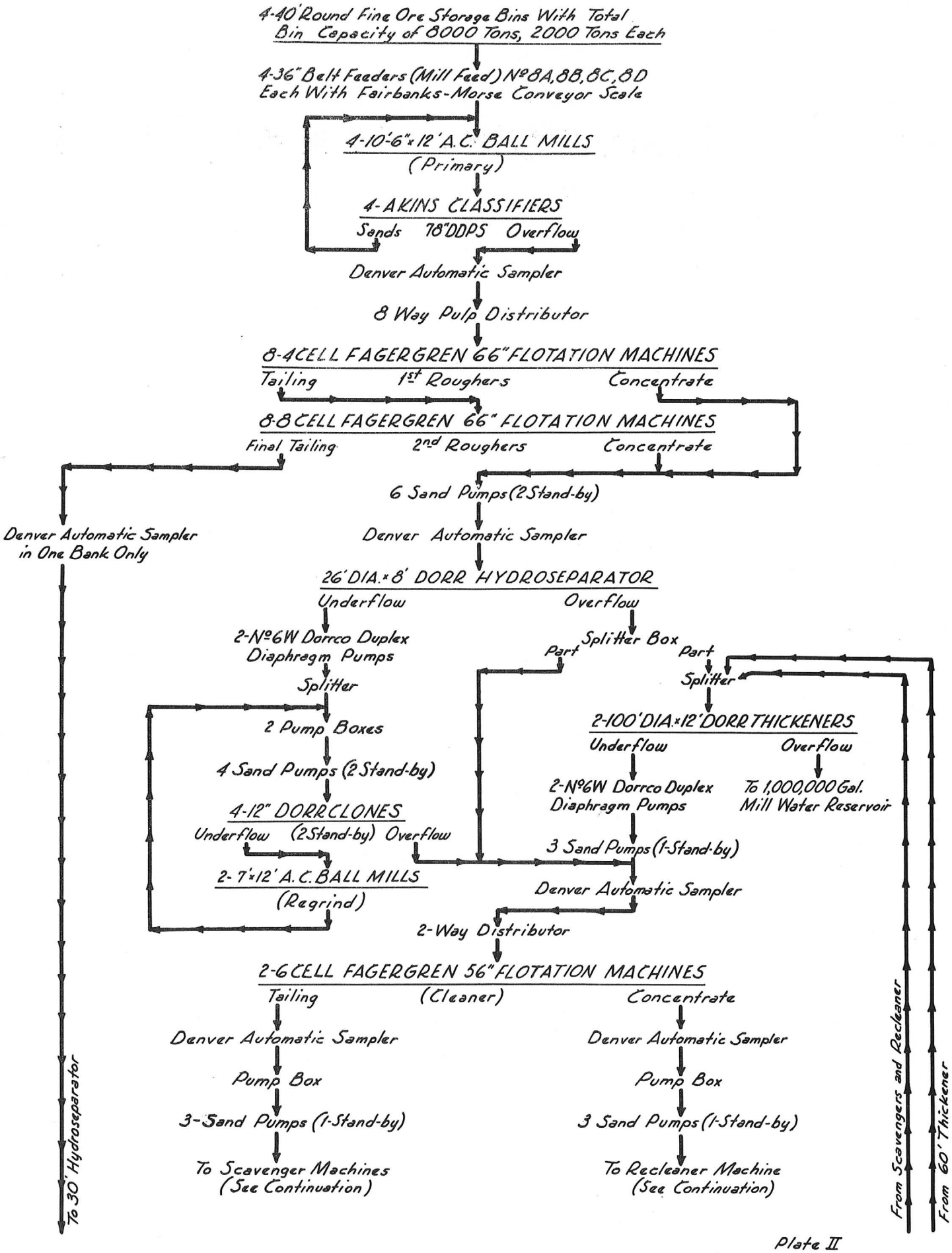

4-40' Round Fine Ore Storage Bins With Total Bin Capacity of 8000 Tons, 2000 Tons Each
4-36" Belt Feeders (Mill Feed) Nº 8A, 8B, 8C, 8D Each With Fairbanks-Morse Conveyor Scale
4-10'-6" x 12' A.C. BALL MILLS
(Primary)
4-AKINS CLASSIFIERS
Sands 78"DDPS Overflow
Denver Automatic Sampler
8 Way Pulp Distributor
8-4 CELL FAGERGREN 66" FLOTATION MACHINES
Tailing 1st Roughers Concentrate
8-8 CELL FAGERGREN 66" FLOTATION MACHINES
Final Tailing 2nd Roughers Concentrate
6 Sand Pumps (2 Stand-by)
Denver Automatic Sampler in One Bank Only
Denver Automatic Sampler
26' DIA. x 8' DORR HYDROSEPARATOR
Underflow
Overflow
2-Nº 6W Dorrco Duplex Diaphragm Pumps
Splitter Box
Part
Part
Splitter
Splitter
2 Pump Boxes
4 Sand Pumps (2 Stand-by)
4-12" DORR CLONES
Underflow (2 Stand-by) Overflow
2-7' x 12' A.C. BALL MILLS
(Regrind)
2-100' DIA. x 12' DORR THICKENERS
Underflow
Overflow
2-Nº 6W Dorrco Duplex Diaphragm Pumps
To 1,000,000 Gal. Mill Water Reservoir
3 Sand Pumps (1-Stand-by)
Denver Automatic Sampler
2-Way Distributor
2-6 CELL FAGERGREN 56" FLOTATION MACHINES
Tailing (Cleaner) Concentrate
Denver Automatic Sampler
Pump Box
3-Sand Pumps (1-Stand-by)
To Scavenger Machines (See Continuation)
Denver Automatic Sampler
Pump Box
3 Sand Pumps (1-Stand-by)
To Recleaner Machine (See Continuation)
To 30' Hydroseparator
From Scavengers and Recleaner
From 60' Thickener

Plate II

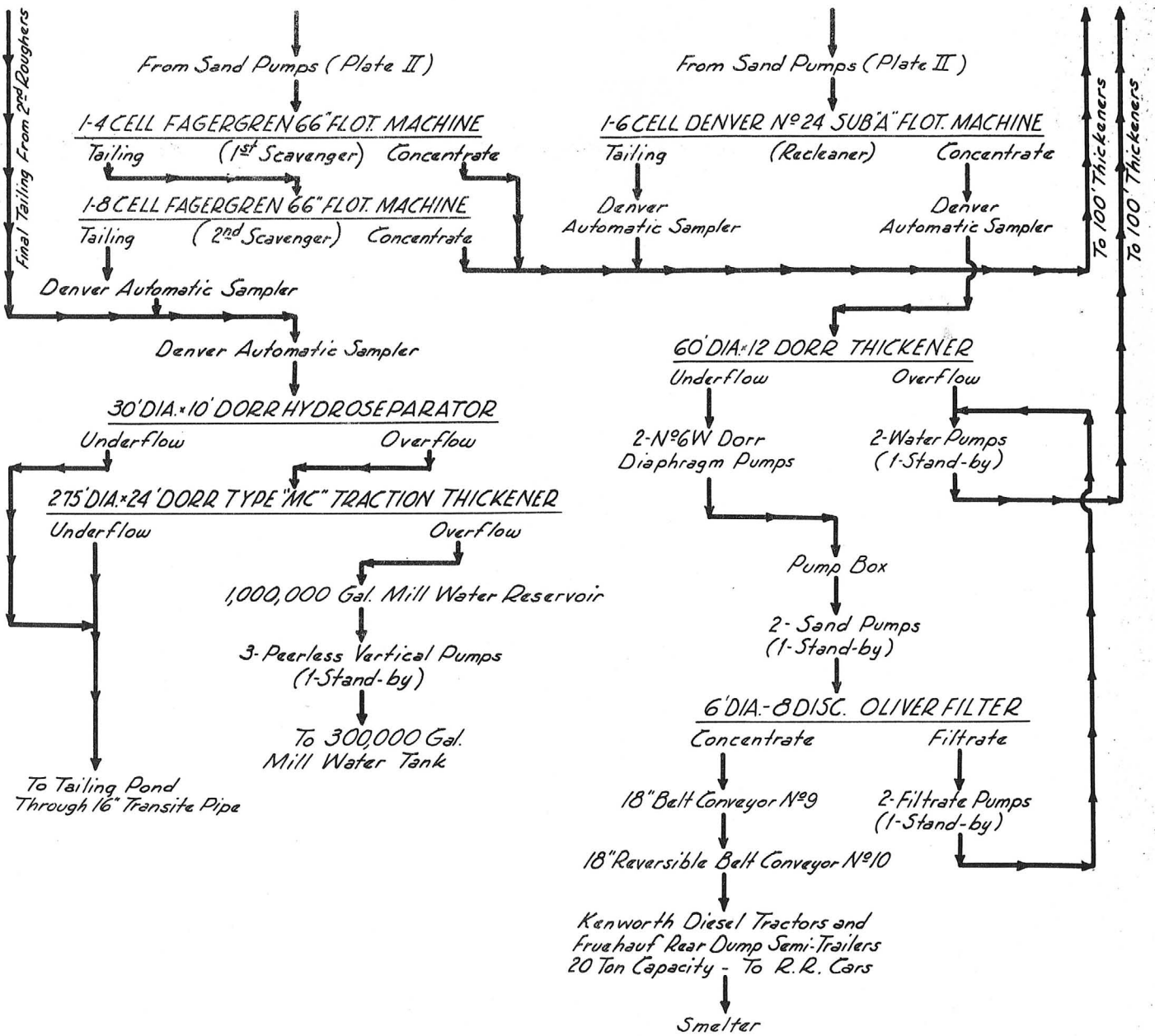
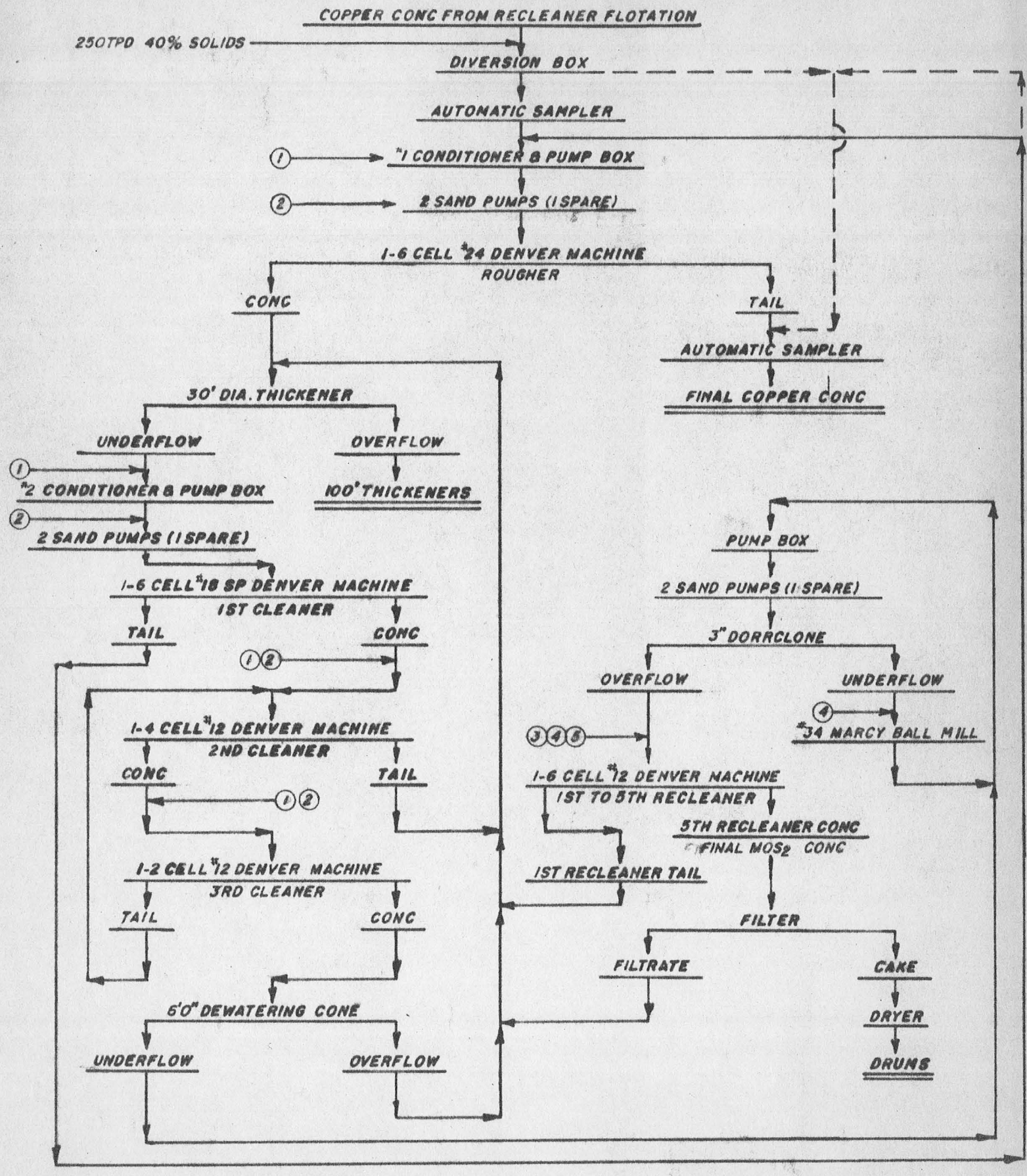

From Sand Pumps (Plate II)
From Sand Pumps (Plate II)
Final Tailing From 2nd Roughers
1-4 CELL FAGERGREN 66" FLOT. MACHINE
Tailing
(1st Scavenger)
Concentrate
1-6 CELL DENVER Nº 24 SUB"A" FLOT. MACHINE
Tailing
(Recleaner)
Concentrate
1-8 CELL FAGERGREN 66" FLOT. MACHINE
Tailing
(2nd Scavenger)
Concentrate
Denver Automatic Sampler
Denver Automatic Sampler
Denver Automatic Sampler
Denver Automatic Sampler
To 100' Thickeners
To 100' Thickeners
60' DIA. × 12 DORR THICKENER
Underflow
Overflow
2-Nº6W Dorr Diaphragm Pumps
2-Water Pumps (1-Stand-by)
30' DIA. × 10' DORR HYDROSEPARATOR
Underflow
Overflow
275' DIA. × 24' DORR TYPE "MC" TRACTION THICKENER
Underflow
Overflow
Pump Box
1,000,000 Gal. Mill Water Reservoir
2-Sand Pumps (1-Stand-by)
3-Peerless Vertical Pumps (1-Stand-by)
6' DIA.-8 DISC. OLIVER FILTER
Concentrate
Filtrate
To 300,000 Gal. Mill Water Tank
18" Belt Conveyor Nº9
2-Filtrate Pumps (1-Stand-by)
To Tailing Pond Through 16" Transite Pipe
18" Reversible Belt Conveyor Nº10
Kenworth Diesel Tractors and Fruehauf Rear Dump Semi-Trailers 20 Ton Capacity - To R.R. Cars
Smelter

Plate III

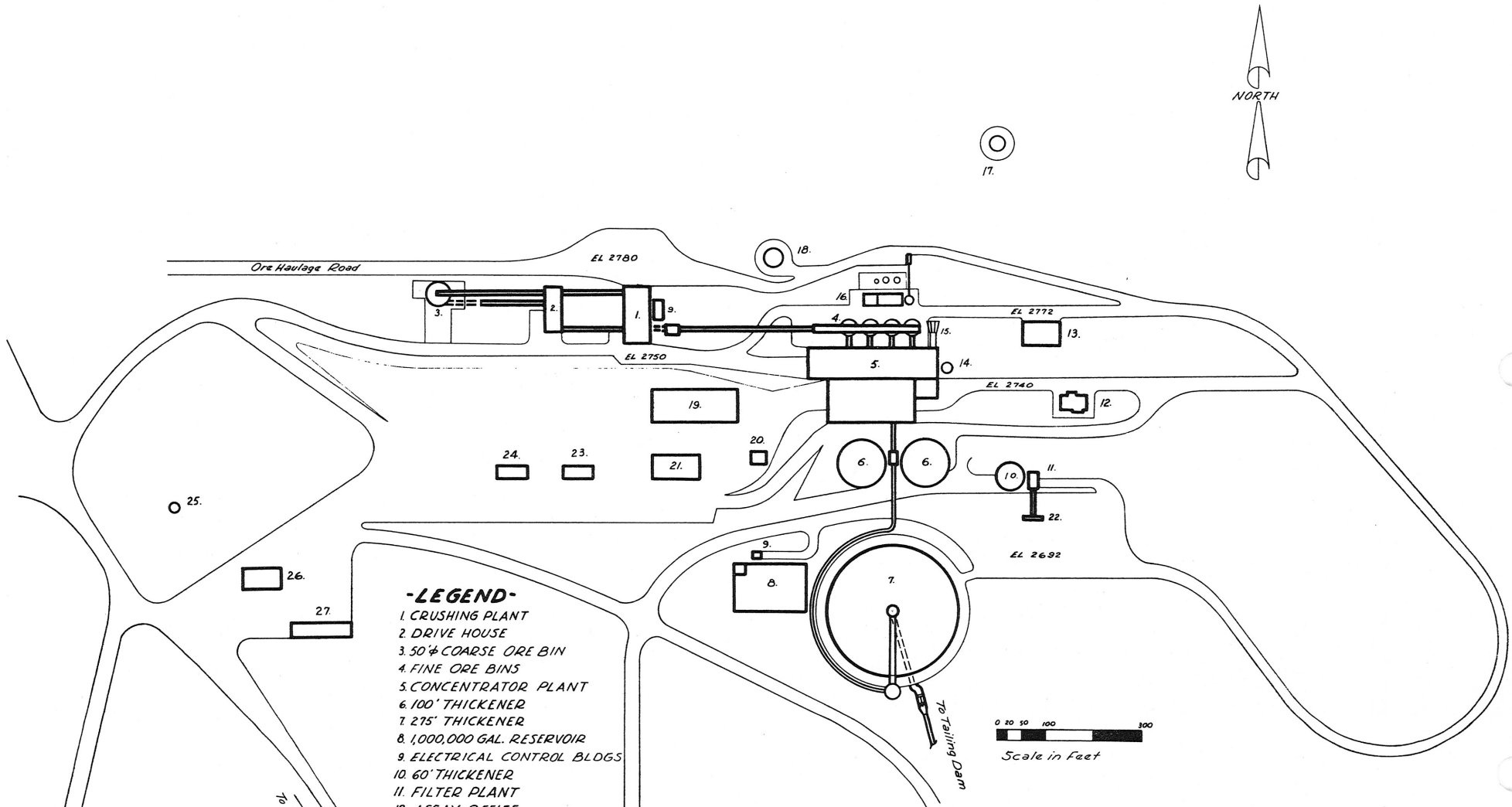
PROPOSED MOLYBDENUM CIRCUIT



(1) H_2SO_4
(2) $NA_4FE(CN)_6$
(3) NACN
(4) NA_2SiO_3
(5) FROTHER

SILVER BELL - PLATE IX

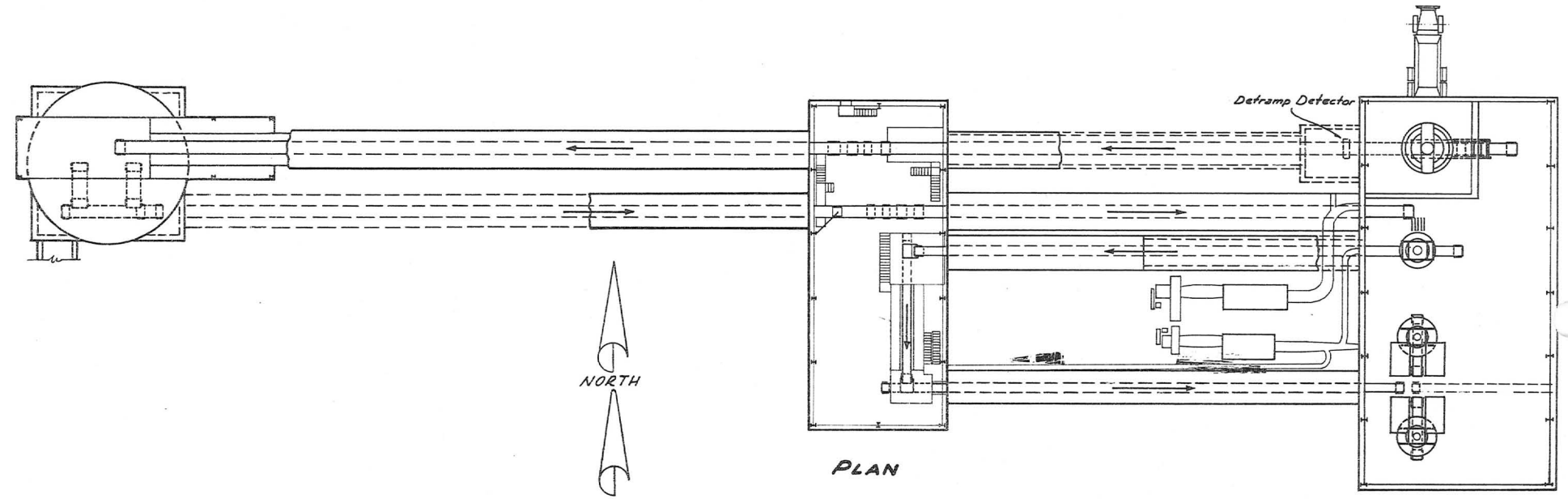
D37



-LEGEND-

1. CRUSHING PLANT
2. DRIVE HOUSE
3. 50'ϕ COARSE ORE BIN
4. FINE ORE BINS
5. CONCENTRATOR PLANT
6. 100' THICKENER
7. 275' THICKENER
8. 1,000,000 GAL. RESERVOIR
9. ELECTRICAL CONTROL BLDGS
10. 60' THICKENER
11. FILTER PLANT
12. ASSAY OFFICE
13. SUB STATION
14. 26'HYDROSEPARATOR
15. BALL DUMP
16. LIME AND REAGENT PLANT
17. 100,000 GAL. FIRE TANK
18. 300,000 GAL. MILL TANK
19. MACHINE AND ELECTRICAL SHOPS
20. OIL STORAGE BLDG.
21. WAREHOUSE
22. CONCENTRATE TRUCK LOADING AREA
23. CHANGE HOUSE
24. FIRST AID
25. 10,000 GAL. DOMESTIC TANK
26. GENERAL OFFICE
27. GARAGE

FIG 1 - GENERAL LAYOUT



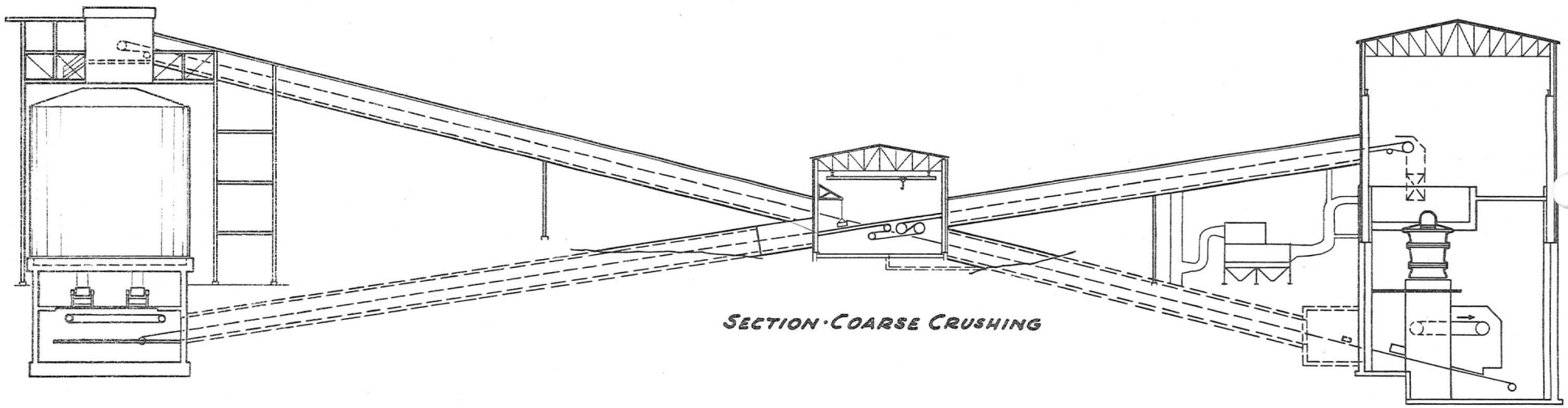


FIG 2 CRUSHING PLANT

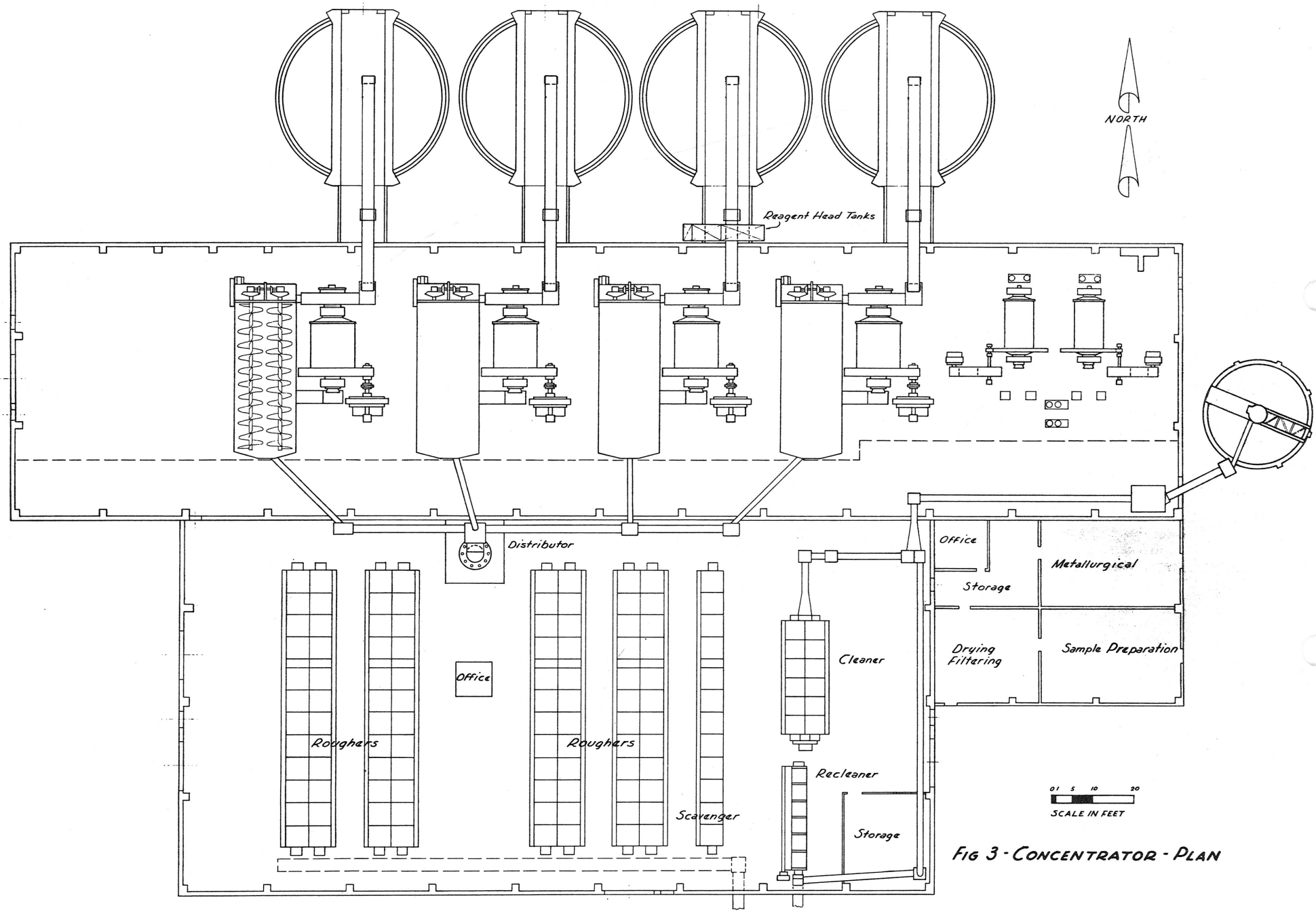


FIG 3 - CONCENTRATOR - PLAN

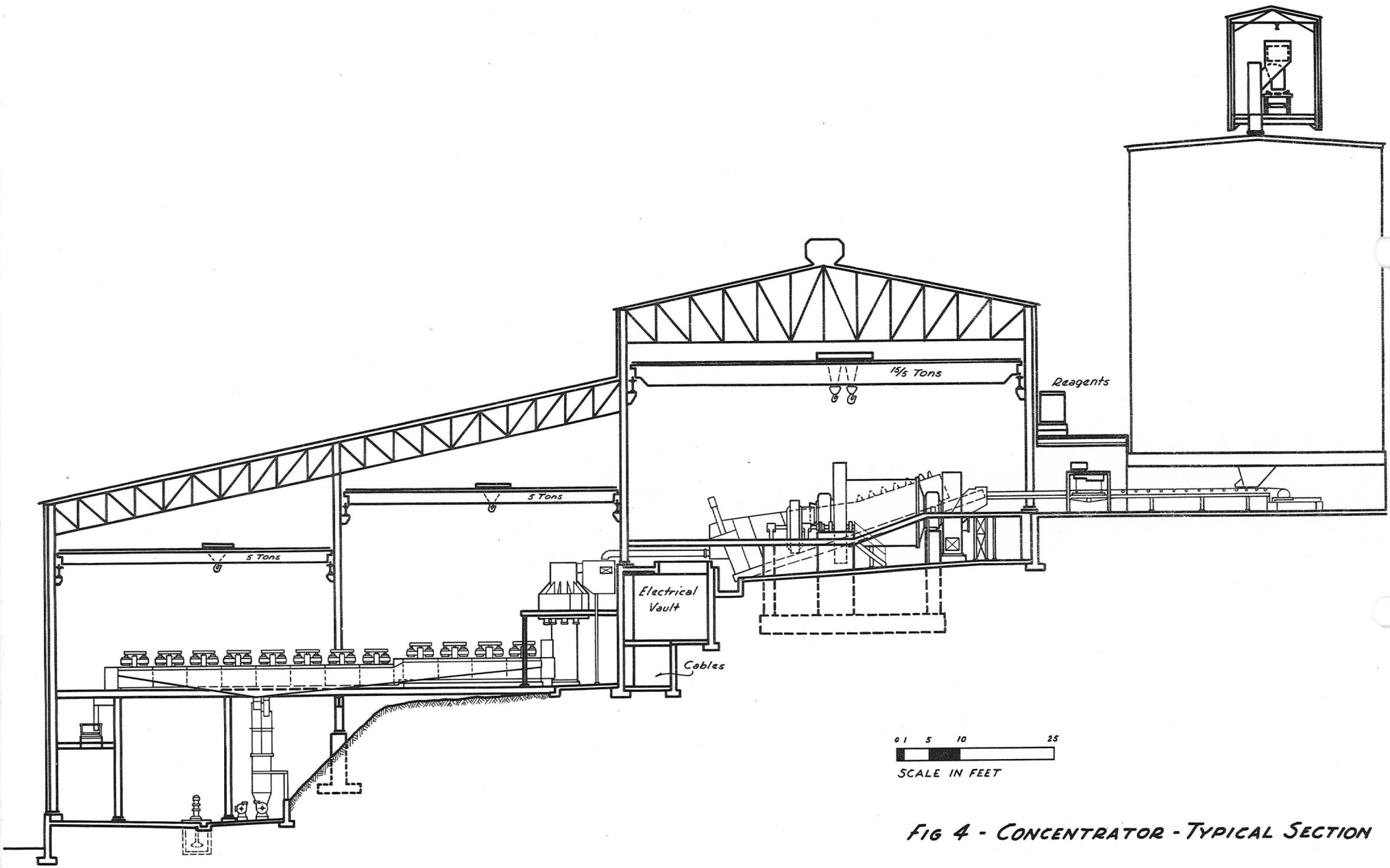


FIG 4 - CONCENTRATOR - TYPICAL SECTION

1956

Silver Bell Pit Development

By
J. J. Sense

American Smelting and Refining Company
Silver Bell, Arizona

B17

SILVER BELL PIT DEVELOPMENT

The Silver Bell 7500-ton per day open pit operation of American Smelting and Refining Company is located about 40 miles northwest of Tucson, to the west of Avra Valley, at the southern end of the Silver Bell Mountains.

DISTRICT HISTORY:

Development on the Silver Bell copper deposits began in 1873 on the Mammoth lode. In 1881, after construction of the Southern Pacific Railway through Tucson, the Huachuca Mining and Smelting Company began mining rich oxidized copper ore from the Mammoth, Old Boot and Blue Coat claims. In 1882, four different companies operated in the district but were soon discouraged by transportation problems and low metal prices.

In 1891, Silver Bell Mining Company built a smelter in Tucson and operated it intermittently. In 1902, the Imperial Copper Company obtained the Old Boot, Mammoth, and other claims, developed a sizable ore body and built a railroad from Red Rock to Silver Bell, which they completed in 1904. During this period, several companies were organized, including Oxide Copper Company, to develop the Young America Group and the Cleveland-Arizona Copper Company (later El Tiro Copper Company) to develop claims adjoining the Imperial and Indiana-Arizona Company. In 1915, American Smelting and Refining Company purchased the holdings of Imperial Copper Company and operated underground mines until 1919. In 1934, all machinery, equipment and buildings were moved out, and Arizona Southern Railway from Red Rock to Silver Bell was dismantled. In 1940, the present operator acquired the property of the Oxide Copper Company, which had drilled 76 holes, and outlined a disseminated copper deposit between 1909 and 1912, which, during those early days, was considered too low grade to be commercial.

B16

During this same period, Imperial drilled 87 holes in the El Tiro area, second pit area of the present operation.

A number of estimates were made for opening up the property, but because of the relative low tonnage of the deposit, any possible program did not seem attractive.

In 1948, a camp was established to accommodate crews for check drilling and additional exploration work. This work further increased the reserves and made it possible to enter into an agreement in November, 1951, with Defense Material Procurement Agency. This agreement provided for complete financing by the Company and a floor price of 24-1/2 cents per pound of copper, subject to adjustment for increased operating costs, for 177 million pounds of the first 197 million pounds produced.

The unusual feature of the above history is that both of the present pit areas, the Oxide and the El Tiro, were recognized and extensively drilled some forty years before the present operation became a reality.

GEOLOGY:

All of the early mining in the Silver Bell district was in replacement type ore bodies. The present production is from porphyry-type ores occurring in two deposits known as the "Oxide" and "El Tiro" ore bodies. These bodies are spaced some two airline miles apart, with northwesterly trending zone of hydrothermal alteration several miles in length. Alaskite, dacite and monzonite porphyry, with minor andesite dikes parallel to the alteration zone, have been enriched by supergene chalcocite to form the two ore bodies.

The Oxide pit obtains its name from a claim in the district, not from the type of ore. The Oxide ore body is saucer-shaped, varying in thickness from 100 to 200 feet beneath 100 feet of leach capping. Dimensions are 1500 feet by 2100 feet.

B15

The El Tiro ore body is elipsoid shaped, but very irregular in outline and cross-section. The ore is found beneath 100 feet to 300 feet of leach capping and varies in thickness from 100 feet to 300 feet. The dimensions of the El Tiro pit are 1300 feet by 2200 feet.

Additional details on geology can be obtained by referring to a paper titled "Structure and Mineralization, Silver Bell", by Kenyon Richard and J. H. Courtright, A.I.M.E., New York, February 1954.

WORK DONE BY CONTRACTORS:

In order to get the stripping work started more quickly, without waiting for the delivery of excavating equipment and also because of the relatively short life of the property, it was decided to do the preliminary stripping work by contract. The stripping contract was awarded to the Isbell Construction Company.

Construction work was also done under contract, the camp being constructed by the Utah Construction Company, and the mill by the Stearns-Roger Manufacturing Company.

STRIPPING AND MINING:

Stripping at the Oxide pit was started late in December, 1951, and built up from 4,000 tons that month to over 500,000 tons the following May. By May 1953, a rate of 1,000,000 tons per month was reached. At that time two 6-yard shovels, one 3-yard shovel, seven 24 -yard trucks, seven 15-yard trucks, six churn drills, one rotary drill, three D-8 caterpillars, one DW-10, one grader and various service trucks were in use. The stripping rate has decreased to 300,000 tons per month, and this pit is currently producing two-thirds of the daily ore tonnage. By January 31, 1956, 18.5 million tons of waste and 4.6 million tons of ore had been removed from the Oxide Pit.

B14

During preliminary stripping operations, a drainage dike to the north of the pit was constructed with 3,000,000 tons of waste from the several higher benches on the north and east sides of the pit area. Another 2,200,000 tons was moved to the east of the pit area, and the balance of the waste and oxidized material was moved to the southwest of the pit. Topography was such that over 90 percent of the waste was disposed of within 100 feet of its original elevation, even though waste was stripped over a vertical range of 400 feet. All waste disposal road grades were held under 7 percent. The average length of haul has been 0.8 miles, with only a small tonnage being hauled over one mile.

Stripping was started at the El Tiro pit in March, 1953. The stripping rate has built up to 600,000 tons per month, and this pit is currently producing one-third of the ore tonnage. Eventually, one half of the daily tonnage will be from each pit. By January 31, 1956, 10.3 million tons of waste and 500,000 tons of ore had been removed from this pit.

The topography of the El Tiro area is similar to the Oxide area, and as in the Oxide pit, over 90 percent of the El Tiro waste was disposed of within 100 feet of its original elevation. During this preliminary stripping, 4,000,000 tons were moved to the east of the pit, 4,000,000 tons were moved to the northeast of the pit, and the balance of the waste and oxidized material was moved to the west of the pit area. The length of haul for the El Tiro waste has averaged 0.4 miles, and has never exceeded 0.8 of a mile.

The length of ore haul, 4 miles from pit perimeter to the mill, presented some interesting problems.

The sub-grade for this haul road was formed for one mile on each end with waste from the two pits. The two-mile central portion was brought to grade by balancing cuts and fills. A maximum grade of two percent was maintained.

B13

To obtain low truck maintenance, good tire cost and avoid continuous sprinkling and grading, the El Tiro road was paved.

To further reduce haulage costs, six new trucks were put into service for the El Tiro ore haul. This unit is the Kenworth 802-B truck-tractor with dump semi-trailer. This truck-trailer combination is powered by a turbo-charged NRT-600 Cummins diesel producing 300 hp, and has a capacity of 32 cubic yards (struck). Further details on these haulage units can be obtained by referring to a paper entitled "A Discussion of Rear Dump Trailers", by Furman Byars, presented at the annual meeting in Tucson, Arizona, December 1955.

The equipment currently in use at Silver Bell consists of: Three 6- yard electric shovels, (two in the El Tiro pit and one in the Oxide pit), three 3-yard diesel powered shovels, (one in El Tiro and two in the Oxide pit), eight 15-yard trucks, seven 25-yard trucks, six 32-yard trucks, one rotary drill, eight churn drills, two DW10 tractors, two D-8 caterpillars, one road grader, and various service trucks.

PIT LAYOUT

Both the El Tiro Pit and the Oxide Pit have been laid out on a 1 to 1½, or 56° back slope. The shape and size of the ore body governs the selection of this slope. The rock is reasonably firm, there are no known faults parallel to the perimeters, and the life of both pits is comparatively short, 12 years, so little difficulty from slides of rock is expected with a 1 to 1½ slope.

A bench interval of 30 feet was originally planned, but this was later changed to 40 feet. The main reason for this change was to permit the contractor, Isbell Construction Company, to use their 6-yard shovels to a better advantage. Some of the lower benches may be mined on a 30-foot interval.

SUMMARY:

In summary, the two ore bodies have a reserve of 32,000,000 tons, the majority of which are in the Oxide ore body. The average assay of the two pits, four miles apart by road, is 0.9 percent copper. The combined stripping ratio for the two pits is 1.2 waste to 1 ore. Present pit equipment with truck haulage and modern milling practice, make the operation feasible.

B11

ASPHALT MIXED SURFACE MAT FOR HEAVY-DUTY ORE HAULAGE ROAD

AT

SILVER BELL MINING PROPERTIES OF

AMERICAN SMELTING AND REFINING COMPANY

BY

LUTHER M. KRUPP

MEETING OF THE ARIZONA

SECTION OPEN PIT DIVISION, A. I. M. & M. E.

APRIL 23, 1956

AT SILVER BELL, ARIZONA

B10

ABSTRACT

This paper concerns a subject on construction of a road for the American Smelting and Refining Company connecting the El Tiro Pit with their mill.

Most state laws restrict highway truck axle loads on paved roads to 18,000# for single axle and 32,000# for tandem axles.

Since completing the road under discussion, we have hauled approximately 500,000 tons of ore over 2½" mat of asphalt mix in nine months. The bulk of this was hauled with the new Kenowrth trailer trucks. The single axle loads of these trailers have been averaging 80,000#. Some ore was hauled with Euclid FFD trucks with tandem axle loads of 120,000# to 130,000#.

This is unusually heavy loading for asphaltic pavement, but with the exceptionally good sub-base it is thought that results will be satisfactory, which has been the case so far.

The asphalt surface is 3.5 miles long. Alignment was laid out on topographical maps flown by Fairchild.

Elevation at the El Tiro Pit end is 2,650'; drops to a low of 2,615' and the elevation at the mill is 2,780', or 130' higher than at the beginning. Maximum down grade is 2% with maximum adverse grade of 2.5%. Minimum radius of curvature is 1000'. Super elevations were figured for a speed of 40 miles per hour, and rotated about the centerline.

Specifications were in accordance with the Arizona State Highway Department with special provisions added.

The finished roadway was to be 40' wide. This was to consist of a 3' wide penetrated shoulder on the southsside, 30' of asphalt mix 2½" deep,

and 7' of penetration on the north shoulder. The subgrade was to be 6" of compacted gravel (100% pass 1" screen) of which a 30' width 2½" deep would be windrowed to be mixed for the asphalt mat. The mixer was to be of the pugdill type. A 0.015 ft/ft. crown was called for.

Reasoning behind the width and shoulder arrangement was as follows: loaded trucks would be traveling the south side. They would be required to stay on the mixed portion and not travel the 3' shoulder. Empty trucks traveling on the north side would be permitted to run on the penetrated 7' shoulder when passing the loaded trucks if necessary. Thus, 30' of mixed asphalt mat should be sufficient for 95% of the traffic, and 10' of shoulders would be protected by the penetration.

Excavation work began June 1953 which involved 283,000 tons of rock to be drilled, blasted and moved to fill areas. An equal amount of pit run waste was also used in the fills. The road was brought to 6" below final grade with native material loaded and placed with scrapers. The finer material served as a seal for the large rock in the fills. This initial phase of the work was completed in the summer of 1954. The road was then opened to traffic which consisted of pickups, water and service trucks, empty pit trucks, cats, plus 71,490 tons of ore hauled mostly by Euclid FFD trucks.

Since many small drainage basins were blocked by the fills, metal culverts were installed to handle normal run-off. Gentle dips were placed to handle flash floods. Most of the fill material was large rock with very little fines. Normal run-off storm water passes through these fills as if they weren't there.

In June 1955 the road was again brought to 6" of final grade by scrapers. Care was taken to avoid "Caliche" (Material from which adobe

bricks are composed). Once "caliche" becomes wet and is covered it will never dry out, always remaining plastic.

A 2,000 ton/hour crusher was set up about one-fourth mile from the road near the mid-point. The material run through the crusher was an alaskite as collected in a stream bottom. All material was reduced to 1" maximum size and 3/8" chips were screened out. The sieve analysis of the remaining material was as follows:

Average Sieve Analysis:

Screen	% Pass	Arizona Specifications % Pass
1"	100	100
#3	65.1	50-65
#10	38.7	(Not Required)
#200	9.0	3-12

Density 138 lbs/cubic foot compacted - 110 lbs/cubic foot loose. The 1" gravel was placed in two layers of 3" depth 40' wide each. The first layer was watered and well compacted by a pneumatic roller. After this layer of gravel had been placed, a small amount of ore was hauled over it which greatly aided compaction. The second layer was spread for uniformity and then a 30' width 2½" depth was windrowed to be mixed with asphalt. A Barber Greene, Model 848, traveling mixer was used on a 7.5 ft^3 windrow to mix 4.5% by weight, SC-4 oil. The mix was laid with a Cat #12 Motor Patrol and compacted with a pneumatic roller to a 2½" minimum thickness of asphalt mat, the 3/8" chips were than applied over .35 gallon/yd^2 of asphalt emulsion seal coat. The shoulders were prepared and penetrated with 0.5 gal/yd^2 of SC-2 oil with two passes on successive days---0.3 gallon on first pass and 0.2 gallon on the second. The road was opened to all traffic except during actual laying of the asphalt mat.

A 900' length of asphalt mat, starting at the mill, gave considerable trouble. After about three weeks of heavy usage, it became soft and spongy showing tire tracks and heel marks of shoes. The surface did not tend to crack but became wavy.

The entire 900' length 30' wide was ripped up. The oil mat was found to be over-rich, running 5.5% to 6% oil and the subgrade was damp. After the subgrade was ripped up, dried and relaid, a Seaman Rotatiller type mixer was run on the windrowed asphalt cake for pulverization. A small amount of gravel and MC-2 asphalt were added to the windrow. This was thoroughly mixed, relaid, sealed and chipped with no further difficulties in this area to date.

After two months of use, a total of about 200 yd^2 of asphalt mat in six areas were repaired. These seemed to be due to subgrade failure. In repairing these areas, caliche was found under the gravel base. This "caliche" was removed and replaced with gravel and the asphalt mat was patched with mix from a stockpile.

Costs of the road are as follows:

1. Sub-grade including cut and fill, pit waste, select material and all work prior to June 1955, including reshape roadway preliminary to wpaving. $34,360 per mile

2. Gravel in place, asphalt and mixing, laying mat, sealing and chips and shoulder penetration $14,842 per mile

Total cost per mile was $49,202.

By comparison, the county road from the American Smelting and Refining Company office to El Paso Gas pumping plant, a distance of 7.5 miles, cost $15,438 per mile. This road is only 22' wide and did not require the cut and fill work involved in the El Tiro Road.

The Kenworth trailers have a tendency to bounce when empty as do most trucks with rigid mounted axles. It was decided that the effects of this after

continued usage might make the asphalt mat wavy. Therefore, on February 1, 1956, the traffic pattern was changed from a right-hand to a left-hand system. It was felt this would eliminate any possibility of a wavy asphalt mat and assure uniform wear and compaction on the full width of the road. The driving pattern will probably be reversed from time to time.

At this time the El Tiro Road has been in service about nine month. As was previously stated, this is not sufficient time to fully evaluate this work. However, we are very pleased with the results to date.

The county road previously mentioned as a comparison cost was also constructed by Isbell. The road was built and surfaced at the same time the American Smelting and Refining Company mill materials and machinery was being hauled in about 2½ years ago. All mill concentrate has been hauled over this road to date with no signs of surface break-up. This road is also giving satisfactory service. We feel other mining operations may be able to adapt an asphalt mixed surface to their semi-permanent heavy duty haul roads.

SILVER BELL CONCENTRATOR

By Norman Weiss, Milling Engineer
American Smelting and Refining Company,
Salt Lake City, Member A.I.M.E. July, 1954.
Revised To conform With Existing Conditions
By W. H. Tuttle, Assistant Metallurgist,
American Smelting and Refining Company
Silver Bell, Arizona. Junior Member A.I.M.E.
April, 1955.

This paper is to be presented at the Spring Meeting
of the Minerals Beneficiation Division, Arizona Section
A.I.M.E., Silver Bell, March 26, 1956.

SILVER BELL CONCENTRATOR

By Norman Weiss, Milling Engineer, American Smelting and Refining Company, Salt Lake City. Member A.I.M.E. July, 1954.
Revised To Conform With Existing Conditions By W. H. Tuttle, Assistant Metallurgist, American Smelting and Refining Company, Silver Bell, Arizona. Junior Member A.I.M.E., April, 1955.

April 1956

The 7500 tons-per-day Silver Bell open-pit copper mining operation of the American Smelting and Refining Company is situated in Pima County, in the Silver Bell Mountains about 35 airline miles northwest of Tucson, Arizona. Access is by road which turns west from the Casa Grande highway (Arizona 84), near Rillito. The 7500-ton mill which will be described in this paper is now treating ore from the Oxide pit a half-mile away, and El Tiro pit 4 miles distant by road.

HISTORY

Silver Bell is not a new discovery. Eighty years ago the Boot Mine operated only one-half mile east of El Tiro, and later became the Mammoth Mine. The Silver Bell, the called "Silver Belle", and the town of Silver bell were known in the late 1880's. The Imperial Copper Company was formed in 1903, and in 1907 the El Tiro Copper Company came into being as the successor to the Cleveland Arizona Copper Company. A concentrator was built near the Mammoth Mine and a railroad from the mill to Red Rock. In 1907, a copper smelter was built at Sasco, a small place 14 miles east of Silverbell.

All of these, mill, railroad, smelter, and hamlets called Silverbell and Sasco, are now vanished, but up to 1930 they had produced over 70,000,000 lb. of copper and a little lead and silver.

The American Smelting and Refining Company entered the district in 1915 and through the years consolidated the separate holdings as opportunity offered. From time to time estimates were made with the thought of developing the property, but copper prices in relation to construction costs did not make the project attractive.

In 1948 an exploration camp was set up to check drilling and continue exploratory work. This work increased ore reserves sufficiently to encourage the Company to develop the property under prevailing copper prices and with the assurance afforded by a government floor price contract for part of the production.

Stearns-Roger Manufacturing Company of Denver was engaged to construct the milling plant, and work on the site was started in June 1952 and terminated February 1954. Test running was begun in March and regular operation on a 24-hour basis was started soon thereafter.

GENERAL FEATURES

The property lies at the west end of the broad Avra valley now becoming well known for its production of fine cotton. The terrain slopes gently for nine miles from the valley floor at el 2020 ft. up to the modern town of Silver Bell, el 2650 ft, pop. 950, estab 1952. The mill is situated 100 ft higher, and at this point the grade increases sharply to the top of Portland Ridge (el 3315) which stands as a natural curtain between the Oxide pit and the plant.

The general layout of the concentrator and auxiliary buildings is illustrated in Fig. 1. Most of these buildings are of conventional reinforced concrete and steel construction with galvanised corrugated steel roofing and siding. Skylight-green alsynite is used to supplement artificial lighting in all of the large buildings. Continuous ridge ventilators are generally employed.

Artificial lighting is both incandescent and fluorescent. The principal lights in the crushing plant are 15 high-bay reflectors with 1000-w clear incandescent lamps, spaced 20 ft. Thirty-nine of these are also used to light the grinding section of the concentrator. The flotation floor is illuminated by 120, 2-tube 60 in. fluorescent lamps, 90 w per tube, or 1.3 w per sq. ft.

GEOLOGY AND MINERALOGY

The "Oxide" and "El Tiro" ore bodies are disseminated copper deposits, the copper occuring principally as chalcocite, representing two or three-fold enrichment of lean primary chalcopyrite.

At present the ore comes to the mill from the Oxide and El Tiro pits with approximately 70% coming from the former. In this ore the chalcocite, with pyrite and minor chalcopyrite, is present as discrete grains and narrow seams. These sulphides comprise about 10% of the ore material.

Three intrusive porphyries, monzonite, andesite, and dacite, comprise the host rock. These are irregularly silicified and contain both clay and sericite alteration products.

The Oxide ore body is tabular in form, varying from 100 to 200 ft. in thickness, beneath 100 ft. of leached capping. Dimensions are 1500 ft. by 2100 ft., elevation ranging from 2600 ft. to 3000 ft. present entry and bottom level at 2780 ft. with a bench interval of 40 ft.

In comparison, the El Tiro ore body 4 miles distant is generally lower grade with lower oxide copper content and higher molybdenum values than the Oxide ore body. The El Tiro ore body is an irregular ellipsoid in form, varying from 100 to 300 ft. in depth, beneath 100 to 300 ft. of leached capping. Dimensions are 1300 ft. by 2200 ft, elevation 2500 ft. to 2900 ft., with a 40 ft. bench interval.

For details the reader is referred to "Structure and Mineralization, Silver Bell" by Kenyon Richard and J. H. Courtright, A.I.M.E. New York, February 1954.

CRUSHING

The arrangement of the crushing plant (Fig. 2) provides low-cost operation by virtue of simplicity and compactness. All four crushers are under one roof and one traveling crane. Conveyors occupy the minimum amount of building space. Either open- or closed-circuit crushing can be employed.

The work of this plant is to crush 7500 tons per day of pit ore to ball mill feed size of approximately one-half inch. The crushing section consists of the crushing plant building, served by a 50-ton Shaw-Box crane with 15-ton auxiliary hoist; the conveyor drive house, which contains transfer conveyor 4 and the motors, drive mechanisms, and takeups for conveyors 1,2,3, and 5; the coarse ore storage bin and feeders; and connecting conveyors, dust system, and other auxiliaries.

The flow sheet is shown in Plate 1. Ore is hauled to the mill in 25- and 40-ton Euclid end-dump and 40 ton Kenworth trailer dump trucks, and dumped into the feed hopper of a 48-in. Traylor "TC" gyratory crusher. After reduction to 6-8 in. the product drops directly upon a 72-in. Stephens-Adamson pan feeder, and then to belt conveyor 1 (See Table I for size, speed, slope, etc. of all belt conveyors and belt feeders). A steel bin of 3,000 tons capacity receives the ore from conveyor 1, reducing surges by providing storage for 3-5 hours. Close liason with the two pits, shop and office is provided by radio.

D38

Flow of ore from the surge bin is regulated by two Stephens-Adamson tunnel loading gates, and two 48-in. flat-belt feeders 1A and 1B. The gates are hinged and counterweighted, and control is provided by depth of bed regulation and variable speed drives actuated by the secondary crusher operation. The belt feeders discharge upon an impact conveyor 1C which feeds conveyor 2.

Secondary and tertiary crushing equipment, consisting of one heavy duty 7 ft. Symons standard and two heavy duty 7 ft. Symons short head cone crusher, is housed in the same building as the primary (gyratory) crusher. The ore from the 3000-ton surge bin crosses a stationary grizzly situated above the standard cone crusher. The undersize (1½ in.) passes directly to conveyor 3, while the oversize is crushed to approximately 1½ in. and then discharged upon conveyor 3. The twice-crushed ore now proceeds by conveyors 3, 4, and 5 to the screens which precede the third and last crushing stage.

Four Tyler 6 x 10 ft. single-surface Ty-rock S-300 screens with 5/8 in. square apertures remove the finished ore ahead of the two tertiary crushers. The oversize product from the screens passes through the tertiary crusher and is carried on 46 in. conveyor 5 C to conveyor 3 where it joins the grizzly undersize and the secondary crusher product. These products then proceed to the same Ty-Rock screens, giving a closed circuit operation. The undersize product from the screens is carried by 36-in. conveyor 6 over a Merrick weightometer to conveyor 7 on the fine ore bins. The ore is discharged by a Robins type S motorized tripper.

The plant was designed for 1000 tph in the primary section and 650 tph in the secondary and tertiary sections with the present closed circuit operation. At the beginning of operations in 1954, the tertiary section was operated in open circuit with the tertiary product joining the screen undersize on conveyor 6 and thence to the fine ore bins. With the open circuit, the capacity was 800 tph in the secondary and tertiary sections.

D2n

After 3 months of open circuit operation the change to the closed circuit was made because of the necessity of a finer feed to the ball mills. The plant was designed with liberal screening area and belt capacity with closed circuiting in mind.

Fine ore storage consists of four cylindrical steel bins 40 ft. dia. x 53 ft, each with volumetric capacity of 2000 wet tons, total 8000 wet tons, based on 20 cu. ft. of ore per ton. The actual draw capacity is approximately 50% of these figures. The Robins tripper, motorized, does not travel continuously, but is spotted at a number of stations over the bins. The feed slot is sealed by means of a 22-in. dust belt over a safety grating.

Protection of crushing equipment from tramp metal is provided by a detramp electronic detector on conveyor 1 and a 49-in x 65-in. suspended magnet over conveyor 2.

Rock boots are installed wherever advisable to lessen impact on belts, and chutes are lined with manganese steel or rubber at points where excessive wear can be expected.

All conveyor belts are spliced by vulcanizing, the longer belts field-spliced and the shorter ones supplied endless. The larger pulleys are straight-face. Conveyors are chain driven from gear reductions coupled to squirrel-cage induction motors through centrifugal couplings.

A Nock & Garside freight service elevator of 4000-lb. capacity runs from the basement of the crushing plant to truck-dump level, with four entrance landings.

Interlock System - The electrical interlock system is so arranged that stopping any machine will automatically stop all ore-carrying equipment preceding it, but the shutdown of any ore-carrying device does not stop a crushing or screening unit.

D26

Failure of a lubrication system automatically causes shutdown of the corresponding crusher. In case of excessive or insufficient flow of oil or high oil temperature an alarm system is energized, providing audible and visible signals and also actuating a time relay which shuts down the crusher. The time between signal and shutdown may be varied between 3 and 5 minutes.

The sequence of starting and interlock is given below, with other causes for automatic shutdown:

Primary circuit

1. Belt conveyor 1.
   a. High level in coarse ore bin
   b. Belt misalignment
   c. Detramp detector
2. Pan feeder.
3. Primary crusher (not stopped by (1) or (2).
   a. High-low oil flow (after time delay)
   b. High oil temperature (after time delay)

Secondary circuit

1. Belt conveyors 7 - 6 - 5C
   a. Belt misalignment
2. Tertiary crushers (not stopped by (1).
   a. High-low oil flow
   b. High oil temperature
3. Screens (interlocked only for starting).
4. Belt conveyors 5 - 4 - 3.
   a. Belt misalignment
5. Secondary crusher, stopped only by
   a. High-low oil flow
   b. High oil temperature.
6. Belt conveyors 2 - 1C - 1A and 1B.

D25

Selector switches are provided so that one or more of the four screens or one of two parallel crushers or belts can be operated with the others idle.

Conveyor interlocking is accomplished by use of plugging switches on pulleys other than the drive pulley.

An inter-communication system saves the operators many steps, with stations at the following strategic points: top of coarse ore bin, discharge of coarse ore bin, conveyor drive house, primary crusher control panel, secondary and tertiary crusher control panel, pan feeder, gallery of conveyor 6, and top of fine ore bins.

Dust Control - In general the system is arranged to draw dust-laden air down through the generating point, rather than counter to the flow of ore. Dust is picked up wherever possible from relatively large enclosures, the fines entering at one end under a curtain and then expanding to fill the space while dropping out coarser material. A basic velocity of 3500 fpm is used, and this is increased to 4000 fpm at the collector, then reduced to 2500-3000 fpm through fan and stack.

At the primary crusher the main exhaust points are at the back of the pit oppisite dump point; the secondary points are the crusher discharge hopper and the hopper discharge.

At the secondary crusher air is exhausted from the grizzly chute, crusher feed hopper, crusher discharge hopper, and hopper discharge to conveyor 3.

At the tertiary crushers air is exhausted from the surge bin which feeds the four screens and the screen-undersize hopper. Also air is drawn from the tertiary crusher feed hoppers, crusher discharges, and at the point where the screen undersize meets conveyor 6. About 5000 cfm is exhausted from the conveyor transfers 3 to 4 and 4 to 5.

Two Rotoclones serve the above collection points. The first exhausts 35000 cfm from the primary crusher circuit, most of this coming from the feed pit. The second exhausts 25500 cfm from the secondary and tertiary circuits.

B24

The primary collector appears to have more capacity than necessary while the secondary does not have enough; the two circuits are to be balanced. The sludge from the Rotoclones is pumped continuously to the flotation plant.

In addition to the two wet collectors a 5500 cfm Wheelabrator dry collector operates on top of the fine ore bins, exhausting from the conveyor 6 to 7 transfer, the tripper on conveyor 7, and from the fine ore bins. The bags are shaken mechanically, and the dust is dropped into the No. 4 fine ore bin.

Water sprays are installed at strategic points throughout the crushing plant to lay the dust.

GRINDING AND FLOTATION

The concentrator building covers 38300 sq. ft., and includes three main sections: Grinding floor 67 x 280 or 18900 sq. ft., Flotation floor 92 x 181 or 16640 sq ft., and laboratories 46 x 60 or 2760 sq ft. Fig. 3 and 4 show the general plan and section. The grinding floor contains the four primary ball mills and classifiers, and the two regrind mills and accessories. The flotation floor contains the rougher, scavenger, cleaner, and recleaner flotation machines. Both floors have space for additional units and repairs.

Tables II and III may be referred to in the following description of the flow sheet.

Grinding - Each of the four primary grinding sections consists of one fine ore bin and feeder, one 10 ft. 6 in. diam. inside shell x 12 ft. effective length Allis-Chalmers grate-discharge ball mill; and one 78 in. duplex type S Akins classifier (submerged spiral). The ore at 1/2 in. size drops through a single 2 ft. by 6 ft. rectangular opening in the concrete bottom of the fine ore bin, into a steel discharge chute with adjustable swing gate. A 36-in. conveyor equipped with Fairbanks-Morse conveyor scale carries the ore to the ball mill.

D23

The ball mill feeder is a 72-in. radius, double rubber lined scoop with ball charging drum. Primary mills were initially charged with balls of several sizes from 3 in. down, but at present the daily ration consists predominately of 3 in. with a few 2 in. and 2½ in. exclusively in one mill.

At the present three types of shell liners are used in the primary mills: wave and one half, double wave, and Allis Lorain. The outer feed end liners are Ni-Hard alloy and the throat liners and grates are of chrome-molybdenum alloy steel. The mills are driven by 900 hp. synchronous motors through herringbone gears at a speed of 18.05 rpm, equivalent to 74 percent of critical speed with new linings.

The discharge of each ball mill flows to an Akins Classifier set at 4in-12 slope, spiral speed 4 rpm. The classifiers are in conventional closed-circuit with their ball mills carrying a 200 to 250% circulating load.

The classifier overflow product from the four 78-in. Akins classifiers flows in rubber-lined pipe and launders to a central box, then to a 10-compartment pulp distributor, stationary type. Only eight compartments are in use, two being reserved for possible extension of the flotation section.

A ball mill must often be positioned accurately for inspection, bolt tightening, relining, and other repairs. Because the load is unbalanced by virtue of the cascading ball charge, fluid pulp, and scoop feeder, such "spotting" or "inching" presents a problem. In large concentrators with a dozen or more grinding mills it is accepted practice to remove a whole mill including its ball charge to the repair bay and replace it with a newly repaired unit. This requires a large traveling crane in the range of 150-250 tons. In such concentrators the crane has ample capacity for "inching", but at Silver Bell, where there was no need for a heavy crane except for inching, we installed an E-M Incher.

D55

Inching by electrical means is accomplished by transferring the mill motor power feed from the normal 4160-v bus to the inching bus by a double-throw disconnect switch. The three inching buses alternately carry a D-C current from the motor generator set through contactors controlled by a timing device. This method transmits D-C power to the stator coils in phase group sequence to cause rotation of polarity in slow motion. While the stator polarity is rotating the rotor polarity remains constant as in normal operation and the rotor turns as the stator polarity rotates. The inching rotation of the large motor can be reversed, and inching speed can be increased or decreased by manual control of the timing device.

The 15-ton Shaw-Box overhead crane with 5-ton auxiliary hoist, and a 1-ton jib crane fill all other requirements on the grinding floor.

Grinding balls are hauled from the railroad in a special semi-trailer with low hinged sides. The road at the ball bins, east of the No. 1 fine ore bin, is so arranged that the trailer empties itself when the sides are unlatched. The ball bin is of concrete, with sloping bottom, in three sections of 105, 105, and 40 tons capacity, the last for regrinding balls.

From the ball bins the balls are hand-fed into 10-in. pipes and roll into a steel hopper located just inside the mill. From here they are fed as needed into 10 cu. ft. ball buckets, which in turn are carried by the 15-ton overhead crane to the platforms at the ball mill scoop feeders. The balls drop into the ball-charging drum of the scoop feeders. The daily ration is weighed by means of a Hydroscale carried on the crane hook.

Flotation - The flotation equipment comprises a roughing section of 96 Fagergren 66-in. level-type cells, divided among eight 12-cell machines in two levels of 4 and 8 cells each; a cleaning section of 12 Fagergren 56-in. level-type cells in 2 machines of 6 cells; a scavenger machine of 12 Fagergren 66-in. cells arranged in two levels of 4 and 8 cells; and a recleaner machine consisting of 6 No. 24 (43 in. x 43 in.) Denver "Sub-A" cells. Two Shaw-Box 5-ton overhead cranes serve this floor.

D21

The flow sheet of the flotation section is shown in Plates 2 and 3. Pulp from the distributor flows through an 8-in. pipe to each of the 8 rougher machines, the quantity being regulated by a weir. A 12-in. drop between the 4th and 5th cell in each 12-cell string facilitates intermediate sampling and reagent addition, while also permitting a steeper slope of concentrate launder.

The tailing of the last cell of all machines drops into a common tailing launder. The rougher tailing is automatically sampled.

The rougher concentrate flows to the pump floor (see section Fig. 4) and is pumped to a 26 ft. hydroseparator for preliminary classification. The underflow is metered by two diaphragm pumps and split to the two regrinding sections. Each regrind section consists of a 7 ft. diam x 12 ft. Allis-Chalmers overflow ball mill with trash trommel, a pair of centrifugal pumps (operating and standby), and a pair of 12-in. Dorrclones (operating and standby, or both if desired).

The coarse, thickener, fraction of the rougher concentrate is pumped to the Dorrclones; the spigot product of these enters the feed trunion of the ball mills; the ball mill discharge passes through the trommel and into the pump box, there combining with the original feed to the regrind section and returning to the Dorrclones.

The overflows of the hydroseparator and the Dorrclones are dilute. The pipes, launders and boxes which carry dilute pulps are so arranged that a part or all of each may be thickened before going to the cleaners, the balances going directly to the cells. This arrangement, perhaps unique, provides the unlimited flexibility, since the quantity of water added in the rougher concentrate launders, or in the form of sprays, or for the purpose of obtaining optimum density of Dorrclone feed, can be changed over a wide range without producing adverse effects in the cleaners. Thickeneing is done in two 100-ft. thickeners which are adequate for all contingencies.

D20

In practice, all of the Dorrclone overflow and about one-fifth of the hydroseparator overflow have gone directly to the cleaners. The underflows of the 100 ft. thickeners are controlled with diaphragm pumps and then elevated to the cleaners by centrifugal pumps. The overflows go to the reservoir (see Water).

The feed to the first cleaners, consisting of the Dorrclone overflows, part of the hydroseparator overflow, and the underflow of the 100-ft. thickeners, is divided by a split launder and switch between two 6-cell 56-in. Fagergren machines. The cleaner concentrate is pumped to the recleaner (see Plate 3), a 6 cell No. 24 Denver "Sub-A" machine, where the final concentrate is produced. The recleaner tailing flows to the 100-ft. thickeners.

The first cleaner tailing is pumped to a "scavenger" machine of twelve 66 in. Fagergren cells. This machine is a duplicate of the 8 roughers and is so placed that it could be used as a rougher with only the addition of a feed pipe from the pulp distributor. As a scavenger it is expected to float out most of the recoverable copper from the cleaner tailing. The concentrate proceeds to the 100-ft. thickeners. The scavenger tailing is sampled before it joins the rougher tailing, and then the joint tailing is sampled again.

This practice of re-floating the cleaner tailing and then rejecting it, in contrast to the conventional cyclic procedure, has the advantage of preventing an accumulation of activated, barren pyrite in the flotation circuit. By eliminating water, this procedure also helps to control the flotation time and the densities of the circuits.

Reagents are prepared in a separate plant north of the concentrator. Facilities include a storage bin for pebble lime, storage agitators for lime slurry, a storage tank for Dowfroth 250 and a reagent and lime building. The last is a Steelox building 28 x 104 ft. divided into three sections for hydration of lime, storage of reagents in drums, and dissolving of soluble reagents.

D19

Lime in pebble form is delivered by truck to a shallow hopper and conveyed to a steel bin of 170 tons live capacity with conical bottom and a discharge gate. From here the lime is fed to a 5 x 6 ft. Marcy ball mill. The discharge flows to a 4 ft. Dorr "FS" classifier, with rake product returning to the ball mill. The lime slurry overflows the classifier and is pumped to two 18 ft. diam x 18 ft. steel tanks equipped with Dorr "AP" paddle agitators. From these storage tanks centrifugal pumps circulate the slurry through the concentrator and back to the agitators.

Dowfroth 250 comes from the RR siding in a tank truck and is stored in a 12000-gal. tank. From here a small line carries a one-day supply to a head tank in the mill.

Soluble collectors are stored in the reagent building and dissolved as 10 percent solutions in 5 ft. Diam x 5 ft. steel tanks. The solutions are pumped to storage tanks at the mill. Milk of lime is fed to the primary mills the regrind mills, and recleaner. Reagent 238 goes to all ball mills. Xanthate Z-6 is fed to the primary ball mills, head of the rougher circuit, middle of the rougher circuit, and head of scavenger machine. Dowfroth 250 is added at the head of the rougher machines and at other points as desired.

The alkalinity is controlled with free lime titrations of the primary classifier overflow, feed to cleaners, feed to recleaners, scavenger tailing, and final tailing. Essential copper control assays are run at two-hour intervals.

The molybdenum section, now under construction, will treat the recleaner concentrate to recover the molybdenite present in the ore, (See plate IV for flowsheet). The Morenci process using sodium ferrocyanide and sodium cyanide as depressants and sulfuric acid as a pH modifier will be utilized here. Extensive test work done here at Silver Bell indicates that approximately 80% of the molybdenite in the copper concentrate can be recovered.

The concentrator is well protected against mineral losses from leaks and spills by sump pumps. Three Hazelton No. 2½ type "VN" pumps, capacity 150 gpm, are placed in the ball mill floor drains, one in the regrind section, and three more onthe pump floor.

Other sand pumps are described in Table II.

CONCENTRATE HANDLING

The final concentrate froth from the Denver recleaner is automatically sampled in flow to the 60-ft. thickener (See Fig. 1) The underflow is controlled either with diaphragm pumps or by spigot aperture in the adjoining filter plant. This is a 3-story steel building 32 x 36 ft, 34 ft. eave height. The thickened concentrate drops from the diaphragm pumps on the intermediate floor to centrifugal sand pumps on the bottom floor, and is elevated to the 6 ft. 8-disc Oliver filter on the third floor. The concentrate is filtered at the rate of 20 tons per hour on the 8 discs which have enough capacity for the 250 tons average daily production.

The thickener overflow is pumped to the 100-ft. thickeners for recovery of casual losses of concentrate. A Hazelton sump pump reclaims spills from a tunnel below the thickener and filter plant.

Filtered concentrate is conveyed to 20-ton end-dump semi-trailers and then hauled 23 miles to Plata, the Company siding at the Southern Pacific main line near Rillito. At this point, the trailers are emptied into a receiving hopper by means of a headframe and winch. The concentrate is loaded into gondola cars by conveyors, sampled, weighed on a Ferguson track scale, sprayed with lime, and hauled to A.S.&R.'s El Paso smelter.

TAILING DISPOSAL

Final tailing from the rougher and scavenger machines flows through 809 ft. of 3 x 2 wood launder, slope 3/8 in. per foot, to a 30 ft. hydroseparator and a 275 ft. thickener. Most of the tailing material is diverted

into the 275 ft. traction thickener while the coarser particles are scalped off by a launder gate and sent into the 30-ft. hydroseparator. The overflow of the hydroseparator is sent into the 275 ft. thickener. The underflows of both tanks are orfice-controlled at a concrete box conveniently located outside the thickener tunnel. From this box the thickened tailing flows through class 50, 16 in. diameter transite pipe laid on 0.8% grade to a concrete Y above the two tailing dams.

The tailing flows from the concrete Y through class 100, 16 inch diameter transite pipe, which encircles the main dam. One branch of the loop crosses a reserve dam which spans the same canyon as the main dam, but at a higher elevation. The tailing can be deposited in either the main dam or the reserve dam as needed. The tailing flows from the main 16-in. line through 4-in. spigots at 52-ft. intervals. About 5% of the tailing is directed through 10 inch Krebs cyclones, to produce an underflow product which dries rapidly for dam building purposes. The underflow of the cyclones is deposited on the embankment and the overflow is deposited 40 to 60 ft. inside the berm. The other 95% of the tailing is deposited in the same manner as the cyclone overflow.

For details the reader is referred to "Tailing Disposal at Silver Bell" by Russell Salter, a paper presented at the Arizona Section A.I.M.E. Tucson, December, 1955.

WATER

Water is pumped from three 500 ft. wells in the valley, 9 miles south east of the concentrator. A 90,000 gal sand-settling tank receives water from the well pumps, and two radio-controlled booster pumps do the rest of the job, one located at the tank and the other 6 miles up the 18-in. line.

The 18-in. pipe delivers to a 125,000 gal. control tank at the mill. Overflow of this tank into the 275' tailing thickener is makeup for the mill.

For townsite, fire-fighting, and all other requirements around the plant, and the pits where a pure water is needed, a domestic water tank holding 200,000 gal. is located at el 2900 ft. This tank is filled by three 500-gpm pumps in the concentrator, drawing from the 125,000 gal. control tank. A pressure-break tank of 10,000 gal. capacity for residential supply of domestic water may be bypassed in case of fire in the town.

The water that is reclaimed from the mill pulps is accumulated in the 1,000,000 gallon mill water reservoir west of the tailing thickener. This reclaimed water is made up of the overflows from the 100-ft. thickeners and the tailing thickener and the water decanted from the tailing disposal areas. The overflows of the three thickeners are clear under normal operation, but some further sedimentation does occur in the reservior, which must be cleaned periodically.

The decant line is constructed of 18-in. transite pipe surrounded by reinforced concrete poured on bed rock. The decanted water flows into a 3,000,000 gal. holding reservoir through the 18-in. line and then is pumped through an 7-in. transite line to the mill water reservoir.

Mill water is then pumped from the reservoir to a 300,000 gal. head tank at el 2800, using three Peerless vertical close-coupled turbine pumps, rated 3,000 gpm capacity each through 150 ft. static head. Electrode controls in the head tank start and stop the pumps successively.

POWER

Electrical power for the operation is generated by Tucson Gas, Electric Light & Power Company and transmitted 40 miles to Silver Bell at 46 kv. The mill substation (See Fig. 1) is situated 160 ft. east of the concentrator and 12 ft. higher than the ball mill floor. The high-voltage bus feeds through a 10,000 kva transformer which supplies 4160 volts for the mill area and town, a 2,000 kva transformer supplying 13,800 volts for the

DIS

water pumps and El Tiro pit, and three 333 kva trahsformers supplying 2400 volts to the Oxide pit.

The power for the plant is carried from the substation at 4160 v in buried cable to a distribution vault under the ball mill floor (Fig. 4) Motor voltages are 4160 and 440, the higher being used for motors of 200 hp or more. All secondary power is carried in underground conduits, keeping the plant area free of overhead cables.

A standby diesel-powered generator, 300 kw, 2400 v, occupies a small prefabricated steel building in the substation. Storage batteries with trickle chargers are used throughout the plant for automatic emergency lighting.

AUXILIARY BUILDINGS

Attached to the mill at the east aide and level with the flotation floor are laboratories for sample preparation and process testing, occupying 2760 sq. ft. The filtering and drying room equipment includes pressure filters, steam plates for mine and mill sludge samples, and electric dryers. The dry preparation section contains jaw and Cy-Roll crushers, pulverizers, screen grading devices, and cutting floor. The test laboratory is fully equipped for flotation work. An office for the metallurgist and a storage room complete the facilities.

Assay Office - Conveniently situated on the main east road, the assay office is housed in a Steelox 28 x 57 ft. lined and insulated building with built-up roof and steel partitions. The laboratories include facilities for fire assay, electrolytic copper analysis, and other common analytical procedures.

Other auxiliary buildings include two conventional steel buildings with galvanized corrugated steel roofing and siding. The first of these is a 52 by 182 ft. machine shop housing carpenter, electrical, repair, welding, truck repair, and general mechanical repair areas. The other building is a 52 by 101 ft. warehouse with office, shelving, storage bins, loading ramp

B14

and dock.

The smaller auxiliary buildings are prefabricated. These include a 28 by 43 change house, an oil and paint storage house, a twelve vehicle garage, and a 28 by 68 ft. first aid building with a first aid room a meeting room and a garage for the ambulance and fire truck.

The General Office, of concrete block construction, completes the list of auxiliary buildings at the Silver Bell Concentrator.

MATERIAL HANDLING

With the railroad siding 23 miles from the plant, trucks must bear the burden of supplying Silver Bell with all of its needs. At present, all of the 23 miles is paved, but repairs are frequently necessary due to heavy summer rainfall. Many supplies travel all the way by truck from source to point of use at the mill, for example, lime, and reagents in drums. Others come in by rail and are transferred to truck at the siding.

Facilities at the siding for transferring incoming freight are an American stiff-leg derrick with 36 ft. mast and 60 ft. boom having capacity of 60 tons at an 18-ft. radius; a car puller; Dowfroth pump for unloading from tank cars to tank truck at 200 gpm; 30-in. diam. Stearns circular lifting magnet for unloading grinding balls.

Dependence upon truck transportation is reflected in the arrangement of the plant. Every building is easily accessible, roads are wide, and sufficient space between buildings rules out traffic jams and saves turn-a round time. The work of the mobile units, which include winch trucks, scoop trucks, a truck-mounted P & H crane, and earth-moving equipment, is facilitated by these intra-plant roads, unhampered by overhead power lines or low headroom caused by launders, conveyors, or pipe lines. The interiors of the main buildings are also readily accessible to trucks and other mobile units.

D13

ACKNOWLEDGMENTS

Grateful acknowledgment is made to Mr. Norman Weiss, whose original paper was used as a basis for this paper, and to the technical and administrative staff at Silver Bell, whose assistance is greatly appreciated in bringing this paper up to date.

TABLE I - BELT CONVEYORS AND BELT FEEDERS

Designation	Description	Size Material	Width x Length (Centers)	Tons per Hour	Slope In. Per Ft.	Speed Ft. Per Min	Motor HP
1	Primary crusher to coarse ore bin	-8"	48 in. x 445 ft.	1000	3	300	150
1A, 1B	Coarse ore bin feeders	-8"	48 in. x 12'6"	200-700 ea.	-	25-75	10
1C	Feeders to conveyor 2	-8"	42 in. x 29 ft.	700	-	336	15
2	To secondary crusher	-8"	42 in. x 398 ft.	700	1 7/8	332	100
3	Sec. crusher & Conveyor 5C to Conveyor 4	-1½"	36 in. x 163 ft.	1200	2 11/16	476	60
4	Conveyor 3 to conveyor 5	-1½"	36 in. x 45 ft.	1200	1 5/8	487	15
5	Conveyor 4 to screens	-1½"	36 in. x 165 ft.	1200	3 1/2	476	60
5C	Tertiary crushers to conveyor 3	-1/2"	36 in. x 16 ft.	500	-	245	5
6	Screens to conveyor 7	-1/2"	36 in. x 379 ft.	700	3 5/8	466	125
7	Conveyor 6 to fine ore bins	-1/2"	36 in. x 219 ft.	700	-	458	25
8A,B,C,D	Ball mill feeders	-1/2"	36 in. x 50 ft. to	120	-	32-64	3
9	Filter to conveyor 10	Fine	18 in. x 91 ft.	20	-	159	3
10	Truck loader	Fine	18 in. x 17 ft.	20	-	159	3
11	Lime Hopper to Storage	-1"	18 in. x 91 ft.	100	2 3/4	311	5
12	Lime storage to lime plant	-1"	18 in. x 25 ft.	10	3 1/2	59	3
13	Plata - Concentrate to conveyor 14	Fine	24 in. x 128 ft.	190	4	196	20
14	Plata - Conveyor 13 to cars	Fine	24 in. x 22 ft.	210	- -	216	5

All conveyors have troughing carrying idlers except 1A, 1B, 10 which have flat, impact idlers.

TABLE II - SILVER BELL - SAND PUMPS

Duty	No. of Pumps Operating	No. of Pumps Standby	Description	Normal GPM Each	Vertical Lift Ft.	Dia. In. Disch. Pipe	Motor HP Each
Rougher Concentrate to 26 ft. hydroseparator	4	2	2-4" Wilfley "K" 3-B-41-5 Hydroseal 1 Hazelton 4"B,"CT"	345	50	5	20 15
Feed to regrind section Dorrclones	2	2	1-Hydroseal AB-41-5 3-Denver SRL-C 3"x3"	215	59*	4	15 15
Cleaner concentrate to recleaner	2	1	3-Denver SRL-C 3"x3"	190	21	4	5
Cleaner tailing to scavenger	2	1	3-Hydroseal B-41-5	375	21	5	7.5
Discharge 100 ft. thickeners to cleaner	2	1	2-Hazelton 3""CT" 1-Hydroseal A-41-5	90	32	2½	7.5 7.5
Thickened final concentrate to filters	1	1	1-Denver SRL-2"x2" 1-2" Vacseal	56	43	2	5

*Includes 47 ft. allowance for 25 psi at cyclones.

TABLE XII TYPICAL PROPERTIES OF SLURRY PELL PRODUCTS

Product	Average % Solids	Free CaO lbs per ton of Solution	Average Screen Analysis (% on Mesh) +.371"	+35	+48	+65	+100	+200	-200	-325	Average Assay (%) Cu.	NaCN	Fe	Insol	Mo
Crusher product	96.4		17.2	73.6	1.2	0.9	0.9	1.4	4.6						
Flotation feed	20	0.16			3.9	11.2	15.2	21.0	48.6		1.00	0.13	3.5	87.6	
Rougher concentrate	8				2.1	6.5	9.6	20.6	11.4	49.8	10.5		19.0		
Hydroseparator Overflow	3							1.7	3.5	94.8	10.5		12.0		
Hydroseparator underflow	42				7.4	14.9	19.1	29.5	14.1	15.0	10.5		23.0		
Dorrclone overflow	21	0.40					1.2	5.5	13.7	79.6	10.5		23.0		
Dorrclone underflow	68				4.0	8.9	12.3	23.5	31.1	20.2	11.6		31.0		
Cleaner tailing	18										1.07		18.4		
Recleaner concentrate	45						1.1	4.5	13.7	80.7	26.3	1.66	25.2	10.8	0.60
Recleaner tailing	16	0.18									3.36		24.4		
Scavenger tailing	36										0.50	0.27	13.0	65.2	0.011
Rougher tailing	22	0.17			3.4	9.1	14.2	21.8	51.5		0.23	0.10	2.6	90.0	0.009
Final tailing	46	0.04			2.8	9.0	12.2	21.0	55.0		0.24	0.10	2.9	89.8	0.009
Filtered concentrate	89.1														

Note: For products without screen sizes, use recleaner concentrate sizing.

AMERICAN SMELTING AND REFINING COMPANY
SILVER BELL UNIT
Silver Bell, Arizona

TAILING DISPOSAL AT SILVER BELL

by R. Salter

The 7500-tons-per-day Silver Bell open-pit copper mining and milling operation of the American Smelting and Refining Company is situated in the Silver Bell Mountains some 35 airline miles northwest of Tucson. The 7500-ton mill went into full operation in the spring of 1954, and one of the first major problems encountered was the disposal of flotation tailing. In this paper we propose to describe the evolution of our present disposal procedures, with the assistance of slides.

I. General Layout

The mill tailing flows from the concentrator through a wooden launder to a 30 ft. hydroseparator with conical bottom 10 ft. total depth at the center. The launder is 32 in. wide inside by 20 in. high, lined with 1 in. pine on the bottom and sides, replaceable when worn to save the main launder from wear. The slope is 3/8 in. per foot. There are two bypass gates in this launder ahead of the hydroseparator making it possible to bypass the tailing directly to the 275 ft. diameter tailing thickener. The hydroseparator removes a large portion of the coarse material in the tailing, which would otherwise create a heavier load on the thickener rakes and drive mechanism.

The 275 ft. Dorr traction thickener is fitted with 4 discharge pipes for the thickened tailing, of which two are used. These are 8 in. lines fitted with 8 in. plug cock valves at the cone. The discharges from the tailing thickener and from the hydroseparator are controlled by means of orifice plates.

From the underflow collecting box the tailing flows through class 50 and 100, 16 in. diameter Johns-Manville transite pipe. The class 50pipe runs from a collection box to a concrete Y. This Y forms a junction point

from which the class 100 pipe makes a loop around the main dam; one branch of the loop crosses a reserve dam which is placed at a higher elevation than the main dam. Adequate vents made of 10 in. pipe are installed in the tailing line at every significant change of elevation in that line.

Both dams were originally built of barrow obtained from the area in which they are located. The main dam was built 50 feet above the lowest point of the arroyo, and the reserve dam was built 24 feet above the lowest point in its arroyo. As there is approximately 150 ft. drop in elevation between the concentrator and main dam, a series of drop boxes was installed to avoid excessive grade on the tailing line and wear on the pipe. These drop boxes are circular concrete pipes 4 ft. diameter by 6 ft. high, which are now being removed one by one as the level of the dam rises.

After the tailing line was laid 4 in. spigots were installed in the line for takeoff into the dam. These were put in at 52 ft. intervals, or every fourth length of transite pipe, and the flow through them is controlled with 4 in. plug cocks. A decant line was installed under the dams for recovery of water. This line is constructed of reinforced concrete, lined with 18" transite pipe. Two decant towers were placed in the main dam and one in the reserve dam. A three million gallon ground reservoir was built below the main tailing dam for storing water from the tailing dam before returning it to the mill.

II. Early Phases of Dam Building

Little was known about the characteristics of the Silver Bell tailings at the time operations were started, and it soon became apparent that many problems had to be solved before the tailing disposal system would be reasonably trouble free.

When the concentrator was ready for operation, a large tonnage

D7

of waste rock was ground for bedding the tailing thickener bottom, which was found to form an excellent smooth, hard bottom for operation of the rakes. After the bedding was completed, the concentrator began treating ore from the pit. It was then that trouble was encountered. Due to the nature of the ore, the underflow of the thickener was extremely viscous and induced a very slow rate of flow causing choking of the line. It would then have to be broken and flushed out.

To remedy this choking, a water line (10 in.) was installed at the collecting box for flushing the tailing line when the tailings began to flow slowly. Choking would be evidenced by pulp backing up in the collecting box and vents, and when this occurred, the tailing flow would have to be cut off or severely reduced until the line was cleared. When these conditions did not seem to improve, investigation into some of the reasons for the high viscosity of the pulp was made.

Mr. George Rosevears of the Arizona Department of Mineral Resources was contacted to conduct viscosity tests on the tailings. Mr. Roseveare's findings were that alkalinity strongly affected viscosity of the tailings. Readings on the viscosimeter on a pulp of 45% solids, showed a range from 147 grams at a pH 11.0 down to 84 grams when the pH was reduced to 9.4 after sulphuric acid was added.

It was apparent from these tests that alkalinity of the pulp would have to be kept to a minimum at which satisfactory metallurgy could be obtained.

Subsequently, alkalinity in flotation was reduced to a minimum and pulp flow through the tailing line improved. This, however, did not entirely solve the problem of dam building.

The high viscosity of the pulp discharged to the dam would not allow any of the sands to deposit against the berm. It would retain too much water, creating a soupy mass which required a long drying time.

As the original dam was rapidly being filled, it was necessary to begin raising the dam by the use of a dragline with a 1 yd. bucket. Due to the nature of the material deposited, it would not stack well because of its wetness, and would have to lie on the dam for a considerable period of time before drying sufficiently to be compacted. This difficulty was accentuated by heavy rains at that time which delayed normal drying.

With availability of sufficient barrow in the area the building of the dam with tailings was abandoned in favor of barrow. When additional dam building was required this material was used. Several methods of obtaining the barrow were tried, the first of which was the use of the dragline and 20 ton Euclid T Trucks. The barrow was spread and compacted with a Caterpillar D-4 tractor equipped with angle dozer blade.

This method proved rather expensive and slow. Subsequently, three 16 yds. Euclid scrapers were employed using a Caterpillar D-8 tractor for a pusher and a D-4 tractor to level the barrow on the dam. This method proved much faster and less costly. A total of 3000 yds. per day of barrow could be placed on the dam when the barrow was not too difficult to obtain and two successive 5 ft. lifts were made in this manner.

III. Present Practice

When it was seen that it would be impossible to build the dam with normally deposited tailings, and that building the dam with barrow would eventually become impractical, investigation into other means was undertaken to solve the problem. There were two alternatives available,

since the reserve dam did not contain enough area to impound tailings for a long enough period to allow the tailings in the main dam to dry sufficiently.

These were:

(1) Construct another tailing dam containing sufficient area to allow for enough drying time of the deposited tailing to permit satisfactory dam building.

(2) Develop a method whereby the major portion of coarse material in the tailing would separate from the slime giving better drainage of water and result in rapid drying.

Since construction of a new dam was a major undertaking and would require considerable time and investment, alternative (2) was given serious consideration.

The most attractive means considered under alternative (2) was the use of cyclones for a sand-slime separation. Subsequently, a Krebs Cyclone, Model D10B was secured for test, mounted on a rubber tired carriage to make it portable, and then taken to the dam and connected to one of the spigots. The cyclone immediately began to produce an excellent sand product which when deposited began to build up above the surrounding tailings that were deposited in the normal manner.

The drainage from this deposited sand was extremely good and the deposit formed a slope of 8% for a distance of 50 ft. from the edge of the berm, whereas the slope of normally deposited tailings was only .3%.

The cyclones are operated at pressures ranging from 2 to 10psi according to the head in the tailing line. They are equipped with 3 in. standard pipe feed inlet, 3½ in. vortex finder and 1½ in. apex valve. Typical screen analysis of cyclone products are given in the following tables:

	Feed		Overflow		Underflow	
Solids %	47		41		67	
Tons/Hr. Solids	16.4		11.1		5.3	
Screen Size	Wt. %	Cum. %	Wt. %	Cum. %	Wt. %	Cum. %
+ 48 Mesh	2.2	2.2	0.6	0.6	7.1	7.1
+ 65 "	9.0	11.2	4.2	4.8	19.6	26.7
+ 100 "	12.2	23.4	11.2	16.0	18.8	45.5
+ 150 "	10.4	33.8	10.0	26.0	8.9	54.4
+ 200 "	6.8	40.6	7.2	33.2	4.0	58.4
+ 325 "	11.2	51.8	13.2	46.4	6.4	64.8
- 325 "	48.2	100.0	53.6	100.0	35.2	100.0
Total	100.0		100.0		100.0	

The screen sizings clearly show the increase in coarser sand obtained from the cyclone operation and the decrease in the finer sizes. The actual amount of slimes in the minus 325 mesh product is only sufficient to insure good compaction and binding to prevent seepage that would occur with clean sand.

The tonnage of underflow obtained from the cyclone amounted to 32% of its feed; this would be far more than required for dam building if the entire amount of mill tailings were to be cycloned. From estimates previously made, approximately 5% of the total tonnage of tailings is needed as a sand product to maintain adequate dam building and each cyclone would take approximately 5% of the total tonnage of tailings, indicating not less than three cyclones would be required to produce this amount of sand. To insure an adequate amount of sand product, six cyclones were installed.

During the early period of cyclone operation it wasnot possible to carry the overflow any great distance beyond the dam because of the soupy nature of the normally deposited tailings. As progress was made, however, it became noticeable that the rapid drainage of water and drying of the deposited material permitted the overflow pipes of the cyclones to be extended farther from the main dam. This was also true of the spigots that

were not connected to the cyclones. These overflow lines are now carried out a distance of 40 to 60 feet where they are allowed to discharge.

The first cyclones, as previously noted, were mounted on wheel carriages to make them readily portable. This practice was changed in favor of an "A" Frame mounting built on skids and so constructed also that it could be picked and moved by a winch truck. The cyclones are mounted at an angle of approximately 10° from horizontal.

The cyclones are normally set at successive spigots on the tailing line which gives a center distance of 260 ft. between the No. 1 and No. 6 cyclones. Sand is allowed to deposit until it has reached the level of the underflow discharge spout, and the cyclones are then moved to another location. This leaves valleys between the points where the cyclones discharged sand. After this material has drained of excess water and compacted, the cyclones are then set in the valleys for further fill.

This method produces a wall of sand 6 ft. to 7 ft. high along the length of the berm. When this is completed, the overflow pipes of the cyclones are connected directly to the tailing line outlets and allowed to discharge normally for a period of time.

When the tailings from the cyclone underflow has dried sufficiently the main berm is then built up in 5 ft. lifts using a dragline equipped with a 1 yd. light weight bucket. The dragline operator deposits the fill behind him until he has reached material that is too wet to stack. He then levels and compacts the material with a Caterpillar D-8 Dozer, repeating this process of stacking and leveling until the 5 ft. lift has been completed.

The dam walls are maintained at a slope of 1½ to 1, the main lift being maintained at 30 ft. vertical steps. When this elevation has been

D2

reached, the face of the new berm is stepped in 16 ft. and the main tailing distribution line is raised to the level where the step was made.

The normal crew used on dam operation consists of one man per shift as a dam tender, one man part-time (4 to 5 days a month) as equipment operator for berm building, and four to five laborers two days a week for moving cyclones, connecting spigots, etc.

SILVER Bell (F) Pima Co.

HMC

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Fife Symington, Governor Edward Z. Fox, Director

NOTICE OF THE PRELIMINARY DECISION TO ISSUE AN INDIVIDUAL AQUIFER PROTECTION PERMIT

Pursuant to Arizona Administrative Code, Title 18, Chapter 9, Article 1, the Director of the Arizona Department of Environmental Quality intends to issue an individual Aquifer Protection Permit to the following applicant(s):

On or about June 15, 1994

Public Notice No. 24-94AZAP
ASARCO,INC- SILVER BELL UNIT Site
ASARCO Incorporated
Silver Bell Unit
25,000 W. Avra Valley Road
Marana, AZ 85653

Aquifer Protection Permit No. P-100510

The ASARCO,INC- SILVER BELL UNIT site is located approximately 17 miles west of Marana, Arizona in Pima County, Arizona, over groundwater of the Tucson A.M.A. Basin and the Pinal A.M.A Basin in Township 11S, Range 08E, Sections 32,33, and 34, and in Township 12S, Range 08E, Sections 3, 4, 5, 10, 11, and 12, -Gila and Salt River Base Line and Meridian. Latitude 32° 22' 56.0" North and Longitude 111° 27' 43.0" West.

The proposed facility is a copper leaching operation consisting of two leach dumps and in-situ leaching of rubblized ore within the existing Oxide and El Tiro open pits, and in the proposed West Oxide and North Silver Bell open pits. Copper ore will be leached with a dilute sulfuric acid solution. Solutions will be collected in lined impoundments and pumped via pipelines to a solvent extraction-electrowinning plant for processing. Solutions stripped of copper will be recycled into the dump and rubble leaching circuits. The facility will process approximately 6,700 gallons of solution per minute and generate approximately 50 tons of copper of 99.99% purity per day.

The areas designated for rubblized leaching will be fractured using controlled, close-spaced blasting to create zones of fractured rock and high hydraulic conductivity. Controlled blasting will create a surface along which leach solutions will flow and drain to the collection sump in the bottom of the open pits immediately below the rubblized zones. The high contrast in hydraulic conductivity between the rubblized zone and the underlying bedrock will result in minimal losses of leach solution from the leach zones.

SILVER BELL (B)

KHMC on

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Fife Symington, Governor Edward Z. Fox, Director

MU94-0228

September 15, 1994

To All Concerned Citizens

RE: Permit for: ASARCO Incorporated - SILVER BELL UNIT,
Silver Bell Copper Leaching (SX-EW) Project
Permit No. P-100510

Enclosed are copies of the Responsiveness Summary and Executive Summary, together with a copy of the permit which has been issued.

I appreciate your comments and understand your concerns in this regard. If you have further questions after reading the permit and summaries, please call me at (602) 207-4693.

Sincerely,

Patrick Finton

Patrick Finton
Environmental Engineering Specialist

Enclosures (3)

AMC

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Fife Symington, Governor Edward Z. Fox, Director

MU94-0228

September 15, 1994

To All Concerned Citizens

RE: Permit for: ASARCO Incorporated - SILVER BELL UNIT,
Silver Bell Copper Leaching (SX-EW) Project
Permit No. P-100510

Enclosed are copies of the Responsiveness Summary and Executive Summary, together with a copy of the permit which has been issued.

I appreciate your comments and understand your concerns in this regard. If you have further questions after reading the permit and summaries, please call me at (602) 207-4693.

Sincerely,

Patrick Finton

Patrick Finton
Environmental Engineering Specialist

Enclosures (3)

HHC
+
Silver Bell
File

AQUIFER PROTECTION PERMIT NO. P- 100510

RESPONSIVENESS SUMMARY

August 26, 1994

Facility: ASARCO Incorporated - SILVER BELL UNIT, Silver Bell Copper Leaching (SX-EW) Project

Permittee: ASARCO Incorporated
Silver Bell Unit
25,000 W. Avra Valley Road
Marana, Arizona 85653

Comments (C) and Responses (R):

The Mining Unit did not receive a request for a Public Hearing; therefore, a Public Hearing was not held.

Comment 1

The Department received 58 letters from the general public. All of the letters, except for one, were positive and requested the Department to issue the permit. The one exception letter simply asked for additional information requesting copies from our file..

Response 1

For the one letter requesting information, information was sent, and follow-up phone calls were made to see if the individual needed any additional information.

Comment 2

EPA Region IX requested a time extension to the comment period and asked for additional information.

Response 2

The extension request was denied. The additional information was sent to EPA Region IX.

EXECUTIVE SUMMARY
AQUIFER PROTECTION PERMIT NO. P-100510

Facility Name:

ASARCO, Incorporated - SILVER BELL UNIT, Silver Bell Copper Leaching (SX-EW) Project

Facility Location:

The proposed facility is located in Section 11 of Township 12 S, Range 08 E, Gila and Salt River Baseline and Meridian in Pima County, approximately 17 miles west of Marana, Arizona. The proposed facility is located over the groundwaters of the Tucson A.M.A. Basin and the Pinal A.M.A. Basin.

Facility Description:

The proposed facility is a copper leaching operation consisting of two leach dumps and in-situ leaching of rubblized ore within the existing Oxide And El Tiro open pits, and in the proposed West Oxide and North Silver Bell open pits. Copper ore will be leached with a dilute sulfuric acid solution. Solutions will be collected in lined impoundments and pumped via pipelines to a solvent extraction-electrowinning plant for processing. Solutions stripped of copper will be recycled into the dump and rubble leaching circuits. The facility will process approximately 6,700 gallons of solution per minute and generate approximately 50 tons of copper of 99.99% purity per day.

Best Available Demonstrated Control Technology (BADCT):

The proposed facility BADCT relies on a combination of engineered and site specific hydrogeologic characteristics. Both leach dumps will be constructed in steep-walled canyons resting on fractured bedrock with an average permeability of 1.0×10^{-5} cm/sec. In addition, elements of the Asarco Silver Bell Mine meeting BADCT are as follows:

1. Site prep.
2. Material placement of the #1 and #2 dump leach material so that a very coarse zone of rock lies at the base.
3. Surface runon/runoff control.
4. Solution management.
5. Collection ponds lined with a 60-mil high density polyethylene (HDPE) liner, overlying a prepared subgrade on top of low permeability bedrock.
6. Well defined canyon area for material placement and containment to ensure all solutions and materials stay within the dump.

7. Steep topography within the canyon area that reduces the possibility of solution ponding under the dump.
8. Bedrock outcrops with minimal alluvial cover which minimizes solution head.
9. No nearby surface waters, and the facility is not located within the 100-year flood zone per FEMA maps.\
10. Reconnaissance geologic mapping of the dump leach facilities show no major geologic structures.

All mine shafts and wells that currently exist in the leach dump areas will be backfilled and sealed with an acid-resistant concrete to prevent the shafts and wells from acting as conduits to the subsurface.

The areas designated for rubblized leaching will be fractured using controlled, close-spaced blasting to create zones of fractured rock and high hydraulic conductivity. Controlled blasting will create a surface along which leach solutions will flow and drain to the collection sump in the bottom of the open pits immediately below the rubblized zones. The high contrast in hydraulic conductivity between the rubblized zone and the underlying bedrock will result in minimal losses of leach solution from the leach zones.

All surface impoundments and leach dumps shall be protected from the run-on from the 100-year, 24-hour storm event. All surface impoundments and leach dumps are designed and operated to contain the direct precipitation from the 100-year, 24 storm event plus the normal operating solution volumes and maintain adequate freeboard in the surface impoundments. All excess flows from the leach dumps will be directed to the open pit collections sumps. All flows from the in-situ rubble leach areas will be directed to the open pit collection sumps.

Seven new surface impoundments will be constructed to contain mine leaching solutions (pregnant leach solutions (PLS) and raffinate). The No. 1 and No. 2 PLS collection ponds associated with the No. 1 and No. 2 leach dumps and the distribution raffinate pond shall be constructed with a single 60-mil HDPE liner overlying a prepared and compacted subgrade. These three ponds shall all lie within the zone of capture of the hydrologic sink associated with North Silver Bell open pit. Four surface impoundments (Main Raffinate Pond, Intermediate Raffininate Pond, Intermediate PLS Pond and Plant Feed PLS Pond) shall be lined with primary and secondary 60-mil HDPE with a leak detection system over a prepared and compacted subgrade. All pipelines connecting the facilities in the SX-EW circuit shall be constructed of HDPE or 316 stainless steel pipe.

Monitoring Requirements:

Ambient groundwater quality shall be monitored in ten (10) downgradient and two (2) upgradient monitor wells for a minimum

of six (6) quarters prior to the commencement of leaching. The data collected shall be used to calculate alert levels in the point of compliance monitor wells. Monitoring shall be in accordance with PART IV, TABLE II.B., Suite A and Suite B of the permit.

Groundwater quality input monitoring shall be conducted at ten (10) point of compliance wells for hazardous and non-hazardous constituents. Two (2) (MW-1 and MW-10) of the ten (10) monitor wells shall be installed in accordance with the compliance schedule, PART II.H.6, and shall be installed at least two years prior to the initiation of leaching of dump leach No. 2 and West Oxide Rubble, respectively, and in accordance with PART IV, TABLE II.A. and then TABLE II.B.. Two (2) additional monitor wells (MW-8 and MW-12) shall be located and installed pending the completion of the study for the Silver Bell existing facilities in accordance with PART II.C.2.b.. All POC wells are located downgradient of the pollutant management area, which is defined by the boundary of the hydrologic sink formed by the excavation of the open pit below the water table.

Groundwater level monitoring shall be conducted in the monitor wells and in a series of piezometers and drill holes to document the establishment and continued presence of the hydrologic sinks associated with the two existing open pits and the two proposed open pits. The permittee shall conduct a hydrologic survey of the North Silver Bell area and West Oxide area after the first year of excavation of the pits, in accordance with the compliance schedule, PART II.H.9. The permittee shall propose a groundwater level monitoring plan for all new and existing hydrologic sinks for review and approval by the ADEQ APP Section, within one year after the initiation of excavation of the open pits in accordance with PART II.H.7. (Compliance Schedule).

Leaching process solution shall be monitored in accordance with PART IV, TABLE I.A. and TABLE I.B. Discharge limits are established for benzene and PAHs in accordance with PART IV., TABLE I.B.

Compliance with Aquifer Water Quality Standards (AWQS):

All dump leaching and rubble leaching shall be conducted within the zone of capture of the hydrologic sinks (cone of depression) associated with the two proposed and two existing open pits. The permittee has documented the existence of hydrologic sinks associated with the existing Oxide and El Tiro Pits. Hydrologic sinks driven by evaporation or pumping or both are effective in capturing contaminated groundwater and are commonly used to prevent the migration of pollutants to water supply wells. Because all leaching solutions not captured by the leach dump facilities or at the point of collection below the rubble zones will be captured by the hydrologic sinks, it is believed that Aquifer Water Quality Standards will be maintained at the point of compliance.

Point of Compliance:

Twelve points of compliance and monitor wells have been established for this facility in accordance with PART II.C.2 and PART IV, TABLE II.A. and II.B..

Storm/Surface Water Considerations:

The leach dumps, pregnant solution ponds and raffinate ponds shall be protected from the run-on from the 100-year, 24-hour storm event. All surface impoundments and leach pads shall be constructed and operated to contain the direct precipitation resulting from the 100-year, 24-hour storm event plus the normal operating volume of solution without overtopping the impoundments and shall maintain sufficient freeboard in all surface impoundments except during storm events in accordance to PART II.A.6.. Excess flows from the dump leach pads will report to the pit bottom. All flows contacting the rubble leach areas will report to the pit bottoms.

Financial Capability:

The permittee has provided the financial information required by A.A.C. R18-9-108.B.8. Review of that information indicates that the permittee is financially capable to cover the cost of construction, operation, closure and post-closure care.

Technical Capability:

The permittee has and is currently operating hydrometallurgical base metal leaching operation and other mining operations in Arizona and the United States. The permittee's consultant, SHB-AGRA has designed numerous leaching operations in Arizona and the Western United States. Both are believed to be technically capable.

Compliance Schedule:

A compliance schedule has been established in the permit to address permitting of the existing portions of the Silver Bell Unit. The permittee must submit an application for all existing operations within 24 months of the effective date of the permit. The compliance schedule also addresses the establishment of alert levels, construction of monitor wells, development of groundwater level monitoring plans and submittal of a facility emergency response plan.

STATE OF ARIZONA

AQUIFER PROTECTION PERMIT NO. P-100510

PART I. AUTHORIZATION TO DISCHARGE POLLUTANTS IN A MANNER SUCH THAT CURRENT AND REASONABLY FORESEEABLE FUTURE USES OF THE AQUIFER ARE PROTECTED

In compliance with the provisions of Arizona Revised Statutes (A.R.S.) Title 49, Chapter 2, Articles 1, 2 and 3; Arizona Administrative Code (A.A.C.) Title 18, Chapter 9, Article 1; A.A.C. Title 18, Chapter 11, Article 4; and conditions set forth in this permit:

Facility Name: ASARCO Incorporated- SILVER BELL UNIT, Silver Bell Copper Leaching (SX-EW) Project

Owner:
ASARCO Incorporated
180 Maiden Lane
New York, NY 10038

Operator:
ASARCO Incorporated
Silver Bell Unit
25,000 W. Avra Valley Road
Marana, AZ 85653

is authorized to operate the ASARCO Incorporated-SILVER BELL UNIT, Silver Bell Copper Leaching (SX-EW) Project facility located approximately 17 miles west of Marana, Arizona, in Pima County, over groundwater of the Tucson A.M.A. groundwater basin and the Pinal A.M.A. groundwater basin in Township 11 S, Range 08 E, Sections 32, 33, and 34, and in Township 12 S, Range 08 E, Sections 3, 4, 5, 10, 11, and 12, - Gila and Salt River Base Line and Meridian:

Latitude	32° 22' 56.0"	North
Longitude	111° 27' 43.0"	West

This permit shall become effective on the date of the WQD Director's signature and shall be valid for the life of the facility (operational, closure, and post-closure periods) provided that the facility is constructed, operated, and maintained pursuant to all the conditions of this permit according to the design and operational information documented or referenced in PARTS I, II, III, IV, V, VI, and VII of this Permit, and such that Aquifer Water Quality Standards are not violated.

Brian E. Munson
Director
Water Quality Division
Arizona Department of Environmental Quality
Signed this 8 day of September, 1993

PART II. SPECIFIC CONDITIONS

A. Discharge Limitations

1. The permittee is authorized to operate a hydrometallurgical base metal leaching facility. The facility is comprised of two leach dumps; four in-situ (rubble) leach areas, four pregnant leach solution (PLS) ponds, three raffinate ponds, and solution ditches, according to the approved plans and diagrams in the Aquifer Protection Permit (APP) application referenced in PART V.

2. Specific Discharge Limitations are listed in PART IV, TABLE I.A. and I.B.

3. Dump Leach Process

   a. Dump leaching shall be restricted to two (2) leach dumps and associated solution collection and transport ditches, PLS ponds, raffinate ponds, as specified in the approved plans and designs submitted with the APP application referenced in PART V.

   b. A dilute sulfuric acid dump leach process shall be utilized as described in the approved plans submitted with the APP application referenced in PART V.

   c. Leached ore generated by dump leach processing shall not be removed from the dump leach pads. Removal or transfer of leached ore shall be considered a major modification to the facility.

4. In-Situ Rubble Leach Process

   a. The in-situ rubble leach process shall be restricted to four (4) areas and associated solution collection ponds, transport ditches, PLS ponds, and raffinate ponds, as specified in the approved plans and designs submitted with the APP application referenced in PART V.

   b. A dilute sulfuric acid dump leach process shall be utilized as described in the approved plans submitted with the APP application referenced in PART V.

   c. Leached ore generated by in-situ rubble leach processing shall not be removed from the in-situ rubble leach areas. Removal or transfer of leached ore shall be considered a major modification to the facility.

5. Facilities shall be located as follows:

Identifier	Facility	Latitude/Longitude
001A	No. 1 Dump Leach	32°25'50"/111°31'20"
001B	No. 1 PLS Collection Pond	32°26'03"/111°31'47"
002A	No. 2 Dump Leach	32°25'40"/111°32'30"
002B	No. 2 PLS Collection Pond	32°25'51"/111°32'33"
003	North Silver Bell Rubble Leach	32°25'56"/111°32'24"
004	El Tiro Rubble Leach	32°24'57"/111°32'15"
005	West Oxide Rubble Leach	32°23'57"/111°30'52"
006	Oxide Rubble Leach	32°23'50"/111°30'22"
007	Plant Raffinate Pond	32°23'25"/111°29'52"
008	Intermediate Raffinate Pond	32°24'40"/111°31'57"
009	Distribution Raffinate Pond	32°25'28"/111°31'12"
010	Intermediate PLS Pond	32°24'23"/111°32'27"
011	Plant Feed PLS Pond	32°23'18"/111°30'17"

6. All leach dumps, PLS ponds, and raffinate ponds shall be protected from the run-on from the 100-year, 24-hour storm event. All leach dumps, PLS ponds, and raffinate ponds shall be so designed, constructed and operated to contain the direct precipitation from the 100-year, 24-hour storm event plus the normal operating solution volumes and maintain sufficient freeboard to prevent overtopping, with the exception of the No. 1 and No. 2 PLS Collection Ponds. Overflows from the No. 1 and No. 2 PLS Collection Ponds shall flow via spillway to the North Silver Bell open pit collection sumps. Three feet of freeboard shall be maintained in all surface impoundments, with the exception of the No. 1 and No. 2 PLS Collection Ponds, at all times except during storm events and periods of planned maintenance, during which one and one-half (1.5) feet of freeboard shall be maintained.

7. The permittee shall not initiate any dump or in-situ (rubble) leaching prior to the development of the hydrologic sink downgradient of the leaching facilities. No dump or in-situ (rubble) leaching shall occur outside of the capture zone of the hydrologic sinks as defined in the ASARCO letters (see PART V.A.6) and potentiometric map (S-903-06 G) dated August 14, 1992.

B. Summary of BADCT Elements

The elements of the ASARCO Silver Bell Mine meeting BADCT are as follows:

1. Site preparation designed to minimize infiltration, including:

   a. Grubbing the native plants.
   b. Eliminating unconsolidated overburden.
   c. Backfilling and sealing underground mine workings that are under the dumps.
   d. Smoothing the side slopes to eliminate uneven topography.

2. Material placement of the #1 and #2 dump leach material so that a very coarse zone of rock lies at the base.

3. Surface runon\runoff control, consisting of:

   a. A diversion channel designed to divert storm flows associated with a 100 year, 24 hour rain event from entering the facility.

   b. Solution containment structures designed to capture and contain all storm flows that enter the facility associated with a 100 year, 24 hour rain event, in addition to the normal operating volumes.

4. Solution management, consisting of :

   a. Sequencing of leaching activities (wet/dry cycling so that only portions of the leach dumps will be leached at any one time).

   b. Daily inspection of dumps and ponds.

   c. Continual monitoring of the facility, which at a minimum will include the measurement of the solution flows, measuring pond freeboard, pump amps, line pressures, and record keeping of these measurements.

   d. An appropriate contingency plan.

5. Collection ponds which will be lined with a 60-mil high density polyethylene (HDPE) liner, overlying a prepared subgrade on top of low permeability bedrock.

6. Well defined canyon area for material placement and containment to ensure that all solutions and materials stay within the dump.

7. Steep topography within the canyon area that reduces the possibility of solution ponding under the dump.

8. Bedrock outcrops with minimal alluvial cover, which when removed, will minimize the solution head.

9. Low permeability bedrock for the dump leach foundation.

10. No nearby surface waters, and the facility is not located within the 100 year flood zone per FEMA maps.

11. Reconnaissance geologic mapping of the dump leach facilities which shows no major geologic structures that might enhance infiltration.

12. Rubble leaching will take place only within the pit hydrologic sinks and within the ultimate pit limits that the rubblization creates.

C. Monitoring Requirements

All monitoring required in this permit shall continue for the duration of the permit, regardless of the discharge or operational status of the facility, unless otherwise designated in this permit or an approved contingency plan. This monitoring program may be modified, including possible reduction of monitoring frequencies and parameters with Department approval after 24 months from the effective date of this permit. Requests for such changes must be written and include justification for the changes.

1. Discharge Monitoring

Raffinate and PLS from the mine shall be monitored according to PART IV, TABLES I.A. and I.B. in order to characterize potential discharge.

a. Leach Solution Monitoring

(1) The leach solution used in the dump and in-situ (rubble) leach process shall be monitored for inorganic parameters in PART IV, TABLE I.A. on a quarterly basis for four consecutive quarters and then afterward as may be required under the contingency plan should a violation of a permit condition occur.

(2) The leach solution used in the dump and in-situ (rubble) leach process shall be monitored and reported according to the terms and frequencies in PART IV, TABLE I.B.

(3) The permittee may submit a written request to modify Alert Levels for leach solution monitoring. Such a request shall include a summary of adequate test results justifying the change.

2. Groundwater Monitoring

a. Hazardous Point(s) of Compliance

The hazardous substance point(s) of compliance designated for this facility shall be located at the downgradient edge of the pollutant management area in the uppermost aquifer. The following monitor wells shall be constructed and used to monitor for hazardous pollutants:

POC Monitoring Well	Latitude	Longitude
MW-1	32°25'40"N	111°32'54"W
MW-2	32°25'59"N	111°32'51"W
MW-3	32°26'13"N	111°32'32"W
MW-4	32°26'18"N	111°31'48"W
MW-5	32°26'06"N	111°31'00"W
MW-7	32°25'20"N	111°32'42"W
MW-8	To be Determined	
MW-10	To be Determined	
MW-11	32°23'17"N	111°29'47"W
MW-12	To be Determined	

If alert levels for hazardous substances are exceeded at the point(s) of compliance, the permittee may be required to establish additional point(s) of compliance and to monitor at those point(s) of compliance.

b. Non Hazardous Point(s) of Compliance

Monitoring for non hazardous substances shall be conducted at the hazardous substance point(s) of compliance monitor wells. Non hazardous monitor wells will not be installed except pursuant to measures outlined in the contingency plan or this section. The non hazardous substance point(s) of compliance monitor wells shall be located between the facility and the property boundary and the appropriate monitoring points shall be designated and located as follows:

POC Monitoring Well	Latitude	Longitude
NH-1	32°26'37"N	111°31'33"W
NH-2	32°26'58"N	111°33'17"W
NH-3	32°25'54"N	111°33'04"W
NH-4	32°24'57"N	111°33'31"W
NH-5	32°24'22"N	111°33'30"W
NH-6	32°22'33"N	111°32'30"W
NH-7	32°22'33"N	111°30'48"W
NH-8	32°22'37"N	111°29'51"W

If alert levels for non hazardous substances are exceeded at the hazardous substance point(s) of compliance monitor wells, the permittee shall install the appropriate monitor well(s) at the point(s) of compliance established above.

If alert levels for non-hazardous substances are exceeded at the non hazardous point(s) of compliance, the permittee may be required to establish additional point(s) of compliance and to monitor at those point(s) of compliance.

The Director may designate additional points of compliance if information on groundwater gradients or other pertinent information indicates the need.

c. Monitoring Well Locations

A total of 12 monitoring wells shall be constructed at the locations indicated in PART IV, TABLE II.A.

(1) Monitoring wells MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-9, and MW-11 shall be installed a minimum of six quarters prior to operation of Leach Dump No. 1.

(2) Monitoring wells MW-1, and MW-10 shall be installed a minimum of eight quarters prior to the initiation of leaching of leach dump no. 2 and the West Oxide rubble leach, respectively.

The initial location and installation of MW-8, MW-10, and MW-12 will be delayed pending the completion of the study for the Silver Bell existing facilities. Specifically, MW-8 and MW-10 shall be located and installed within 750 feet of the PMA in the area to the south of the El Tiro Pit and proposed West Oxide Pit, and MW-12 shall be located and installed within 750 feet of the PMA to the southeast of oxide pit and to the south of the tailings facilities. (As referenced in PART II.H.10., the permittee shall submit an application for an individual APP for all existing facilities within 24 months of the effective date of this permit.)

All monitoring wells shall be installed and located according to plans approved by the Arizona Department of Water Resources (ADWR) and the ADEQ Aquifer Protection Program Section as referenced in PART V.A. and as stipulated in PART II.C.5.b.

After construction, the ADWR registration numbers of the wells shall be incorporated into this permit in PART IV, TABLE II.A.

d. Ambient Groundwater Quality Monitoring

Within two years, the permittee shall provide 8 quarterly analyses of groundwater samples to establish background ambient water quality data for evaluating any long-term changes in quality in accordance with PART IV, TABLE II.A. The initiation of ambient groundwater monitoring shall occur at least six (6) quarters prior to the initiation of leaching operations.

Within 30 days of receipt of the analyses of the ambient water quality samples, the permittee shall submit a report to the ADEQ Aquifer Protection Program Section with the subsequent quarterly Self-Monitoring Report, required in PART II.I. The report shall include all data and calculations necessary to establish valid ALs and AQLs for each well on a well by well basis. The method for establishing ALs and AQLs shall be as follows:

(1) Aquifer Quality Limits (AQLs)

AQLs shall be established for parameters with primary Aquifer Water Quality Standards (AWQS).

If ambient concentration (mean) plus 3.188 times the standard deviation is below the AWQS, then AQL = AWQS.

If ambient concentration (mean) plus 3.188 times the standard deviations exceeds the AWQS, then AQL = Mean + 3.188 SD.

(2) Alert Levels (ALs)

Alert Levels shall be calculated as follows:

Calculated AL = Mean + 3.188 SD.

and established as follows:

(i) Alert Levels for parameters with primary AWQS

If calculated AL is below primary AWQS, then AL = Calculated AL
If calculated AL exceeds primary AWQS, then no AL shall be established.

(ii) Alert Levels for parameters without primary AWQS

AL = Calculated AL

If "non-detects" are measured for certain parameters during the ambient groundwater monitoring, then upon completion of ambient monitoring, the permittee shall propose an acceptable methodology to calculate, where applicable, the ALs or AQLs for that parameter.

Ambient groundwater monitoring for radiochemicals shall be conducted in accordance with PART IV, TABLE II.A and shall continue for 4 consecutive quarters. At the end of four quarters the permittee shall submit the ambient monitoring data to the ADEQ Aquifer Protection Section for a determination if continued monitoring of radiochemicals is needed. The submittal shall include copies of the laboratory analytical reports and the accompanying QA/QC information. If approved by the ADEQ the monitoring requirement shall be dropped. If not approved by the ADEQ the monitoring frequency shall be reduced to annual.

e. Compliance Monitoring

After completion of the initial ambient groundwater monitoring requirements, the permittee shall continue to monitor each well for the indicator parameters listed in PART IV, Table II.B. Suite B to determine that ALs have not been exceeded. If an AL of an indicator parameter has been exceeded in a well(s), then the permittee shall begin monitoring that well(s) as per PART IV, TABLE II.B. Suite A. on a quarterly basis. Monitoring of Table II.B. Suite A. parameters will continue until the constituent(s) concentration is below the AL or AQL for two consecutive samples.

ittee may submit a written request to reduce the monitoring in PART IV, Table II.B. Suite A. upon completion of the ambient er monitoring program established in accordance with PART nd in accordance with the following criteria:

ıe parameter in question has not been detected for at least six (6) of e eight (8) consecutive quarters of the ambient monitoring period, d the detection limit is below any established or proposed numeric quifer Water Quality Standard. If no numeric AWQS exists for the rameter in question, the acceptable detection limit shall be approved advance by the ADEQ Aquifer Protection Section The permittee ay propose the use of the practical quantitation limit as an acceptable tection limit if the sample matrix results in difficulties in achieving ndard method detection limits;

ıe parameter in question has not been detected in the process lutions used in the leaching and solvent extraction-electrowinning ocesses, nor is known to be present in the process solutions because its use as a reagent or because of its presence in a reagent used in e process. Acceptable detection limits for the process solutions all be in accordance with PART II.C.2.e.(1).;

nzene and the polynuclear aromatic hydrocarbons listed in PART , Table I.B. shall not be removed should the contingency for oundwater monitoring of these constituents be implemented, unless ierwise adequately proven to the Department that benzene and/or PAHs are not present;

l analyses shall be performed using the same analytical method for ch parameter in question such that equivalent detection limits are ieved;

e permittee shall submit a written report indicating the parameter(s) oposed for deletion and accompanied by the supporting data as tlined in PART II.C.2.e., including the laboratory analytical orts and quality assurance/quality control data, to the ADEQ quifer Protection Section for review and approval;

on review and approval by the ADEQ the parameters in question ll be dropped from the list of monitoring parameters.

onal Monitoring

QA/QC Requirements

Pre-operational Monitoring

ition of the surface impoundment and ers the subgrade shall be inspected ee of sharp objects of any kind that e the liner. Ruts caused by the uipment or by the geomembrane pment must be leveled by hand. The tor or designated quality control m shall inspect the subgrade to insure paration has been achieved and tested e approved criteria submitted with the n, referenced in PART V. and PART plans).

testing shall be conducted on 100% ms. Destructive tests for shear and hall be performed at least every 300 field seam, and at least every 500 actory seam. Seam testing shall be in th ASTM D4437 (for field seams), 5 (for factory seams), and in h the approved criteria submitted with ication, referenced in PART V and QA/QC) of this permit.

shall install a pump capable of st 10 gpm (14,400 gpd) in the p of the leak detection system to n one (1) foot of head on the r for the following solution ponds: n) Raffinate Pond, (2) Intermediate l, (3) Intermediate PLS Pond, and (4) S Pond.

;

, solution ponds, and diversion l be inspected as specified in PART I.

in) Raffinate Pond (007), Intermediate l (008), Intermediate PLS Pond (010), Feed PLS Pond (011) leak detection e monitored for fluid presence on a nd pumped as needed. Records of the d shall be maintained by the permittee for a period of five (5) years from the ion.

b. Facility Maintenance Inspection

(1) The facility and pollution control structures shall be inspected for the items listed in PART IV, TABLE III. A log of these inspections shall be kept at the facility for five (5) years from the date of each inspection, available for review by ADEQ personnel.

(2) If any damage of the pollution control structures is identified during inspection, proper repair procedures shall be performed. All repair procedures and material(s) used shall be documented on the Self-Monitoring Report and Documentation Form and submitted quarterly to the ADEQ, Aquifer Protection Program Section. If no damage to the pollution control structures is identified during the quarter, the permittee shall indicate that the required inspections occurred during the quarter.

4. Sampling Protocols

a. Discharge Monitoring

(1) Leach Process Solution Monitoring

The permittee shall conduct leach process solution monitoring in accordance with PART IV, TABLE I.A. and TABLE I.B.

Daily process solution monitoring shall be performed in accordance with the permittee's standard procedures for process control solution analyses.

b. Groundwater Monitoring

(1) Sampling procedures, preservation techniques and holding times shall be consistent with the May, 1991 ADEQ Quality Assurance Project Plan.

(2) Static water levels shall be measured and recorded prior to sampling. Wells shall be purged of at least three borehole volumes (as calculated using the static water level) or until indicator parameters (pH, temperature, conductivity) are stable, whichever represents the greater volume. If evacuation results in the well going dry, the well should be allowed to recover to 80% of the original borehole volume. An explanation for reduced pumping volumes, a record of the volume pumped, and modified sampling procedures shall be reported on the Self- Monitoring Report and Documentation Form.

c. Operational Monitoring

(1) Freeboard Monitoring

All freeboard measurements shall consist of the vertical distance between the fluid surface and the lowest point on the berm of the pond.

5. Installation and Maintenance of Monitoring Equipment

a. Monitoring Equipment

The permittee shall provide monitoring or sampling access, ports or devices at the facility for all monitoring required by this permit.

b. Groundwater Monitoring Equipment

All groundwater monitoring wells, required by this permit, shall be installed and maintained according to plans approved by the ADEQ Aquifer Protection Program Section so that proper groundwater samples can be collected. Should additional groundwater wells be determined necessary, the construction details shall be submitted to the ADEQ Aquifer Protection Program Section for approval.

6. Monitoring Records

a. Discharge Monitoring Records

(1) The following information associated with each sample, inspection or measurement and the name of each individual who performed the sampling or measurement should be included in the monitoring records;

(a) Date, time and exact place of sampling, inspection, or measurement and the name of each individual who performed the sampling or measurement.

(b) Procedures used to collect the sample or make the measurement.

(c) Date on which sample analysis was completed.

(d) Name of each individual and laboratory who performed the analysis.

(e) Analytical techniques or methods used to perform the sampling and analysis.

(f) Chain of custody records.

(g) Any field notes relating to the information described in subparagraphs a through f above.

(2) Operational Monitoring/Facility Inspection Records

(a) Facility Inspection Records

The following information shall be recorded for weekly facility inspections:

Name of inspector, date and approximate time of inspection, condition of facility components listed in PART IV, TABLE III, and any damage or malfunction and repairs performed.

(3) Process Solution Monitoring

The permittee shall record the date on which daily measurements of solution flowrates and solution levels of each pond are taken. Chain of custody forms are not required for daily process solution monitoring.

(4) Groundwater Monitoring Records

All information required in PART II.C.6.a.(1) shall be recorded for each groundwater sample collected as required by this permit.

D. Contingency Plan Requirements

The permittee shall maintain at least one copy of the approved contingency plan(s) at the location where day-to-day decisions regarding the operation of the facility are made. The permittee shall revise promptly all copies of the contingency plan(s) to reflect approved changes. The permittee shall advise anyone responsible for the operation of the facility of the location of copies of all contingency and emergency plans. In addition to any information contained in the contingency plan referenced in Part V.A, at a minimum, the following contingency requirements shall be implemented.

1. AL/DL/AQL Contingencies

a. Discharge Alert Level Exceedance

(1) Primary Leachate Collection Sumps in Surface Impoundments (PLS and Raffinate Ponds)

The permittee shall initiate the following actions within five days of becoming aware that the volume pumped from a leak detection sump is greater than 5,000 gpd.

(a) Conduct the necessary tests to determine the location of leaks in the primary liner, including, if necessary, emptying of the impoundment.

(b) Quantify and record the amount of fluid pumped from the leachate collection system.

(c) Repair all identified points of leakage into the leachate collection system.

(2) Benzene and Polynuclear Aromatic Hydrocarbon (PAH) Monitoring

Within 30 days of becoming aware of an exceedance of the alert level or discharge limit for benzene and/or the five PAHs listed in PART IV, TABLE I.B., the permittee shall initiate monitoring for benzene and PAHs in the facility point of compliance monitor wells for eight quarters and thereafter monitor on an annual sampling and reporting frequency. The results of the initial groundwater sampling shall be submitted to the ADEQ Aquifer Protection Program Section within 30 days of receipt of the results. The Department may require additional monitoring, studies or remedial activities beyond those specified in the permit.

2. General AL/AQL/DL Contingencies

Alert Level (AL), Discharge Limit (DL) or Aquifer Quality Limit (AQL) Exceedance

a. The permittee shall notify the Department at the address specified in PART II.I.1 within five days of becoming aware of the exceedance of an Alert Level, Discharge Limit or Aquifer Quality Limit.

b. Verification sampling shall be conducted within 15 (fifteen) days of becoming aware that Alert Level, Discharge Limit or Aquifer Quality Limit has been exceeded.

c. Within five days of receiving the results of verification sampling from the laboratory, the permittee shall notify the Department of the results, at the address indicated in PART II.I.1, regardless of whether the results are positive or negative.

(1) If the results of verification sampling indicate that an AL, DL or AQL has not been exceeded, the permittee shall assume that no exceedance has occurred; no further action is required until the next scheduled monitoring round.

(2) If the results verify that a DL or AQL has been exceeded, the permittee shall, within 30 days of receiving the laboratory results verifying that a DL, or AQL has been exceeded, submit to the ADEQ, Aquifer Protection Program Section, either (a) or (b) of the following:

(a) a written report which includes the documentation specified in PART II.I.3.b. Upon approval by the Department, the permittee shall initiate the actions necessary to mitigate the impacts of the violation. At a minimum, the plan shall include provisions for more frequent sampling until constituent concentration is below the AL, DL or AQL for two consecutive samples. The plan shall indicate if any additional parameters are to be tested.

(b) a demonstration that the DL or AQL exceedance resulted from error(s) in sampling, analysis, or statistical evaluation.

(3) If the results verify that an AL has been exceeded, the permittee shall, if requested by the Director, within 30 days of receiving the laboratory results verifying that an AL has been exceeded, submit to the ADEQ Aquifer Protection Program Section, either (a) or (b) of the following:

(a) a written report describing the causes, impacts or mitigation of the discharge.

(b) a demonstration that the AL exceedance resulted from error(s) in sampling, analysis, or statistical evaluation.

(4) Upon review of the report documenting an AL, DL, or AQL exceedance, the Department may require additional monitoring and/or action beyond those specified in this permit.

3. Accidental Discharge

a. The permittee shall correct any failure that results in an accidental discharge and take the following actions:

(1) Within 30 days of an accidental discharge that might cause the exceedance of an AQL or might cause imminent and substantial endangerment to public health or the environment, the permittee shall submit to the ADEQ Aquifer Protection Program Section a written report that includes the documentation required in PART II.I.3.

(2) Upon review of the above required report, the Department may require additional monitoring and/or actions.

b. Emergency Response

(1) The permittee shall provide for emergency response on a 24-hour basis in the event that a condition arises which results in imminent and substantial endangerment to public health or the environment. The plan shall be kept at the facility and provide for the following:

(a) designation of an emergency response coordinator who shall notify ADEQ, Aquifer Protection Program Section and activate the necessary contingency plan in the event of an emergency;

(b) a general description of the procedures, personnel and equipment to be used to assure appropriate mitigation of unauthorized discharges; and

(c) a list of names, addresses and telephone numbers of persons to be contacted in the event of an emergency.

(2) The emergency response coordinator shall notify the ADEQ, Aquifer Protection Program Section immediately in the event that emergency response measures are taken or those portions of the contingency plan that address an imminent and substantial endangerment are activated.

4. Slope Failures

If a slope failure involving the leach dumps, rubblized zones, surface impoundments or liners occurs the permittee shall promptly close the active area in the vicinity of the failure, and conduct a field investigation of the failure to analyze its origin and extent, its impact on the facility operations, temporary and permanent repairs and changes in operational plans considered necessary.

E. Temporary Cessation

The permittee shall notify the ADEQ Aquifer Protection Program Section in writing before any temporary cessation of operations at the facility. Notification of the temporary cessation does not relieve the permittee of any permit requirements unless otherwise specified in this permit.

Accompanying the notification shall be a description of any measures to be taken to maintain discharge control systems such that discharge is minimized to the maximum extent practicable during temporary cessation.

F. Closure

1. The permittee shall notify the ADEQ, Aquifer Protection Program Section of the intent to cease, without intent to resume, an activity for which the facility was designed or operated prior to ceasing. Within 90 days following notification, the permittee shall submit for approval, to ADEQ Aquifer Protection Program Section, a closure plan which eliminates, to the greatest extent practicable, any reasonable probability of further discharge from the facility and of exceeding Aquifer Water Quality Standards at the applicable point of compliance. This plan shall be in addition to the approved closure method referenced in the facility file. The plan shall describe the following details:

   a. The approximate quantities and the chemical, biological, and physical characteristics of the materials to be removed from the facility;

   b. the destination of the materials to be removed from the facility and an indication that placement of the materials at that destination is approved;

   c. the approximate quantities and the chemical, biological, and physical characteristics of the materials that will remain at the facility;

   d. the methods to be used to treat any materials remaining at the facility;

   e. the methods to be used to control the discharge of pollutants from the facility;

   f. any limitations on future land or water uses created as a result of the facility's operations or closure activities;

   g. the methods to be used to secure the facility;

   h. an estimate of the cost of closure; and

   i. a schedule for implementation of the closure plan and the submission of a post-closure plan.

2. Upon completion of closure activities, the permittee shall give written notice to ADEQ Aquifer Protection Program Section indicating that the approved closure plan has been fully implemented.

G. Post-Closure

1. Post-closure requirements by the ADEQ, Water Permit Unit will be based on the review of facility closure activities.

2. The post-closure plan shall ensure that any reasonable probability of further discharge from the facility, and of exceeding Aquifer Water Quality Standards at the applicable points of compliance, are eliminated, to the greatest extent practicable. If a modified post-closure plan is deemed to be necessary, the modified plan shall describe all of the following:

a. The duration of the post-closure care.

b. The monitoring procedures to be implemented by the permittee, including monitoring frequency, type, and location.

c. A description of the operating and maintenance procedures to be implemented for aquifer quality protection devices, such as liners, treatment systems, pump-back systems, and monitoring wells.

d. A schedule and description of physical inspections to be conducted at the facility following closure.

e. An estimate of the cost of post-closure maintenance and monitoring.

f. A description of limitations on future land or water uses, or both, at the facility site as a result of facility operations.

3. The permittee shall notify ADEQ Aquifer Protection Program Section in writing when the post-closure activities have been completed.

4. At a minimum, post-closure requirements shall include maintenance and monitoring activities, as described in the plans referenced in PART IV, TABLE III and PART V.A. These shall essentially consist of: periodic verification that all the containment and monitoring structures and facilities retain their integrity and their operability; appropriate repairs as necessary; and monitoring of groundwater and leachate. These activities will continue for a period of time to be determined at the time of closure, and approved by the ADEQ Aquifer Protection Program Section, and neither shall their frequency be modified nor the monitoring ceased without approval by the ADEQ.

H. Compliance Schedule Requirements

1. The permittee shall submit to the ADEQ Aquifer Protection Program Section within 24 months of the effective date of the permit, the tabulated ambient groundwater monitoring data as required in PART IV TABLE II.

2. The permittee shall, within 24 months of the effective date of the permit, or prior to the initiation of leaching, whichever comes first, submit to the ADEQ Aquifer Protection Program Section, a report which includes the statistical calculations of the alert levels and aquifer quality limits to be established for the point of compliance monitor wells. The report shall include copies of the laboratory analytical reports and the QA/QC procedures using in collection and analysis of the samples.

3. The permittee shall, within 60 days of the effective date of the permit, submit a copy of a facility emergency response plan to the ADEQ Aquifer Protection Program Section. The plan shall include the information as referenced in PART II.D.3.b.

4. The permittee shall submit to the ADEQ Aquifer Protection Program Section, within 30 days of the completion of construction, the as-built construction drawings for all leach dumps, liner systems, PLS ponds, raffinate ponds, and storm water diversion structures. All construction drawings shall be signed and sealed by a professional engineer registered in the State of Arizona.

5. The permittee shall, within 30 days of completion of construction of the facilities referenced in PART II.H.4., submit the results of all quality assurance/quality control testing to the ADEQ Aquifer Protection Program Section.

6. The permittee shall install groundwater monitor wells MW-1 and MW-10 at least 24 months prior to the initiation of leaching activities at leach dump No. 2 and the West Oxide Pit rubble leach, respectively. MW-1 and MW-10 shall be monitored in accordance with PART IV, TABLE II.A., and the ambient monitoring data and statistical AL and AQL calculation shall be submitted to the ADEQ Aquifer Protection Program Section prior to the initiation of leaching operations at leach dump No. 2 and the West Oxide Pit rubble leach for review, approval and incorporation into the permit and in accordance with PART II.C.2.d. Upon the completion of ambient monitoring the permittee shall conduct monitoring of MW-1 and MW-10 in accordance with PART IV, TABLE II.B. Suite B.

7. The permittee shall submit to the ADEQ Aquifer Protection Program Section a report documenting the existing hydrologic conditions in the North Silver Bell open pit and surrounding areas and the West Oxide open pit and surrounding areas prior to the initiation of leaching operations, but no longer than one year after the initiation of excavation of the open pits.

8. The permittee shall, within 30 days of the initiation of pre-mine activities, submit notification to the ADEQ Aquifer Protection Program Section of the initiation of pre-mine activities. Pre-mine activity is conventional truck and shovel mining that is performed prior to actual leaching.

9. The permittee shall, at the end of the one year pre-mine activities, submit to the ADEQ Aquifer Protection Program Section a proposal for a groundwater level monitoring plan, including proposed locations of fixed piezometer pairs and other measurement locations, proposed frequency of monitoring and reporting, and proposed minimum sample point density for the Oxide, West Oxide, El Tiro and North Silver Bell open pits and surrounding areas. Upon review and approval by the ADEQ Aquifer Protection Program Section the monitoring plan shall be incorporated into the permit.

10. The permittee shall, within 24 months of the effective date of the permit, submit an application for an individual Aquifer Protection Permit for all existing facilities and existing discharging activities at the ASARCO Silver Bell Unit, including, but not limited to all leaching operations, surface impoundments, tailings facilities and pollution control facilities.

11. The permittee shall submit, within thirty days of receipt of the fourth quarter results of polynuclear aromatic hydrocarbon (PAH) monitoring, a written report to the ADEQ Aquifer Protection Program Section proposing the alert levels for the five PAHs. The alert levels shall be based on the practical quantitation limits achieved during analysis of the four quarterly samples during the first year of monitoring, if the practical quantitation limits exceed 0.005 milligrams per liter (mg/L). The permittee shall direct the analytical laboratory to take the steps necessary to achieve the lowest detection limits possible. Upon review and approval by the ADEQ Aquifer Protection Program Section the alert levels shall be incorporated into the permit.

If at any time during the life of the permit, the permittee is able to adequately prove to the Department that neither Benzene nor one of the five PAHs are present in the process solution, then upon review and approval by the Department, Benzene and/or one the PAHs shall be dropped from the list of monitoring parameters.

I. Reporting Requirements

1. Reporting Location

Signed copies of all reports required herein shall be submitted to the Department at:

Arizona Department of Environmental Quality
Aquifer Protection Program Section
3033 North Central Ave
Phoenix, Arizona 85012
Phone Number: (602) 207-4622

2. Monitoring Reporting

a. The permittee shall complete the Self-Monitoring Report and Documentation Form provided by the Department to reflect facility inspection requirements designated in PART IV, TABLE III and submit to the ADEQ, Aquifer Protection Program Section quarterly along with other reports required by this permit. Facility inspection reports shall be submitted no less frequently than quarterly, regardless of operational status.

b. PART IV, TABLES I.A., I.B., II.A., and II.B. contain the frequency for reporting results from discharge and groundwater monitoring requirements. Results shall be submitted in the Self-Monitoring Report Form. Monitoring methods shall be recorded and any deviations from the methods and frequencies prescribed in this permit shall be reported.

c. The permittee shall complete the Self-Monitoring Report Forms, to be supplied by the Department, to the extent that the information reported may be entered on the form. The results of all monitoring required by this permit shall be submitted in such a format as to allow direct comparison with the limitations and requirements of the permit.

3. Permit Violation Reporting

a. The permittee shall notify the ADEQ Aquifer Protection Program Section within five days of becoming aware of a violation of any permit condition.

b. The permittee shall submit a written report within 30 days after becoming aware of the violation of a permit condition. The report shall document all of the following:

(1) A description of the violation and its cause;

(2) the period of violation, including exact date(s) and time(s), if known, and the anticipated time period during which the violation is expected to continue;

(3) any action taken or planned to mitigate the effects or the violation, or to eliminate or prevent recurrence of the violation;

(4) any monitoring activity or other information which indicates that any pollutants would be reasonably expected to cause a violation of an Aquifer Water Quality Standard; and

(5) any malfunction or failure of pollution control devices or other equipment or process.

4. Modification Reporting

a. All requests for permit modifications shall be done in accordance with PART VI.H.3., unless otherwise specified in this permit.

b. Requests for a major modification to a facility (as defined in PART V.C.24.) shall be submitted at least 180 calendar days before making the major modification.

5. Operational Reporting

a. The permittee shall report operational conditions listed in PART IV, TABLE III in the Self-Monitoring Report form quarterly. If none of the conditions occur, the report shall say "no event"for a particular reporting period. If the facility is not in operation, the permittee shall indicate that fact in the Self-Monitoring Report.

b. The permittee shall submit data required in PART IV, TABLES I through IV regardless of the operating status of the facility unless otherwise approved by the Department or allowed in this permit.

6. Self-Monitoring Reports

The Self-Monitoring Report shall include: Copies of laboratory analysis forms, documentation on sampling date and time, name of sampler, static water level prior to sampling, sampling method, purging volume, indicator parameters, analytical method, method detection limit, date of analysis, preservation and transportation procedures, and analytical facility. Data shall be compiled on standardized forms which allow comparison with past reports.

7. Samples taken report due by:

Samples taken during quarter beginning	Quarterly Report due by
Jan	Apr 28
Apr	Jul 28
Jul	Oct 28
Oct	Jan 28

PART III. OTHER CONDITIONS

A. Analytical Methodology

The water samples shall be analyzed using EPA approved methods or Arizona State approved methods listed in PART IV, TABLES I and II. Alternative EPA or Standard Methods may be substituted for the methods specified in PART IV so long as equivalent or better detection limits are achieved. The analysis shall be performed by a laboratory licensed by the Arizona State Laboratory. For results to be considered valid, all analyses shall be performed by a licensed and certified laboratory and all analytical work shall meet quality control standards specified in the approved methods. A list of certified laboratories can be obtained at the address listed below:

Arizona Department of Health Services
Office of Laboratory Licensure and Certification
3443 North Central Avenue
Phoenix, Arizona 85012
Phone Number: (602) 255-3454

B. Environmental Laboratory Contact

Upon submittal of the samples to a state-certified laboratory for analysis, a copy of the appropriate portions of the signed permit shall be forwarded to the laboratory for reference.

PART IV. TABLES

DISCHARGE MONITORING

TABLE I.A
LEACHING PROCESS SOLUTION MONITORING

Sampling Point Number	Identification	Location
001B	No. 1 PLS Collection Pond	32°26'03" N/111°31'47" W
007	Plant (Main) Raffinate Pond	32°23'25" N/111°29'52" W

Parameter	Discharge Limit [1]	Alert Level [2]	Analytic Method [3]	Monitoring Frequency	Reporting Frequency
Suite A General Inorganics					
				Quarterly for four quarters; As may be required by contingency plan thereafter	Quarterly for four quarters; As may be required by contingency plan thereafter
pH (field)	N/A	N/A	N/A	"	"
Specific Conductance (field)	N/A	N/A	N/A	"	"
Temperature (field)	N/A	N/A	N/A	"	"
pH (lab)	N/A	N/A	EPA 150.1	"	"
Specific Conductance (lab)	N/A	N/A	EPA 120.1	"	"
Temperature (lab)	N/A	N/A	EPA 170.1	"	"
Calcium	N/A	N/A	EPA 215	"	"
Magnesium	N/A	N/A	EPA 242.1	"	"
Potassium	N/A	N/A	EPA 258.1	"	"
Sodium	N/A	N/A	EPA 273.1	"	"
Chloride	N/A	N/A	EPA 325	"	"
Fluoride	N/A	N/A	EPA 340	"	"
Nitrate-Nitrite as N	N/A	N/A	EPA 353	"	"
Sulfate	N/A	N/A	EPA 375	"	"
Hardness [4]	N/A	N/A	Calculation	"	"
Total Dissolved Solids (TDS)	N/A	N/A	EPA 160.1	"	"

TABLE I.A (Cont.)

Metals [5]:

Antimony	N/A	N/A	EPA 204	"	"
Arsenic	N/A	N/A	EPA 206	"	"
Barium	N/A	N/A	EPA 208	"	"
Beryllium	N/A	N/A	EPA 210	"	"
Cadmium	N/A	N/A	EPA 213	"	"
Chromium	N/A	N/A	EPA 218	"	"
Copper	N/A	N/A	EPA 220	"	"
Iron	N/A	N/A	EPA 236	"	"
Lead	N/A	N/A	EPA 239	"	"
Manganese	N/A	N/A	EPA 243	"	"
Mercury	N/A	N/A	EPA 245	"	"
Nickel	N/A	N/A	EPA 249	"	"
Selenium	N/A	N/A	EPA 270	"	"
Thallium	N/A	N/A	EPA 279	"	"
Zinc	N/A	N/A	EPA 289	"	"

Radiochemicals[5]:

Gross Alpha Particle Activity	N/A	N/A	EPA 900.1	Quarterly for four quarters; As per contingency plan thereafter	Quarterly for four quarters; As per contingency plan thereafter
Radium- 226	N/A	N/A	EPA 903.1	"	"
Radium- 228	N/A	N/A	EPA 904	"	"
Uranium (total) [6]	N/A	N/A	EPA 908	"	"
Radon- 222 [6]	N/A	N/A	EPA 908	"	"

TABLE I.B
GENERAL ORGANICS

Sampling Point Number	Identification	Location
001B	No. 1 PLS Collection Pond	32°26'03" N/111°31'47" W
007	Plant (Main) Raffinate Pond	32°23'25" N/111°29'52" W

Parameter	Discharge Limit [1]	Alert Level [2]	Analytic Method [3]	Monitoring Frequency	Reporting Frequency
Flow Rate (Pond 011)	9000 gpm	N/A	Flow Meter	Daily	Quarterly
Benzene	Reserved	0.005	EPA 602	Quarterly for four quarters; thereafter annually	Quarterly for four quarters; thereafter annually
Benzo (b) fluoranthene	Reserved	*	EPA 610	"	"
Benzo (a) pyrene	Reserved	*	EPA 610	"	"
Dibenzo (a,h) anthracene	Reserved	*	EPA 610	"	"
Dibenzo (a,i) pyrene	Reserved	*	EPA 610	"	"
Indeno (1,2,3- cd) pyrene	Reserved	*	EPA 610	"	"

TABLE II.A
AMBIENT GROUNDWATER MONITORING

Sampling Point Number	Well Number	Cadastral Location (x-y-z)NN	ADWR Registration Number	Latitude	Longitude
01	MW- 1			32 25' 40" N	111 32' 54" W
02	MW- 2			32 25' 59" N	111 32' 51" W
03	MW- 3			32 26' 13" N	111 32' 32" W
04	MW- 4			32 26' 18" N	111 31' 48" W
05	MW- 5			32 26' 06" N	111 31' 00" W
06	MW- 6			32 25' 15" N	111 31' 08" W
07	MW- 7			32 25' 20" N	111 32' 42" W
08	MW- 8			To be Determined	
09	MW- 9			32 24' 09" N	111 30' 13" W
10	MW- 10			To be Determined	
11	MW- 11			32 23' 17" N	111 29' 47" W
12	MW- 12			To be Determined	

TABLE II.A. (Cont.)

Parameter	Analytical Method [3]	Sampling Frequency	Reporting Frequency
General Inorganics:			
pH (field)	N/A	Qtly for 8 Qtrs	Qtly for 8 Qtrs
Specific Conductance (field)	N/A	"	"
Temperature (field)	N/A	"	"
pH (lab)	EPA 150.1	"	"
Specific Conductance (lab)	EPA 120.1	"	"
Temperature (lab)	EPA 170.1	"	"
Calcium	EPA 215	"	"
Magnesium	EPA 242.1	"	"
Potassium	EPA 258.1	"	"
Sodium	EPA 273.1	"	"
Alkalinity (Total)	EPA 310	"	"
Bicarbonate [7]	Calculation	"	"
Chloride	EPA 325	"	"
Fluoride	EPA 340	"	"
Nitrate- Nitrite as N	EPA 353	"	"
Sulfate	EPA 375	"	"
Hardness	Calculation	"	"
Total Dissolved Solids (TDS)	EPA 160.1	"	"
Metals [5]:			
Antimony	EPA 204	Qtly For 8 Qtrs	Qtly For 8 Qtrs
Arsenic	EPA 206	"	"
Barium	EPA 208	"	"
Beryllium	EPA 210	"	"
Cadmium	EPA 213	"	"
Chromium	EPA 218	"	"
Copper	EPA 220	"	"
Iron	EPA 236	"	"
Lead	EPA 239	"	"
Manganese	EPA 243	"	"
Mercury	EPA 245	"	"
Nickel	EPA 249	"	"
Selenium	EPA 270	"	"
Thallium	EPA 279	"	"
Zinc	EPA 289	"	"

TABLE II.A. (Cont.)

Radiochemicals [5,6]:

Gross Alpha Particle Activity	EPA 900.1	Quarterly for 4 quarters	Quarterly for 4 quarters
Radium 226	EPA 903.1	"	"
Radium 228	EPA 904	"	"
Uranium (total) [6]	EPA 908	"	"
Radon 222 [6]	EPA 908	"	"

TABLE II.B
GROUNDWATER MONITORING

Sampling Point Number	Well Number	Cadastral Location (x-y-z)NN	ADWR Registration Number	Latitude	Longitude
01	MW- 1			32 25' 40" N	111 32' 54" W
02	MW- 2			32 25' 59" N	111 32' 51" W"
03	MW- 3			32 26' 13" N	111 32' 32" W
04	MW- 4			32 26' 18" N	111 31' 48" W
05	MW- 5			32 26' 06" N	111 31' 00" W
07	MW- 7			32 25' 20" N	111 32' 42" W
08	MW- 8			To be Determined	
10	MW- 10			To be Determined	
11	MW- 11			32 23' 17" N	111 29' 47" W
12	MW- 12			To be Determined	

TABLE II.B., SUITE A

Parameter	AQL (mg/l) [1]	Alert Level [2]	Analytical Method [3]	Sampling Frequency	Reporting Frequency
Suite A-General Inorganics:					
				As Per Contingency Plan	As Per Contingency Plan
Calcium	N/A	Reserved	EPA 215	"	"
Magnesium	N/A	Reserved	EPA 242.1	"	"
Potassium	N/A	Reserved	EPA 258.1	"	"
Sodium	N/A	Reserved	EPA 273.1	"	"
Alkalinity (Total)	N/A	Reserved	EPA 310	"	"
Bicarbonate [7]	N/A	Reserved	Calculation	"	"
Chloride	N/A	Reserved	EPA 325	"	"
Fluoride	Calculated	Reserved	EPA 340	"	"
Hardness [4]	N/A	Reserved	Calculation	"	"
Nitrate - Nitrite as N	Calculated	Reserved	EPA 353	"	"
Suite A-Metals [5]:					
Antimony	Calculated	Reserved	EPA 204	As Per Contingency Plan	As Per Contingency Plan
Arsenic	Calculated	Reserved	EPA 206	"	"
Barium	Calculated	Reserved	EPA 208	"	"
Beryllium	Calcualted	Reserved	EPA 210	"	"
Cadmium	Calculated	Reserved	EPA 213	"	"
Chromium	Calculated	Reserved	EPA 218	"	"
Lead	Calculated	Reserved	EPA 239	"	"
Mercury	Calculated	Reserved	EPA 245	"	"
Nickel	Calculated	Reserved	EPA 249	"	"
Selenium	Calculated	Reserved	EPA 270	"	"
Thallium	Calculated	Reserved	EPA 279	"	"
Suite A- Radiochemicals [5]:					
Gross Alpha Particle Activity	Calculated	Reserved	EPA 900.1	As Per Contingency Plan	As Per Contingency Plan
Radium-226	Calculated	Reserved	EPA 903.1	"	"
Radium-228	Calculated	Reserved	EPA 904	"	"
Uranium (total) [6]	N/A	Reserved	EPA 908	"	"
Radon-222 [6]	N/A	Reserved	EPA 908	"	"

TABLE II.B., SUITE B

Parameter	AQL (mg/l)[1]	Alert Level [2]	Analytical Method [3]	Sampling Frequency	Reporting Frequency
General Inorganics:				Quarterly	Quarterly
pH (field)	N/A	Calculated[8]	N/A	"	"
Specific Conductance (field)	N/A	Reserved	N/A	"	"
Temperature (field)	N/A	N/A	N/A	"	"
pH (lab)	N/A	N/A	EPA 150.1	"	"
Specific Conductance (lab)	N/A	N/A	EPA 120.1	"	"
Copper [5]	N/A	Calculated	EPA 220	"	"
Sulfate	Reserved	Calculated	EPA 375	"	"
Total Dissolved Solids (TDS)	N/A	Calculated	EPA 160.1	"	"
Iron	N/A	Calculated	EPA 236	"	"
Manganese	N/A	Calculated	EPA 243	"	"
Zinc	N/A	Calculated	EPA 289	"	"

Explanation to footnotes:

1 - All discharge limits (DLs) and aquifer quality limits (AQLs) are in milligrams per liter (mg/L) unless otherwise indicated.

2 - All alert levels are in milligrams per liter (mg/L) unless otherwise indicated.

3 - All analytical methods are EPA methods unless otherwise indicated.

4 - Hardness may be determined using EPA method 130 or as the sum of the Ca and Mg concentrations expressed as $CaCO_3$

5 - All metals and radiochemical analyses shall be conducted for the dissolved fraction (dissolved metals and dissolved radiochemicals) and shall be filtered to .10 microns.

6 - Uranium species and Radon-222 are only required to be tested if the gross alpha particle activity exceeds 15 picocuries per liter (pCi/L). Uranium (total) is the sum of the individual uranium isotopes, U-234, U-235, and U-238.

7 - Bicarbonate may be determined using EPA method 310 or may be determined by calculation.

8 - The alert level for pH shall be set equal to the mean - (1.5)(log units)

N/A means not applicable.

Reserved means that the Arizona Department of Environmental Quality reserves the right to establish discharge limits (DLs), aquifer quality limits (AQLs), and/or alert levels (ALs) at a later date. Any future change of a DL, AQL, and/or AL shall be negotiated with the permittee.

Calculated means that AQLs and ALs shall be established as set forth in PART II.C.2.d.

* - Alert levels for the five polynuclear aromatic hydrocarbons (PAHs) shall be determined using the practical quantitation limits developed from the first year (four quarters) of process solution monitoring in accordance with PART II.H.11.

TABLE III
FACILITY INSPECTION

Parameter	Performance Levels	Inspection Frequency
PLS and Raffinate Ponds	No visible cracks or leaks in liner;	Quarterly
Freeboard	Minimum three-feet of freeboard; No evidence of seepage	Daily
No. 1 and 2 PLS Collection Ponds spillway and overflow channels	Free of obstructions, debris Not overgrown with vegetation	Quarterly
PLS and Raffinate Pond Berm Integrity	No substantial erosion; No evidence of seepage Not overgrown with vegetation	Quarterly or after major rain event (2" in 24 hrs)
PLS and Raffinate Pond Leak Detection Sumps	No impairment of access;	Weekly
Storm Water Diversion Ditches	No substantial erosion Not overgrown with vegetation Free of obstruction, debris	Quarterly
Monitor Well Integrity	Wellhead cap or box locked and secure No visible damage	Quarterly and as sampled

TABLE IV
OPERATIONAL REPORTING SUMMARY

Operational Condition	Specific Reference for Necessary Action
Alert Level Exceedance	PART II.D.1.a
Groundwater Alert Level Exceedance	PART II.D.2.c.(3)
Aquifer Quality Level Violation	PART II.D.2.c.(2)
Accidental Discharge	PART II.D.3
Emergency Response	PART II.D.3.b
Temporary Cessation	PART II.E
Closure	PART II.F
Post-Closure	PART II.G
Major Modification to Facility	PART II.I.4.b
Modification to Permit	PART VI.H.3
Change in Owner or Operator	PART VI.H.4
Bankruptcy or Environmental Enforcement Against the Permittee	PART VI.C

PART V. REFERENCES: PERTINENT INFORMATION

A. References

The terms and conditions set forth in this permit have been developed based upon the information contained in the following:

1. Field Inspection Form(s) dated

2 Permit Application dated November 27, 1991

3. Aquifer Impact Review dated May 4, 1992

4. Plan Review File Number .....

5. Plan Approval by Mining APP Unit dated .....

6. Amendments to above No. 2 dated 2-10-92, 6-18-92, 8-14-92, 9-24-92, 10-9-92, 10-19-92, 11-11-92, 12-18-92, 1-4-93, 1-12-93, 2-11-93, 2-18-93, 4-5-93, 5-14-93, 4-25-94, BADCT Letter from ADEQ.

7. Public Notice dated .....

8. Public Hearing comments, correspondence and any additional supplemental information contained in the permit file.
.....
.....

9. Other .....

B. Facility Information

1. Facility Contact Person David J. Duncan

2. Address 25,000 W. Avra Valley Road, Marana, Arizona 85653

3. Emergency Telephone Number: (602) 682-2420 (work) and (602) 744-4654 (home)

The Department shall be notified within 30 days of the change in facility contact person.

4. Landowner of Facility Site ASARCO, Incorporated
Address 180 Maiden Lane, New York, NY 10038

C. Definitions

1. **"Alert Level (AL)"** means a numeric value, expressing either a concentration of a pollutant or a physical or chemical property of a pollutant, which is established in an individual Aquifer Protection Permit and which serves as an early warning indicating a potential violation of either an Aquifer Water Quality Standard at the applicable point of compliance, or any permit condition.

2. **"Applicant"** means the owner or operator of the facility.

3. **"Aquifer Protection Permit (APP)"** means an individual, or general permit issued pursuant to A.R.S. Section 49-203 and 49-241 through 251, and A.A.C. R18-9-101 et sec.

4. **"Aquifer Quality Limit (AQL)"** means the maximum amount of a given constituent which the permit conditions allow in the aquifer at the point of compliance. AQLs shall only be established for constituents with primary AWQSs.

5. **"Aquifer Water Quality Standard"** means a standard established pursuant to A.R.S. Section 49-221 and 49-223.

6. **"Areal composite sample"** means a set of samples collected from an area and combined into a single sample. The number and spacing shall be representative of the quality of the accumulated material.

7. **"BADCT"** means the Best Available Demonstrated Control Technology, processes, operating methods, or other alternatives to achieve the greatest degree of discharge reduction determined for a facility by the Director pursuant to A.R.S. Section 49-243.B and D.

8. **"Chain of Custody Form"** is used to maintain and document sample possession for enforcement purposes (User's Guide to the EPA Contract Laboratory Program).

9. **"Department"** means the Department of Environmental Quality.

10. **"Director"** means the Director of Environmental Quality or the Director's designee.

11. **"Discharge"** means, for purposes of the aquifer protection permit program prescribed by A.R.S. Title 49, Chapter 2, Article 3, the addition of a pollutant from a facility either directly to an aquifer or the land surface or the vadose zone in such a manner that there is a reasonable probability that the pollutant will reach an aquifer.

12. **"Discharge Impact Area"** means the potential areal extent of pollutant migration, as projected on the land surface, as the result of a discharge from a facility.

13. **"Discharge Limitation (DL)"** means any restriction, prohibition, limitation or criteria established by the Director, through a rule, permit or order, on quantities, rates, concentrations, combinations, toxicity, and characteristics of pollutants.

14. **"Drywell"** has the meaning ascribed to it in A.R.S. Section 49-331.3.

15. "Environment" means navigable waters, any other surface water,groundwater, drinking water supply, land surface, subsurface strata or ambient air, within or bordering on this state.

16. "Exceedance" means the detection of a pollutant at levels or concentrations exceeding limits established in this permit.

17. "Existing facility" means a facility on which construction began before the effective date of this chapter and which is neither a new facility nor a closed facility. For purposes of this definition construction on a facility has begun if the facility owner or operator has either:

    a. Begun, or cause to begin, as part of a continuous on-site construction program any placement, assembly or installation of a building, structure or equipment; or

    b. Entered a binding contractual obligation to purchase a building, structure or equipment which is intended to be used in its operation within a reasonable time. Options to purchase or contracts which can be terminated or modified without substantial loss, and contracts for feasibility engineering and design studies ,do not constitute a contractual obligation for purposes of this definition.

18. "Facility" means any land, building, installation, structure, equipment, device, conveyance, area, source activity or practice from which there is, or with reasonable probability may be, a discharge.

19. "Groundwater Quality Protection Permit" means a permit issued by the Arizona Department of Health Services or the Department pursuant to A.A.C. R9-20-208 prior to September 26, 1989.

20. "Hazardous substance" means:

    a. Any substance designated pursuant to Section 311(b)(2)(a) and 307(a) of the Clean Water Act;

    b. any element, compound, mixture solution or substance designated pursuant to Section 102 of CERCLA;

    c. any hazardous waste having the characteristics identified under or listed pursuant to A.R.S. 49-922;

    d. any hazardous air pollutant listed under 112 of the Federal Clean Air Act (42 United States Code Section 7412);

    e. any imminently hazardous chemical substance or mixture with respect to which the administrator has taken action pursuant to Section 7 of the Federal Toxic Substances Control Act (15 United States Code Section 2606); and

f. any substance which the Director, by rule, either designates as a hazardous substance following the designation of the substance by the Administrator under the authority described in subdivisions (a) through (e) of this paragraph or designates as a hazardous substance on the basis of a determination that such a substance represents an imminent and substantial endangerment to public health.

21. **"Inert material"** means that which is insoluble in water and will not decompose or leach substances to water, such as broken concrete, brick, rock, gravel, sand, uncontaminated soils.

22. **"Injection well"** means a well which receives a discharge through pressure injection or gravity flow.

23. **"mg/l"** means milligrams per liter.

24. **"Major Modification(s) to a Facility"** means any of the following:

a. A physical change in an existing facility or change in its method of operation that results in a significant alteration in the characteristics or volume of the pollutants discharged.

b. The addition of a process or major piece of production equipment, building or structure that is physically separated from the existing operation and that causes a discharge.

25. **"NPDES Permit"** means a permit issued by the United States Environmental Protection Agency for discharge to the waters of the United States as required by the Clean Water Act, as amended.

26. **"New Facility"** means a previously closed facility that resumes operation or a facility on which construction was begun after the effective date of this chapter on a site at which no other facility is located or to totally replace the process or production equipment that causes the discharge from an existing facility. A major modification to an existing facility is deemed a new facility to the extent that the criteria in A.R.S. 49-243, subsection B, paragraph 1 can be practicably applied to such modification. The following constitute major modification:

(a) A physical change in an existing facility or change in its method of operation that results in a significant alteration in the characteristics or volume of the pollutants discharged.

(b) The addition of a process or major piece of production equipment, building or structure that is physically separated from the existing operation and that causes a discharge.

For purposes of this definition construction on a facility has begun if the facility owner or operator has either:

(i) Begun, or caused to begin as part of a continuous on-site construction program, any placement, assembly or installation of a building, structure or equipment.

(2) Entered a binding contractual obligation to purchase a building, structure or equipment which is intended to be used in its operation within a reasonable time. Options to purchase or contracts which can be terminated or modified without substantial loss, and contracts for feasibility engineering and design studies, do not constitute a contractual obligation for purposes of this definition.

27. **"Operator"** means any person who makes management decisions regarding facility operations governed by this permit.

28. **"Owner"** means any person holding legal or equitable title in any real property subject to this permit.

29. **"Point of Compliance"** means the designated point or points, as determined by the Director pursuant to A.R.S. Title 49, Section 244, at which compliance with Aquifer Water Quality Standards shall be determined.

30. **"Pollutant"** means fluids, contaminants, toxic wastes, toxic pollutants, dredged spoil, solid waste, substances and chemicals, pesticides, herbicides, fertilizers and other agricultural chemicals, incinerator residue, sewage, garbage, sewage sludge,munitions, petroleum products, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and mining, industrial,municipal and agricultural wastes or any other liquid, solid, gaseous or hazardous substances.

31. **"Pre-Mine Activity"** means conventional truck and shovel mining that is performed prior to actual leaching of the ore. This can include placing ore in leach dumps before the start of leaching, stripping overburden, laying solution lines and other operations that are directly associated with bringing the mine into immediate production.

32. **"Recharge project"** has the meaning ascribed to it A.R.S. Section 45-651.5.

33. **"Regulation"** means A.A.C. Title 18, Chapter 9, Article 1, requirements for facilities affecting aquifer water quality.

34. **"Sewage"** means wastes from toilets, baths, sinks, lavatories, laundries, and other plumbing fixtures in residences, institutions, public and business building, mobile homes, water craft, and other places or human habitation, employment, or recreation.

35. **"Sewage disposal system"** means a system for a sewage collection, treatment and discharge by surface or underground methods.

36. **"Surface impoundment"** means a pit, pond or lagoon, having a surface dimension that is equal to or greater than its depth, which is used for the storage, holding, settling, treatment or discharge of liquid pollutants containing free liquids.

37. **"Temporary cessation"** means any cessation or operation of a facility for a period of greater than 60 days but which is not intended to be permanent.

38. **"Toxic pollutant"** means a substance that will cause significant adverse reactions if ingested in drinking water. Significant adverse reactions are reactions that may indicate a tendency of a substance or mixture to cause long-lasting or irreversible damage to human health.

39. **"ug/l"** means micrograms per liter.

40. **"Underground storage and recovery project"** has the meaning ascribed to it in A.R.S. Section 45-802.6.

41. **"Vadose zone"** means the zone between the ground surface and any aquifer.

42. **"Well"** means a bored, drilled or driven shaft, pit or hole whose depth is greater than its largest surface dimension.

PART.VI GENERAL CONDITIONS: RESPONSIBILITIES

A. Preservation of Rights

This permit shall not be construed to abridge or alter causes or action or remedies under the common law or statutory law, criminal or civil, nor shall any provision of this permit, or any act done by virtue of this permit, be construed so as to stop any person, this state or any political subdivision of this site, or owners or land having groundwater or surface water rights or otherwise, from exercising their rights or, under the common law or statutory law, from suppressing nuisances or preventing injury due to discharges.

B. Monitoring Requirements

The permittee shall conduct any monitoring activity necessary to assure compliance with any permit condition, with Aquifer Water Quality Standards, and with A.R.S. 49-241 through 49-251:

1. The permittee shall install, use and maintain all monitoring equipment in acceptable condition or provide alternate methods approved by the Department; and

2. the permittee is required to conduct monitoring of a type and frequency sufficient to yield data which are representative or the monitored activity and approved by the Department.

C. Reporting of Bankruptcy or Environmental Enforcement

The permittee shall notify the ADEQ, Aquifer Protection Permit within five (5) days after the occurrence of either:

1. The filing of bankruptcy by the permittee; or

2. the entry or any order or judgment against the permittee for the enforcement of any environmental protection statute and in which monetary damages or civil penalties are imposed.

D. Site Examination

1. On presentation of credentials, the Department may, is reasonably necessary, inspect the facility or an activity used for the generation, storage, treatment, collection or disposal of any waste or pollutant, and where records are kept for the purpose of ensuring compliance with A.R.S. Title 49, Chapter 2, A.A.C. R18-9-101 through 130 and this permit, or to verify information submitted in a permit application, or documented in a permit including any permit conditions.

2. The Department may:

   a. Obtain samples;

   b. analyze or cause to be analyzed any samples either on site or at another location;

   c. take photographs;

   d. inspect equipment, activities, facilities and monitoring equipment or methods of monitoring; or

   e. inspect and copy any records required to be maintained.

3. Any pertinent information required by the permit shall be available for on-site inspection during normal business hours. The owner or operator of the property shall be afforded the opportunity to accompany an ADEQ inspector. Split samples, receipts, and copies of photographs will be provided to the facility owner or operator if the owner or operator requests them at the time the samples(s) is (are) obtained or the photograph(s) is (are) taken as the case may be. A copy of the results of any analyses made of samples, monitoring, or testing shall be furnished promptly to the owner or operator.

4. Inspections shall be conducted pursuant to the appropriate provisions of the Arizona Revised Statutes.

E. Proper Operation

1. The permittee shall at all times operate the facility so as to ensure the greatest degree of discharge reduction achievable through application of the best available demonstrated control technology, processes, operation methods or other alternatives, including, where practicable, no discharge of pollutants as determined in the application process.

2. The permittee shall operate the facility to ensure that pollutants discharged will in no event cause or contribute to a violation of aquifer water quality standards at the applicable point of compliance for the facility, or that no pollutants discharged will further degrade, at the applicable point of compliance, the quality of any aquifer that already violates the aquifer quality standard for that pollutant.

F. Technical and Financial Capability

1. The permittee shall maintain the technical and financial capability necessary to fully carry out the terms of this permit.

2. Any bond, insurance policy or trust fund provided as a demonstration of financial capability in the permit application (R18-9-108.8.c.iii.) shall be in effect prior to any activity authorized by this permit and remain in effect for the duration of the permit.

G. Other Rules and Laws

The issuance of this permit does not waive any federal, state, county or local government rules, regulations or permits applicable to this facility.

H. Permit Actions

1. This permit may be modified, transferred, renewed or revoked under the rules of the Department. The filing of a request by the permittee for a permit action does not stay any existing permit condition.

2. The Director shall issue a public notice of all proposed permit actions pursuant to R18-9-124.

3. Permit Modification

a. Request for modification of a permit shall be made in writing by the permittee, the Department, or any affected person, and shall identify the specific item(s) to be considered for modification and the facts and reasons which justify the request.

b. The permittee may be required to submit additional information pursuant to A.A.C. R18-9-108, including an updated permit application.

c. The Director may modify an individual Aquifer Protection Permit if the Director determines any one or more of the following:

(1) That material and substantial alterations or additions to a permitted facility justify a change in permit conditions;

(2) that the discharge from the facility violates or could reasonably be expected to violate any Aquifer Water Quality Standard;

(3) that rule or statutory changes have occurred, such as to require a change in the permit; and/or

(4) that there has been a change of an applicable point of compliance.

d. With written concurrence of the permittee, the Department may make minor modifications to a permit for any of the following reasons without giving public notice or conducting a public hearing:

(1) To correct typographical errors;

(2) increase the frequency of monitoring or reporting;

(3) change an interim compliance date in a compliance schedule if the permittee can show just cause and that the new date does not interfere with the attainment of a final compliance date requirement;

(4) change construction requirements, if the alteration complies with the requirements of these rules and provides equal or better performance; or

(5) replace monitoring equipment, including wells, if such replacement results in equal or greater monitoring effectiveness.

4. Permit Transfer

a. The Director may transfer an individual Aquifer Protection Permit if the Director determines that the proposed transferee will comply with ARS 49-241 through 49-251 and A.A.C. Chapter 9, Article 1, regardless of whether the permittee has sold or otherwise disposed of the facility, until the Director transfers the permit.

b. The proposed transfer or and the transferee shall notify the Department within ten days after any change in the owner or operator of the facility. The notice shall include the name and signature of the transferor owner or operator, the name and signature of the transferee owner or operator; and the name and location of the facility.

c. Information required in R18-9-108.A.1, 2, 3 and 6; B.7, 8, and 9; and D. shall be submitted about the Transferee prior to transfer of the permit.

5. Permit Revocation and Suspension

The Director may suspend or revoke this permit for any of the following reasons:

a. Noncompliance by the permittee with any applicable provision of Title 49, Chapter 2, Article 3 or the Arizona Revised Statutes, A.A.C. Title 18, Chapter 9, Article 1 or permit conditions;

b. the permittee's misrepresentation or omission of any fact, information or data related to the permit application or permit;

c. the Director determines that the permitted activity is causing or may cause a violation of any Aquifer Water Quality Standard; or

d. a permitted discharge has the potential to cause or will cause imminent and substantial endangerment to public health or the environment.

I. Confidentiality of Information

1. Any information submitted to or obtained by the department pursuant to A.R.S. 49-243 may be available to the public unless it is designated confidential. Information or a particular part of the information shall be considered confidential on either:

a. A showing, satisfactory to the Director, by any person that the information, or a particular part of the information, if made public, would divulge the trade secrets of the person; or

b. a determination by the attorney general that disclosure of the information or a particular part of the information would be detrimental to an ongoing criminal investigation or to an ongoing or contemplated civil enforcement action under A.R.S. Title 49, Chapter 2 in Superior Court.

2. Criteria for Determining Confidentiality

a. A confidentiality claim has been made at the time the information was submitted or obtained;

b. the facility owner or operator has shown that reasonable measures have been taken to protect the confidentiality of the information and intends to continue to take such measures;

c. the information is not, and has not been, reasonably obtainable without the facility owner or operator's consent by persons other than governmental bodies by use of legitimate means, other than discovery based on a showing of special need in a judicial or quasi-judicial proceeding;

d. no statute or rule specifically requires disclosure of the information; and

e. the facility owner or operator has shown that disclosure of the information is likely to cause harm to its competitive position.

3. Financial information required in the permit or permit application will be held confidential. Notwithstanding, the Director may disclose any records,reports or information obtained from any person in regard to this permit, including records, reports or information obtained by the Director or Department employees, to:

a. Other state employees concerned with administering A.R.S. Title 49, Chapter 2, or if the records, reports or information are relevant to any administrative or judicial proceeding under that chapter; and/or

b. employees of the United States Environmental Protection Agency, if such information is necessary or required to administer and implement or comply with the Clean Water Act, and Safe Drinking Water Act, CERCLA or provisions and regulations relating to those acts.

4. Claims of confidentiality for the following information shall be denied:

a. The name and address of any permit applicant or permittee;

b. the chemical constituents, concentrations and amounts of any pollutant discharge; or

c. the existence or level of a concentration of a pollutant in drinking water or in the environment.

J. Violations; Enforcement

Any person who owns or operates a facility contrary to the provisions of ARS Title 49, Chapter 2, who violates the conditions specified in the A.A.C. Title 18, Chapter 9, Article 1, or this permit, is subject to the enforcement actions prescribed in A.R.S. Title 49, Chapter 2, Article 4 or the Arizona Revised Statutes.