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Do we have hole locations.

Only #6 seems really strong
Should consider moving #6

I didn't see any sulphide Cu's - where is difference

ZONIA PROJECT

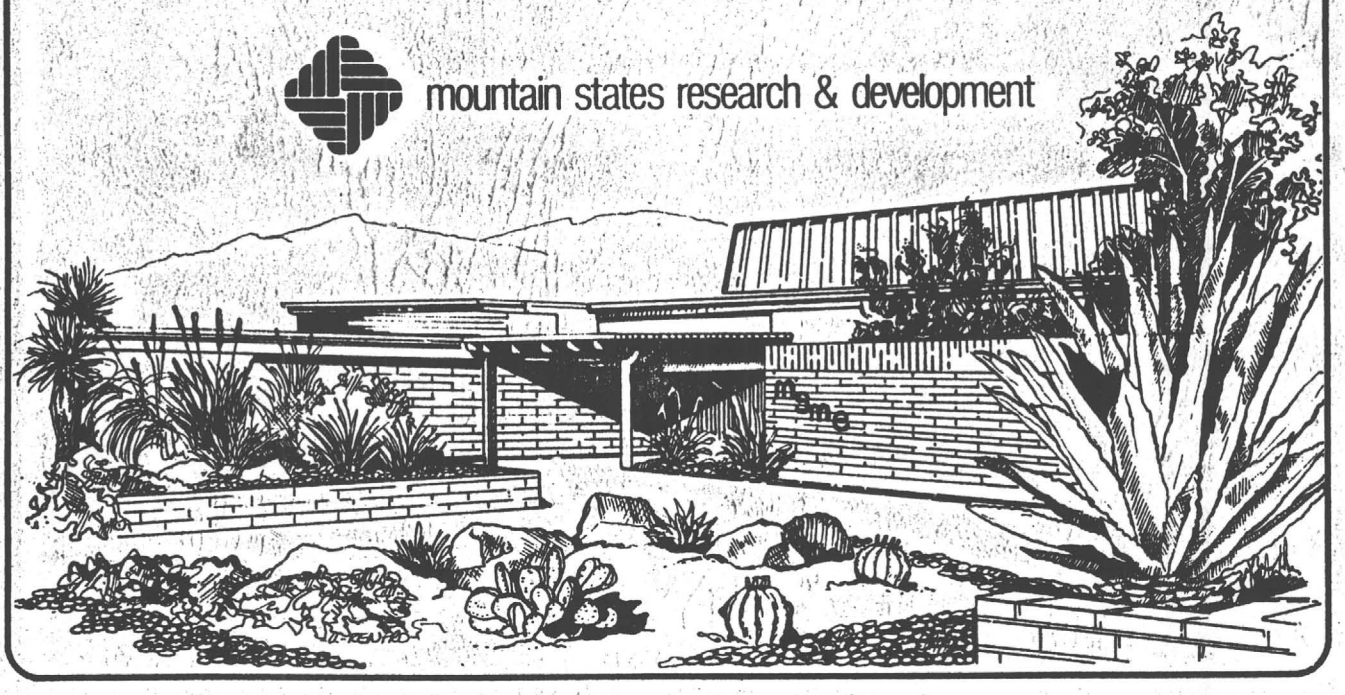
RESOURCE EVALUATION

FOR

NERCO MINERALS COMPANY

MISRD - extraction rates pretty low
5¢/Kwh reasonable?

mountain states research & development



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ZONIA PROPERTY

EVALUATION

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By:

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Post Office Box 17960
Tucson, Arizona 85731

Project No. 2482

Date: December 13, 1982

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mountain states

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APPENDIX

A INTERVAL ASSAY AVERAGES

B LABORATORY TEST SHEETS

BACK COVER ENVELOPES

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DRAWINGS NO.S 3 AND 4, CONCEPTUAL FLOWSHEETS

SECTION 1

INTRODUCTION

NERCO Minerals Company and Mountain States Research and Development (MSRD) reached agreement on October 15, 1982, retaining MSRD to assist NERCO in determining the feasibility of recovering valuable minerals from the Zonia Property. It was agreed that all testwork and evaluation reports would be completed by December 17, 1982.

The scope of work to be performed by MSRD was generally delineated as follows:

1. Select drilling system and obtain drill samples from leach heaps and in-situ leaching sites. Assay samples obtained.

2. Perform laboratory and bench metallurgical testing.

3. Develop simple flowsheet and estimate capital/operating costs.

4. Provide technical advice regarding potential problems which could affect mineral recovery.

This work is now complete and is reported in the balance of this report.

SECTION 2

SUMMARY AND CONCLUSIONS

This analysis was performed within a short time period, as required by the agreement. Thus, the estimates which were made are necessarily tentative. For example, a more complete design of the drilling program and a longer term laboratory testing program would have tended to produce more accurate estimates. Nevertheless, MSRD believes that the work which has been done will provide NERCO with an adequate base for decision in regard to possible property acquisition.

A tabulation of MSRD's analyses is shown on the following page. The results indicate that the most viable option would be to refit the plant and continue leaching of the existing leach heaps and in-situ basins.

Although the cementation option appears to be the lowest cost means of producing copper, MSRD recommends that solvent extraction-electrowinning (SX-EW) be the process of choice because of the difficult marketability of cement copper.

COST SUMMARY (x 1000)

Item	Resume Leaching of Present Heads & In-Situ Sites		Crush & Restock Heads for Leaching Continue In-Situ Leaching		Contract Crushing & Restocking for Leaching - Continue In-Situ Leaching	
	Copper Recovery by Cementation	Copper Recovery by SX-EW	Copper Recovery by Cementation	Copper Recovery by SX-EW	Copper Recovery by Cementation	Copper Recovery by SX-EW
1. Salaries	189	189	364	364	189	189
2. Labor	695	573	2,478	2,356	695	573
Power	221	417	355	622	221	488
Water	17	17	17	17	17	17
Fuel (Mobile equipment)	24	-	562	538	24	-
Sulfur	861	-	1,150	-	1,150	-
Acid	-	888	-	1,182	-	1,182
Scrap	610	-	817	-	817	-
Organic	-	181	-	181	-	181
Kerosene	-	111	-	111	-	111
Contract Crushing & Restocking	-	-	-	-	6,595	6,595
3. Repair Supplies (5% of capital)	158	259	464	565	158	259
4. Operating Supplies (30% of repair supplies)	47	78	139	170	47	78
5. Taxes & Insurance (2% of capital)	63	103	186	226	63	103
General Overhead (20% of 1 + 2 + 3 + 4 + 5)	230	240	726	736	230	240
Contingencies (10%)	312	306	726	707	361*	342*
TOTAL	3,427	3,362	7,984	7,775	10,567	10,358
AMORTIZATION (2 yr @ 15%)	1,942	3,182	5,710	6,950	1,942	3,182
Salvage Value (10% of equipment cost)	57	117	475	535	57	117
NET TOTAL OPERATING COST	5,312	6,427	13,219	14,190	12,452	13,423
CAPITAL COST	3,157	5,174	9,283	11,300	3,157	5,174
Copper production (lb)	3,819	3,819	5,112	5,112	5,112	5,112
Cost per pound copper	$1.39	$1.68	$2.59	$2.78	$2.44	$2.63
Smelter toll for Cement copper	$0.22		$0.22		$0.22	
Cost per pound Salable copper	$1.61	$1.68	$2.81	$2.78	$2.66	$2.63

*No contingency charge to contract crushing

SECTION 3

DESCRIPTION AND HISTORY

Reports of the McAlester Fuel Company indicate that the Zonia Property was operated from 1966 to 1975 and produced 33,663,000 pounds of copper. The ore was mined by open pit technique and stocked adjacent to the pit for heap leaching. The copper mineralization is largely chrysocolla and leaching was obtained by the use of acid solutions. Copper was extracted from pregnant leach solutions by cementation on de-tinned can scrap.

The grade of the ore which was stocked for leaching is said to have been 0.6 percent copper. McAlester reports that the grade of this material was determined by a drilling program and pilot plant operation. No records are available to substantiate this work.

Late in the operating period, two blocks of ore adjacent to the pit were drilled, blasted, leveled, and prepared for In-situ leaching. These sites, known as site 5 and site 6, were evaluated at 0.216 and 0.311 percent copper, respectively. Reported production from these two sites to date is 2,969,000 pounds of copper.

Undisturbed blocks of ore adjacent to the In-situ sites are reported to total 20,500,000 tons assaying 0.299 percent copper.

Almost all of the process equipment has been sold and removed from the property. Usable equipment which remains includes: three barren liquor pumps, three In-situ well pumps, a D-8 bulldozer in poor condition, and office and shop buildings.

Rehabilitation of the property will essentially require a complete new plant installation.

SECTION 4

PLAN OF APPROACH

A site visit to the Zonia Property was made on October 21, 1982, by two representatives of Mountain States Mineral Enterprises, Inc. (MSME), together with Mr. Dennis Day, NERCO Project Manager. A thorough inspection of the property was made and drill hole sites in the leach heaps were determined. (Drill hole sites in the in-situ areas were determined at a later date.)

A drilling contractor was hired, Sergent, Hauskins and Beckwith, and drilling was started on October 27, 1982. The holes were drilled using Odex rotary or auger techniques, with augering preferred when possible because of better sample quality. Drilling was completed on November 7, 1982. A tabulation of the drilling is shown on Drawings 1 and 2 at the back cover of this report.

Ten foot composite samples of drill cuttings were taken from each hole under the supervision of an MSRD sample technician. Samples were placed in plastic sacks, appropriately labelled, and delivered to MSRD's laboratory at Vail, Arizona.

Each sample was placed in a pan and air dried and then split by recognized techniques to provide an assay sample plus material for use in subsequent testing.

Water and sludge samples were taken from the storage and evaporation pond on the property which has been used to accommodate excess water from the in-situ areas during the past few years. These samples were assayed, including X-ray Spectographic analysis of the sludge samples.

While drilling and sampling was in progress, preliminary feasibility studies were initiated to evaluate application of known means of recovering copper from the Zonia Property. Subjects considered were generally as follows: (1) Recovery of copper by cementation versus recovery by solvent extraction-electrowinning. (2) Continued leaching of the ore in place versus the effect of crushing, screening, and restocking for further leaching. (3) Cost of contracting for removing existing heaps and restocking after crushing. (4) Capital costs for each of the above possibilities.

Interval samples from the drill holes were assayed for total copper, acid soluble copper, and iron. Twenty-nine randomly selected samples were also assayed for gold and silver.

Copper content of the leach heaps and in-situ basins were estimated, based upon the interval assays.

Recoverable copper was estimated, based upon results of laboratory leaching tests, historical data from the site, and MSRD's in-house experience with copper leaching operations.

Cost of producing copper from the Zonia Property was estimated, using costs determined by the feasibility studies, two year write off of capital costs, and estimated recoverable copper.

SECTION 5

DRILLING AND SAMPLING

A drilling and sampling program was implemented to obtain samples from the four leach areas with the highest tonnage and, reportedly, copper grade. In planning the drill program, the four leach areas were drilled in the following priority sequence:

1. Leach Basin No. 1
2. Leach Basin No. 3
3. In-situ Basin No. 6
4. In-situ Basin No. 5

As the overall drill program was limited by time and budget, the drill patterns for Leach Basins 1 and 3 were designed to give an assay profile through the long and deepest axis of each pile. Three randomly spaced holes were drilled and sampled in each of the In-situ areas.

This is also the area less leached than most.

DILL PROCEDURES

Two drilling and sampling methods were used during this program. The preferred method incorporated hollow stem auger with split spoon or ring samplers. Where auger refusal occurred due to large rocks, the Odex System was used. These two methods are described below.

Drilling equipment consisted of a truck mounted Central Mine Equipment Drill, Model CME 75. The unit had a 6-ton hydraulic pull down capacity and 8,450 foot-pounds of torque to the drill stem. The drill and sampling equipment listed below was utilized as required to meet the varying conditions encountered.

Hollow-Stem Auger - 6-5/8" OD, (3-1/4") ID
Drive Hammer, 140-lb.
Split Spoon - 2" OD, 1-3/8" ID
Ring Sampler - 2.42" ID
Halco Mach 4 Down-The-Hole Hammer
Casing, 5"
Compressor, 365 CFM Capacity

The sample program was designed to provide continuous samples for each 10-foot interval in a borehole. The samples were placed in plastic bags and appropriately identified.

Typically the two procedures were as follows:

- Split Spoon and Ring Sampler

After setting up the hole location, the 2.5-foot split spoon (or ring sampler) was driven into the pile with a 140-lb. hammer to its full depth and then withdrawn. A second sampler was then driven from a depth of 2.5 to 5.0 feet and

withdrawn. Upon withdrawal, the samplers were opened and the entire sample placed in a plastic sample bag. The hollow-stem auger was then drilled to the 5.0-foot depth, leaving the auger in place. The next two samplers were then driven through the auger's hollow stem to sample the next 5.0-feet of material. Thus by alternating sampling and augering, the sample was obtained ahead of the auger and the auger emplacement prevented collapse of the hole above the sampler. Where the sampler could not be advanced the full five feet due to hard rock, the auger was drilled to the point of interference to dislodge the rocks and then recommenced sampling. If the rocks were too large and augering could not free a path for the sampler, the Odex System equipment was set up to continue drilling.

- Odex System

This system was developed in Sweden and involves the use of a rotary bit on hollow stem drill rod which is rotated inside of casing which is driven even with the drill bit. High pressure air introduced through the drill stem supplies air to a down-the-hole hammer which drives the casing and also acts as a carrier to bring the cuttings to the surface. At the surface the cuttings are caught by a deflector and form a pile around the drill hole. After each 10-feet of advance, a grab sample was taken from the accumulated cuttings, bagged, and appropriately identified. The area was then cleaned in preparation for collecting the next 10-feet of cuttings. On occasion, foam was injected into the air supply to clean the hole and free the drill bit if stuck.

Simplified logs were made for each hole to identify the drill. Method, blow counts, when using the split spoon, significant material changes, and depth drilled.

What About #2

Information received from McAlester indicated a packed bottom under leach Basin #1, and asphalt liner under Leach Basin #3, and that the water table had risen into In-situ Basins #5 and #6. This information was used as a guide in determining the depth each hole was drilled.

The material in Leach Basins #1 and #3 was either smaller sized than anticipated or, quite probably, had been significantly broken up by previous leaching operations. This allowed sampling of these basins by split spoon virtually throughout the program. The two In-situ areas apparently had much larger rocks throughout the pile and, therefore, the Odex System method was used on Basin #6. Three holes were drilled to the water table in this area. Due to breakage of the Halco hammer and unavailability of a replacement, the three holes planned for Basin #5 were drilled with the split spoon. All three holes were terminated at relatively shallow depths due to refusal of the sampler and auger.

Statistics for the drill program are shown on Table I.

Were any of the holes continued to the bottom of the liner

TABLE I

DRILL PROGRAM STATISTICS

Drill Hole No.	Footage By Sample Type Odex	Split Spoon/Ring	Total
1-1-1	42.5	5.0	47.5
1-2-1		56.5	56.5
1-2-2		105.5	105.5
1-2-3		45.0	45.0
1-3-1		75.0	75.0
1-3-2		100.0	100.0
1-3-3		48.0	48.0
1-4-1		52.5	52.5
1-4-2		47.5	47.5
1-4-3		37.5	37.5
1-5-1		50.0	50.0
1-5-2		45.0	45.0
1-5-3		37.5	37.5
1-5-4		32.5	32.5
1-5-5		40.0	40.0
1-6-1		35.0	35.0
3-1		30.0	30.0
3-2		45.0	45.0
3-3		50.0	50.0
3-4		62.5	62.5
3-5		67.5	67.5
3-6		67.5	67.5
3-7		87.5	87.5
5-1-1		13.5 (1)	13.5
5-3-1		75.5 (1)	75.5
5-5-1		30.0 (1)	30.0
6-1	38.5	52.5	91.0
6-2	118.0		118.0
6-3	147.0		147.0
TOTAL	346.0	1,394.0	1,740.0

(1) Drilling stoped due refusal auger and sampler.

SECTION 6

LABORATORY TESTING

SAMPLE PREPARATION AND ASSAYS

Leach basin samples received at MSRD facilities between October 28, 1982 and November 11, 1982, were prepared for assay analysis utilizing standard sample preparation procedures. As illustrated on Flowsheet I, page 10, all samples were received and logged according to date of arrival. Specific samples were selected for moisture determination and weighed prior to drying. Net drying weights of each sample were recorded.

Riffle mixing and splitting was done in a Jones riffle splitter three times the average diameter of the sample. A 1/8 split portion of each sample was crushed to ±10 mesh, and pulverized to minus 100-mesh and assayed for acid soluble copper, total copper and iron. A list of sample identifications and assay determinations for samples received at MSRD is provided on pages 14 through 17.

Samples selected specifically for metallurgical testing were individually treated by sample preparation to provide a representative split of each leach basin sample provided.

Flowsheets outlining sample preparation for these selected footages are located on pages 11 through 13.

In order to obtain representivity of some samples, it was necesary to utilize an entire sample. If a greater amount of sample than needed for metallurgical testing or assay analysis was provided, a reject of each sample was retained in storage.

Samples of wastewater pond, i.e., sludges and solutions, were obtained on site at the client's request. Assays and spectrographic X-ray results are located on pages 18 through 20 of this report.

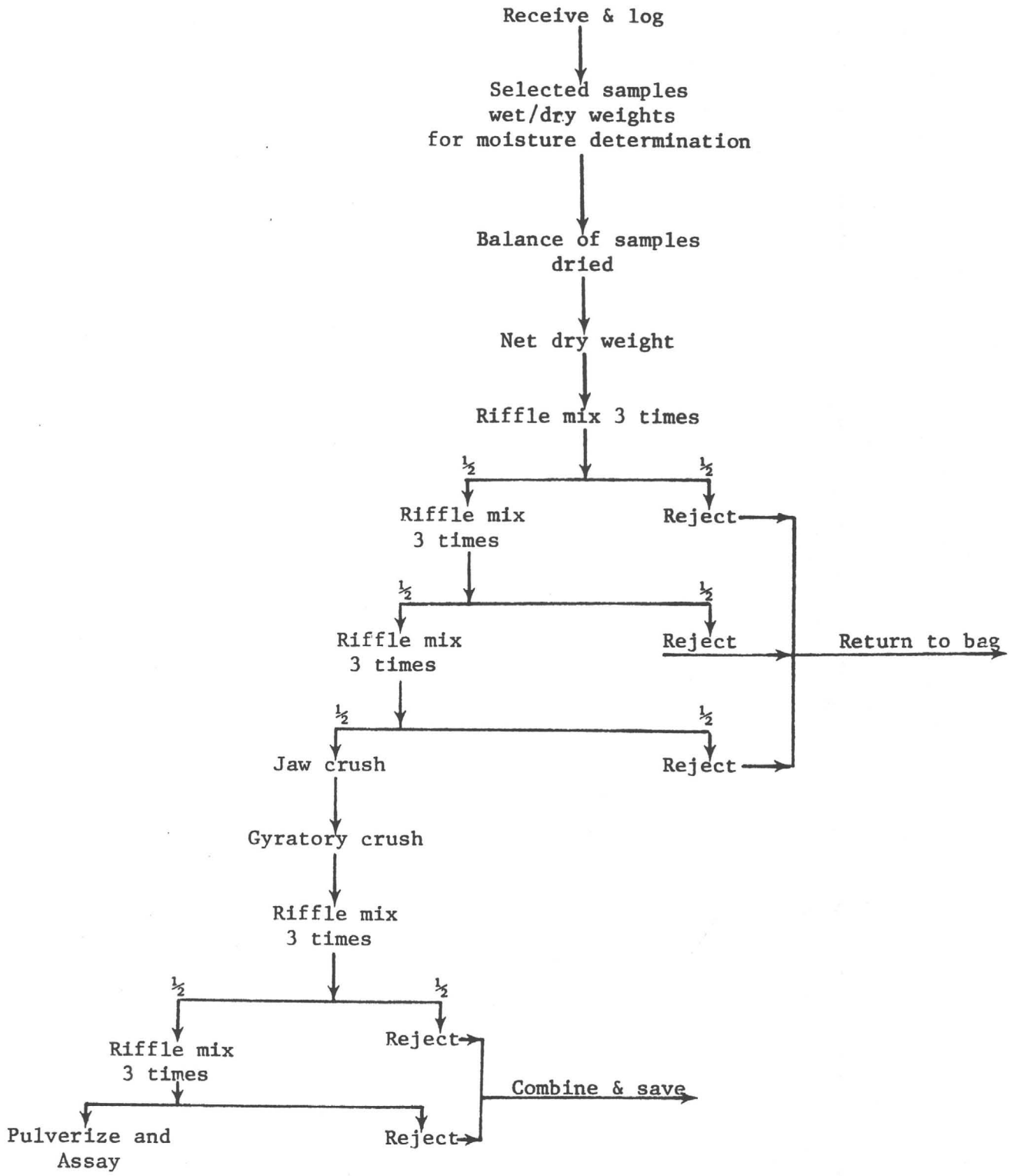
METALLURGICAL TESTING

Metallurgical testing of MSRD facilities was performed to determine extractable quantities of acid soluble copper contained in selected leach basin samples.

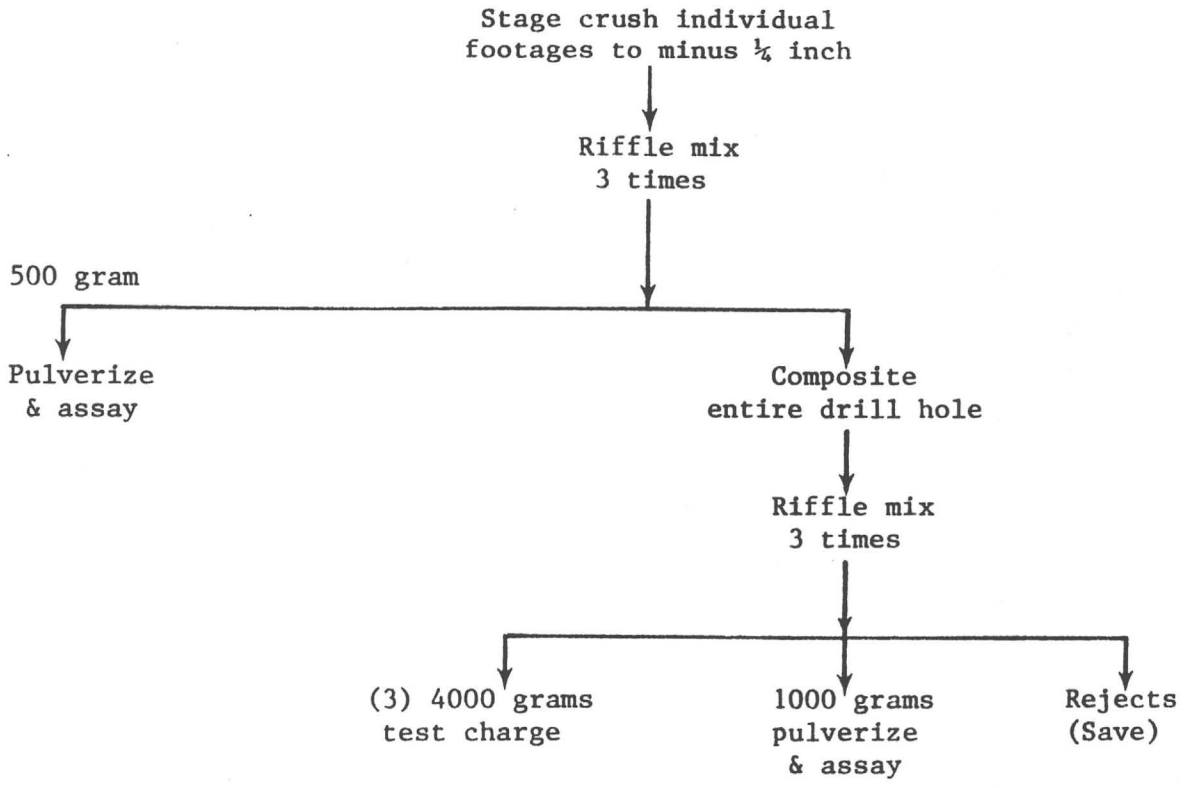
All tests were conducted for a 48-hour leaching period at 50% solids and a maintained pH of ±2.0 with sulfuric acid.

Leached pulps were filtered to obtain a pregnant solution followed by three single volume washes of water with adjusted pH of 2.0 with sulfuric acid. Pregnant and wash solutions were measured and assayed for copper, ferric iron, and free acid. The leached residue was dried, weighed, pulverized, and assayed for acid soluble copper, total copper, and iron.

2482
SAMPLE PREPARATION
FLOWSHEET I
TREATMENT OF INDIVIDUAL FOOTAGE SAMPLES

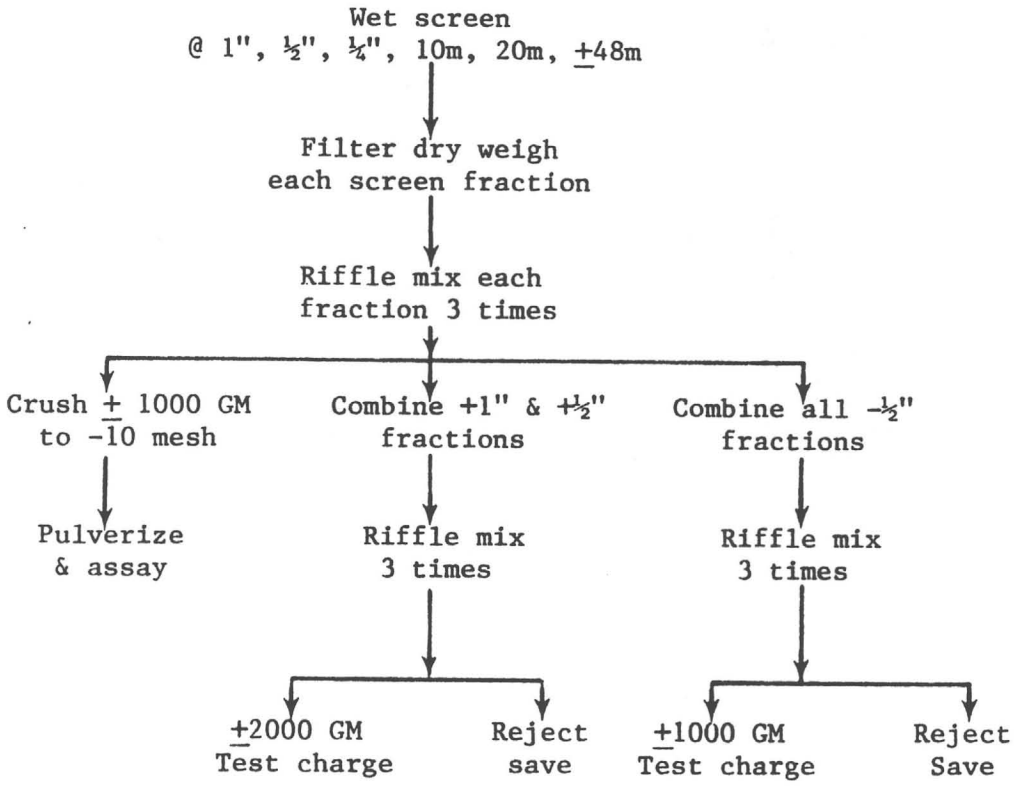


2482
SAMPLE PREPARATION
FLOWSHEET II
SAMPLE 1-1-1 (TEST JS-1)

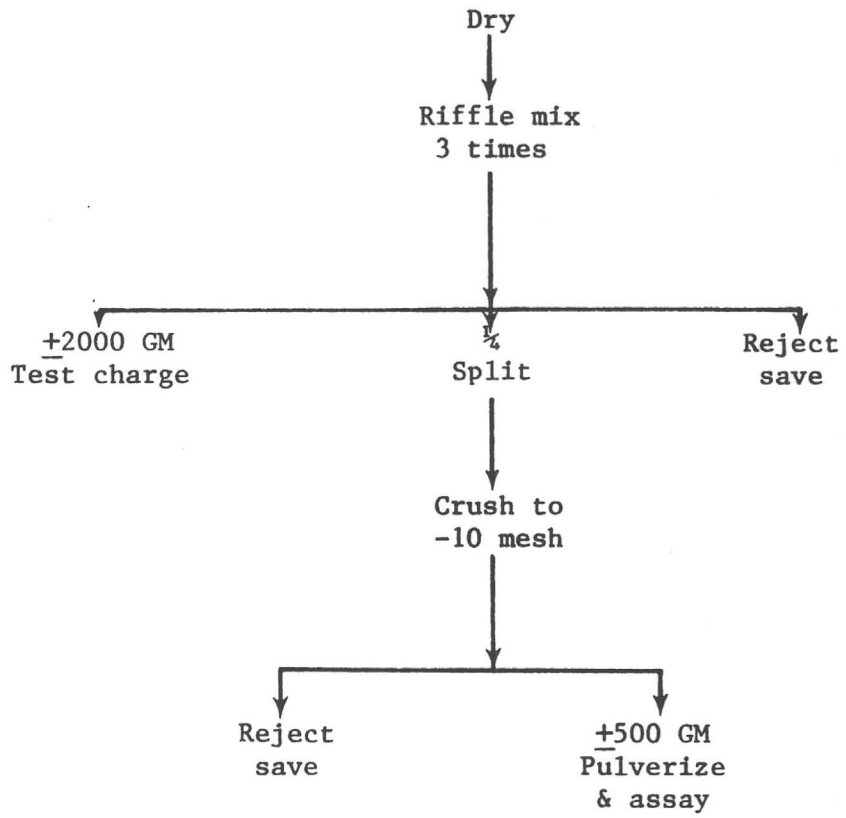


mountain states

2482
SAMPLE PREPARATION
FLOWSHEET III
LEACH TESTS JS-2A THROUGH JS-6B



2482
SAMPLE PREPARATION
FLOWSHEET IV
LEACH TESTS JS-7 THROUGH JS-21



2482
LEACH BASIN SAMPLE
INDIVIDUAL ASSAYS

Hole Number	Footage	Acid Soluble Cu %	Total Cu %	Fe %	Au	Ag oz/t
1-1-1	0' - 10'	0.03	0.17	3.27		
	10' - 20'	0.04	0.16	3.5		
	20' - 30'	0.03	0.15	3.55		
	30' - 36'	0.05	0.18	3.89		
	36' - 37.5'	0.04	0.24	4.85		
	37.5' - 41'	0.07	0.16	4.07		
	41' - 44.5'	0.03	0.06	5.7		
1-2-1	0' - 10'	0.05	0.12			
	10' - 20'	0.05	0.15			
	20' - 30'	0.48	0.59			
	30' - 40'	0.05	0.20			
	40' - 50'	0.05	0.17		0.001	0.25
	50' - 57.5'	0.03	0.12			
1-2-2	0' - 10'	0.02	0.11			
	10' - 20'	0.04	0.12			
	20' - 30'	0.05	0.17			
	30' - 40'	0.09	0.25			
	40' - 50'	0.04	0.14			
	50' - 60'	0.06	0.15			
	60' - 70'	0.05	0.18		0.004	N.D.
	70' - 80'	0.06	0.21			
	80' - 90'	0.08	0.25			
	90' - 100'	0.04	0.08			
	100' - 110'	0.01	0.02			
1-2-3	0' - 10'	0.02	0.10			
	10' - 20'	0.08	0.17			
	20' - 30'	0.08	0.20			
	30' - 40'	0.06	0.19			
	40' - 45'	0.06	0.09			
1-3-1	0' - 10'	0.02	0.10			
	10' - 20'	0.03	0.12			
	20' - 30'	0.18	0.35			
	30' - 40'	0.05	0.17			
	40' - 50'	0.04	0.12			
	50' - 60'	0.09	0.24		0.004	N.D.
	60' - 70'	0.06	0.23			
	70' - 75'	0.03	0.12			
1-3-2	0' - 10'	0.02	0.08			
	10' - 20'	0.02	0.10			
	20' - 30'	0.02	0.14		0.006	N.D.
	30' - 40'	0.02	0.12			
	40' - 50'	0.05	0.17			
	50' - 60'	0.07	0.20			
	60' - 70'	0.11	0.27			
	70' - 80'	0.10	0.28			
	80' - 90'	0.05	0.18			
	90' - 100'	0.05	0.22			

Hole Number	Footage	Acid Soluble Cu %	Total Cu %	Fe %	Au	Ag oz/t
1-3-3	0' - 10'	0.03	0.13			
	10' - 20'	0.03	0.21			
	20' - 30'	0.02	0.14			
	30' - 40'	0.02	0.12			
	40' - 50'	0.06	0.20			
1-4-1	0' - 10'	0.02	0.07			
	10' - 20'	0.05	0.17			
	20' - 30'	0.03	0.15			
	30' - 40'	0.03	0.15		0.014	N.D.
	40' - 50'	0.05	0.18			
	50' - 52.5'	0.05	0.10			
1-4-2	0' - 10'	0.03	0.09			
	10' - 20'	0.02	0.12			
	20' - 30'	0.06	0.21			
	30' - 40'	0.03	0.17			
	40' - 50'	0.03	0.16			
1-4-3	0' - 10'	0.02	0.09			
	10' - 20'	0.02	0.14			
	20' - 30'	0.02	0.13			
	30' - 35'	0.03	0.12			
1-5-1	0' - 10'	0.22	0.29			
	10' - 20'	0.07	0.16			
	20' - 30'	0.03	0.10		0.001	N.D.
	30' - 40'	0.11	0.26			
	40' - 50'	0.05	0.20			
1-5-2	0' - 10'	0.03	0.10	2.3		
	10' - 20'	0.16	0.25	4.2		
	20' - 30'	0.24	0.36	4.0		
	30' - 40'	0.06	0.15	3.2	0.006	N.D.
	40' - 45'	0.06	0.18	3.1		
1-5-3	0' - 10'	0.07	0.13			
	10' - 20'	0.22	0.35			
	20' - 30'	0.50	0.63	3.7		
	30' - 37.5'	0.19	0.27	2.5		
1-5-4	0' - 10'	0.04	0.10	3.3		
	10' - 20'	0.03	0.13	3.0		
	20' - 30'	0.05	0.16	3.3		
1-5-5	0' - 10'	0.03	0.14	3.4		
	10' - 20'	0.04	0.14	2.9		
	20' - 30'	0.03	0.13	2.8		
	30' - 40'	0.04	0.19	3.7		

Will this hurt?

Leach Basin Sample (cont)

Hole Number	Footage	Acid Soluble Cu %	Total Cu %	Fe %	Au	Ag oz/t
1-6-1	0' - 10'	0.06	0.24	3.8		
	10' - 20'	0.10	0.29	4.2	0.018	0.09
	20' - 30'	0.05	0.17	2.9		
	30' - 35'	0.05	0.21	3.6		
3-1	0' - 10'	0.04	0.18	3.2	0.004	0.31
	10' - 20'	0.13	0.34	4.0		
	20' - 30'	0.06	0.17	6.0		
3-2	0' - 10'	0.15	0.37	4.6		
	10' - 20'	0.03	0.13	4.1		
	20' - 30'	0.03	0.13	4.7	0.006	N.D.
	30' - 40'	0.04	0.18	3.9		
	40' - 45'	0.05	0.18	12.8		
3-3	0' - 10'	0.04	0.17	5.0		
	10' - 20'	0.07	0.16	5.2		
	20' - 30'	0.04	0.16	4.0		
	30' - 40'	0.05	0.19	5.1	0.004	0.32
	40' - 50'	0.05	0.08	16.2		
3-4	0' - 10'	0.21	0.31	3.5		
	10' - 20'	0.15	0.27	4.1		
	20' - 30'	0.07	0.20	3.5		
	30' - 40'	0.10	0.25	3.1		
	40' - 50'	0.07	0.17	2.8	0.004	0.05
	50' - 60'	0.06	0.18	3.7		
	60' - 62.5'	0.10	0.13	3.6		
3-5	0' - 10'	0.06	0.15	3.1		
	10' - 20'	0.07	0.16	2.6		
	20' - 30'	0.04	0.14	2.8		
	30' - 40'	0.31	0.47	4.3		
	40' - 50'	0.06	0.20	3.8		
	50' - 60'	0.04	0.18	3.2	0.004	N.D.
	60' - 67.5'	0.04	0.06	2.5		
3-6	0' - 10'	0.03	0.19	3.7		
	10' - 20'	0.03	0.12	2.8		
	20' - 30'	0.03	0.09	2.0	0.014	N.D.
	30' - 40'	0.02	0.14	3.1		
	40' - 50'	0.05	0.15	3.5		
	50' - 60'	0.05	0.19	3.4		
	60' - 67.5	0.08	0.13	3.3		
3-7	0' - 10'	0.05	0.19	3.4		
	10' - 20'	0.09	0.23	3.3		
	20' - 30'	0.07	0.15	2.5		
	30' - 40'	0.04	0.11	2.0		
	40' - 50'	0.05	0.17	3.2		
	50' - 60'	0.05	0.14	3.0		
	60' - 70'	0.19	0.38	3.8		
	70' - 80'	0.05	0.23	4.2	0.008	N.D.
	80' - 87.5'	0.08	0.16	3.6		

Hole Number	Footage	Acid Soluble Cu %	Total Cu %	Fe %	Au	Ag oz/t
5-1-1	0' - 10'	0.03	0.13	3.4		
	10' - 15'	0.02	0.06	2.1		
5-3-1	0' - 10'	0.02	0.08	2.3		
	10' - 20'	0.07	0.18	2.9		
	20' - 30'	0.12	0.31	2.5		
	30' - 40'	0.17	0.40	4.3		
	40' - 50'	0.15	0.35	4.2	0.001	0.25
	50' - 60'	0.22	0.41	3.9		
	60' - 70'	0.17	0.33	2.7		
	70' - 75'	0.18	0.31	2.2	0.010	0.25
5-5-1	0' - 10'	0.03	0.11	3.9		
	10' - 20'	0.05	0.17	2.6		
	20' - 30'	0.13	0.26	3.0	0.004	N.D.
6-1	0' - 10'	0.05	0.15	2.7		
	10' - 20'	0.13	0.28	4.1	0.006	N.D.
	20' - 30'	0.12	0.21	2.5		
	30' - 40'	0.18	0.27	2.8		
	40' - 50'	0.14	0.32	5.8		
	51' - 61'	0.07	0.17	3.0	0.001	0.24
	61' - 71'	0.07	0.21	5.3		
	71' - 81'	0.04	0.13	3.6		
	81' - 91'	0.04	0.15	4.4		
6-2	0' - 10'	0.06	0.20	3.7		
	10' - 20'	0.08	0.21	4.8		
	20' - 30'	0.09	0.18	5.1	0.001	0.03
	30' - 40'	0.21	0.34	4.3		
	40' - 50'	0.05	0.15	3.4	0.006	0.09
	50' - 60'	0.06	0.13	2.5		
	60' - 70'	0.15	0.24	3.1		
	70' - 80'	0.18	0.30	3.0	0.006	0.38
	80' - 90'	0.18	0.33	4.4		
	90' - 100'	0.29	0.37	2.7		
	100' - 110'	0.22	0.33	3.4	0.004	0.05
	110' - 118'	0.07	0.21	3.4		
6-3	0' - 10'	0.04	0.24	3.2		
	10' - 20'	0.55	0.92	3.9		
	20' - 30'	0.81	1.17	4.1	0.008	0.23
	30' - 40'	1.06	1.35	3.0		
	40' - 50'	1.35	1.54	3.5		
	50' - 60'	0.46	0.68	4.5	0.010	0.30
	60' - 70'	0.40	0.77	6.3		
	70' - 80'	0.14	0.34	4.7		
	80' - 90'	0.23	0.37	3.2	0.010	0.09
	90' - 100'	0.21	0.37	3.7		
	100' - 110'	0.26	0.38	3.6		
	110' - 120'	0.25	0.40	4.1	0.014	0.16
	120' - 130'	0.14	0.25	3.0		
	130' - 140'	0.04	0.16	2.7	0.004	N.D.
	140' - 147'	0.07	0.20	3.0		

mountain states

2482

WASTE WATER

POND

ANALYSIS

Sample	Location	Cu g/l	Cu %	Fe %	Fe g/l	Fe g/l	Ag oz/t	pH	EMF MV
5'	Center	0.79			0.25	0.25	N.D.	2.60	560.0
15'	Center	1.00			2.19	2.18	N.D.	2.30	420.0
25'	Center	1.15			2.80	2.77	N.D.	2.20	425.0
35'	Center	1.13			2.70	2.64	N.D.	2.25	420.0
Sludge			0.17	13.1			0.058		
5'	Dam End	0.81			0.26	0.26	N.D.	2.63	540.0
15'	Dam End	0.82			0.25	0.25	N.D.	2.60	550.0
25'	Dam End	0.82			0.25	0.25	N.D.	2.60	550.0
35'		0.81			0.26	0.24	N.D.	2.60	550.0
Sludge			0.10	7.7			0.035		

FLUO RESCENT
X RAY
SPEC TROGRAPHIC
Analytical Laboratory

718 Sherman Street (rear)
Denver, Colorado 80203
Phone (303) 837-1396
Merlyn L. Salmon, Manager

XXXX QUALITATIVE
XXXX SEMI-QUANTITATIVE
____ QUANTITATIVE

ANALYTICAL REPORT

Job Number 30492
Page 1 of 2 Pages
Date 24 Nov 1982

TO: Mountain States R&D 2482 E. Calhoun

SAMPLE: 2482-2-25170 Dam end

Copper	1300	Iron	59000	Lanthanum	
Silver		Cobalt		Cerium	
Gold		Nickel	62	Praseodymium	
Zinc	440	Cesium		Neodymium	
Cadmium		Rubidium	110	Samarium	
Mercury		Barium	960	Europium	
Gallium		Strontium	190	Gadolinium	
Indium		Titanium	1200	Terbium	
Thallium		Zirconium	290	Dysprosium	
Germanium		Hafnium		Holmium	
Tin		Thorium		Erbium	
Lead	300	Vanadium		Thulium	
Arsenic		Columbium		Ytterbium	
Antimony		Tantalum		Lutetium	
Bismuth		Chromium	22	Yttrium	54
Selenium		Molybdenum			
Tellurium		Tungsten			
Bromine		Uranium			
Iodine		Manganese	410		

The values above are estimated elemental concentrations in:
____ per cent XXXX parts per million ____ grams per liter

No check was made for elements with atomic numbers less than 22.

By Merlyn L. Salmon

NOTE: A PORTION OF THE REPORTED SAMPLES WILL BE RETAINED ON FILE FOR A PERIOD OF TWO YEARS FROM THE ABOVE DATE. THE REMAINDER OF THE SAMPLE WILL BE RETAINED FOR THIRTY DAYS PENDING RECEIPT OF WRITTEN INSTRUCTIONS FOR DISPOSAL FROM

FLUO RESCENT
X RAY
SPEC TROGRAPHIC
Analytical Laboratory

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Merlyn L. Salmon, Manager

XXXX QUALITATIVE
XXXX SEMI-QUANTITATIVE
_____ QUANTITATIVE

ANALYTICAL REPORT

Job Number 30492
Page 2 of 2 Pages
Date 24 Nov 1982

TO:

Mountain States R&D

SAMPLE: 2482-2-25171 Center

Copper	2200	Iron	120000	Lanthanum	
Silver		Cobalt		Cerium	
Gold		Nickel	98	Praseodymium	
Zinc	350	Cesium		Neodymium	
Cadmium		Rubidium	210	Samarium	
Mercury		Barium	1200	Europium	
Gallium		Strontium	320	Gadolinium	
Indium		Titanium	1200	Terbium	
Thallium		Zirconium	300	Dysprosium	
Germanium		Hafnium		Holmium	
Tin	49	Thorium		Erbium	
Lead	400	Vanadium		Thulium	
Arsenic		Columbium		Ytterbium	
Antimony		Tantalum		Lutetium	
Bismuth		Chromium	350	Yttrium	35
Selenium		Molybdenum			
Tellurium		Tungsten			
Bromine		Uranium			
Iodine		Manganese	700		

The values above are estimated elemental concentrations in:
_____ per cent XXXX parts per million _____ grams per liter

No check was made for elements with atomic numbers less than 22.

By Merlyn L. Salmon

NOTE: A PORTION OF THE REPORTED SAMPLES WILL BE RETAINED ON FILE FOR A PERIOD OF TWO YEARS FROM THE ABOVE DATE. THE REMAINDER OF THE SAMPLE WILL BE RETAINED FOR THIRTY DAYS PENDING RECEIPT OF WRITTEN INSTRUCTIONS FOR DISPOSAL. FROM

Test JS-1

As described on Flowsheet II, page 11, this sample at -1/4 inch was a composite of the entire leach basin sample identified as 1-1-1. Primarily initiated as a scoping test, test results would yield a baseline of information on the performance of succeeding testwork.

Indicated overall copper extraction from this leach basin composite was 29.9% acid soluble copper or 5.1% of the total copper. Acid consumption was 17.0 pounds H_2SO_4 per ton feed. A copy of the test data sheet is provided on page B-1 of Appendix B.

Tests JS-2A through JS-6B

A series of 10 tests was performed on screened fractions of selected samples in order to determine extraction efficiency and acid consumption.

Prior to leaching, a split of each sample was subjected to a wet/dry screening at various sizes (see Flowsheet III, page 12). Each fraction was weighed, recorded, pulverized and assayed for acid soluble copper, total copper and iron. Hence, a mineral distribution could be studied. As in a majority of cases, mineral distribution was fairly uniform throughout the ore sample. A breakdown of the assay/screen analysis performed on these five samples is located on pages 22 through 26.

Leaching tests were performed on minus 3 inch plus 1/2 inch fractions and minus 1/2 inch fractions. Metallurgical results consistently indicated higher copper extraction and acid consumption in the minus 1/2 inch screen fraction. A test data summary sheet for this test series is provided on page 27 of this report. Individual test sheets are on pages B-2 through B-11 of Appendix B.

Tests JS-7 through JS-21

Leaching tests JS-7 through JS-21 were performed on selected leach basin samples after drying. Having determined that mineral distribution throughout a majority of the samples was uniform, these tests were conducted on the ore at the received sizes (Flowsheet IV, page 13).

Metallurgical results indicated extractions of acid soluble copper between 14.5% and 65.0% and a range of total copper extraction between 4.5% and 35.5%.

Metallurgical data summary for this test series is found on page 28. Individual test data sheets are on pages B-12 through B-26 on Appendix B.

mountain states research & development

Project No. 2482 | Date 11/23/82 | Sample ID Hole 121 30' - 40' | Test No. JS-2A/B

METALLURGICAL RESULTS

Product	Weight [%]	Assay %			Contents %			Distribution %		
		A.S. Cu	T. Cu	Fe	A.S. Cu	T. Cu	Fe	A.S. Cu	T. Cu	Fe
Plus 1 inch	27.13	0.04	0.18	3.4	0.011	0.045	0.92	24.4	20.7	21.1
Plus ½ inch	9.42	0.09	0.28	4.1	0.008	0.026	0.39	17.8	12.0	9.0
Plus ¼ inch	13.19	0.06	0.21	3.9	0.008	0.028	0.51	17.8	12.9	11.7
Plus 10 mesh	19.98	0.04	0.22	4.0	0.008	0.044	0.80	17.8	20.3	18.4
Plus 20 mesh	6.80	0.03	0.22	4.1	0.002	0.015	0.28	4.4	6.9	6.4
Plus 48 mesh	6.71	0.04	0.22	4.2	0.003	0.015	0.28	6.7	6.9	6.4
Minus 48 mesh	16.77	0.03	0.26	7.0	0.005	0.044	1.17	11.1	20.3	27.0
Head (Calc.)	100.00	0.04	0.22	4.4	0.045	0.217	4.35	100.0	100.0	100.0
Head (Assay)		0.05	0.20							
Minus 3" +½"	36.55	0.05	0.19	3.6	0.019	0.071	1.31	42.2	32.7	30.1
Minus ½"	63.45	0.04	0.23	4.8	0.026	0.146	3.04	57.8	67.3	69.9
Head (Calc.)	100.00	0.04	0.22	4.4	0.045	0.217	4.35	100.00	100.00	100.00

Remarks:

Grinding Data

Mesh	Wt. [%]

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Project No. 2482 | Date 11/23/82 | Sample ID 122 - 80' - 90' | Test No. JS-3A/B

METALLURGICAL RESULTS

Product	Weight (%)	Assay %			Content %			Distribution %		
		A.S. Cu	T. Cu	Fe	A.S. Cu	T. Cu	Fe	A.S. Cu	T. Cu	Fe
Plus 1 inch	27.90	0.07	0.23	3.8	0.020	0.064	1.06	25.3	26.0	23.6
Plus ½ inch	7.10	0.10	0.27	4.2	0.007	0.019	0.30	8.9	7.7	6.7
Plus ¼ inch	11.16	0.10	0.26	4.3	0.011	0.029	0.48	13.9	11.8	10.7
Plus 10 mesh	22.76	0.08	0.27	4.8	0.018	0.061	1.09	22.8	24.8	24.3
Plus 20 mesh	8.18	0.05	0.23	4.0	0.004	0.019	0.33	5.1	7.7	7.3
Plus 48 mesh	7.54	0.09	0.22	4.2	0.007	0.017	0.32	8.9	6.9	7.1
Minus 48 mesh	15.36	0.08	0.24	5.9	0.012	0.037	0.91	15.1	15.1	20.3
Head (Calc.)	100.00	0.08	0.25	4.5	0.079	0.246	4.49	100.0	100.0	100.0
Head (Assay)		0.08	0.25							
Minus 3" +½"	35.00	0.08	0.24	3.9	0.027	0.083	1.36	34.2	33.7	30.3
Minus ½"	65.00	0.08	0.25	4.8	0.052	0.163	3.13	65.8	66.3	69.7
Head (Calc.)	100.00	0.08	0.25	4.5	0.079	0.246	4.49	100.0	100.0	100.0

Remarks:

Grinding Data

Mesh	Wt. (%)

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Project No. 2482 | Date 11/23/82 | Sample ID 131 - 70' - 75' | Test No. JS-4A/B

METALLURGICAL RESULTS

Product	Weight (%)	Assay %			Content %			Distribution %		
		A.S. Cu	T. Cu	Fe	A.S. Cu	T. Cu	Fe	A.S. Cu	T. Cu	Fe
Plus 1 inch	17.70	0.04	0.06	2.35	0.007	0.011	0.42	24.1	8.1	9.7
Plus ½ inch	8.14	0.02	0.46	4.9	0.002	0.037	0.40	6.9	27.2	9.3
Plus ¼ inch	11.18	0.02	0.11	4.2	0.002	0.012	0.47	6.9	8.8	10.9
Plus 10 mesh	20.81	0.02	0.12	3.9	0.004	0.025	0.81	13.8	18.4	18.7
Plus 20 mesh	8.33	0.02	0.11	3.8	0.002	0.009	0.32	6.9	6.6	7.4
Plus 48 mesh	8.89	0.02	0.11	3.9	0.002	0.010	0.35	6.9	7.4	8.1
Minus 48 mesh	24.95	0.04	0.13	6.2	0.010	0.032	1.55	34.5	23.5	35.9
Head (Calc.)	100.00	0.03	0.14	4.3	0.029	0.136	4.32	100.0	100.0	100.0
Head (Assay)		0.03	0.12							
Minus 3" +½"	25.84	0.03	0.19	3.2	0.009	0.048	0.82	31.0	35.3	19.0
Minus ½"	74.16	0.03	0.12	4.7	0.020	0.088	3.50	69.0	64.7	81.0
Head (Calc.)	100.00	0.029	0.136	4.32	0.029	0.136	4.32	100.0	100.0	

Remarks:

Grinding Data

Mesh	Wt. (%)

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Project No. 2482 | Date 11/23/82 | Sample ID 132 - 50' - 60' | Test No. JS-5A/B

METALLURGICAL RESULTS

Product	Weight (%)	Assay %			Content %			Distribution %		
		A.S. Cu	T. Cu	Fe	A.S. Cu	T. Cu	Fe	A.S. Cu	T. Cu	Fe
Plus 1 inch	23.89	0.05	0.10	2.8	0.012	0.002	0.67	14.1	1.2	20.4
Plus ½ inch	9.63	0.06	0.17	2.8	0.006	0.016	0.27	7.1	9.2	8.2
Plus ¼ inch	13.84	0.14	0.23	2.32	0.019	0.032	0.32	22.4	18.5	9.7
Plus 10 mesh	20.41	0.12	0.24	3.1	0.024	0.049	0.63	28.2	28.3	19.1
Plus 20 mesh	7.08	0.10	0.23	3.5	0.007	0.016	0.25	8.2	9.2	7.6
Plus 48 mesh	7.19	0.08	0.21	3.5	0.006	0.015	0.25	7.1	8.7	7.6
Minus 48 mesh	17.96	0.06	0.24	5.0	0.011	0.043	0.90	12.9	24.9	27.4
Head (Calc.)	100.00	0.09	0.17	3.3	0.085	0.173	3.29	100.0	100.0	100.0
Head (Assay)		0.07	0.20							
Minus 3" +½"	33.52	0.05	0.05	2.8	0.018	0.018	0.94	21.2	10.4	28.6
Minus ½"	66.48	0.10	0.23	3.5	0.067	0.155	2.35	78.8	89.6	71.4
Head (Calc.)	100.00	0.09	0.17	3.3	0.085	0.173	3.29	100.0	100.0	

Remarks:

Grinding Data

Mesh	Wt. (%)

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Project No. 2482 | Date 11/23/82 | Sample ID 133 - 40 - 50 | Test No. JS-6A/B

METALLURGICAL RESULTS

Product	Weight (%)	Assay %			Content %			Distribution %		
		A.S. Cu	T. Cu	Fe	A.S. Cu	T. Cu	Fe	A.S. Cu	T. Cu	Fe
Plus 1 inch	32.74	0.03	0.11	4.4	0.010	0.036	1.44	24.4	21.2	31.6
Plus ½ inch	8.90	0.03	0.15	3.6	0.003	0.013	0.32	7.3	7.6	7.0
Plus ¼ inch	16.57	0.06	0.18	3.8	0.010	0.030	0.63	24.4	17.6	13.8
Plus 10 mesh	18.61	0.05	0.19	4.1	0.009	0.035	0.76	21.9	20.6	16.7
Plus 20 mesh	5.59	0.03	0.20	4.1	0.002	0.011	0.23	4.9	6.5	5.1
Plus 48 mesh	5.39	0.03	0.22	4.6	0.002	0.012	0.25	4.9	7.1	5.5
Minus 48 mesh	12.20	0.04	0.27	7.5	0.005	0.033	0.92	12.2	19.4	20.3
Head (Calc.)	100.00	0.04	0.17	4.6	0.041	0.170	4.55	100.0	100.0	100.0
Head (Assay)		0.06	0.20							
Minus 3" +½"	41.64	0.03	0.12	4.2	0.013	0.049	1.76	31.7	28.8	38.6
Minus ½"	58.36	0.05	0.21	4.8	0.028	0.121	2.79	68.3	71.2	61.4
Head (Calc.)	100.00	0.04	0.17	4.6	0.041	0.170	4.55	100.0	100.0	100.0

Remarks:

Grinding Data

Mesh	Wt. (%)

2482
Test Data Summary
Tests JS-1 through JS-6B

Test No.	Sample I.D.	Size	Head Assay A.S. Cu %	Head Assay Total Cu %	Calculated Head Assay A.S. Cu %	Calculated Head Assay Total Cu %	H_2SO_4 Consumption #/t	Extraction A.S. Cu %	Extraction Total Cu %
JS-1	1-1-1 Composite	-¼"	0.04	0.15	0.03	0.17	17.0	29.9	5.1
JS-2A	1-2-1 30' - 40'	-2" + ½"	0.05	0.19	0.03	0.15	4.1	21.3	4.0
JS-2B	1-2-1 30' - 40'	-½"	0.04	0.23	0.03	0.20	10.9	34.0	5.3
JS-3A	1-2-2 80' - 90"	-2" + ½"	0.08	0.24	0.18	0.32	5.5	5.4	3.1
JS-3B	1-2-2 80' - 90'	-½"	0.08	0.25	0.05	0.22	10.7	25.3	5.3
JS-4A	1-3-1 70' - 75'	-2" + ½"	0.03	0.19	0.02	0.10	6.2	23.2	4.6
JS-4B	1-3-1 70' - 75'	-½"	0.03	0.12	0.03	0.12	12.4	40.6	8.4
JS-5A	1-3-2 50' - 60'	-2" +½"	0.05	0.05	0.05	0.15	4.0	18.2	6.0
JS-5B	1-3-2 50' - 60'	-½"	0.10	0.23	0.09	0.24	11.4	22.1	8.5
JS-6A	1-3-3 40' - 50'	-2" +½"	0.03	0.12	0.04	0.13	3.9	12.1	4.2
JS-6B	1-3-3 40' - 50'	-½"	0.05	0.21	0.04	0.20	11.9	30.7	6.8

2482
Test Data Summary
Tests JS-7 through JS-21

Test No.	Sample I.D.	*Size	Head Assay A.S. Cu %	Head Assay Total Cu %	Calculated Head Assay A.S. Cu %	Calculated Head Assay Total Cu. %	H_2SO_4 Consumption #/t	Extraction A.S. Cu %	Extraction Total Cu %
JS-7	1-5-4 0' - 10'	-2"	0.04	0.10	0.02	0.11	6.2	40.7	6.4
JS-8	1-6-1 20' - 30'	-2"	0.05	0.17	0.04	0.18	5.5	38.0	9.0
JS-9	3-2 20' - 30'	-2"	0.03	0.13	0.02	0.14	12.4	37.9	4.5
JS-10	3-4 50' - 60'	-2"	0.06	0.18	0.05	0.17	6.9	43.8	11.5
JS-11	3-6 50' - 60'	-2"	0.05	0.19	0.05	0.21	11.0	31.9	8.0
JS-12	6-1 61' - 71'	-2"	0.07	0.21	0.07	0.21	14.4	48.9	16.1
JS-13	6-1 20' - 30'	-2"	0.12	0.21	0.14	0.25	11.9	65.3	35.5
JS-14	6-2 30' - 40'	-2"	0.21	0.34	0.19	0.32	14.9	21.0	12.7
JS-15	6-3 100' - 110'	-2"	0.26	0.38	0.13	0.35	12.4	45.8	17.2
JS-16	6-3 30' - 40'	-2"	1.06	1.35	1.13	1.34	16.9	19.3	16.3
JS-17	6-2 100' - 110'	-2"	0.22	0.33	0.19	0.38	19.8	64.9	32.0
JS-18	5-1-1 10' - 15'	-2"	0.02	0.06	0.03	0.15	9.2	14.5	2.6
JS-19	5-3-1 60' - 70'	-2"	0.17	0.33	0.17	0.34	12.9	61.6	30.0
JS-20	5-3-1 30' - 40'	-2"	0.17	0.40	0.13	0.40	10.7	59.1	19.0
JS-21	5-5-1 20' - 30'	-2"	0.13	0.26	0.13	0.28	11.6	27.5	12.9

*Leach basin samples "As Received" from field

SECTION 7

RESOURCE EVALUATION

An order-of-magnitude assessment of recoverable copper values was made based upon the assays of interval samples from the drill holes. Copper content was calculated from the arithmetic average of interval assays for each drill hole, and the average assay of the drill holes in each of the leach basins was determined. Weighting of the drill hole assays by depth or other means was considered and rejected as illogical, because of the limited number and random spacing of the holes. (Assay logs and averages are shown in Appendix A.

The wastewater pond was evaluated based upon samples of impounded leach solutions and samples of sludge from the bottom of the pond. The only significant value in this area appears to be the copper content of the impounded leach liquor.

LEACH HEAPS

Average drill hole interval assays for Leach Basins 1 and 3 were as below.

	Total Cu	Acid Soluble Cu
Leach Basin 1	0.184	0.074
Leach Basin 3	0.190	0.071

These assays are remarkably similar and lead to the conclusion that the tenor of the two areas is the same. Therefore, an average assay for the total of both areas would be as below.

	Total Cu	Acid Soluble Cu
Leach Basin 1 plus Leach Basin 3	0.187	0.0725

The following data is calculated from these assays and the 7,130,249 tons of ore reportedly stocked in Leach Basins 1, 2, and 3. (Leach Basin 2 was not drilled, but is relatively much smaller than other two areas.)

	Total Cu	Acid Soluble Cu
Existing copper content	26,667,131 lb.	10,388,861 lb.
Add: copper reported recovered to date		30,565,277 lb.
Original copper content	57,232,408	40,904,138 lb.
Original ore grade	0.401%	0.287%

Based on the above, copper recovery from these heaps to date is calculated as follows.

$$\frac{30,565,277}{57,232,408} = 53\% \text{ of original total copper}$$

$$\frac{30,565,277}{40,904,138} = 75\% \text{ of original acid soluble copper}$$

MSRD concludes that additional copper recovery from these heaps will be limited to the following "order-of-magnitude" estimates.

Assume 30% extraction of the remaining acid soluble copper by continued leaching of the heaps as they exist:

0.3 X 10,338,861 = 3,101,658 lb. Cu.

Assuming 55% extraction of the remaining acid soluble copper by crushing, re-stocking, and leaching of new heaps:

0.55 X 10,338,861 = 5,686,374 lb. Cu.

It is hypothesized that the ore grade of 0.6% Cu which was reported by McAlester Fuel Company was based upon drill hole assays and that mining dilution resulted in an actual assay more nearly that calculated by MSRD. A tabulation of metallurgical data as calculated by MSRD vs. that reported by McAlester is shown below.

	MSRD	McAlester
Reported Tons of Ore	7,130,249	7,130,249
Grade of Original Ore	0.401% Cu	0.60% Cu
Copper in Original Ore	57,232,408 lb.	85,678,353 lb.
Reported Copper Production	30,565,277 lb.	30,565,277 lb.
Copper Remaining in Ore	26,667,131 lb.	55,113,076 lb.
Grade of Present Ore	0.187% Cu	0.386% Cu

IN-SITU SITES - LEACH BASINS 5 & 6

Average drill hole assays for in-situ leach basins 5 and 6 were as below.

	Total Cu	Acid Soluble Cu
Area 5	0.190	0.078
Area 6	0.356	0.210

The small number and random spacing of the drill holes in these areas are only qualitative and do not necessarily indicate the true tenor of the ore in place. Nevertheless, an average of these assays is shown below for use in the following estimates.

	Total Cu	Acid Soluble Cu
Basin 5 + Basin 6	0.273	0.144

The following data is calculated from these assays and the 7,657,388 tons of ore reportedly broken by in-situ blasting.

	Total Cu	Acid Soluble Cu
Existing Copper Content	41,809,388 lb.	22,053,277 lb.
Add: Copper Recovered to Date		2,969,244 lb.
Original Copper Content	44,778,562 lb.	25,022,501 lb.
Original Ore Grade	0.292%	0.163%

Based on the above, copper recovery from these areas to date is calculated as follows:

$$\frac{2,969,224}{38,992,243} = 6.6\% \text{ of original total copper}$$

$$\frac{2,969,224}{24,749,501} = 12.0\% \text{ or original acid soluble copper}$$

MSRD recommends that the ultimate extraction from an in-situ leaching operation should be estimated at no more than 30 percent. Using 30 percent ultimate extraction, copper production from these areas is calculated as follows.

0.3 X 25,022,501	=	7,506,750 lb. Cu
Less: Extraction to date		2,969,414 lb. Cu
Remaining extractable Cu		4,537,336 lb. Cu

A tabulation of metallurgical data is calculated by MSRD vs. the reported by McAlester Fuel Company is shown below.

	MSRD	McAlester
Reported Tons of Ore	7,657,388	7,657,388
Grade of Original Ore	0.292	0.271
Copper in Original Ore	44,778,562	41,520,808 lb.
Reported Copper Production	2,969,224 lb.	2,696,224 lb.
Copper Remaining in Ore	41,809,338 lb.	38,551,584 lb.
Grade of Present Ore	0.273	0.252

McAlester's estimate that 18,081,053 pounds of copper are extractable from the in-situ areas assumes extraction of 50 percent of the total copper, or approximately 85 percent of the acid soluble copper.

Estimated extractable copper	18,081,053 lb.
Plus: Copper extracted to date	2,696,224 lb.
Total copper extraction	20,777,277 lb.

$$\frac{20,777,277}{41,247,808} = 50\% \text{ of total copper}$$

MSRD believes this to be an unrealistic estimate - conceivably obtainable, but very unlikely to occur.

POTENTIAL COPPER PRODUCTION

Continued leaching of the heaps and in-situ areas as they exist would yield the following estimated production.

From Heaps	3,101,658 lb. Cu
From In Situ	4,537,336 lb. Cu
Total	7,638,994 lb. Cu

The rate of extraction would be a declining curve, so that not all of this recovery could be made in a two year period. Nevertheless, the following calculations assume all of this production would be made within two years.

Two year production	7,638,994 lb. Cu
One year production	3,819,497 lb. Cu
Daily production	10,913 lb. Cu.
Daily solution flow	1,500 gpm @ 0.6 gm Cu/l

Mining, crushing, and re-stocking of the existing heap leach material and continued operation of the in situ areas would yield the following estimated production.

From Heaps	5,686,374 lb. Cu
From In Situ	4,537,336 lb. Cu
Total	10,223,710 lb. Cu

Again assuming complete recovery within two years:

Two year production	10,223,710 lb. Cu
One year production	5,111,855 lb. Cu
Daily production	14,605 lb. Cu
Daily solution flow	1,500 gpm @ 0.8 gm Cu/l

WASTEWATER POND

The wastewater pond associated with the Zonia operation has been used to store solutions pumped from the in-situ leach basins since cessation of production. This pumping is being done periodically in order to minimize possible contamination of ground water by copper being leached by meteoric water from the in-situ basins.

A boat was floated upon this pond, and an MSRD technician extracted solution samples for various depths at two locations on the pond. Samples of sludge from the bottom of the pond were also obtained from two locations. The assays of these samples are shown below.

Sample	Depth	Ag	Fe^{+++}	Cu	pH
Center of Pond	5'	ND	0.25 g/l	0.79 g/l	2.60
	15'	ND	2.18 g/l	1.00 g/l	2.30
	25'	ND	2.77 g/l	1.15 g/l	2.20
	35'	ND	2.64 g/l	1.13 g/l	2.25
Dam End of Pond	5'	ND	0.26 g/l	0.81 g/l	2.63
	15'	ND	0.25 g/l	0.82 g/l	2.60
	25'	ND	0.25 g/l	0.82 g/l	2.60
	35'	ND	0.24 g/l	0.81 g/l	2.60
Center Sludge	-	0.058 Oz/T	13.1%	0.17%	-
Dam End Sludge	-	0.035 Oz/T	7.7%	0.10%	-

The two sludge samples were also subjected to semi-quantitative fluorescent X-ray spectographic analysis. The results of these analyses did not show any significant concentration of valuable elements.

The area of wastewater pond was estimated from available topographic map at 426,400 square feet, or 9.79 acres. Using one gram per liter as the average copper assay of the contained water, the copper content of the pond at various assumed average depths was calculated as shown below.

Assumed Av. Depth	Gallons	Pounds Copper
10 ft.	31,189,472	260,276
15 ft.	47,842,080	399,242
20 ft.	63,789,440	532,323

MSRD does not consider this copper to be an additional resource, since it represents value which has been extracted from the in-situ sites since cessation of operations, and would, therefore, be sutractable from copper which has been calculated as remaining and extractable from the in-situ leach basins.

SECTION 8

PRELIMINARY FEASIBILITY STUDIES

Consideration was given to the following processes for recovery of copper from the Zonia Property.

1. Resume sprinkle irrigation of leach heaps as they exist and resume delivery of acid solution to existing in-situ leach basins.

2. Crush material in existing leach heaps to one-inch size, re-stock in heaps, and irrigate new heaps by sprinkling. Resume delivery of acid water to existing in-situ leach basins.

3. Treat pregnant solutions from heap and in-situ leaching by cementation to produce cement copper.

4. Treat pregnant solutions from heap and in-situ leaching by solvent extraction-electrowinning (SX-EW) to produce cathode copper.

Flowsheets for these processes were developed and are shown conceptually on drawings nos. 3 and 4. Lists of major equipment required were developed and the cost of each major item was determined by obtaining quotation from reputable suppliers. Capital cost estimates were prepared by Mountain States Engineers' estimating department, using standard techniques for preliminary estimation. Capital costs shown are believed to be within +30 -5 percent. An exception was made for cost of a solvent extraction-electrowinning plant. In this case, capital cost was factored by standard methods from published cost of a similarly sized plant. Therefore, the capital cost shown for SX-EW should be considered to be only of order-of-magnitude accuracy.

Operating cost for each process was developed using estimated labor rates for the area, current costs for chemicals and reagents and standard factors for supply and overhead items. Power costs were calculated using a cost of $0.05 per kilowatt hour. Water cost was estimated from historical data at site.

All process calculations were based upon the following estimated design bases.

Solution Flow	1,500 gallons per minute
Solution Assay	0.6 to 0.8 gm/l Cu
Production Rate	
Leaching of undisturbed heaps	10,913 lb. Cu per day
Leaching of crushed and re-stocked heaps	14,605 lb. Cu per day
Days per Year	350
Leaching Plant Availability	100 percent
Cementation & SX-EW Availability	95 percent
Crushing Plant Availability	70 percent

CEMENTATION OPTION

PROCESS DESCRIPTION

Heap Leaching: Barren leach solution will be pumped to a reservoir located on a hill adjacent to the leach heaps. Solution will flow from the reservoir to the leach heaps by gravity. Each leach heap will be served by an 8-inch PVC header pipe. Irrigation will be accomplished by impact type sprinklers, served by 4-inch and 2-inch PVC piping connected to the header. Pregnant leach solution will flow from the heaps by existing natural solution channels, as was the former practice, to a plastic lined pregnant solution pond.

In-situ Leaching: Barren leach solution will be pumped to in situ leach basin injection wells. Pregnant solution will be pumped from recovery wells to the plastic-lined pregnant solution pond.

Cementation: Pregnant liquor will be pumped to an absorption tower served by a 25-ton sulfur burner. SO2 gas from the sulfur burner will serve to reduce ferric iron content of the solution and produce acid required for leaching after subsequent recycling. Solution discharged from the absorption tower will flow by gravity through a series of ten cementation cells with a solution retention time of approximately 17.5 minutes for precipitation of copper. The cementation cells will be designed for service by a front-end loader. The loader will charge iron scrap into the cells and will periodically remove cement copper by moving the contents of a cell to a washing screen. High pressure water on the washing screen will separate cement copper from unreacted iron. Cement copper slurry will flow to a settling sump. Unreacted iron will be returned to the cells. Cement copper will be pumped periodically from the settling sump to a solar drying pad.

CEMENTATION OPTION

MAJOR EQUIPMENT LIST

ITEM	QUANTITY	DESCRIPTION	H.P.
8" Pipe	1,500'	Fiberglass, 250 psi	-
8" Pipe	5,100'	PVC	-
2" Pipe	8,000'	PVC	
1" Pipe	10,000'	PVC	
Preg. Liquor Pond	1	2×10^6 gal..	-
Preg. Liquor Pond	3	4 X 3 X 12	225
Reservoir	1	240×10^3 gal.	-
Loader	2	Cat 950	-
Screen	1	6 X 14	7.5
Cementation Launder	10	Concrete	-
Belt Conveyor	1	30" X 75'	15
Cement Copper Sump	1	Concrete	-
Solar Drying Pad	1	20,000 $ft.^2$	-
Truck	1	10 Ton Dump	-
Truck	1	2 Ton Flat	-
Sprinklers	420	14-D-TNT	-
Sulfur Burner	1	25 T	10
Sulfur Storage Tank	2	13.75' X 27' w/Steam Coils	-
Sulfur Unload Tank	1	8' X 22' w/Steam Coils	-
Waste Heat Boiler	1	4,000 lb./hr.	-
Air Compressor	1	600 cfm	100
Inst. Air Compressor	1	-	5
Absorption Tower	1	1,500 gpm	-
Instrument Package	1	-	-

(Existing barren liquor and in-situ well pumps not included in this estimate.)

CEMENTATION OPTION

CAPITAL COST ESTIMATE

The following captial cost estimate was prepared by Mountain States Engineers, based upon the foregoing list of major equipment.

The total capital estimate for battery limit plant, including provision for infrastructure such as employee change facilities, repair bay, etc., and including a 15 percent contingency allowance, is $3,157,000.

MOUNTAIN STATES ENGINEERS, INC.
ESTIMATE SUMMARY

CLIENT: NERCO
PROJECT: CEMENTATION PLANT
LOCATION: ZONIA, ARIZONA
REV. NO. _____ REV. DATE: _____ U.S. $ [x] OTHER [ ]

PROJECT NO. 2482
ISSUE DATE: NOVEMBER 23, 1982
BY: W. HANNAN/J. C. LUTZ
APPROVED BY: H. Ehrich

		HOURS	LABOR	MATERIAL EQUIPMENT	OTHER	TOTAL
0	EARTHWORK & SITE IMPROVEMENTS				85,000	85,000
1	CONCRETE				239,000	239,000
2	STRUCTURAL				100,000	100,000
3	BUILDING ITEMS				130,000	130,000
4	PROCESS EQUIPMENT		90,000	454,000		544,000
5	PIPING		36,000	68,000	20,000	124,000
6	ELECTRICAL				140,000	140,000
7	INSTRUMENTATION		10,000	49,000		59,000
8	MISCELLANEOUS DIRECT COSTS				52,000	52,000
	TOTAL DIRECT COST		136,000	571,000	766,000	1,473,000
9.1	TEMPORARY FACILITIES AND CAMPS					
9.2	FIELD SUPERVISION AND SUPPORT					
9.3	TOOLS AND EQUIPMENT					
9.4	INSURANCE AND BOND	@ 35%				516,000
9.5	FIELD PAYROLL BURDEN & OVERHEAD					
9.6	MISCELLANEOUS FIELD INDIRECTS					
	INDIRECT FIELD COST					516,000
	TOTAL FIELD COST					1,989,000
9.7	ENGINEERING					179,000
9.8	HOME OFFICE SERVICES					119,000
	TOTAL FIELD AND ENGINEERING					2,287,000
9.9	CONTINGENCY (15 %)					343,000
9.9	ESCALATION (0 %) NONE - ALL COSTS 4TH QUARTER 1982					0
	SUBTOTAL					2,630,000
9.9	FEE (5 %)					132,000
9.9	CLIENT'S COSTS MOBILE EQUIPMENT					395,000
	TOTAL (ACCURACY IS ASSUMED TO BE WITHIN- 5 % AND + 30 %)					3,157,000

CEMENTATION OPTION

OPERATING COST SUMMARY

	Item	DOLLARS PER YEAR (X 1000) Leaching of Undisturbed Heaps	Leaching of Crushed & Re-Stocked Heaps
(1)	Salaries	189	189
(2)	Labor	695	695
	Power	221	221
	Water	17	17
	Fuel (Mobile Equipment)	24	24
	Sulfur	861	1,150
	Scrap Iron	610	817
(3)	Repair Supplies (5% of Capital)	158	158
(4)	Operating Supplies (30% of Repair Supplies)	47	47
(5)	Taxes & Insurance (2% of Capital)	63	63
	General Overhead (20% of 1+2+3+4+5)	230	230
	Contingencies (10%)	312	312
	TOTAL	3,427	3,923

CEMENTATION OPTION

SALARY COST

JOB	NO.	$/YEAR	$/YEAR W/30% FRINGE
Superintendent	1	40,000	$ 52,000
Accountant	1	30,000	39,000
Clerk	1	15,000	19,500
Maintenance Foreman	1	30,000	39,000
Operations Foreman	1	30,000	39,000
			$188,500

CEMENTATION OPTION

LABOR COST

LABOR COST FOR LEACHING & CEMENTATION	NO. PER DAY	RATE $ PER HOUR	$ PER WEEK	350 DAYS/YEAR OPERATING - $/YEAR INCLUDING 30% FRINGE
Operator	4	12.00	2,688	174,720
Helper	4	10.00	2,240	145,600
Loader Operator	1	12.00	672	43,680
Truck Driver	1	12.00	672	43,680
Laborer	4	9.00	2,016	131,040
*Mechanic	3	15.00	1,800	117,000
*Electrician	1	15.00	600	39,000
				$694,720

* = 5 Day Manning

Rotating Crew: 1 Operator
1 Helper

Balance: Day Shift Only

CEMENTATION OPTION

POWER COST

	Installed HP	Factor	Demand
Barren Liquor Pumps (Est. 4 running @ 75 HP)	300	1	300
Screen	7.5	1/3	3
Belt Conveyor	15	1/3	5
Sump Pump	7.5	1/3	3
Sulfur Barren	10	1	10
Plant Air Comp.	100	0.2	20
Inst. Air Comp.	5	0.2	1
In-situ Pumps (Est. 4 @ 75 HP)	300	1	300
			642
		+ 10% for Misc.	64
			706 HP

706 X .746 = 527 KW

526 X 24 X $0.05 = $632/Day

632 X 350 = $221,200/Year

CEMENTATION OPTION

WATER COST

1,500 GPM Process Flow

Assume 20% Loss

1,500 X 0.2 = 300 GPM

$$HP = \frac{(GPM) \times TDH \times SP.\ GR.}{3{,}960 \times Pump\ Eff.}$$

$$= \frac{300 \times 400}{3{,}960 \times 0.7} = 43$$

Use 50 HP for Water Power Cost

50 X .746 X 24 X $0.05 = $45/Day

Well Rent = $100/Mo.

$$\frac{100}{30} = \$3/Day$$

Water Cost = 45 + 3 = $48/Day

48 X 350 = $16,800/Year

CEMENTATION OPTION

FUEL COST
(Mobile Equipment)

Truck - Av. 1 Trip/Day Shipping

40 Mi. X 2 X 1/5 Gal./Min.	=	16 Gal./Day
Loader - 8 Hr. X 5 Gal./Hr.	=	40 Gal./Day
		56 Gal./Day
56 X 350 X $1.20/Gal	=	$23,520/Year

CEMENTATION OPTION

SULFUR COST

Assume 3 lb. S/1 lb. Cu per historical record.

(a) Leaching of undisturbed heaps.

10,913 lb. Cu X 3 = 32,739 = 16.9 Tons S

16.4 X $150/T X 350 = $861,000/Year

(b) Leaching of crushed and re-stocked heaps.

14,605 lb. Cu X 3 = 43,815 = 21.9 Tons S

21.9 X $150/T x 350 = $1,149,750/Year

CEMENTATION OPTION

SCRAP IRON COST

Assume 2 lb. Fe/1 lb. Cu per historical record.

(a) Leaching of undisturbed heaps.

10,913 lb. Cu X 2 = 21,826# = 10.9 Tons Fe

10.9 X $160/T X 350 = $610,400/Year

(b) Leaching of crushed and re-stocked heaps.

14,605 lb. Cu X 2 = 29,210# = 14.6 Tons Fe

14.6 X $160/T x 350 = $817,600/Year

SX-EW OPTION

PROCESS DESCRIPTION

Heap Leaching: Barren leach solution will be pumped to a reservoir located on a hill adjacent to the leach heaps. Solution will flow from the reservoir to the leach heaps by gravity. Each leach heap will be served by an 8-inch PVC header pipe. Irrigation will be accomplished by impact type sprinklers, served by 4-inch and 2-inch PVC piping connected to the header. Pregnant leach solution will flow from the heaps by existing natural solution channels, as was the former practice, to a plastic-lined pregnant solution pond.

In-situ Leaching: Barren leach solution will be pumped to in-situ leach basin injection wells. Pregnant solution will be pumped from recovery wells to the plastic-lined pregnant solution pond.

Solvent Extraction - Electrowinning: Pregnant liquor will be pumped to mixer-settler extraction tanks where it will be contacted by kerosene containing a small percentage of an ion-exchange resin sensitive to copper. The copper from the pregnant solution will be extracted to the kerosene solution or "organic" phase. The organic phase will be pumped to stripping tanks, where it will be contacted by aqueous spent electrolyte which is more acidic and lower in volume than the pregnant solution. The lower pH will cause the copper ions to leave the organic phase and enter the spent electrolyte. Pregnant electrolyte will be pumped to an electrolytic tank house, where pure copper anodes will be deposited.

The SX-EW process will generate about one pound of acid per pound of copper produced. The balance of acid required for leaching will be supplied by addition of acid to the barren liquor pond.

SX-EW OPTION

CAPITAL COST ESTIMATE

Cost for a suitable SX-EW plant was estimated by escalating costs published by a reputable engineering firm. (E&MJ, July 1972)

Cost for six at 270 gpm modules of $2,180,000 (1972) was escalated to a 1982 cost of $5,174,000 using the AMAX EMX Modified Index. (Ref. Cost Engineering, Vol. 24/No. 3, June 1982)

This cost is for a battery limit plant and it does not include infrastructure such as offices, change rooms, etc. Neither does it include pumps and pipelines for leaching.

Nevertheless, MSRD feels that this cost is sufficiently accurate for use in the present property evaluation study.

MSRD is well equipped to proceed with a more accurate and inclusive estimate, should the cost of that effort appear to be justified.

SX-EW OPTION

SALARY COST

JOB	NO.	$/YEAR	$/YEAR W/30% FRINGE
Superintendent	1	40,000	$ 52,000
Accountant	1	30,000	39,000
Clerk	1	15,000	19,500
Maintenance Foreman	1	30,000	39,000
Operations Foreman	1	30,000	39,000
			$188,500

SX-EW OPTION

OPERATING COST SUMMARY

	Item	DOLLARS PER YEAR (X 1000) Leaching of Undisturbed Heaps	Leaching of Crushed & Re-Stocked Heaps
(1)	Salaries	189	189
(2)	Labor	573	573
	Power	417	488
	Water	17	17
	Fuel (Mobile Equipment)	-	-
	Acid	888	1,182
	Organic	181	181
	Kerosene	111	111
(3)	Repair Supplies (5% of Capital)	259	259
(4)	Operating Supplies (30% of Repair Supplies)	78	78
(5)	Taxes & Insurance (2% of Capital)	103	103
	General Overhead (20% of 1+2+3+4+5)	240	240
	Contingencies (10%)	306	342
	TOTAL	3,362	3,763

SX-EW OPTION

LABOR COST

LABOR COST FOR LEACHING & SX-EW	NO. PER DAY (1)	RATE $ PER HOUR (2)	$ PER WEEK (3)	350 DAYS/YEAR OPERATING - $/YEAR INCLUDING 30% FRINGE (4)
Operator	4	12.00	2,688	174,720
Helper	4	10.00	2,240	145,600
Laborer	2	9.00	1,008	65,520
Truck Driver	1	12.00	672	43,680
*Mechanic	2	15.00	1,200	78,000
*Electrician	1	15.00	600	39,000
*Electrician Helper	1	10.00	400	26,000
				$572,520

* = 5 Day Manning

SX-EW OPTION

POWER COST

(a) Leaching of undisturbed heaps:

Power for leaching only		HP
Barren Liquor Pumps		300
In-situ Pumps		300
		600
	+10%	660

660 X 24 X .746 X $0.05 X 350 = $206,791/Year

Power for SX-EW @ 1.1 KWH/lb. Cu

10,913 X 1.1 X $0.05 X 350 = $210,075/Year

TOTAL = $416,866/Year

(b) Leaching of crushed and re-stocked heaps:

Power for leaching only = $206,791/Year

Power for SX-EW @ 1.1 KWH/lb. Cu

14,605 X 1.1 X $0.05 X 350 = $281,146/Year

TOTAL = $487,937/Year

SX-EW OPTION

ACID COST

Assume historical average	=	10 lb. Acid/lb. Cu
Less Acid generated by SX	=	1 lb. Acid/lb. Cu
Net requirement	=	9 lb. Acid/lb. Cu

Cost of Acid	$25/T
Freight (Morenci-Wickenburg)	$27.60/T
TOTAL	$52.60/T

(a) Leaching of undisturbed heaps:

$$\frac{10{,}726 \times 9 \times 350 \times \$52.60}{2000} = \$888{,}595/\text{Year}$$

(b) Leaching of crushed and re-stocked heaps:

$$\frac{14{,}267 \times 9 \times 350 \times \$52.60}{2000} = \$1{,}181{,}950/\text{Year}$$

SX-EW OPTION

ORGANIC COST

ORGANIC COST:

Assume Organic loss	=	0.01% of Aqueous Flow
@ 1,500 gpm	=	1,712 lb./Day Solution
@ 5% LIX Reagent	=	86 lb./Day Organic Loss
86 X $6.00 X 350	=	$180,600/Year

KEROSENE COST:

@ 1,500 gpm	=	1,712 lb./Day Solution
@ 95% Kerosene	=	1,626 lb./Day Kerosene Loss
1626/7.93	=	205 Gal./Day Kerosene Loss
205 X $1.55 X 350	=	$111,213/Year

CRUSHING OPTION

PROCESS DESCRIPTION

The existing leach heaps will be excavated by a bulldozer - front-end loader combination, loaded into trucks, and hauled to a centrally located crushing plant. Haulage trucks will dump into a receiving hopper served by a 48-inch pan feeder. The pan feeder will deliver to a two-deck vibrating grizzly. The vibrating grizzly will produce three products: minus 1/2-inch material for re-stocking; minus 4-inch, plus 1/2-inch feed to secondary crushing, and plus 4-inch material as feed to primary crushing. The primary crusher will be a 25" X 40" jaw crusher, producing additional feed for the secondary crusher. The secondary crusher will be a 1500S cone crusher, producing a minus 1/2-inch product for re-stocking. A scalping screen will remove minus 1/2-inch material from secondary crusher feed. All minus 1/2inch material produced by the crushing plant will be loaded into trucks by a front-end loader and hauled to re-stocking sites. Leach heaps will be constructed at re-stocking sites by dumping and trimming with a bulldozer.

CRUSHING OPTION

MAJOR EQUIPMENT LIST

ITEM	QUANTITY	DESCRIPTION	H.P.
Truck Hopper	1	15' X 25" x 20' Depth	-
Pan Feeder	1	48" X 15'	7.5
Vibrating Grizzly	1	8' X 20', 2 Decks	50
Jaw Crusher	1	25" X 40"	125
Screen	1	4' X 12'	7.5
Cone Crusher	1	1500S	250
Belt Conveyor	3	24" X 150'	75
Bulldozer	1	D-8	-
Front-End Loader	3	988-B	-
Truck	6	769-C	-

CRUSHING OPTION

CAPITAL COST ESTIMATE

The following capital cost estimate was prepared by Mountain States Engineers, based upon the foregoing list of major equipment.

The total capital estimate for battery limit plant, including provision for infrastructure such as employee change facilities, repair bay, etc., and including a 15 percent contingency allowance, is $6,126,000.

MOUNTAIN STATES ENGINEERS, INC.
ESTIMATE SUMMARY

CLIENT: NERCO
PROJECT: CRUSHING FACILITY
LOCATION: ZONIA, ARIZONA
REV. NO. _____ REV. DATE: _____ U.S. $ [X] OTHER [ ]

PROJECT NO. 2482
ISSUE DATE: NOVEMBER 23, 1982
BY: W. HANNAN/J. C. LUTZ
APPROVED BY: H. Ehrich

		HOURS	LABOR	MATERIAL EQUIPMENT	OTHER	TOTAL
0	EARTHWORK & SITE IMPROVEMENTS					
1	CONCRETE					
2	STRUCTURAL					
3	SUPPORT FACILITIES				130,000	130,000
4	PROCESS EQUIPMENT			517,900	x 2.2	1,140,000
5	PIPING					
6	MAIN POWER				40,000	40,000
7	INSTRUMENTATION					
8	MISCELLANEOUS DIRECT COSTS					
	TOTAL DIRECT COST					1,310,000
9.1	TEMPORARY FACILITIES AND CAMPS					
9.2	FIELD SUPERVISION AND SUPPORT					
9.3	TOOLS AND EQUIPMENT					
9.4	INSURANCE AND BOND	@ 35%				459,000
9.5	FIELD PAYROLL BURDEN & OVERHEAD					
9.6	MISCELLANEOUS FIELD INDIRECTS					
	INDIRECT FIELD COST					459,000
	TOTAL FIELD COST					1,769,000
9.7	ENGINEERING @ 9%					159,000
9.8	HOME OFFICE SERVICES @ 6%					106,000
	TOTAL FIELD AND ENGINEERING					2,034,000
9.9	CONTINGENCY (15 %)					305,000
9.9	ESCALATION (0 %) NONE - ALL COSTS 4TH QUARTER 1982					0
	SUBTOTAL					2,339,000
9.9	FEE (5 %)					117,000
9.9	CLIENT'S COSTS MOBILE EQUIPMENT					3,670,000
	TOTAL (ACCURACY IS ASSUMED TO BE WITHIN- 5 % AND + 30 %)					6,126,000

CRUSHING OPTION

OPERATING COST SUMMARY*

	ITEM	DOLLARS PER YEAR (X 1000)
(1)	Salaries	175
(2)	Labor	1,783
	Power	134
	Fuel (Mobile Equipment)	538
(3)	Repair Supplies (5% of Capital)	306
(4)	Operating Supplies (30% of Repair Supplies)	92
(5)	Taxes & Insurance (2% of Capital)	123
	General Overhead (20% of 1+2+3+4+5)	496
	Contingencies (10%)	365
	TOTAL	4,012

*All costs shown are in addition to requirements for leaching and cementation and/or SX-EW.

CRUSHING OPTION

SALARY COST

Since leaching and cementation or SX-EW will be under way simultaneously, the following are additional salary costs.

JOB	NO.	$/YEAR	$/YEAR W/30% FRINGE
Clerk	1	15,000	$ 19,500
Crushing Plant Foreman	4	30,000	156,000
			$175,500

CRUSHING OPTION

LABOR COST

LABOR COST TO MINE, HAUL, CRUSH, AND RE-STOCK ZONIA DUMPS	NO. PER DAY	RATE $ PER HOUR	$ PER WEEK	350 DAYS/YEAR OPERATING - $/YEAR INCLUDING 30% FRINGE
Bulldozer Operator	3	12.00	2,016	131,040
Loader Operator	6	12.00	4,032	262,080
Truck Driver	18	12.00	12,096	786,240
Crusher Operator	3	12.00	2,016	131,040
Crusher Helper	3	10.00	1,680	109,200
Laborer	3	9.00	1,512	98,280
Mechanic*	4	15.00	2,400	156,000
Electrician*	1	15.00	600	39,000
General Labor*	3	9.00	1,080	70,200
				1,783,080

* = 5 Day Manning

CRUSHING OPTION

POWER COST

	Installed HP	Factor	Demand
Pan Feeder	7.5	0.8	6
Grizzly	50	0.8	40
Jaw Crusher	125	0.6	75
Screen	7.5	1	8
Cone Crusher	250	0.8	200
Belt Conveyors	75	0.8	60
			389 HP
		Plus 10%	39
		TOTAL	428 HP

428 X 0.746 X 24 X 350 X $0.05 = $134,100/Year

CRUSHING OPTION

FUEL COST
(Mobile Equipment)

FRONT-END LOADERS: 2C 988-B

13.2 Gal./Hr.

350 X 24 X 0.7 X 13.2 = 77,616 Gal./Yr./Loader

X 2 = 155,000 Gal. for Two Loaders

D-8 BULLDOZER

10.8 Gal./Hr.

350 X 24 X 0.7 X 10.8 = 64,000 Gal./Yr.

769C TRUCK (6 UNITS)

6.5 Gal./Hr.

6 X 350 X 24 X 0.7 X 6.5 = 229,000 Gal./Day

TOTAL	155,000	
	64,000	
	229,000	
	448,000	Gal./Yr.

448,000 X $1.20 = $537,600/Yr.

CONTRACT CRUSHING OPTION

The cost of contracting for excavation, crushing, screening, and re-stocking the leach heaps was estimated. This option would have the obvious advantage of reducing both capital and operating costs if crushing and re-stocking were employed to process the heap material.

MSRD contacted N.A. Degerstrom, Inc., a reputable mining contractor with considerable experience in heap leaching operations, and requested a preliminary quotation for this service. A preliminary quotation of $1.85 per ton was received for performance of work generally described as follows:

> Excavate approximately 7,000,000 tons of run-of-mine material from the existing leach heaps, crush to minus one inch, and re-stock for further leaching within a two year period. It was estimated that this work would be performed by excavating with 992 loaders to a portable crushing plant and using truck haulage to move the crushed product to re-stocking sites, with a maximum 2,000 foot haul.

Annual cost for this service would thus be as follows:

$$\frac{7,130,249}{2} \times \$1.85 = 6,595,480 \text{ per year}$$

MARKETABILITY OF CEMENT COPPER

Cement copper is generally marketable only to commercial copper smelters. It has small potential as a chemical feedstock because of its variable analysis and the fact that it is usually contaminated by iron particles, rocks, and other debris during its production. Powdered copper for chemical use is generally produced from refined copper under controlled conditions.

Commerical copper smelters handle cement copper by mixing it with low grade sulfide concentrates and smelting it either in reverbatory or flash furnaces. If low grade sulfide concentrates are not available, they will not purchase cement copper. The toll for smelting cement copper is currently in excess of 20 cents per pound of copper. This high toll is justified by high copper losses to slag which are encountered when cement copper is furnaced.

For the above reasons, MSRD does not recommend adopting a cementation process for copper production at this time.

APPENDIX A

DRILL HOLE ASSAYS

Arithmetic Averages of Interval Assays

Leach Basin 1

Hole	Total Cu	Acid Soluble Cu
1-1-1	0.156	0.047
1-2-1	0.225	0.115
1-2-2	0.153	0.049
1-2-3	0.150	0.060
1-3-1	0.181	0.063
1-3-2	0.176	0.064
1-3-3	0.160	0.032
1-4-1	0.137	0.038
1-4-2	0.150	0.034
1-4-3	0.120	0.023
1-5-1	0.202	0.096
1-5-2	0.208	0.110
1-5-3	0.345	0.245
1-5-4	0.130	0.040
1-5-5	0.150	0.035
1-6-1	0.228	0.065
1-6-2	0.258	0.150
AVERAGE	0.184	0.074

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Arithmetic Averages of Interval Assays

Leach Basin 3

Hole	Total Cu	Acid Soluble Cu
3-1	0.230	0.077
3-2	0.198	0.060
3-3	0.152	0.050
3-4	0.216	0.109
3-5	0.194	0.089
3-6	0.144	0.041
3-7	0.196	0.074
AVERAGE	0.190	0.071

mountain states

Arithmetic Averages of Interval Assays

In-situ Leach Basins 5 and 6

Hole	Total Cu	Acid Soluble Cu
5-1-1	0.095	0.025
5-3-1	0.296	0.138
5-5-1	0.180	0.070
AVERAGE	0.190	0.078
6-1	0.210	0.093
6-2	0.249	0.137
6-3	0.609	0.401
AVERAGE	0.356	0.210

mountain states research & development

Project No. 2482	Date	Test Sample No. Hole 1-1-1 Comp.	Test
H_2SO_4 TEST LOG SHEET	11/10/82	Test Sample Weight 4000.0 g	JS - 1

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids [%]	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	4.9*								
Agitation	Hours 0	50	1.8		9.0						
	1	50	1.85								
	6	50	2.0								
	24	50	3.0* 2.0		3.0						
	30	50	3.0* 2.0		8.0						
	48	50	1.7						1.7		
Reagent Consumption					17.0						

Remarks

Washed with (3) 1 1 H_2O

*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution [%]		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	2.9305	0.106	0.222		0.311		0.311	27.2		4.6
WASH SOLUTION	3.1005	0.0097	0.025		0.031		0.031	2.7		0.5
LEACHED RESIDUE	4000.0	0.02		0.16	0.80		6.40	70.1		94.9
HEAD [CALCULATED]	4000.0	0.03		0.17	1.142		6.742	100.0		100.0
HEAD [ASSAY]		0.04		0.15						
OVERALL Cu RECOVERY								29.9		5.1

Remarks

Screen Analysis Residue

Mesh	[%]

msrd-14

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Project No. 2482

H_2SO_4 TEST LOG SHEET

Date 11/16/82

Test Sample No. ~~1½"~~ 1-2-1 - 30' - 40'

Test Sample Weight 2155 g

Test JS - 2A

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	6.8*								
Agitation	Hours 0	50	2.0		3.6						
	1	50	1.9								
	6	50	1.9								
	24	50	2.25* 2.0		0.9						
	30	50	2.0								
	48	50	2.4						0.2		
Reagent Consumption					4.1						

Remarks
Wash with (3) 700 ml H_2O @ pH 2.0
*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	1.825	0.061	0.043		0.111		0.111	17.6		3.3
WASH SOLUTION	2.117	0.011	0.024		0.023		0.023	3.7		0.7
LEACHED RESIDUE	2155.0	0.023		0.148	0.496		3.189	78.7		96.0
HEAD (CALCULATED)	2155.0	0.03		0.15	0.630		3.323	100.0		100.0
** HEAD (ASSAY)		0.05		0.19						
OVERALL Cu RECOVERY								21.3		4.0

Remarks
**Calculated by screen fraction distribution assay

Screen Analysis Residue

Mesh	(%)

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Project No. 2482	Date	Test Sample No. $-\frac{1}{2}''$	Test
H_2SO_4 TEST LOG SHEET	11/16/82	1-2-1 30' - 40' Test Sample Weight 1000 g	JS - 2B

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	4.75*								
Agitation	Hours 0	50	1.8		7.9						
	1	50	1.9								
	6	50	1.95								
	24	50	2.6* 2.0		2.0						
	30	50	2.2* 2.0		1.6				0.3		
	48	50	2.45								
Reagent Consumption					10.9						

Remarks

Wash with (3) 300 ml @ pH 2.0 washes

*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	0.580	0.107	0.048		0.062		0.062	20.5		3.2
WASH SOLUTION	0.970	0.042	0.037		0.041		0.041	13.5		2.1
LEACHED RESIDUE	977.0	0.02		0.19	0.20		1.86	66.0		94.7
HEAD (CALCULATED)	977.0	0.03		0.20	0.303		1.963	100.0		100.0
** HEAD (ASSAY)		0.041		0.23						
OVERALL Cu RECOVERY								34.0		5.3

Remarks

**Calculated by screen fraction distribution assay

Screen Analysis Residue

Mesh	(%)

mountain states research & development

Project No. 2482

H_2SO_4 TEST LOG SHEET

Date 11/16/82

Test Sample No. +½" 1-2-2 80' - 90'

Test Sample Weight 2027 g

Test JS - 3A

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	6.4*								
Agitation	Hours 0	50	2.0		3.9						
	1	50	2.0								
	6	50	2.05								
	24	50	2.45* 2.05		1.0						
	30	50	2.25* 2.0		1.2						
	48	50	2.4						0.3		
Reagent Consumption					5.5						

Remarks
Wash with (3) 700 ml H_2O @ pH 2.0
*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	1.563	0.110	0.072		0.172		0.172	4.7		2.7
WASH SOLUTION	2.053	0.013	0.040		0.027		0.027	0.7		0.4
LEACHED RESIDUE	2017.0	0.173		0.308	3.489		6.212	94.6		96.9
HEAD (CALCULATED)	2017.0	0.18		0.32	3.688		6.411	100.0		100.0
** HEAD (ASSAY)		0.08		0.24						
OVERALL Cu RECOVERY								5.4		3.1

Remarks
**Calculated by screen fraction distribution assay

Screen Analysis Residue

Mesh	(%)

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Project No. 2482	Date	Test Sample No. -½"	Test
H_2SO_4 TEST LOG SHEET	11/16/82	1-2-2 80' - 90' Test Sample Weight 1000 g	JS - 3B

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	4.1*								
Agitation	Hours 0	50	1.8		3.9						
	1	50	2.2* 2.0		1.6						
	6	50	2.3* 2.05		1.2						
	24	50	2.6* 2.0		2.4						
	30	50	2.4* 2.0		2.0						
	48	50	2.4						0.2		
Reagent Consumption					10.7						

Remarks
Wash with (3) 300 ml H_2O @ pH 2.0
*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	0.630	0.136	0.075		0.086		0.086	18.9		4.0
WASH SOLUTION	0.960	0.030	0.078		0.029		0.029	6.4		1.3
LEACHED RESIDUE	999.0	0.034		0.204	0.340		2.038	74.7		94.7
HEAD (CALCULATED)	999.0	0.05		0.22	0.455		2.153	100.0		100.0
** HEAD (ASSAY)		0.08		0.25						
OVERALL Cu RECOVERY								25.3		5.3

Remarks
**Calculated by screen fraction distribution assay

Screen Analysis Residue

Mesh	(%)

mountain states research & development

Project No. 2482

H_2SO_4 TEST LOG SHEET

Date 11/16/82

Test Sample No. +½"
1-3-1 70' - 75'
Test Sample Weight 1209 g

Test JS - 4A

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	6.5*								
Agitation	Hours 0	50	1.9		3.3						
	1	50	1.95								
	6	50	2.0								
	24	50	2.5* 2.0		2.0						
	30	50	2.2* 2.0		1.3						
	48	50	2.4						0.2		
Reagent Consumption					6.2						

Remarks
Wash with (3) 400 ml H_2O @ pH 2.0
*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	1.074	0.045	0.048		0.048		0.048	19.2		3.8
WASH SOLUTION	1.193	0.008	0.020		0.010		0.010	4.0		0.8
LEACHED RESIDUE	1202.0	0.016		0.10	0.192		1.202	76.8		95.4
HEAD (CALCULATED)	1202.0	0.02		0.10	0.250		1.260	100.0		100.0
** HEAD (ASSAY)		0.03		0.19						
OVERALL Cu RECOVERY								23.2		4.6

Remarks
**Calculated by screen fraction distribution assay

Screen Analysis Residue

Mesh	(%)

msrd-14

mountain states research & development

Project No. 2482	Date	Test Sample No. -½"	Test
H_2SO_4 TEST LOG SHEET	11/16/82	1-3-1 70' - 75' Test Sample Weight 1000 g	JS - 4B

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	4.4*								
Agitation	Hours 0	50	1.9		3.9						
	1	50	2.6		2.0						
	6	50	2.6* 2.05		2.0						
	24	50	2.75 2.0		3.1						
	30	50	2.35 2.0		2.0						
	48	50	2.45						0.3		
Reagent Consumption					12.4						

Remarks
Wash with (3) 300 ml pH 2.0 H_2O
*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	0.620	0.105	0.056		0.065		0.065	25.9		5.4
WASH SOLUTION	0.945	0.039	0.040		0.037		0.037	14.7		3.0
LEACHED RESIDUE	994.0	0.015		0.112	0.149		1.113	59.4		91.6
HEAD (CALCULATED)	994.0	0.03		0.12	0.251		1.215	100.0		100.0
** HEAD (ASSAY)		0.03		0.12						
OVERALL Cu RECOVERY								40.6		8.4

Remarks
**Calculated by screen fraction distribution assay

Screen Analysis Residue

Mesh	(%)

mountain states research & development

Project No. 2482

H_2SO_4 TEST LOG SHEET

Date 11/16/82

Test Sample No. +½" 1-3-2 50' - 60'

Test Sample Weight 1833 g

Test JS - 5A

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	6.9								
Agitation	Hours 0	50	2.0		2.1						
	1	50	2.1		0.2						
	6	50	2.2* 2.05		0.6						
	24	50	2.3* 2.0		1.1						
	30	50	2.15* 2.0		0.9						
	48	50	2.3						0.4		
Reagent Consumption					4.0						

Remarks
Wash with (3) 600 ml H_2O @ pH 2.0
*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			grams Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	1.412	0.083	0.091		0.117		0.117	13.3		4.4
WASH SOLUTION	1.955	0.022	0.036		0.043		0.043	4.9		1.6
LEACHED RESIDUE	1805.0	0.040		0.140	0.722		2.527	81.8		94.0
HEAD (CALCULATED)	1805.0	0.05		0.15	0.882		2.687	100.0		100.0
** HEAD (ASSAY)		0.05		0.05						
OVERALL Cu RECOVERY								18.2		6.0

Remarks
**Calculated by screen fraction distribution assay

Screen Analysis Residue

Mesh	(%)

mountain states research & development

Project No. 2482

H_2SO_4 TEST LOG SHEET

Date 11/16/82

Test Sample No. -½"
1-3-2 50' - 60'
Test Sample Weight 1000 g

Test JS - 5B

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	4.65*								
Agitation	Hours 0	50	1.9		3.9						
	1	50	2.4		2.0						
	6	50	2.2* 2.0		1.6						
	24	50	2.6 2.0		2.4						
	30	50	2.3* 2.0		2.0						
	48	50	2.4						0.2		
Reagent Consumption					11.4						

Remarks
Wash with (3) 300 ml H_2O @ pH 2.0
*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	0.600	0.212	0.079		0.127		0.127	14.3		5.5
WASH SOLUTION	0.962	0.072	0.082		0.069		0.069	7.8		3.0
LEACHED RESIDUE	985.0	0.07		0.216	0.690		2.123	77.9		
HEAD (CALCULATED)	985.0	0.09		0.24	0.886		2.319	100.0		
** HEAD (ASSAY)		0.10		0.23						
OVERALL Cu RECOVERY								22.1		8.5

Remarks
**Calculated by screen fraction distribution assay

Screen Analysis Residue

Mesh	(%)

mountain states research & development

Project No. 2482	Date	Test Sample No. +½" 1-3-3 40' - 50'	Test
H_2SO_4 TEST LOG SHEET	11/16/82	Test Sample Weight 2022 g	JS - 6A

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	7.0*								
Agitation	Hours 0	50	2.0		1.9						
	1	50	2.1		1.4						
	6	50	1.95								
	24	50	2.25* 2.05		1.0						
	30	50	2.1* 2.0		0.6						
	48	50	2.3						0.5		
Reagent Consumption					3.9						

Remarks
Wash with (3) 700 ml H_2O pH 2.0
*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	1.642	0.052	0.037		0.085		0.085	9.6		3.3
WASH SOLUTION	2.204	0.010	0.015		0.022		0.022	2.5		0.9
LEACHED RESIDUE	1992.0	0.039		0.124	0.777		2.470	87.9		95.8
HEAD (CALCULATED)	1992.0	0.04		0.13	0.884		2.577	100.0		
** HEAD (ASSAY)		0.03		0.12						
OVERALL Cu RECOVERY								12.1		4.2

Remarks
**Calculated by screen fraction distribution assay

Screen Analysis Residue

Mesh	(%)

mountain states research & development

Project No. 2482 H_2SO_4 TEST LOG SHEET	Date 11/16/82	Test Sample No. -½" 1-3-3 40' - 50 Test Sample Weight 1000 g	Test JS - 6B

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	4.75*								
Agitation	Hours 0	50	1.8		4.9						
	1	50	2.2		1.6						
	6	50	2.1* 2.0		0.8						
	24	50	2.8* 1.9		3.5						
	30	50	2.2* 2.0		1.6						
	48	50	2.4						0.25		
Reagent Consumption					11.9						

Remarks
Wash with (3) 300 ml H_2O @ pH 2.0
*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	0.625	0.126	0.061		0.079		0.079	17.7		3.9
WASH SOLUTION	0.940	0.062	0.055		0.058		0.058	13.0		2.9
LEACHED RESIDUE	1001.0	0.031		0.188	0.310		1.882	69.3		93.2
HEAD (CALCULATED)	1001.0	0.04		0.20	0.447		2.019	100.0		100.0
** HEAD (ASSAY)		0.05		0.21						
OVERALL Cu RECOVERY								30.7		6.8

Remarks
**Calculated by screen fraction distribution assay

Screen Analysis Residue

Mesh	(%)

mountain states research & development

Project No. 2482	Date	Test Sample No.	Test
H_2SO_4 TEST LOG SHEET	11/22/82	1-5-4 0' - 10' Test Sample Weight 2130 g	JS - 7

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	3.9*								
Agitation	Hours 0	50	2.0		2.4						
	1	50	2.2* 2.0		0.75						
	6	50	2.15* 2.0		0.75						
	24	50	2.4* 2.0		1.9						
	30	50	2.2* 2.0		0.75						
	48	50	2.6						0.2		
Reagent Consumption					6.2						

Remarks
Washed with (3) 600 ml H_2O @ pH 2.0

*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	1.638	0.057			0.093		0.093	26.1		4.1
WASH SOLUTION	1.490	0.035			0.052		0.052	14.6		2.3
LEACHED RESIDUE	2107.2	0.010		0.010	0.211		2.107	59.3		93.6
HEAD (CALCULATED)	2107.2	0.02		0.11	0.356		2.252	100.0		100.0
HEAD (ASSAY)		0.04		0.10						
OVERALL Cu RECOVERY								40.7		6.4

Remarks

Screen Analysis Residue

Mesh	(%)

mountain states research & development

Project No. 2482	Date	Test Sample No.	Test
H_2SO_4 TEST LOG SHEET	11/22/82	1-6-1 20' - 30' Test Sample Weight 2198 g	JS - 8

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids [%]	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	4.05*								
Agitation	Hours 0	50	2.0*		2.3						
	1	50	2.2* 2.0		0.7						
	6	50	2.1* 2.0		0.7						
	24	50	2.5* 2.0		2.2						
	30	50	2.05* 2.0		0.4						
	48	50	2.3						0.4		
Reagent Consumption					5.5						

Remarks
Washed with (3) 600 ml H_2O @ pH 2.0

*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution [%]		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	1.774	0.172			0.305		0.305	32.9		7.8
WASH SOLUTION	1.579	0.030			0.047		0.047	5.1		1.2
LEACHED RESIDUE	2211.0	0.026		0.16	0.575		3.538	62.0		91.0
HEAD [CALCULATED]	2211.0	0.04		0.18	0.927		3.89	100.0		100.0
HEAD [ASSAY]		0.05		0.17						
OVERALL Cu RECOVERY								38.0		9.0

Remarks

Screen Analysis Residue

Mesh	[%]

mountain states research & development

Project No. 2482	Date	Test Sample No.	Test
H_2SO_4 TEST LOG SHEET	11/22/82	3-2 20' - 30' Test Sample Weight 2171 g	JS - 9

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	4.6*								
Agitation	Hours 0	50	2.0		2.8						
	1	50	6.3* 2.0		5.9						
	6	50	2.3* 2.0		1.3						
	24	50	2.6* 2.0		2.6						
	30	50	2.1* 2.0		0.4						
	48	50	2.5						0.3		
Reagent Consumption					12.4						

Remarks
Washed with (3) 600 ml H_2O @ pH 2.0

*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	1.790	0.063			0.113		0.113	32.2		3.8
WASH SOLUTION	1.522	0.013			0.020		0.020	5.7		0.7
LEACHED RESIDUE	2177.2	0.010		0.13	0.218		2.830	62.1		95.5
HEAD (CALCULATED)	2177.2	0.02		0.14	0.351		2.963	100.0		100.0
HEAD (ASSAY)		0.03		0.13						
OVERALL Cu RECOVERY								37.9		4.5

Remarks

Screen Analysis Residue

Mesh	(%)

mountain states research & development

Project No. 2482	Date	Test Sample No.	Test
H_2SO_4 TEST LOG SHEET	11/22/82	3-4 50' - 60' Test Sample Weight 2237 g	JS - 10

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	4.0								
Agitation	Hours 0	50	2.0		2.3						
	1	50	2.4 2.0		1.6						
	6	50	2.1 2.0		0.7						
	24	50	2.5 2.0		2.5						
	30	50	2.2 2.05		0.7						
	48	50	2.3						0.4		
Reagent Consumption					6.9						

Remarks
Washed with (3) 600 ml H_2O @ pH 2.0

*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	1.389	0.242			0.336		0.336	33.6		8.8
WASH SOLUTION	1.4215	0.072			0.102		0.102	10.2		2.7
LEACHED RESIDUE	2243.3	0.025		0.15	0.561		3.365	56.2		88.5
HEAD (CALCULATED)	2243.3	0.05		0.17	0.999		3.803	100.0		100.0
HEAD (ASSAY)		0.06		0.18						
OVERALL Cu RECOVERY								43.8		11.5

Remarks

Screen Analysis Residue

Mesh	(%)

mountain states research & development

Project No. 2482	Date	Test Sample No.	Test
H_2SO_4 TEST LOG SHEET	11/22/82	3-6 50' - 60' Test Sample Weight 2194 g	JS - 11

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	5.0								
Agitation	Hours 0	50	1.9		3.3						
	1	50	2.7* 2.0		2.0						
	6	50	2.4 2.0		1.3						
	24	50	3.4 2.0		3.3						
	30	50	2.4 2.05		1.5						
	48	50	2.7						0.2		
Reagent Consumption					11.0						

Remarks
Washed with (3) 600 ml H_2O @ pH 2.0

*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			grams Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	1.698	0.171			0.290		0.290	25.7		6.4
WASH SOLUTION	1.528	0.046			0.070		0.070	6.2		1.6
LEACHED RESIDUE	2191.9	0.035		0.19	0.767		4.165	68.1		92.0
HEAD (CALCULATED)	2191.9	0.05		0.21	1.127		4.525	100.0		100.0
HEAD (ASSAY)		0.05		0.19						
OVERALL Cu RECOVERY								31.9		8.0

Remarks

Screen Analysis Residue

Mesh	(%)

mountain states research & development

Project No. 2482

H_2SO_4 TEST LOG SHEET

Date 11/22/82

Test Sample No. 6-1 61' - 70'

Test Sample Weight 2149 g

Test JS - 12

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	6.8								
Agitation	Hours 0	50	1.85		4.1						
	1	50	2.9 1.9		2.8						
	6	50	2.4 2.0		1.5						
	24	50	3.6 2.0		3.7						
	30	50	2.6 2.0		2.6						
	48	50	2.9						0.15		
Reagent Consumption					14.4						

Remarks
Washed with (3) 600 ml H_2O @ pH 2.0

*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	1.653	0.38			0.628		0.628	41.4		13.6
WASH SOLUTION	1.507	0.075			0.113		0.113	7.5		2.5
LEACHED RESIDUE	2151.5	0.036		0.18	0.775		3.873	51.5		83.9
HEAD (CALCULATED)	2151.5	0.07		0.21	1.516		4.614	100.0		100.0
HEAD (ASSAY)		0.07		0.21						
OVERALL Cu RECOVERY								48.9		16.1

Remarks

Screen Analysis Residue

Mesh	(%)

mountain states research & development

Project No. 2482	Date	Test Sample No.	Test
H_2SO_4 TEST LOG SHEET	11/22/82	6-1 20' - 30' Test Sample Weight 2202 g	JS - 13

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids [%]	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	6.6								
Agitation	Hours 0	50	1.9		3.6						
	1	50	2.4 2.0		1.5						
	6	50	2.4 2.0		1.5						
	24	50	3.3 2.0		3.1						
	30	50	2.5 2.0		2.5						
	48	50	2.7						0.15		
Reagent Consumption					11.9						

Remarks
Washed with (3) 600 ml H_2O @ pH 2.0

*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution [%]		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	2.5847	0.62			1.603		1.603	54.2		29.5
WASH SOLUTION	1.4747	0.222			0.327		0.327	11.1		6.0
LEACHED RESIDUE	2189.3	0.047		0.16	1.029		3.503	34.7		64.5
HEAD [CALCULATED]	2189.3	0.14		0.25	2.959		5.433	100.0		100.0
HEAD [ASSAY]		0.12		0.21						
OVERALL Cu RECOVERY								65.3		35.5

Remarks

Screen Analysis Residue

Mesh	[%]

mountain states research & development

Project No. 2482	Date	Test Sample No.	Test
H_2SO_4 TEST LOG SHEET	11/22/82	6-2 30' - 40' Test Sample Weight 2090 g	JS - 14

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	5.0*								
Agitation	Hours 0	50	1.9		3.4						
	1	50	3.2* 1.9		3.8						
	6	50	2.3* 2.05		1.1						
	24	50	3.5* 2.0		4.2						
	30	50	2.5* 2.0		2.7						
	48	50	2.7						0.15		
Reagent Consumption					14.9						

Remarks
Washed with (3) 600 ml H_2O @ pH 2.0

*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	1.6385	0.44			0.721		0.721	17.9		10.8
WASH SOLUTION	1.5390	0.081			0.125		0.125	3.1		1.9
LEACHED RESIDUE	2087.2	0.153		0.28	3.193		5.844	79.0		87.3
HEAD (CALCULATED)	2087.2	0.19		0.32	4.039		6.690	100.0		100.0
HEAD (ASSAY)		0.21		0.34						
OVERALL Cu RECOVERY								21.0		12.7

Remarks

Screen Analysis Residue

Mesh	(%)

mountain states research & development

Project No. 2482	Date 11/22/82	Test Sample No. 6-3 100' - 110'	Test JS - 15
H_2SO_4 TEST LOG SHEET		Test Sample Weight 2108 g	

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	5.5*								
Agitation	Hours 0	50	1.9		3.4						
	1	50	2.8* 2.0		2.3						
	6	50	2.4* 2.0		1.5						
	24	50	3.0* 2.0		3.2						
	30	50	2.4* 2.0		2.5						
	48	50	2.5						0.25		
Reagent Consumption					12.4						

Remarks
Washed with (3) 600 ml H_2O @ pH 2.0

*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	1.7768	0.60			1.066		1.066	38.5		14.5
WASH SOLUTION	1.4377	0.140			0.201		0.201	7.3		2.7
LEACHED RESIDUE	2095.8	0.072		0.29	1.502		6.078	54.2		82.8
HEAD (CALCULATED)	2095.8	0.13		0.35	2.769		7.345	100.0		100.0
HEAD (ASSAY)		0.26		0.38						
OVERALL Cu RECOVERY								45.8		17.2

Remarks

Screen Analysis Residue

Mesh	(%)

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Project No. 2482	Date	Test Sample No.	Test
H_2SO_4 TEST LOG SHEET	11/22/82	6-3 30' - 40' Test Sample Weight 2119 g	JS - 16

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	6.2*								
Agitation	Hours 0	50	2.0		3.6						
	1	50	3.4* 2.0		3.4						
	6	50	2.9* 1.85		3.8						
	24	50	3.6* 2.0		4.3						
	30	50	2.9* 2.0		3.8						
	48	50	3.1						0.1		
Reagent Consumption					16.9						

Remarks
Washed with (3) 600 ml H_2O @ pH 2.0

*pH prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	1.7269	2.26			3.903		3.903	16.0		13.5
WASH SOLUTION	1.4855	0.54			0.802		0.802	3.3		2.8
LEACHED RESIDUE	2155.8	0.91		1.12	19.618		24.145	80.7		83.7
HEAD (CALCULATED)	2155.8	1.13		1.34	24.323		28.85	100.0		100.0
HEAD (ASSAY)		1.06		1.35						
OVERALL Cu RECOVERY								19.3		16.3

Remarks

Screen Analysis Residue

Mesh	(%)

mountain states research & development

Project No. 2482	Date	Test Sample No.	Test
H_2SO_4 TEST LOG SHEET	11/29/82	6-2 100' - 110' Test Sample Weight 2288 g	JS - 17

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	6.5*								
Agitation	Hours 0	50	2.0		5.1						
	1	50	4.4* 1.95		4.3						
	6	50	3.5* 1.9		3.4						
	24	50	3.4* 2.0		3.4						
	30	50	2.7* 1.9		3.4						
	48	50	2.7*						0.14		
Reagent Consumption					19.8						

Remarks Washed with (3) 3 x 700 ml H_2O @ pH 2.0

*Prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	1.685	1.33	0.031		2.241		2.241	52.2		25.7
WASH SOLUTION	1.910	0.286	0.014		0.546		0.546	12.7		6.3
LEACHED RESIDUE	2277.0	0.066		0.26	1.503		5.920	35.1		68.0
HEAD (CALCULATED)	2277.0	0.19		0.38	4.290		8.707	100.0		100.0
~~Head (Assay)~~ HEAD (ASSAY)		0.22		0.33						
OVERALL Cu RECOVERY								64.9		32.0

Remarks

Screen Analysis Residue

Mesh	(%)

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Project No. 2482	Date	Test Sample No.	Test
H_2SO_4 TEST LOG SHEET	11/29/82	5-1-1 10' - 15' Test Sample Weight 515.7	JS - 18

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	5.6*								
Agitation	Hours 0	50	1.9		3.8						
	1	50	2.0								
	6	50	2.1* 1.8		3.1						
	24	50	2.1* 1.8		3.8						
	30	50	1.8								
	48	50	2.0						0.76		
Reagent Consumption					9.2						

Remarks
Washed with (3) 3 x 150 ml H_2O @ pH 2.0

*Prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	0.370	0.037	0.11		0.014		0.014	10.2		1.8
WASH SOLUTION	0.440	0.014	0.019		0.006		0.006	4.3		0.8
LEACHED RESIDUE	515.0	0.023		0.15	0.118		0.773	85.5		97.4
HEAD (CALCULATED)	515.0	0.03		0.15	0.138		0.793	100.0		
HEAD (ASSAY)		0.02		0.06						
OVERALL Cu RECOVERY								14.5		2.6

Remarks

Screen Analysis Residue

Mesh	(%)

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Project No. 2482	Date	Test Sample No.	Test
H_2SO_4 TEST LOG SHEET	11/29/82	5-3-1 60' - 70' Test Sample Weight 2234.0 g	JS - 19

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids [%]	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	4.5*								
Agitation	Hours 0	50	1.9		3.6						
	1	50	2.6* 2.0		2.7						
	6	50	2.4* 2.0		2.7						
	24	50	2.7* 1.9		3.6						
	30	50	2.1* 1.9		1.8						
	48	50	2.2						0.74		
Reagent Consumption					12.9						

Remarks
Washed with (3) 3 x 700 ml H_2O @ pH 2.0
*Prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution [%]		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	1.580	1.03	<0.01		1.627		1.627	44.2		21.5
WASH SOLUTION	2.060	0.311	<0.01		0.641		0.641	17.4		8.5
LEACHED RESIDUE	2210.0	0.064		0.24	1.414		5.304	38.4		70.0
HEAD [CALCULATED]	2210.0	0.17		0.34	3.682		7.572	100.0		100.0
HEAD [ASSAY]		0.17		0.33						
OVERALL Cu RECOVERY								61.6		30.0

Remarks

Screen Analysis Residue

Mesh	[%]

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Project No. 2482	Date	Test Sample No.	Test
H_2SO_4 TEST LOG SHEET	11/29/82	5-3-1 30' - 40' Test Sample Weight 3067.3 g	JS - 20

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	5.7*								
Agitation	Hours 0	50	1.90		3.8						
	1	50	2.6 2.0		2.6						
	6	50	2.2* 1.85		2.6						
	24	50	2.3* 1.9		2.6						
	30	50	1.9		1.3						
	48	50	2.0						1.1		
Reagent Consumption					10.7						

Remarks
Washed with (3) 3 x 1000 ml H_2O @ pH 2.0
*Prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	2.160	0.82	0.02		1.771		1.771	45.8		14.7
WASH SOLUTION	3.015	0.171			0.516		0.516	13.3		4.3
LEACHED RESIDUE	3040.0	0.052		0.32	1.581		9.728	40.9		81.0
HEAD (CALCULATED)	3040.0	0.13		0.40	3.868		12.015	100.0		
HEAD (ASSAY)		0.17		0.40						
OVERALL Cu RECOVERY								59.1		19.0

Remarks

Screen Analysis Residue

Mesh	(%)

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Project No. 2482	Date 11/29/82	Test Sample No. 5-5-1 20' - 30'	Test
H_2SO_4 TEST LOG SHEET		Test Sample Weight 2031.8	JS - 21

CONDITIONS AND REAGENTS

Point of Addition	Conditions				Reagent Addition				Solution Strength		
	Time Mins.	Solids (%)	pH	Temp.	POUNDS / TON				GRAMS/LITER		
					H_2SO_4				H_2SO_4		
Initial	0	50	3.8*								
Agitation	Hours 0	50	2.0		2.9						
	1	50	2.4* 2.0		1.9						
	6	50	2.2* 2.0		1.9						
	24	50	2.5* 1.9		2.9						
	30	50	2.1* 1.9		2.9						
	48	50	2.1						0.44		
Reagent Consumption					11.6						

Remarks

Washed with (3) 3 x 600 ml H_2O @ pH 2.0

*Prior to H_2SO_4 addition

METALLURGICAL RESULTS

Product	GRAMS or LITERS	Assays g/l or %			Contents grams			Distribution (%)		
		A.S. Cu	Fe^{+++}	Total Cu	A.S. Cu		Total Cu	A.S. Cu		Total Cu
PREGNANT SOLUTION	1.260	0.38	0.36		0.479		0.479	18.4		8.6
WASH SOLUTION	1.580	0.15	0.117		0.237		0.237	9.1		4.3
LEACHED RESIDUE	2024.0	0.093		0.24	1.882		4.858	72.5		87.1
HEAD (CALCULATED)	2024.0	0.13		0.28	2.598		5.574	100.0		100.0
HEAD (ASSAY)		0.13		0.26						
OVERALL Cu RECOVERY								27.5		12.9

Remarks

Screen Analysis Residue

Mesh	(%)