



CONTACT INFORMATION
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U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
STORM WATER NOTICE OF INTENT CENTER



AZR05B690

Dear Operator:

03/13/2002

The EPA has processed your Notice of Intent (NOI) application for the facility noted below. **This facility is authorized to discharge storm water associated with multi-sector activity under the terms and conditions imposed by the EPA's NPDES Storm Water Multi-Sector Permit.** The facility permit number is listed above and the active date of permit coverage is 2/11/2002.

EPA's multi-sector permit requires certain pollution prevention and control measures, possible monitoring and reporting, and annual inspections. Among the conditions and requirements of this permit, you must prepare and implement a pollution prevention plan (PPP) that is tailored to your industrial site. You may also be required to submit monitoring data for your facility's storm water discharges. As a facility authorized to discharge under this storm water multi-sector permit, all terms and conditions must be complied with to maintain coverage and avoid possible penalties.

FACILITY:

ZONIA MINE
P.O. BOX 649
YARNELL, AZ
85362

OPERATOR:

ARIMETCO INC
2700 E EXECUTIVE DRIVE
TUCSON, AZ
85706

You can obtain a copy of the EPA's storm water multi-sector permit, which contains the terms and conditions to which you are now held accountable, from the following website: <http://www.epa.gov/earth1r6/6en/w/sw/msgp2000.pdf>. If you have general questions concerning the storm water program, please call the EPA Region 09 contact: **Eugene Bromley, (415) 744-1906**. If you have questions about this form, contact the Notice of Intent Center at (301) 495-4145.

January 4, 1995

Michael D. Greenslade P.E.
Mining APP Unit
Water Quality Division
Arizona Department of Environmental Quality
3033 North Central Ave.
Phoenix, AZ 85012

Sir,

In response to your letter of December 23, 1994 requesting additional information to complete the technical review of the Zonia Mine APP application, the following documents are provided:

- 1) Complete set of non-proprietary design plans as required for descriptive/permitting purposes.
- 2) APP Drawing List, revised 12/28/94.
- 3) Quality Assurance/soil liners & asphalt liners.
- 4) Emergency Response Plan
- 5) Surface Water Sample Points Map.
- 6) Water Quality Monitoring Plan.

The facility design plan(s) referred to in your letter are synonymous with the design drawings as submitted. The plan 65-65-GA-54, also listed was incorporated into 65-65-GA-53 as listed in the technical review appendix and the revised drawing list.

As you will see from the enclosed plans, additional areas have been included in the design for a No. 6 leach basin and a No. 4 waste rock dump. The leach basin is adjacent to the No. 5 and incorporates the same BADCT measures for design. The 100 year/24 hour precipitation event is contained within a primary and secondary pond system. The primary pond will be doubly lined with a 1 foot minimum thickness clay under 60 mil HDPE synthetic liner. The clay liner once compacted will meet a 1×10^{-7} cm/sec coefficient of permeability standard. The leach basin or pad will also have a 60 mil HDPE liner over a 12 inch minimum, compacted native soil subbase. Details are provided on the plans.

The No. 4 rock dump will provide an alternate site to place overburden and below cutoff rock from the open pit mine. The site is over low permeability granitic bedrock. Only material which has been determined to have negligible acid generation potential will be placed in this area. Yearly monitoring for compliance verification is proposed using laboratory predictive testing of the rock.

Since we had hoped to begin construction of the plant at Zonia in February 1995, I greatly appreciate your efforts to complete the review and formulate a new permit. I will telephone in about a week to see if any design clarifications are needed.

Sincerely,

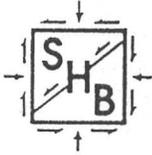


Harrison Matson
Chief Geologist

EVALAST 100

Table 1 - Polymer Modified Asphalt Specifications (hot climate) :

TEST DESCRIPTION ORIGINAL ASPHALT	ASTM METHOD	SPECIFICATION LIMITS	
		MIN	MAX
Penetration, 39.2f (200g/60sec), dmm	D5	15	
Penetration, 77f (100g/5sec), dmm	D5	40	90
Softening point, f	D36	190	
Flash point, 'f	D92	450	
Ductility, 39.2, f (5cm/min), cm	D113	30	
Ductility, 77f (5cm/min), cm	D113	100	
Viscosity, 275f, cst	D2170	1000	
Recovery, 39.2f, %	D113 MOD	60	
Solubility in Tricholrethylene, %	D2042	99	
AGED ASPHALT (RTFO)			
Retained Penetration, 77f, %	D5	60	
Viscosity Ratio, 275f, %	D2170		1.5
Softening Point, f	D36	165	
Ductility, 39.2f (5cm/min), cm	D113	20	



SHB AGRA, INC.
Engineering & Environmental Services

1870 West Prince Road
Suite 66
Tucson, Arizona
U.S.A. 85705
Phone: 602-792-2779
Fax: 602-888-0014

April 15, 1993

Arimetco International Inc.
6245 East Broadway, Suite 350
Tucson, Arizona 85711

SHB Job No. C93-6522

Attention: Mr. Harrison Matson

Re: **Misc. Testing**
Tucson, Arizona
SHB Lab No. 2054

Gentlemen:

Transmitted herewith are copies of laboratory test results performed on a sample recovered from the referenced project. The permeability test sample was remolded to 95% of maximum density as determined by Method ASTM D698-A (118.0 pcf).

Should you have any questions, regarding these results, we would be pleased to discuss them with you.

Respectfully submitted,
SHB AGRA, Inc.

By

Tom L. Romero
Manager Construction Services

Copies: Addressee (2)

**SHB AGRA INC.
ENGINEERING & ENVIRONMENTAL SERVICES**

PROJECT: ARIMETCO INTERNATIONAL
SAMPLE: CLAY FOR DAM CORE

JOB NO. C93-6522
W.O. NO. 1
LAB NO. 2054
DATE 3/25/93

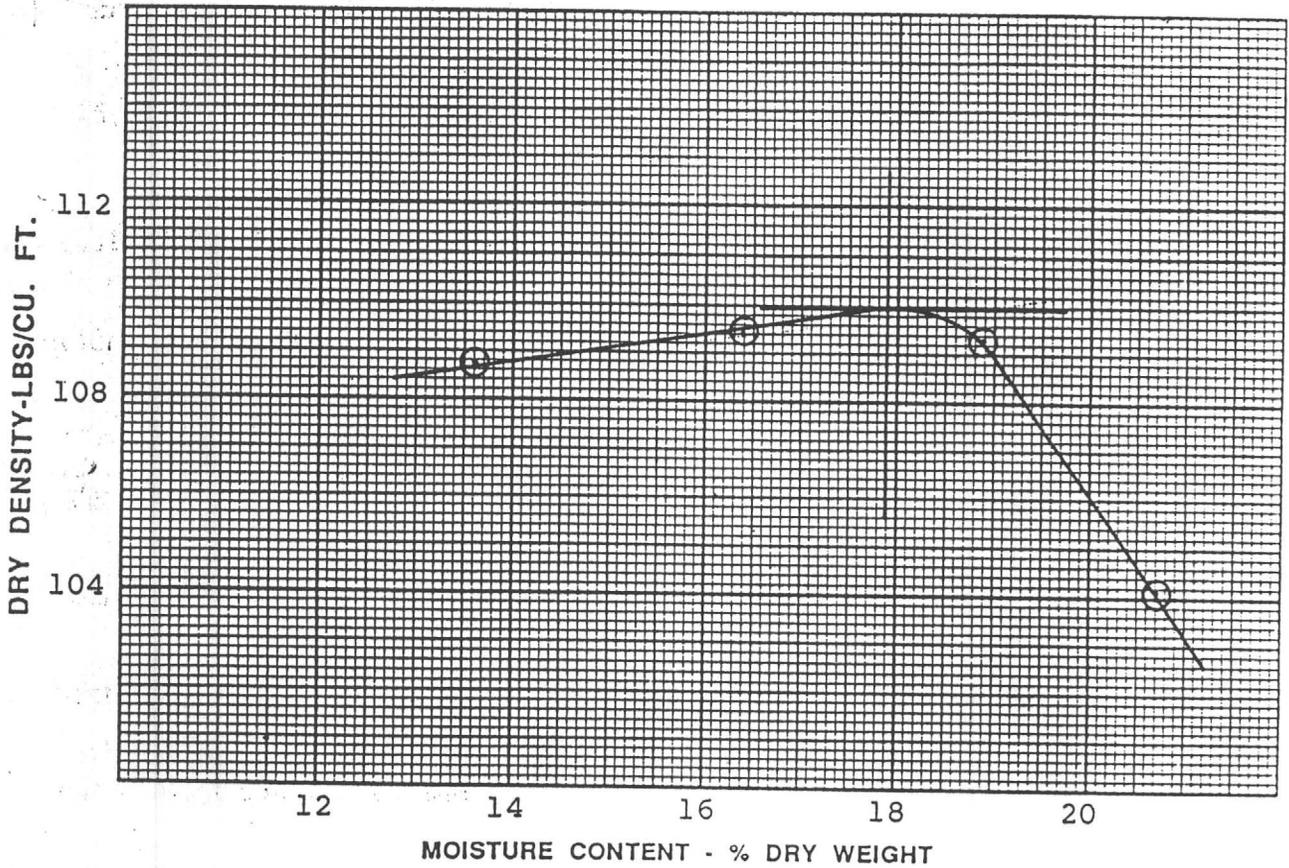
PERMEABILITY TEST (EM1110-2-1906/SW846-9100-1986)
FLEXIBLE WALL PERMEABILITY (ASTM D5084-90)

WET DENSITY	129.7 pcf
DRY DENSITY	112.2 pcf
VOLUME	329.094 cc
INITIAL MOISTURE	17.9%
MOISTURE @ SATURATION	15.6%

HEAD inches	PSI	Q cc	TIME sec.	K cm/sec	K ft/yr
19.76	32	10	109800	1.55E-08	1.60E-02
19.76	32	10	139500	1.22E-08	1.26E-02
19.86	32	6	85500	1.19E-08	1.23E-02
19.90	32	4	30600	2.22E-08	2.30E-02

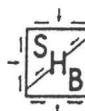
SUMMARY OF MOISTURE DENSITY RELATIONSHIP TESTS

PROJECT Misc. Testing JOB NO. C93-6522



SOURCE	OPTIMUM MOISTURE CONTENT % DRY WT.	MAXIMUM DRY DENSITY LBS/CU. FT.	TEST DESIGNATION	TEST METHOD	LAB NO.
Clay for Dam Core	17.9	118.0	ASTM-698	A	2054

MOISTURE-DENSITY RELATIONSHIP TEST METHOD DATA								
Standard Proctor (ASTM D698)								
METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS./CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	3	25	5.5 lbs	12"	12,375
B	-#4	4"	4.58"	3	25	5.5 lbs	12"	12,317
C	-#4	6"	4.58"	3	56	5.5 lbs	12"	12,317
Modified Proctor (ASTM D1557)								
METHOD	MATERIAL	MOLD		NO. OF LAYERS	BLOWS PER LAYER	HAMMER WEIGHT	HEIGHT OF FALL	COMPACTIVE EFFORT FT. LBS./CU. FT.
		DIAMETER	HEIGHT					
A	-#4	4"	4.58"	5	25	10.0 lbs	18"	56,250
B	-#8	4"	4.58"	5	25	10.0 lbs	18"	55,986
C	-#4	6"	4.58"	5	56	10.0 lbs	18"	55,986



SERGENT, HAUSKINS & BECKWITH

CONSULTING GEOTECHNICAL ENGINEERS
PHOENIX • TUCSON
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ARIMETCO
INTERNATIONAL INC.

March 8, 1995

Mr. Michael Greenslade
Mining A.P.P. Unit
Arizona Department of Environmental Quality
3033 N. Central Ave.
Phoenix, AZ 85012

Dear Mr. Greenslade,

Enclosed is a sample of polymer asphalt, Neste 100, which is of the type proposed for use as a liner at the Zonia Mine.

Since you may not be familiar with this type of liner, a representative of 200 mil material is provided for your inspection.

Sincerely,

Harrison Matson
Chief Geologist

Enclosure(s)

lap

Synthetic Liner Construction/Quality Control Specifications

HDPE liner is supplied in 22.5' wide rolls with seams to be double welded and pressure tested. In irregular pad liner areas where patches are made or holes are plugged, fusion/extrusion welds will be made and vacuum tested. The liner weld testing results will be field documented showing the date, type of test, number of leaks repaired and accompanied by a sketch identifying seam locations.

Following in this section are the liner testing protocols and manufacturer's engineering specifications for the type and quality of synthetic liner to be used in the construction.

Testing Protocol of Liner Welds

An outline of testing protocols is listed on the following page.

Arimetco Inc.

SYNTHETIC LINER

Synthetic Liner Construction/Quality Control Specifications

A single synthetic 0 mil High Density Polyethylene (HDPE) pad liner system will be constructed in order to prevent the diffusion of solution into the compacted soil liner and to optimize solution recovery. In addition to the 0 mil HDPE liner covering the greater pad area, liner coverage will be extended to the exposed, non-collecting containment berm on the pad's perimeter and anchored into the berm's outward shoulder. HDPE liner is specifically chosen for superior puncture resistance, acid/ultra-violet resistance, relative ease of construction and extended period of warranted performance.

HDPE liner is supplied in 22.5' wide rolls with seams to be double welded and pressure tested. In irregular pad liner areas where patches are made or holes are plugged, fusion/extrusion welds will be made and vacuum tested. The liner weld testing results will be field documented showing the date, type of test, number of leaks repaired and accompanied by a sketch identifying seam locations.

Following in this section are the liner testing protocols and manufacturer's engineering specifications for the type and quality of synthetic liner to be used in the construction

4.2 Testing Protocol of Liner Welds

An outline of testing protocols is listed on the following page.

Testing Protocol of Liner Welds

Developed in accordance with recommendations in Poly-Flex reference manual.

1. Air Pressure Test: (for Double Fusion Seam)
 - a. One end of seam to be tested is sealed.
 - b. Needle is inserted through sealed end of channel.
 - c. Channel is charged with air to ensure unobstructed passage through channel.
 - d. Opposite end of channel is sealed.
 - e. Air pump energized to a pressure of 20-25 psi. Valve is closed.
 - f. Passing test: Pressure is sustained for 5 minutes.
Failing test: Pressure loss exceeds 4 psi, or does not stabilize.
 - g. Passing test: Remove needle and seal open end of channel.
Failing test: Locate faulty area, repair, and retest.
 - h. Note results on liner weld test chart.
2. Vacuum Box Test: (for extrusion welds and fusion welds unacceptable for air test)
 - a. Excess overlap trimmed away.
 - b. Clean windows, gasket surfaces, and check for leaks on vacuum box.
 - c. Wet area to be tested with soapy solution to the same size as vacuum box.
 - d. Place box over wetted area and compress.
 - e. Close bleed valve and open vacuum valve.
 - f. Ensure that a leak-tight seal is created.
 - g. Examine geomembrane for a period of approximately 15 seconds through viewing window for presence of soap bubbles.
 - h. If no bubbles occur in approximately 15 seconds, close vacuum valve and open bleed valve, move box to next adjoining area with minimum overlap of 3 inches and repeat.

- i. All areas where soap bubbles appear shall be marked, repaired, and retested.
3. The following procedures shall apply to locations where seams cannot be non-destructively tested, as determined by the inspector:
- a. All hot shoe welds will be visually inspected in entirety for proper overlap, proper rippling, and proper squeeze-out to ensure uniformity and completeness.
 - b. All extrusion welds shall be visually checked for adhesiveness by pulling at edges of weld with hook-knife or similar instrument.
 - c. All welds (extrusion or hot shoe) shall be visually inspected for melt-throughs, and pin-holes.
 - d. Any defective weld will be properly repaired and re-inspected.



December 01, 1994

Mr. Michael D. Greenslade, P.E.
Mining APP Unit
Water Quality Division
Arizona Department of Environmental Quality
3033 N. Central Avenue
Phoenix, AZ 85710

Sir:

As per your letter of November 8, 1994, enclosed is the additional information necessary to process the Zonia Mine Aquifer Protection Permit Application. The enclosures should be inserted into the application as the technical review appendix.

I trust the draft APP will be forthcoming. Thank you for your help and cooperation.

Sincerely,

A handwritten signature in cursive script that reads 'Harrison Matson'. The signature is written in dark ink and is positioned above the printed name and title.

Harrison Matson
Chief Geologist

Zonia Mine Aquifer Protection Permit Application
Technical Review Appendix



Arimetco, Inc.
900 N. Finance Center Dr.
Tucson, AZ 85710

Zonia Mine Aquifer Protection Permit Application
Technical Review Appendix

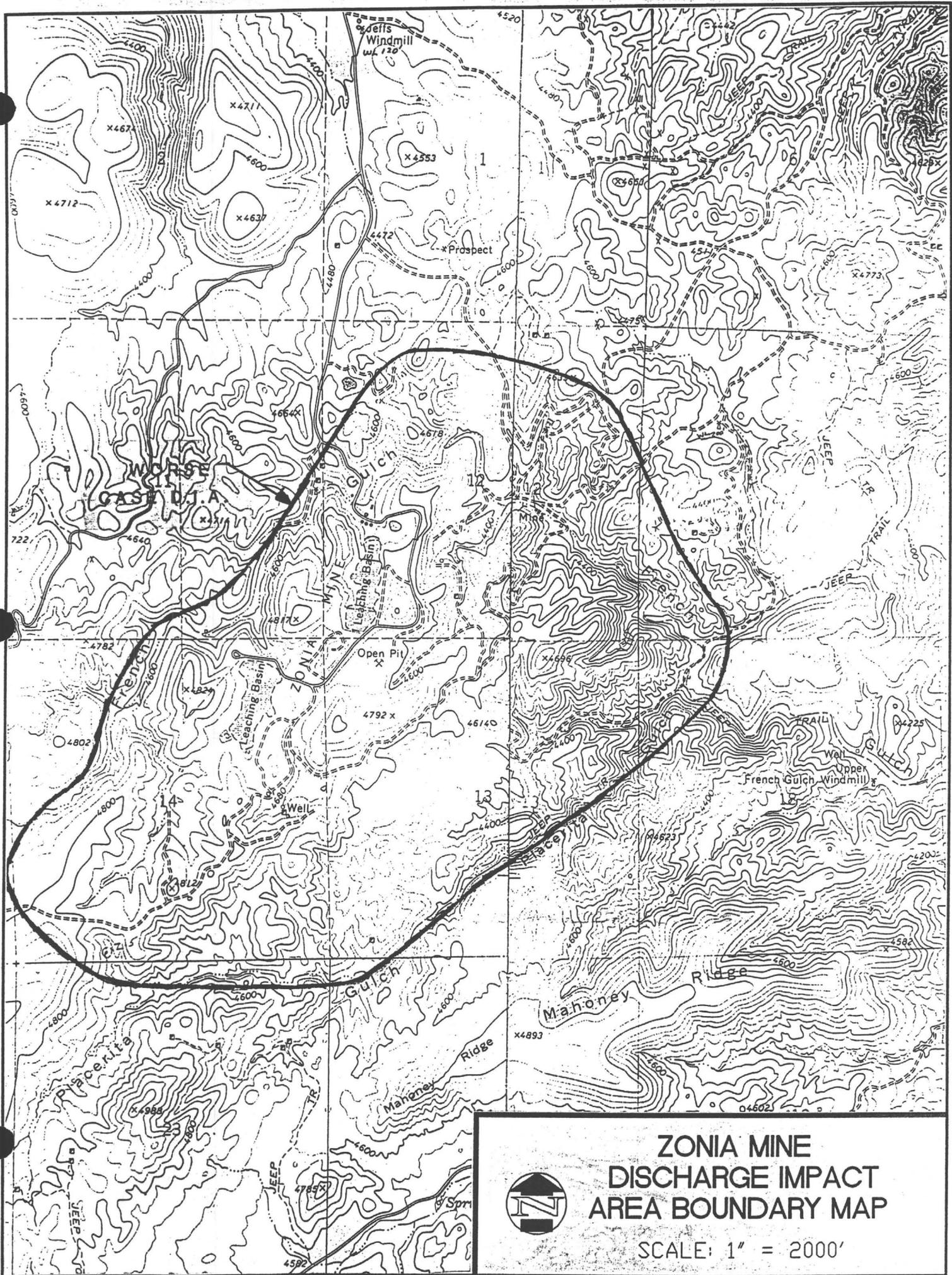
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Map Pocket

Land Status Map	ZEE009
100 Year Flood Plain Map	ZEE007

List of design plans submitted with appendix

65-60-GA-31	Leach Basin 3	General/Arrangement
65-60-GA-32	Leach Basin 3	Sections & Details
65-65-GA-53	Leach Basin 5	Secondary Pond Plan & Details combined as one drawing with 65-65-GA-54
65-44-GA-01	Fueling Station	General/Arrangement
65-46-GA-01	Acid Unloading Station	General/Arrangement
65-65-GA-01	Barren Solution Pond	General/Arrangement
65-65-GA-12	Raffinate Pond	General/Arrangement



WORSE
CASE D.J.A.

ZONIA
MINE

French Gulch

Leaching Basin

Open Pit

French Gulch

Mahoney
Ridge



ZONIA MINE DISCHARGE IMPACT AREA BOUNDARY MAP

SCALE: 1" = 2000'

ZONIA MINE
WELL CONSTRUCTION DATA

Page 1

LOCATION	NAME	DATE DRILLED/ RECONSTRUCTED	TOTAL DEPTH	CASING TYPE/SIZE	FROM	TO
11-4- 14 dab	Old Mill	1911	120'	13" Steel Perforations	0 est. 80	120(?) 120
11-4- 13 abc	Z605	1975/1993	300'	7" Steel 4.5" PVC Perforations	0 0 260	20 288 288
11-4- 12 dcc	Z602	1974/1993	955'	7" Steel 4.5" PVC Open Hole	0 0 192	20 192 900±
11-4- 12 dba-1	Cabin	1911 (?)	100	6" Steel Perforations	0 est. 120	100 (?) 100
11-4- 12 dba-2	Z601	1975	1528'	4" Steel Open Hole	0 969	969 1500
11-4- 12 ccd-2	Z603	1975	1113'	4" Steel Open Hole	0 665	665 (?) 1100
11-4- 12 ccd-1	Cuprite	1975 (?)	874'	8" Steel Open Hole Intersects +200' Horizontal UG development	0 250	250 874

ZONIA MINE
WELL CONSTRUCTION DATA

Page 2

LOCATION	NAME	DATE DRILLED/ RECONSTRUCTED	TOTAL DEPTH	CASING TYPE/SIZE	FROM	TO
11-4- 12 ccc	Z607	1975	1044'	4" Steel Open Hole	0 485	485 (?) 1044
11-4- 12 cba	Instrument Shack	1971	140'	10" Steel Perforations	0 est. 40	140 140
11-4- 14 aba	A-16	1993	400'	8" Steel 4.5" PVC Perforations	0 0 240	20 280 280
11-4- 12 cab	A-14	1993	315'	8" Steel 4" PVC Perforations	0 0 260	20 300 300
11-4- 12 cca	A-8	1/1993 7/1993	600'	Open Hole Abandoned w/ clay & Cuttings	0 0	600 600

Demonstration of Technical Capability

The project design was handled jointly by Arimetco Inc. staff engineers and geologists in cooperation with Western States Engineering and Construction, Inc.. Western States is an Arizona based, registered, consulting engineering firm with a staff of approximately 40 experienced engineers. The Arimetco engineering department staff has been responsible for the design, construction and operation of three separate solvent extraction/electrowinning plants for the recovery of copper by oxide leaching. Aside from the hydrometallurgical recovery facilities designed and constructed, the staff was also responsible for all mine planning and development duties including metallurgical testing, leach pad design and environmental analysis.

Arimetco currently operates and manages the operations of five mine/plant facilities. These are the Yerington, Nevada, open pit copper mine and SX-EW Plant, the Johnson Camp, Arizona, open pit copper mine and SX-EW plant, the Emerald Isle, Arizona, open pit copper mine and SX-EW plant, the Whitecliff, Arizona, natural diatomite mine, and air classification plant, and the Andacaba, Bolivia, underground lead/zinc/silver mine and sulphide concentrator. All properties are supervised by experienced mining engineers.

Financial Assurance Addendum

The total estimated cost of construction including mining equipment required, service facilities and complete plant and initial leach pad construction is \$14,455,000. Direct operating cost is expected to be approximately \$2.25 per ton of ore or about .60 cents per pound of copper produced. Approximately \$124,000 per month is to be paid in wages in Yavapai County from the proposed operation. Several pages of miscellaneous budget data are enclosed for verification.

The cost of closure and post closure care are included in the final reclamation cost estimate. Miscellaneous costs which may have been overlooked for the present study are expected to be fully covered by the salvage value of the equipment and plant at closure. A minimal salvage value of the equipment should be about \$200,000.

The post closure care portion of the reclamation estimate consists of quarterly water quality monitoring for a period of five years. The samples are to be collected and results reviewed by a geologist/hydrologist. The hydrologist will report on the effectiveness of the control systems in place at the closed facility and if necessary recommend improvements. The monitoring will continue until the repeatability of results proves the sampling to be unnecessary and approval is received from A.D.E.Q. for cessation of monitoring.

ZONIA MINE

CAPITAL REQUIREMENTS

Acquisition Pre-Development, Environmental Remediation		\$ 1,742,000
Plant	SX/EW	\$ 3,575,000
	Power & Water	\$ 400,000
	Reagents	\$ 793,000
Leach Pads & Ponds		\$2,337,000
General Engineering & Construction		\$ 587,000
Mining	Equipment	\$ 4,141,000
	Pre-production	\$ 880,000
=====		
Subtotal		\$14,113,000
Contingency		\$ 342,000
Total		\$14,455,000

Zonia Mine

Key Statistics

Mining rate	26,500 tons/day
Plant Production	50,000 lbs/day

Expected Recoveries

<u>Year</u>	<u>% TCu</u>
1	45
2	15
3	10

Production Schedule

<u>Year</u>	<u>Ore (K tons)</u>	<u>Ore Grade</u>	<u>Waste (K tons)</u>	<u>Ratio</u>
1	4650	0.349	2380	0.51
2	4250	0.350	2650	0.62
3	3375	0.347	3525	1.04
4	3855	0.338	3045	0.79
5	4135	0.323	2765	0.67
6	3815	0.339	1435	0.38
7	3930	0.331	1326	0.34
8	4070	0.321	1180	0.29
9	4230	0.308	1020	0.24
10	3875	0.337	1369	0.35
11	3985	0.327	1199	0.30
12	3083	0.321	475	0.15

PROJECT NAME: Zonia Mine, Prescott, Az
PROJECT MANAGER/COORDINATOR A. J. Smith
PROJECT STATUS: Pre-Development
Date of Report: 7/1/94 8:50 AM

MODEL ASSUMPTIONS

Mine:

- 3 shift/5 day per week operation
- Total of 6.9 million tons mined per year
- 5 - 85 ton trucks/1 - 992 Loader at 95% availability
- Initially, 5 trucks would be purchased with 1 loader
- A second loader would be added in the second year of mining
- An additional truck would be purchased in the second and third years, and one every 3 years after that
- Ultimately, a 7-truck 2-loader fleet operational fleet would be maintained to ensure 95% availability
- 3 ancillary operators per shift
- 9 total mine personnel per shift plus a foreman

Personnel:

- Mine: 27 operators
 - 1 Foreman
- Leach Pad: 6 pad operators
- SX/EW: 8 SX Plant operators
 - 6 EW Plant operators
 - 2 SX/EW General operators
 - 1 SX/EW Foreman
- Maintenance: 9 Mechanics - 3 per shift (incl the Lead Man)
 - 3 Oilers (1 per shift)
 - 2 Electricians
 - 1 Maintenance Foreman
- Expl/Devel: 1 Geologist
 - 1 Surveyor
- Admin: 1 General Manager
 - 1 Secretary
 - 1 Warehouseman
- Total: 66 hourly
 - 5 salaried

November 28, 1994

Mr. Mike Rozycki, Director
Planning & Zoning Department
Yavapai County
255 E. Gurley Street
Prescott, AZ 86301

Sir:

I am writing to provide advance notice that Arimetco, Inc. has submitted an application with the Arizona Department of Environmental Quality to construct a new copper mining and processing facility in Yavapai County. The facility is to be located at the site of the Zonia Mine in the Walnut Grove Mining District about six miles southeast of Kirkland Junction.

As you may already know, Arimetco first entered the property in 1993 and began a water quality remediation program which implemented measures to immediately control historic discharge problems. These ongoing efforts have been successful in cleaning up a chronic problem.

The new facility will be a zero discharge design utilizing best available pollution control technology. High purity copper will be produced which will be shipped directly to the consumer without need of smelting. The process is a closed cycle, solvent extraction/electrowinning method of copper production from oxide ores following heap leaching.

The new facility is expected to employ up to seventy people and produce 50,000 pounds per day of copper. Construction will begin once permits are secured, possibly in early spring of 1995.

The principal components of the facility are:

- 1) Five to seven million ton per year open pit mine
- 2) Four ore heaps which will be fully contained with synthetic liners
- 3) Three overburden stockpiles containing non-reactive rock
- 4) Six, doubly lined, primary solution containment ponds

Page two

- 5) A 5,000 gpm solvent extraction and electrowinning plant with full secondary containment and leak detection monitors.
- 6) Fuel and Reagent offloading and storage areas with full secondary containment.
- 7) Truck and equipment repair shop, two bay with aboveground oil recycling storage.

The open pit mine and plantsite are located entirely on private land, which encompasses over 700 acres. The ground is held under a 1993 purchase option from the Zonia Company of Prescott, Arizona.

It is understood that a facility of this type does not come under the jurisdiction of the County Planning and Zoning Department, but that notification is required. Should you need further information on the proposed Arimetco project at Zonia, we would be pleased to provide it. A copy of the Air Quality Permit application will be forwarded to your department when completed.

Sincerely,



Harrison Matson
Chief Geologist

P 899 973 494



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No Insurance Coverage Provided
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PS Form 3800, June 1990

Sent to	
YAVAPAI CO PLANNING & ZONING	
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255 E. GUYLEY	
P.O., State & ZIP Code	
PRESCOTT AZ 86301	
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Return Receipt Showing to Whom, Date, & Address of Delivery	
TOTAL Postage & Fees	\$
Postmark or Date	

100 Year Flood Plain Assessment

An additional copy of ZEE-007, the 100 year flood plan map is appended. This map was derived by a combination of fieldwork, inspection of aerial photographs and calculation of runoff using SCS curves. Due to the relatively high relief in the Zonia mine area, only the channel of French Gulch lies within the Flood Plain. As the channel constricts or widens, the flood plain does the same.

Two monitor wells may at some time, be affected by flooding in French Gulch. The Z601 and cabin wells are located on terraces along the channel. The relatively low level of risk associated with temporary flooding at these sites does not merit preventative action other than normal surface seal construction.

The only facility component which could be adversely affected by location adjacent to the flood plain is the raffinate pond below the plant. Precautions which will be taken to prevent damage to this structure include channel deepening, widening and installation of a concrete, erosion control wall. This erosion control/scour protection wall will be installed on the south bank of French Gulch, along the entire length of the channel where it parallels the pond.

Previously existing PLS solution piping which was located within the French Gulch flood plain has been removed. All pipelines which carry process solutions will be located outside of, or above the maximum limit of the flood plain.

Discharge Impact Area Map

The appended map showing the worst case discharge impact area boundary was derived from data collected and empirical observations performed during the course of the hydrogeologic investigation conducted on the property in 1993. The results of that evaluation are detailed in the study submitted to A.D.E.Q. in November of that year titled Report on the Hydrogeologic Conditions at the Zonia Mine, Yavapai Co., AZ by Harrison Matson. The graphs on pages 54 to 58 specifically deal with the concentration vs. distance from source issue. A 6,000' to 7,000' distance along the ground water flow path was found to attenuate metal concentrations to background levels. The boundary shown reflects this distance as modified by the actual groundwater flow directions at the site.

Asphalt Membrane Liners

The existing leach basins at Zonia were originally prepared for use by installation of an asphalt membrane type liner system. This system has remained an effective containment method over time as evidenced by groundwater monitoring immediately adjacent to the basins.

A similar asphalt membrane system is proposed as an alternate construction method for the secondary liner in new applications. The preferred method submitted with plans for leach pads, calls for a 12 inch compacted native soil liner under the primary synthetic HDPE liner. However, the lack of abundant on-site clay soil and local steep slope site conditions may at times necessitate an alternate method for both economic and engineering reasons. Use of an asphalt membrane beneath the primary synthetic liner will more than meet B.A.D.C.T. standards in that the asphalt liner when used alone, has been demonstrated to be an effective containment method.

Several pages from Asphalt in Hydraulic Structures follow which provide general information on acceptable construction practices. Any new asphalt membranes installed will be placed using manufacturers recommended application rates and standard industry construction practices.

C. Buried Asphalt Membrane

more properly asphalts blown with or without chemical







AQUIFIER PROTECTION PERMIT APPLICATION
ZONIA MINE
YAVAPAI COUNTY, ARIZONA



Arimetco, Inc.
950 N. Finance Center Drive, Suite 180
Tucson, Arizona 85710

Zonia Mine Aquifer Protection Permit Application

Facility Data

Name: Zonia Mine

Date Facility Began: 1966

Expected Life of Facility: 15 - 20 Years

Mailing Address of Facility: Box 649, Yarnell, Arizona 85362

Phone Number: (602) 427-3564

County: Yavapai

Facility Location: Section 12 (all), Section 14 (all), NW 1/4
Section 13, SE 1/4 Section 11, T11N, R4W,
G&SRB&M

Latitude: N 34 19'00" to N 34 17'20"

Longitude: W 112 37'10" to W 112 38'50"

Facility Contact Person: Harrison Matson
Chief Geologist
Arimetco, Inc.
(602) 721-1505

Applicant Information

Arimetco, Inc.
950 N. Finance Center Dr., #180
Tucson, Arizona 85710
Phone: (602) 721-1505
Fax: (602) 290-4276

Owner information

The Zonia Company
212 S. Marina Street
Prescott, Arizona 86303
Phone: (602) 778-2101

Operator Information

Same as applicant

Existing Permits

U.S. Corps of Engineers, Section 404
Nationwide Permit, dated March 23, 1993

Nature of Facility

The Zonia mine is a previously closed oxide copper mine with heap leach, in-situ leach and cement copper recovery components. The facility was in operation from 1966 to 1975 after which only recirculation of leach solutions for containment reasons was practiced. Containment of leach solution has, in the past, been allegedly inadequate. The proposed activities at the Zonia mine, once complete, are intended to fully contain all discharges.

Arimetco, Inc., which is not a responsible party for past discharges, has obtained a lease/option on the property from the Zonia Company. It is Arimetco's intention to re-open the mine and build a new 50,000 lb/day solvent extraction/electrowinning copper production facility. Concurrent with the design and construction of such a new facility, a remediation program will be conducted to assure that a zero discharge operation can be maintained both during and after mining operations have ceased. An application for a temporary Aquifer Protection Permit was made to ADEQ on September 6, 1993 for both the pollution control aspects of the project and the proposed copper production facility. A copy of the proposed remediation plan was included with that application. The purpose of this individual APP Permit Application is to more fully explain the commercial components of the facility and document the plans to achieve zero discharge.

Characterization of Discharge

Existing Facility Components

1) Leach Pads. There are three principal oxide copper heap leach pads existing at the Zonia mine: The original numbering system was obscure so the heaps were reassigned numbers 1-3 with #1 the farthest north, #2 next in line to the south, and #3, the largest one to the south. These heaps are called leach basins at Zonia because they were built to fill canyon basin areas and unlike most leach heaps in use today, they were built with internal dams to store solution. The common practice now is to build free draining heaps which report to an external pond. The leach basins have piping which drains the internal solution storage to the toe. Piping which protrudes from the toe of the leach basins has been the source of much of the uncontrolled discharges from the mine in the past. Valves were installed but are ineffective because the solution simply builds up in the heap after precipitation events and eventually overtops the internal dams. External storage to allow an attenuation of solution volume through evaporation is needed for a reliable, low maintenance solution control system. This external storage is described under the proposed facility design.

A representative analysis of solution discharge from leach basin #1 and #3 was attached to the temporary permit application.

Several photographs are included with the temporary APP application showing construction of leach basin #1 and leach basin #3. The leach basins were reported to have been built by clearing of the canyons and compacting the native soil subbase to

90-95% standard proctor. A spray coating of MC 250 liquid asphalt was then applied as a hot finish seal. In some cases, a three-inch mixed in place soil asphalt layer was also installed as a compacted liner component. Unfortunately only sketchy data is available to verify liner installation. Photographs taken during construction clearly show the asphalt liner being installed at LB #3 and to a lesser extent LB #1. No data are available for LB #2, the smallest of the leach basins.

Liner integrity can only be proven by the use of groundwater monitoring stations strategically located down gradient from the leach basins. Testing to date confirms liner integrity of LB #1 and LB #3. These data were discussed in a report previously submitted titled Hydrogeologic conditions at the Zonia Mine Yavapai Co., Arizona.

Leach Basin #1 will be utilized to complete the leaching cycle of ore previously stacked on the pad. A new leach solution distribution system will be installed. Irrigation within weakly acidified (10gpl) sulfuric acid solution will then commence at a rate of about .005 gallons per minute per square foot of surface area or about 2000 gpm total flow. Collection of solution will be at the newly constructed No. 1 primary containment pond described in the temporary APP application. The solution may then be either sent to the SX/EW plant or to the barren pond for application and upgrading at other leach pad sites.

Leach Basin #3 will have existing ore placed under leach but will also be used to leach freshly mined ore. Liner integrity will be monitored by sampling at the nearby A16 well. Some of

the ore placed by the previous operator has overlapped the outside limits of the existing asphalt liner. Rather than attempting to excavate and probably destroy the liner edge, a new synthetic liner will be installed along the margins of the #3 LB and will extend toward the center, assuring at least 100' overlap of the new and existing liners. Sixty mil HDPE or better will be used. The base of the leach pad slopes at least five percent away from these areas which will prevent migration of fluid outside of the lined areas. Solution from Leach Basin 3 will report to the #3 LB primary containment pond. It will then be transferred by pumping to the new SX/EW plant. In order to assist with solution balance and increase grade, a portion of the flow might be recycled to the heap. Total flow from LB #3 could reach a maximum of 5000 gpm.

Leach Basin #2 will not be used as a leaching site due to the unavailability of data concerning liner construction. The site will be used for an equipment storage yard and truck shop area as discussed in a separate section of the application.

2) In situ Areas. Two areas on the north end of the existing open pit mine were fractured by explosives and used as in-situ leach basins by McAllester Fuels, the former operator. These in-situ areas were the source of some degraded quality water discharges at springs in Zonia Gulch. This is further discussed in the Hydrology Report.

In order to alleviate these discharges which eventually report to French Gulch, a pump back well field is required. Two existing extraction wells, each capable of pumping 200 gpm, were

reestablished and piping installed in an attempt to evaporate the solution by sprays at the uppermost in-situ area. This method was found to be ineffective during the spring precipitation and an alternate method of pumping to storage at the SW holding pond was practiced during wet weather or when the solution level in the wells is high. The solution is transferred via a surface pipeline of 6" HDPE to the Southwest holding pond for evaporation and storage.

3) Ponds. There are four existing containment ponds presently in use at the Zonia mine. The largest is known as the southwest holding pond. This pond was created by construction of a wide earthen dam across a canyon near the head of French Gulch. It was built by the former operator to hold excess process solution and solution which contained more dissolved iron than was desirable for leaching. Capacity is in excess of 100 million gallons. Details of the liner system are not available, but it appears that the area was cleared of brush and the in place soil compacted. The Southwest pond is proposed to be drained within the first two years of commercial production and a smaller portion of the pond relined for use as a PLS pond.

Solution temporarily stored at this location will be used as the initial wetting or make up water for the heaps prior to new operations. Given a potential consumption of approximately 300 to 500 gpm for make up water once heap leaching resumes, it should be possible to completely drain the SW holding pond within a year. The pond will also be needed to store affected groundwater pumped from the in-situ leach basins as part of the

remediation plan. Discharge to this pond may reach a maximum of 400 gpm, 24 hrs./day for several weeks. The SW holding pond dam is located at N 34 17'48" latitude W 112 38'00" longitude.

After the pond has been drained, the area will be converted for use as the No. 4 leach basin area. The native soil subbase will be graded and compacted to a 10^{-7} cm/sec coefficient of permeability and a 60 mil HDPE or equivalent synthetic liner installed. A composite liner system is proposed. Solution and runoff will report to a pond at the north end of the heap leach pad which will also have a similar composite liner system. The existing SW pond dam will be utilized to form a pond with a capacity of about 45 million gallons. The leach basin #4 general arrangement plan is submitted as No. 65-60-GA-41.

East of the SW holding pond about 1000 feet, is another existing containment pond, which catches surface runoff from the southern portion of the Zonia open pit. This area is simply an excavated depression in bedrock which holds water. This south pit runoff containment pond is unlined except for the low permeability bedrock at the site. No discharges other than natural unaffected runoff will report to this area in the future. Water stored in the pond was found to meet all water quality standards as documented in the Hydrology Report. The location is at N 34 17'45" latitude W 112 38'07" longitude.

A third existing pond was utilized by the McAllester Fuels Co. as a raffinate pond or barren solution pond. The pond is east of and uphill from the plantsite. It is reported to be on bedrock schist with a compacted clay liner. The clay liner has

apparently been eroded from the uppermost portion of the pond. The pond has most recently been used to store solutions discharging from the #1 leach basin. These solutions are presently pumped uphill to the pond intermittently at a maximum rate of 200 gpm. New design rate will be a maximum of 5000 gal/min. Capacity is approximately 4 million gallons. A new composite liner system will be installed using 12" of low permeability clay under a 60 mil HDPE or equivalent liner. The barren pond is located at N 34 18'28" latitude W 112 37'55" longitude. Quarterly water quality sampling at the nearby A14 monitor well will provide assurance of liner integrity at this point.

In the past, use of the barren pond for storage depended on the availability of storage in the fourth existing pond on site. A small clay lined pond just below the plant site was built by the Zonia Company to help control discharge from LB #1. The small size of this pond, a few hundred thousand gallons, limits its usefulness so it will be replaced with a new doubly lined pond as discussed under proposed components.

4) Plant. The existing plantsite presently is in use to provide a pump station for solutions from LB #1. The site was formerly used to produce an impure grade of copper by the iron replacement/cementation process. The proposed new solvent extraction electrowinning facility is planned to be built at this location: N 34 18'30" latitude W 112 38'00" longitude.

5) Waste Rock Dumps. As previously reported, the waste rock thus far produced from mining is of a non-acid generating

character. Runoff water from this material was sampled and results were reported to meet drinking water standards. Overburden mined from the pit will be evaluated by the geologist on site as to the acid generation potential and will be treated accordingly. Rock judged benign will be placed on unlined existing dump areas. Rock determined to be a potential acid former, i.e., +.15% sulfide copper, or +1.0% total sulfide would be placed on a designed containment area. However, since none of this type rock has as yet been identified for mining, plans for this separate dump are not developed in detail.

As shown on the site plan, there are at present three existing waste rock stockpiles on the site. The No. 1 Rock Dump is just east of the plant site between 2000N to 3000N and OE to 1200E in the coordinate grid. The No. 2 Rock Dump is at -2000N to -3000N and -1000E to -2000E, located just east of the south runoff containment pond. The No. 3 Rock Dump is NE of the No. 3 LB at ON to -1000N and centered on the -3000E gridline.

Characterization of Discharge

Proposed Facility Components

1) LB #3 Ponds. In order to control discharges from leach basins #2 and #3, two containment ponds will be constructed in series in the drainage below the basins. These ponds will catch the discharge and allow it to evaporate. See design plan ZEE 006 and revised plan 65-65-GA-31. The primary containment pond will have a capacity of approximately 1.3 million gallons and will have a composite liner. The liner system will consist of one 12" thick layer of compacted native clay with a coefficient of permeability of 1×10^{-7} cm/sec in place and one overlying 60 mil HDPE or better synthetic liner. A pump system will be installed with a pipeline capable of transporting discharged solution to either an evaporative spray field, the southwest holding pond, or the plantsite.

The LB #3 secondary containment pond will have a capacity of approximately 3.8 million gallons and will consist of a single liner system of low permeability clay on the bottom and a polyacrylamide spray barrier applied over low permeability granitic bedrock. The steep walls of the canyon prevent usage of any other type of lining system at this specific site.

Construction details are shown on design plan 65-65-GA-32. This pond is to be used only for emergency storage and should be dry during normal operations.

These new containment ponds, in conjunction with internal storage, will be capable of holding runoff from the watershed of the leach basins generated during the 100 year/24 hour event.

The rate and duration of discharge depends on weather conditions as their initial function is to halt discharges associated with precipitation events. One pond will also be utilized, however, as a main PLS collection pond upon renewal of leaching activity. The primary containment pond which is doubly lined will serve as a plant feed pond while the secondary pond will continue to provide backup containment only.

The LB #3 primary pond is located at N 34 18'08" latitude W 112 38' 21" longitude. The LB #3 secondary pond is located at N 34 18'12" latitude W 112 38'22" longitude.

2) #1 LB Ponds. In order to control discharges from the #1 leach basin, two containment ponds will be constructed below that basin while a third existing pond will be relined. The primary containment pond immediately below LB #1 will have a double or composite liner consisting of a 12" minimum thickness of compacted clay with an in-place coefficient of permeability of 1×10^{-7} cm/sec. or better, over which will be placed a 60 mil HDPE synthetic liner. The capacity of the primary containment pond will be at least 1.3 million gallons. A leak recovery/detection system will be installed below the clay liner, over bedrock. Site conditions related to rock weakness on the east abutment limit the size of the containment structure. The leak recovery line will report to the raffinate pond.

Below the primary containment pond and the plantsite, will be built a dual purpose pond called the raffinate pond with a capacity of about 3.1 million gallons. This #1 LB secondary containment pond will have a double synthetic liner on compacted

subbase. A leak recovery system will separate the two liners. The leak recovery line will report to 16" vertical standpipe sump which can be accessed with a portable pump. Each liner will be 60 mil HDPE or better. This pond will also serve as a raffinate staging pond for the new SX/EW plant and will be fitted with pumps to transfer solution to the existing barren solution pond. The barren solution pond will have a new composite liner system installed as previously discussed.

Like the ponds below LB #3, the LB #1 system will also be capable of containing runoff resulting from the 100 year/24 hour precipitation event. The raffinate pond and plantsite will be protected from French Gulch flooding by a concrete 7 x 12' culvert and rip rap or concrete channel wall scour protection.

The location of LB #1 primary pond is N 34 18'27" latitude W 112 38'00" longitude.

The location of LB #1 secondary and raffinate pond is N 34 18'34" latitude W 112 38'00" longitude.

The design plans for all these proposed structures are included in the temporary application as plans ZEE #3 through #5. Revised plans are shown on the attached APP Drawing list.

3) Piping. Transfer of solution from the in-situ area and from the various ponds will be accomplished through the use of a newly installed piping and pumping system. The pipe will be installed on surface, but when conditions require that routing be underground for some short distance, such as to go under an access road, the line will be installed pipe-in-pipe. This will allow any leakage to be observed and the condition repaired

rapidly. The pipeline will be HDPE type, properly sized according to flow rates. Proposed routing is shown on the design plans. In no case will routing be within a channel or plain subject to flooding.

4) New Heap Leach Pad LB 5. In order to accommodate leaching grade ore produced from the open pit mine after year three or four of operation, an additional leach pad area is required. A canyon area north of French Gulch just north of the open pit was selected for use. Construction of this new leach pad area will be similar to the No. 4 LB. The subbase will be prepared by grading and clearing. In place soil will be compacted to a minimum 10^{-6} cm/sec coefficient of permeability and 10^{-7} , if reasonably possible. Geotechnical test work will precede this stage to determine the necessary compaction and, if necessary, the suitable soil amendments. After compaction of the subbase, synthetic liner will be installed. Sixty mil HDPE or equivalent is the liner selected. All seams will be quality control tested as described in a separate section. A transmissive layer of liner cushion sand or equivalent will be installed in a 12" lift above the synthetic for protection from puncture. Ultimate height of the No. 5 heap is expected to be 200 feet at the deepest portion, but will be finally determined following further geotechnical test work.

Two ponds associated with the No. 5 LB leach basin are to be constructed. The No. 5 primary pond will act as a pregnant leach solution recovery pond and also contains storm water discharges. Capacity is about 5 million gallons each, as shown on the drawings 65-60-GA-51 through 54. A summary and results of the

storm water calculations are also shown on the plans.

Construction will be similar to other primary ponds for the project with a clay bottom liner covered by a synthetic membrane of 60 mil HDPE.

A No. 5 secondary containment pond and dam will be constructed downgradient from the primary pond. This secondary pond is to be used only as a short-term storage emergency backup. It is proposed to be clay lined except for the face of the rockfill dam which will have a secondary liner of HDPE on the clay face.

5) Truck Shop. A new maintenance facility will be built as shown on the plans. The site will be near the western edge of the old No. 2 leach basin area. Used oil will be drained into an above ground tank located in a secondary containment area. The truck wash area will drain to a concrete primary containment sump for wash water evaporation or recycle.

6) Acid Unloading Station. Ninety-six to ninety-eight percent sulfuric acid will be delivered to the site in tanker trucks. The acid will be added to recycled leach solution and make up water to create the regenerated leach solution. Approximately 20 grams of sulfuric acid will be added to each liter of water. The trucks will unload into a mild steel tank as per industry standards. Capacity will be approximately 80,000 gallons. The tank will be placed on a minimum 1' thick compacted clay base and spill containment area. The containment area will drain via overflow pipe by gravity to the barren solution pond. The overflow pipe will be 2" HDPE. The containment area will hold a

minimum of 110% of the tank capacity.

The truck unloading area will be located at an elevation above the storage tank and will transfer acid by gravity in an above ground 4" pipe. The trucks will park on a clay-lined pad which will drain to the acid tank containment area for spill protection. Crushed limestone will be available nearby, continuously, for neutralization of small spills.

Transfer piping from the strong acid tank to the barren pond and the plant will be above ground and clearly labeled "Danger - Sulfuric Acid" at regular intervals. Materials will be suitably acid and puncture resistant.

7) SX/EW Plant. The SX/EW plant will be rated as a 50,000 lb copper per day facility but may be built in two stages to achieve that capacity. The plant will have full secondary backup containment for all components including tanks, mixer settlers, and electrowinning cells.

The primary transfer piping will be above ground. Floor drains in the concrete secondary containment slabs will all be pipe-in-pipe for added protection. A secondary containment concrete slab will underlie all components, SX, EW, and Tank Farm. The SX mixer settlers will be constructed with either a masonry outer shell or steel shell and will then be lined with 316 stainless steel sheets. Leak detection ports will be placed through the outer wall on intervals of five feet to correspond with the welded seams of the stainless steel. This will allow quick identification and repair of any leaks which could develop over time. All drains report to the raffinate pond for organic recovery.

Additional details of the plant are provided on the set of oversize plans accompanying the application. A general discussion on the proposed processing method is provided in the following section.

The new SX/EW plant under production conditions, would discharge at the in-flow rate from the leach basins to the raffinate pond. Maximum flow is anticipated to be about 5800 gpm but average about 3500. This would form a closed circuit with no external discharges. The solution would be reacidified to about 10 grams/liter H_2SO_4 at the raffinate pond and then would be pumped to a heap recycle line or the barren solution pond where acid content would be increased to about 20 grams/liter. The chemical characteristics of a typical leach solution are shown under table 4 (from K. Schmitt 1989) in the temporary application and the Hydrology Report.

From either the raffinate or the barren pond the solution would be redistributed to the leach basins. Leach basin #2 would not be used as the existence of a sound liner has not been confirmed. Distribution on the heaps would be at a .003-.005 gallon/minute sq. ft. rate by either drip emitters or sprinklers.

General Discussion on Heap Leaching & SX/EW Processing.

A solvent extraction/electrowinning (SX/EW) process will be used to produce nearly pure consumer ready copper without the necessity of smelting. Slightly acidic solution is percolated through piles of oxide copper bearing rock in leach heaps. Solution pH of 2 is similar to that of lemon juice. This solution which contains dissolved copper at about 1 gram per liter, is then delivered to the SX/EW plant where organic solutions are utilized to transfer the copper from one interdependent process step to another. The organic solutions upgrade and remove impurities from the process stream. The organic solution is an intermediate loop between two aqueous streams. The inflowing 1 gram/liter solution after transfer by the organic is upgraded in the electrolyte solution to about 50 grams per liter copper. Pure copper is then plated out in electrowinning cells by passing an electric current through the electrolyte solution. Each component is described below and a pictorial flow sheet and a process flow diagram are attached.

Leaching

In the first step of the process a +/-20 gram per liter H_2SO_4 in water solution is pumped from the raffinate pond and fed onto the oxide copper ore in leach heaps. The solution is distributed by sprays or drip emitters then percolates through the heap, dissolving copper minerals along the way. The copper-laden water called pregnant leach solution, flows from the base of the leach heap into collection ponds (pregnant leach solution ponds) and is subsequently pumped to the solvent extraction

plant. The leaching process stream contains only small amounts of organics because the raffinate pond serves as a final point of separation and retrieval. Floating organic is regularly reclaimed by skimming and returned to the SX circuit.

Solvent Extraction

In the extraction step, the pregnant leach solution is pumped from the pregnant liquor solution pond to the mixer-settlers where it is mixed with an equal volume of the organic solution. The organic solution consists of a kerosene type solvent, approximately 95 percent SX-7 or equivalent, containing an organic reagent specifically designed to extract copper, approximately 5 percent Acorga M-5640. After flowing through the mixing box, the mixture is allowed to settle and separate as oil and water will. The aqueous leach solution, which has given up its copper to the organic phase, sinks to the bottom and is gravity fed back to the raffinate pond where it is recycled back to the leach heap. The copper-laden organic solution floats to the top of the settlers and is pumped to the stripping process via the loaded organic surge tank.

Mixer-settlers are long shallow open tanks with launders and weirs for making the organic/aqueous separation at one end and have a stainless steel box for mixing solutions at the input end.

In the stripping step, the copper-laden organic solution from the E1 and E2 mixer-settler units is mixed with a copper bearing sulfuric acid solution called the barren electrolyte which is returned from the electrowinning process. Under lower pH conditions than the extractor stage, copper transfers from the

copper-laden organic to the electrolyte. During settling, the now copper-laden aqueous based electrolyte separates from the organic phase and is pumped via the electrolyte feed tank to the electrowinning tank house. The organic solution is recirculated back to the extraction mixer-settlers in a closed loop. Two strip mixer-settlers are typically used that are of slightly smaller size and configuration as the extraction settlers.

Electrowinning

The copper-laden electrolyte is pumped from the electrolyte feed tank through a series of polymer concrete cells containing lead plates alternating with stainless steel "starter" sheets. Each lead plate serves as an anode pole and each stainless steel sheet as a cathode pole of an electrolysis circuit. A direct current is passed through the copper-laden electrolyte, reducing some of the copper ions to copper metal which accumulates on the stainless steel starter blanks. The electrolyte, now depleted of most of its copper, is returned to the stripper section of the SX to have its copper increased again.

Oxygen is generated during the electrowinning process which entrains some electrolyte as a mist immediately above the cells. This mist is suppressed by the use of polystyrene type balls or beads which float on the surface of the cells.

The electrolytic copper is hoisted by overhead crane on a weekly growth cycle and washed of electrolyte in a wash tank in the EW room. The copper is then stripped from the stainless steel sheets and bundled for shipment.

Proposed Contained Discharges

- A. In-situ basins #5 and #6, 400 gpm recovered affected groundwater to the SW holding pond or barren pond for storage.
- B. #1 leach basin, at approximately 500,000 sq. ft. of drainage area, 2000 gpm maximum to LB #1 primary containment pond then to either new SX/EW plant or LB #1 secondary containment pond (raffinate) or barren solution pond. The 5.5 inch, 100 year design storm containment for LB #1 was calculated for the remediation plan to be 3,198,995 gallons, of which 949,042 gallons may be accommodated by in-heap storage. An additional 460,000 gallons of storage would be required if the two year/one hour event is to be simultaneously contained. This capacity is easily met under the proposed plan.
- C. #2 and #3 leach basins, approximately 1,000,000 sq. ft. surface area, 5000 gpm maximum to #3 LB primary containment pond then either to secondary containment pond during prolonged precipitation events or to new SX/EW plant or to the barren solution pond. The SW holding pond may also be used for temporary storage in emergency situations. The 100 year design storm containment for LB #2 and #3 was calculated for the remediation plan to be 7,214,340 gallons of which up to 6,684,692 may be accommodated by in-heap storage. An additional 1,040,000 gallons would be required if the two year/one hour rainfall of .8 inch were to be stored simultaneously. Both events would be contained under

the proposed plan.

- D. Barren Pond, under maximum production conditions, 2000 gpm to LB #1, 5000 gpm to LB #3 or 5000 gpm to LB 4, or 5000 gpm to LB 5.
- E. New Leach Basins 4 and 5, 5000 gpm each from PLS pond to plantsite. Runoff containment is shown on the appended plans.
- F. Southpit runoff pond, captures runoff from the open pit above Placerita Gulch. Hydrology Report date indicates runoff is of good quality not requiring special containment measures.
- G. SX-EW Plant 5800 gpm to raffinate pond.
- H. Raffinate Pond 5800 gpm to barren pond and/or heaps.

Demonstration of Compliance with Standards

The proposed remediation plan is designed to bring the Zonia Mine property into immediate compliance as a zero discharge facility. Continued full remediation of discharges can only be assured over the long run however, after the comprehensive plan for renewal of operations at Zonia has been approved. Besides providing funding through production, the renewal of mining would allow the rubblized rock at the in-situ areas to be removed to the lined heaps for containment. The open pit wall rock thus exposed would not be as fractured, nor would have been affected by acid leaching. Runoff containment would be simplified.

One method by which compliance with water pollution control standards may be demonstrated is through the use of groundwater monitoring wells. A series of monitoring stations is proposed for the Zonia operation as shown on the included site plan. Generalized groundwater flow is toward the northeast from the area of operations. A set of downgradient monitor wells just outside of the pollution management area is proposed as the principal points of compliance.

These wells are currently in existence and are labelled on the plan as Z601, Z602, and cabin wells. Two other wells A14 and A16 are also proposed for use within the pollution management area. Due to its critical placement to verify containment of solutions and liner integrity of LB #3, the A16 well is proposed for use as a non P.O.C. monitor well. A16 was drilled by Arimetco in January 1993. The hole was placed to test surface mapping which showed that LB #3 was partially underlain by a

Tertiary stream channel. The channel was proved to dip toward the west, cross-cutting under the leach basin. This presented itself as a perfect collection point, almost like a leak recovery sump, for migrant solutions from the leach basin if the liner were not intact. Water quality sampling of A16 indicates that no migration has occurred and that the liner is intact.

A14 was also drilled in 1993. This hole will test compliance of the barren solution pond and LB No. 1. Sampling of groundwater from other wells adjacent to the #1 Leach Basin also shows a lack of increased metal values. Samples from the cuprite, Z603 and A-8 drill holes all contain low metal and low sulfate values. This is indicative of liner soundness at the #1 Leach Basin.

A typical monitor well design is appended which shows proposed construction details of any new monitor wells such as A16.

A hydrogeologic report on the property has been prepared and was submitted in September, 1993. This report detailed groundwater sampling results at Zonia and identified locations of suitable monitoring points. A report proposing alert limits for the monitor wells will be tendered upon accumulation of a minimum 8-point data set.

Demonstration of BADCT

All new primary containment ponds will meet BADCT requirements with a dual liner system. This system is a composite type with compacted low permeability clay as the base liner and synthetic 60 mil HDPE or better as the top liner. The synthetic liner rests directly atop the clay so that a plugging action might be effected by the clay if a small puncture occurs in the HDPE.

The existing barren pond which is planned for use will also be relined using this same composite system. Compliance will be tracked by a nearby monitor well, A14.

The LB #1 secondary containment (and raffinate) pond below the plant, will be double lined using two synthetic membranes separated by highly transmissive geonet. A leak recovery line will be installed for hydraulic relief between the liners. This method is used here as site conditions lend themselves to the technique.

Two ponds which are planned for limited use do not have double liners. The LB #3 secondary containment pond cannot be equipped thusly due to the extremely steep rock walls of the narrow canyon where the containment had to be located. Instead the site conditions in conjunction with a novel sealing method are proposed as BADCT. The pond floor is to be sealed with low permeability clay over jointed granite bedrock. The jointed granite and clay are planned to be sealed with a coating of acid resistant crosslinked polymer. Use of this pond would be limited to receiving overflow from the primary pond under adverse

conditions. Likewise, the No. 5 secondary pond will be built with a clay liner only as limited use is projected.

The SW storage pond is not immediately slated for lining due in part to the extremely large capacity, which at this writing is about 80% full. Capacity is in excess of 100,000,000 gallons. The pond is planned to be used only for temporary emergency storage or for a fresh water impoundment until it can be drained. After draining, the area will be fully lined with a composite system as a leach pad.

All new leach pads or basins will be constructed with composite liner systems. The synthetic, 60 mil HDPE or better, will overlies native soil subbase which will be treated by compaction to obtain the minimum permeability reasonably possible.

The SX/EW plant is to be built at the existing plantsite using a full secondary containment design. The mixer settler units and piping will be entirely within a walled concrete containment area to confine possible spills or leaks. The settlers will themselves be concrete with stainless steel internal liners and will have leak detection ports every five feet. Storage tanks will be contained in a concrete lined tank farm area capable of holding 110% of the tank capacity or will be set in individual containment sumps with similar capacities. The EW cells will set on pedestals above a floor sump which will drain to the raffinate pond for full secondary containment. Floor drains will all be double piped, i.e., pipe-in-pipe for full back-up containment.

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Enforcement Actions

The current owner of the Zonia Mine, The Zonia Company of Prescott, Arizona, was cited in November 1992 by the U.S. EPA for violation of the Clean Water Act and ordered to perform certain measures to contain discharges. Arimetco had not taken possession of the property at that time and is an innocent third party in regards to past discharge practices. Arimetco, Inc. agreed to enter and conduct remediation related activities at the minesite on behalf of The Zonia Company. This was done in January 1993 on the expectation of receiving permits to reactivate the facility as a zero discharge operation.

As of this writing, only one enforcement action has ever been taken against Arimetco, Inc. and this singular event was of a minor nature. Arimetco, Inc. operates the Yerington mine and SX-EW plant in Nevada. During the month of November 1990, a finding of alleged violation and order was issued by the Nevada Division of Environmental Protection requiring corrective measures at the Yerington operation. The finding alleged that synthetic liner material was not adequately anchored around a leach pad and that certain berms were not built the required height. In addition to this, it was stated that a report required within thirty days of completion of construction was not timely filed with NDPE. Arimetco, Inc., agreed to pay a fine of \$10,000 and correct the problem. No leach solutions were lost because of the problem and the local groundwater was never compromised.

Certification

I certify that under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that based on my inquiry of those persons immediately responsible for obtaining the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.



Harrison Matson, Chief Geologist

Statement of Financial Officer

All financial information available to me at this time suggests that Arimetco, Inc. is and will be capable of meeting closure plans at the Zonia Mine which are commensurate with closure costs and plans associated with other open pit heap leach facilities of a similar size. Monitoring of water quality conditions near the mine will be regularly scheduled after closure for a minimum of five years and a zero discharge status will be assured. A sum of \$475,000 will be allocated from the net production profits of the mine to guarantee payment of these reclamation related expenses. A special interest bearing trust account will be created and payments deposited on a quarterly basis after the first year of operation to assure closure related funding. A sum of \$10,000 will be deposited as the quarterly payment until a total of \$475,000 is reached. Interest will be allowed to accrue until the fund is needed for reclamation and released by confirmation letter from ADEQ.

Signed:



John A. McKinney
V.P. of Corp. Affairs

Financial Assurance Addendum

The total estimated cost of construction including mining equipment required, service facilities and complete plant and initial leach pad construction is \$14,455,000. Direct operating cost is expected to be approximately \$2.25 per ton of ore or about .60 cents per pound of copper produced. Approximately \$124,000 per month is to be paid in wages in Yavapai County from the proposed operation. Several pages of miscellaneous budget data are enclosed for verification.

The cost of closure and post closure care are included in the final reclamation cost estimate. Miscellaneous costs which may have been overlooked for the present study are expected to be fully covered by the salvage value of the equipment and plant at closure. A minimal salvage value of the equipment should be about \$200,000.

The post closure care portion of the reclamation estimate consists of quarterly water quality monitoring for a period of five years. The samples are to be collected and results reviewed by a geologist/hydrologist. The hydrologist will report on the effectiveness of the control systems in place at the closed facility and if necessary recommend improvements. The monitoring will continue until the repeatability of results proves the sampling to be unnecessary and approval is received from A.D.E.Q. for cessation of monitoring.

ZONIA MINE

CAPITAL REQUIREMENTS

Acquisition Pre-Development, Environmental Remediation		\$ 1,742,000
Plant	SX/EW	\$ 3,575,000
	Power & Water	\$ 400,000
	Reagents	\$ 793,000
Leach Pads & Ponds		\$2,337,000
General Engineering & Construction		\$ 587,000
Mining	Equipment	\$ 4,141,000
	Pre-production	\$ 880,000
=====		
Subtotal		\$14,113,000
Contingency		\$ 342,000
Total		\$14,455,000

Zonia Mine

Key Statistics

Mining rate	26,500 tons/day
Plant Production	50,000 lbs/day

Expected Recoveries

<u>Year</u>	<u>% TCu</u>
1	45
2	15
3	10

Production Schedule

<u>Year</u>	<u>Ore (K tons)</u>	<u>Ore Grade</u>	<u>Waste (K tons)</u>	<u>Ratio</u>
1	4650	0.349	2380	0.51
2	4250	0.350	2650	0.62
3	3375	0.347	3525	1.04
4	3855	0.338	3045	0.79
5	4135	0.323	2765	0.67
6	3815	0.339	1435	0.38
7	3930	0.331	1326	0.34
8	4070	0.321	1180	0.29
9	4230	0.308	1020	0.24
10	3875	0.337	1369	0.35
11	3985	0.327	1199	0.30
12	3083	0.321	475	0.15

	DEPOSIT	INTEREST	BALANCE
1	10,000.00	100.32	10,100.32
2	10,000.00	101.33	20,201.65
3	10,000.00	202.67	30,404.32
4	10,000.00	305.03	40,709.35
5	10,000.00	408.41	51,117.76
6	10,000.00	512.83	61,630.59
7	10,000.00	618.30	72,248.89
8	10,000.00	724.83	82,973.72
9	10,000.00	832.42	93,806.14
10	10,000.00	941.10	104,747.24
11	10,000.00	1,050.86	115,798.10
12	10,000.00	1,161.73	126,959.83
13	10,000.00	1,273.71	138,233.54
14	10,000.00	1,386.81	149,620.35
15	10,000.00	1,501.05	161,121.40
16	10,000.00	1,616.43	172,737.83
17	10,000.00	1,732.97	184,470.80
18	10,000.00	1,850.68	196,321.48
19	10,000.00	1,969.57	208,291.05
20	10,000.00	2,089.65	220,380.70
21	10,000.00	2,210.94	232,591.64
22	10,000.00	2,333.44	244,925.08
23	10,000.00	2,457.18	257,382.26
24	10,000.00	2,582.15	269,964.41
25	10,000.00	2,708.38	282,672.79
26	10,000.00	2,835.88	295,508.67
27	10,000.00	2,964.65	308,473.32
28	10,000.00	3,094.72	321,568.04
29	10,000.00	3,226.09	334,794.13
30	10,000.00	3,358.78	348,152.91
31	10,000.00	3,492.80	361,645.71
32	10,000.00	3,628.16	375,273.87
33	10,000.00	3,764.88	389,038.75
34	10,000.00	3,902.98	402,941.73
35	10,000.00	4,042.46	416,984.19
36	10,000.00	4,183.34	431,167.53
37	10,000.00	4,325.63	445,493.16
38	10,000.00	4,469.35	459,962.51
39	10,000.00	4,614.51	474,577.02
40	10,000.00	4,761.13	489,338.15
41		4,909.22	494,247.37
42		4,958.47	499,205.84
43		5,008.21	504,214.05
44		5,058.46	509,272.51
45		5,109.21	514,381.72
46		5,160.46	519,542.18
47		5,212.24	524,754.42
48		5,264.53	530,018.95
49		5,317.34	535,336.29
50		5,370.69	540,706.98
51		5,424.57	546,131.55
52		5,478.99	551,610.54
53		5,533.96	557,144.50
54		5,589.48	562,733.98
55		5,645.55	568,379.53
56		5,702.19	574,081.72
57		5,759.40	579,841.12
58		5,817.18	585,658.30
59		5,875.54	591,533.84
60		5,934.48	597,468.32
	400,000.00	197,468.32	

NOTE: INTEREST 4% ANNUAL RATE COMPOUNDED MONTHLY

PROJECT NAME: Zonia Mine, Prescott, Az
PROJECT MANAGER/COORDINATOR A. J. Smith
PROJECT STATUS: Pre-Development
Date of Report: 7/1/94 8:50 AM

MODEL ASSUMPTIONS

Mine:

3 shift/5 day per week operation
Total of 6.9 million tons mined per year
5 - 85 ton trucks/1 - 992 Loader at 95% availability
Initially, 5 trucks would be purchased with 1 loader
A second loader would be added in the second year of mining
An additional truck would be purchased in the second and third years, and one every 3 years after that
Ultimately, a 7-truck 2-loader fleet operational fleet would be maintained to ensure 95% availability
3 ancillary operators per shift
9 total mine personnel per shift plus a foreman

Personnel:

Mine:	27 operators
	1 Foreman
Leach Pad:	6 pad operators
SX/EW:	8 SX Plant operators
	6 EW Plant operators
	2 SX/EW General operators
	1 SX/EW Foreman
Maintenance:	9 Mechanics - 3 per shift (incl the Lead Man)
	3 Oilers (1 per shift)
	2 Electricians
	1 Maintenance Foreman
Exp/Devel:	1 Geologist
	1 Surveyor
Admin:	1 General Manager
	1 Secretary
	1 Warehouseman
Total:	66 hourly
	5 salaried

	DEPOSIT	INTEREST	BALANCE
1	10,000.00	100.32	10,100.32
2	10,000.00	101.33	20,201.65
3	10,000.00	202.67	30,404.32
4	10,000.00	305.03	40,709.35
5	10,000.00	408.41	51,117.76
6	10,000.00	512.83	61,630.59
7	10,000.00	618.30	72,248.89
8	10,000.00	724.83	82,973.72
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10	10,000.00	941.10	104,747.24
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12	10,000.00	1,161.73	126,959.83
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14	10,000.00	1,386.81	149,620.35
15	10,000.00	1,501.05	161,121.40
16	10,000.00	1,616.43	172,737.83
17	10,000.00	1,732.97	184,470.80
18	10,000.00	1,850.68	196,321.48
19	10,000.00	1,969.57	208,291.05
20	10,000.00	2,089.65	220,380.70
21	10,000.00	2,210.94	232,591.64
22	10,000.00	2,333.44	244,925.08
23	10,000.00	2,457.18	257,382.26
24	10,000.00	2,582.15	269,964.41
25	10,000.00	2,708.38	282,672.79
26	10,000.00	2,835.88	295,508.67
27	10,000.00	2,964.65	308,473.32
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31	10,000.00	3,492.80	361,645.71
32	10,000.00	3,628.16	375,273.87
33	10,000.00	3,764.88	389,038.75
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53		5,533.96	557,144.50
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38	10,000.00	4,469.35	459,962.51
39	10,000.00	4,614.51	474,577.02
40	10,000.00	4,761.13	489,338.15
	400,000.00	89,338.15	

NOTE: INTEREST 4% ANNUAL RATE COMPOUNDED MONTHLY

CONSOLIDATED BALANCE SHEETS

As of December 31, 1993 and 1992
(In United States Dollars)

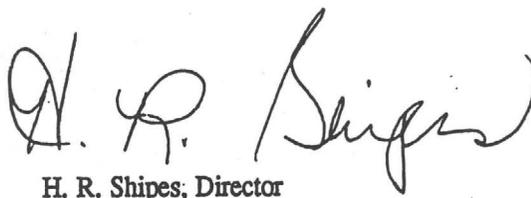
<i>ASSETS</i>	<u>1993</u>	<u>1992</u>
Current assets:		
Cash	\$ 76,888	\$ 5,209,109
Investments (Note 2)	1,109,180	2,735,059
Accounts receivable	384,274	540,842
Inventory (Note 3)	8,076,128	4,777,814
Due from related parties (Note 5)	7,058,994	6,290,573
Prepaid expenses and other assets	<u>715,376</u>	<u>713,643</u>
Total current assets	17,420,840	20,267,040
Restricted cash (Note 11)	541,782	341,362
Property, plant and equipment, net (Note 4)	37,700,734	34,285,789
Investments (Note 2)	163,234	515,451
Due from related parties (Note 5)	—	983,400
Deferred financing costs, net of amortization	<u>423,275</u>	<u>478,484</u>
Total assets	<u>\$56,249,865</u>	<u>\$56,871,526</u>

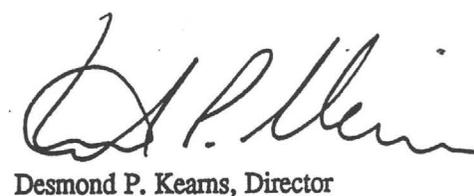
LIABILITIES AND SHAREHOLDERS' EQUITY

Current liabilities:		
Loan payable to a bank (Note 6)	\$ 540,000	—
Accounts payable and accrued liabilities	4,303,167	\$ 4,269,358
Current portion of long-term debt (Note 6)	1,498,517	1,911,283
Current portion of obligations under capital leases (Note 7)	15,000	306,126
Due to related party (Note 5(e))	<u>15,227</u>	<u>202,580</u>
Total current liabilities	6,371,911	6,689,347
Long-term debt, net of current portion (Note 6)	10,894,739	10,225,367
Obligations under capital leases, net of current portion (Note 7)	21,740	143,041
Accrued reclamation and site restoration costs	<u>177,753</u>	<u>—</u>
Total liabilities	<u>17,466,143</u>	<u>17,057,755</u>
Shareholders' equity:		
Common stock (Note 8)	45,348,884	40,948,832
Treasury stock (Note 8)	(114,089)	(78,707)
Accumulated deficit	<u>(6,451,073)</u>	<u>(1,056,354)</u>
Total shareholders' equity	<u>38,783,722</u>	<u>39,813,771</u>
Total liabilities and shareholders' equity	<u>\$56,249,865</u>	<u>\$56,871,526</u>

Contingencies and Commitments (Note 11).

Signed on behalf of the Board


H. R. Shipes, Director


Desmond P. Kearns, Director

The accompanying notes are an integral part of the consolidated financial statements.

**ARIMETCO INTERNATIONAL INC.
CONSOLIDATED STATEMENTS OF OPERATIONS
AND ACCUMULATED DEFICIT**

*As at June 30, 1994
in United States dollars
(Unaudited)*

	Three months ended June 30 1994	Three months ended June 30 1993	Six months ended June 30 1994	Six months ended June 30 1993
Copper pounds sold	4,558,628	5,001,030	8,960,645	9,622,751
Product sales:				
Copper sales	\$ 4,092,459	\$ 4,171,896	\$ 7,799,707	\$ 8,543,580
Lead and silver sales	734,713	786,497	1,214,174	1,660,073
Total product sales	4,827,172	4,958,393	9,013,881	10,203,653
Cost of sales	3,298,636	4,147,052	6,089,895	7,600,930
Gross margin	1,528,536	811,341	2,923,986	2,602,723
Operating expenses:				
General and administrative	658,112	586,582	1,372,686	1,697,895
Abandonment of mineral properties	0	181,582	0	260,719
Exploration	139,569	222,014	267,238	400,769
Depreciation, depletion and amortization	652,160	812,697	1,283,552	1,471,381
Operating income (loss)	78,695	(991,534)	510	(1,228,041)
Non-operating income (expense):				
Interest income	27,267	162,121	62,030	281,788
Management fees from related parties	0	0	0	108,750
Foreign exchange gain (loss)	2,272	0	(54,316)	0
Other income	223,085	115,722	680,699	120,735
Interest expense	(93,572)	(247,508)	(163,595)	(435,394)
Net Income (loss) before income taxes	237,747	(961,199)	525,328	(1,152,162)
Income taxes	----	----	----	----
Net Income (loss)	\$ 237,747	\$ (961,199)	\$ 525,328	\$ (1,152,162)
Basic earnings (loss) per share	\$ 0.01	\$ (0.03)	\$ 0.02	\$ (0.04)
Weighted average number of common shares outstanding	28,738,770	28,379,149	28,738,770	26,389,149
Accumulated deficit beginning of period	\$ 6,163,492	\$ 1,247,317	\$ 6,451,073	\$ 1,056,354
Net Income (loss)	237,747	(961,199)	525,328	(1,152,162)
Accumulated deficit, end of period	\$ 5,925,745	\$ 2,208,516	\$ 5,925,745	\$ 2,208,516

**ARIMETCO INTERNATIONAL INC.
CONSOLIDATED STATEMENTS OF CASH FLOWS**

*As at June 30, 1994
in United States dollars
(Unaudited)*

	Three months ended June 30 1994	Three months ended June 30 1993	Six months ended June 30 1994	Six months ended June 30 1993
Cash flows from operating activities:				
Net income (loss)	\$ 237,747	\$ (961,199)	\$ 525,328	\$ (1,152,162)
Non-cash items:				
Abandonment of mineral properties	0	181,582	0	260,719
Deferred financing costs	13,802	13,803	27,605	27,605
Depreciation, depletion and amortization	652,160	812,697	1,283,552	1,471,381
	903,709	46,883	1,836,485	607,543
Cash provided by (used in) working capital: (Increase) decrease in:				
Inventory	(576,792)	(1,800,298)	(802,619)	(2,245,623)
Accounts receivable	(36,694)	(104,643)	(26,845)	(300,365)
Prepaid expenses and other assets	(157,689)	(125,743)	(160,654)	167,921
Increase (Decrease) in:				
Accounts payable and accrued liabilities	(289,831)	2,276,095	(549,341)	2,231,777
Net cash provided by (used in) operating activities	(157,297)	292,294	297,026	461,253
Cash flows from investing activities:				
Capital expenditures	(917,340)	(3,709,447)	(1,573,990)	(5,125,842)
Proceeds from Investments	0	15,866	157,550	1,162,750
Net cash used in investing activities	(917,340)	(3,693,581)	(1,416,440)	(3,963,092)
Cash flows from financing activities:				
Advances to related parties	144,259	(1,983,269)	(470,393)	(5,899,416)
Repayment of advances to related parties	45,579	500,000	772,432	500,000
Proceeds from issuance of common stock	0	3,928,089	0	3,928,089
Purchase of treasury stock	0	(17,274)	0	(35,382)
Proceeds from long-term debt, net of issuance costs	1,400,000	1,657,179	1,400,000	1,657,179
Repayment of long-term debt	(62,484)	(1,077,149)	(135,068)	(1,488,161)
Increase of obligations under capitalized equipment leases	0	146,722	0	146,722
Repayment of obligations under capitalized equipment leases	0	(75,814)	0	(166,555)
Net cash provided from (used in) financing activities	1,527,354	3,078,484	1,566,971	(1,357,524)
Net increase(decrease) in cash	452,717	(322,803)	447,557	(4,859,363)
Cash at beginning of period	613,510	1,013,911	618,670	5,550,471
Cash at end of period	\$ 1,066,227	\$ 691,108	\$ 1,066,227	\$ 691,108

LINER 0A

HDPE GEOMEMBRANE PHYSICAL PROPERTIES

60 mil

The properties on this page are not part of NSC's Manufacturing Quality Control program and are not included on the material certifications. Seam testing is the responsibility of the installer and/or CQA personnel.

PROPERTIES	METHOD	UNITS	MINIMUM ¹	TYPICAL
Multi-Axial Tensile Elongation	GRI, GM-4	percent	20.0	28.0
Critical Cone Height	GRI, GM-3, NSC mod.	cm	1.0	1.5
Wide Width Tensile	ASTM D 4885			
Stress at Yield		psi	2000	2110
Strain at Yield		%	15.0	20.0
Brittleness Temp. by Impact ²	ASTM D 746	°C	-75	< -90
Coef. of Linear Thermal Exp. ²	ASTM D 696	°C ⁻¹	1.5 x 10 ⁻⁴	1.2 x 10 ⁻⁴
ESCR, Bent Strip	ASTM D 1693	hours	1500	> 10,000
Hydrostatic Resistance	ASTM D 751	psi	450	510
Modulus of Elasticity	ASTM D 638	psi	80,000	135,000
Ozone Resistance	ASTM D 1149, 168 hrs	P/F	P	P
Permeability ²	ASTM E 96	cm/sec · Pa	2.3x10 ⁻¹⁴	8.1 x 10 ⁻¹⁵
Puncture Resistance	FTMS 101, method 2065	ppi	1300	1700
		lbs	78	105
Soil Burial Resistance ²	ASTM D 3083, NSF mod.	% change	10	0
Tensile Impact	ASTM D 1822	ft lbs/in ²	250	420
Volatile Loss ²	ASTM D 1203, A	percent	0.10	0.06
Water Absorption ²	ASTM D 570, 23°C	percent	0.10	0.04
Water Vapor Transmission ²	ASTM E 96	g/day · m ²	0.024	0.009

SEAM PROPERTIES	METHOD	UNITS	MINIMUM ¹	TYPICAL
Shear Strength	ASTM D 4437, NSF mod.	psi	2000	2700
		ppi	120	166
Peel Strength	ASTM D 4437, NSF mod.	psi	1500	1870
(hot wedge fusion)		ppi	90	115
Peel Strength	ASTM D 4437, NSF mod.	psi	1300	1590
(fillet extrusion)		ppi	78	98

STANDARD ROLL DIMENSIONS

Length	1110 feet	Area	16,650 ft ²
Width	15 feet	Weight	5,000 lbs

This information contained herein has been compiled by National Seal Company and is, to the best of our knowledge, true and accurate. All suggestions and recommendations are offered without guarantee. Final determination of suitability for use based on any information provided, is the sole responsibility of the user. There is no implied or expressed warranty of merchantability of fitness of the product for the contemplated use.

NSC reserves the right to update the information contained herein in accordance with technological advances in the material properties.

6H-0893

NSC

NATIONAL SEAL COMPANY
1245 Corporate Blvd. • Suite 300
Aurora, IL 60504
(708) 898-1161 • (800) 323-3820
Fax: (708) 898-3461



HDPE GEOMEMBRANE QUALITY CONTROL SPECIFICATIONS

60 mil

National Seal Company's High Density Polyethylene (HDPE) Geomembranes are produced from virgin, first quality, high molecular weight resins and are manufactured specifically for containment in hydraulic structures. NSC HDPE geomembranes have been formulated to be chemically resistant, free of leachable additives and resistant to ultraviolet degradation.

The following properties are tested as a part of NSC's quality control program. Certified test results for properties on this page are available upon request. Refer to NSC's Quality Control Manual for exact test methods and frequencies.

All properties meet or exceed NSF Standard Number 54.

RESIN PROPERTIES	METHOD	UNITS	MINIMUM ¹	TYPICAL
Melt Flow Index ²	ASTM D 1238	g/10 min	0.50	0.25
Oxidative Induction Time	ASTM D 3895, Al pan, 200°C, 1 atm O ₂	minutes	100	120

SHEET PROPERTIES	METHOD	UNITS	MINIMUM ¹	TYPICAL
Thickness	ASTM D 751, NSF mod.			
Average		mils	60.0	61.5
Individual		mils	57.0	59.7
Density	ASTM D 1505	g/cm ³	0.940	0.948
Carbon Black Content	ASTM D 1603	percent	2.0-3.0	2.35
Carbon Black Dispersion	ASTM D 3015, NSF mod.	rating	A1, A2, B1	A1
Tensile Properties	ASTM D 638			
Stress at Yield		psi	2200	2550
		ppi	132	157
Stress at Break		psi	3800	4850
		ppi	228	298
Strain at Yield	1.3" gage length (NSF)	percent	13.0	16.9
Strain at Break	2.0" gage or extensometer	percent	700	890
	2.5" gage length (NSF)	percent	560	710
Dimensional Stability ²	ASTM D 1204, NSF mod.	percent	1.5	0.4
Tear Resistance	ASTM D 1004	ppi	750	860
		lbs	45	53
Puncture Resistance	ASTM D 4833	ppi	1800	2130
		lbs	108	131
Constant Load ESCR, Single Point	GRI, GM-5a	hours	200	>400

¹ This value represents the minimum acceptable test value for a roll as tested according to NSC's Manufacturing Quality Control Manual. Individual test specimen values are not addressed in this specification except thickness.

² Indicates Maximum Value



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Fax: (708) 898-3461

RECLAMATION PLAN

Zonia Mine
Reclamation Plan

Reclamation of the project area has begun with historical disturbance related remediation work and will be further developed in conjunction with agency contacts, baseline data collection, interim reclamation, and finally post-mining reclamation. The focus of post-mining reclamation will be long-term erosion stability, public safety assurance and affected runoff containment. It is Arimetco, Inc.'s intention to reclaim disturbed areas where conditions and current reclamation technologies permit, as required by the BLM and the appropriate state agencies.

The following discussion outlines the currently proposed reclamation; alternatives will continue to be evaluated with regard to practicality, current industry standards, economics, and public opinion.

Exploration Drilling

All of the long-term exploration outside of the mine area will be covered under a Notice of Intent filed in advance of the work requirements. The current exploration and condemnation drill sites and associated access roads are located where proposed operations facilities are sited and would not require temporary reclamation. These areas would fall under the mine plan reclamation. Drill holes outside of the mine will be abandoned in accordance with ADWR regulations. This generally involves back filling the hole with cuttings to provide a +20' surface plus seal.

Interim Reclamation

A key component of interim reclamation is stabilization and runoff control. This involves the construction of diversion drainages around the facilities and containment ponds below historic point source areas. A large measure of interim reclamation will be implemented prior to commercial operation. This program was previously approved by both the EPA and ADEQ as the 1993 remediation plan. Approximately \$500,000 has been expended to date on this program.

Most reclamation of individual facility components will begin when the facility is permanently closed. For example, the reclamation of the pit and rock dumps would begin when the facilities are permanently closed, but leach pad reclamation would be initiated in stages after the individual leach basins have been depleted. Only the last used leach basin would be reclaimed at final closure.

Arimetco will consult with a range specialist to determine possible revegetation species and rates of application to complement area management plans. The projected best use of the area in the post-mining stage is as unimproved grazing land.

Final Reclamation

The following activities are proposed for the various facility components at Zonia.

Pit

The outside safety berm of haul roads within the pit will be breached after mining to reduce channeling along the route. The pit will be developed as much as possible so the runoff from

surrounding drainages are diverted. During the first several years of development, the insitu area will be mined and removed to the leach basins. This will remove the source area of past groundwater contamination problems and leave minimal work for final reclamation. Soil overburden useful for growth medium will be placed at the waste rock dump south of the pit during mining but very little is anticipated due to the current prestripped condition of the pit. The majority of the pit walls are in competent bedrock which would inhibit erosion potential at the site, therefore no additional contouring is planned.

Signs would be posted at regular intervals around the pits warning the public of potential danger. Perimeter berms and/or fencing to impede vehicular ingress would be erected as additional protection outside of the pit highwalls.

Leach Areas

Reclamation of the leach areas would begin with heap "flushing". Recycling of spent leach solution to the heaps would continue until sulfuric acid and copper levels are sufficiently low in the off-flow solution to preclude further processing. Additional of lime may be utilized to accelerate this process if necessary.

After a spent heap has been sufficiently flushed, a process to impede infiltration of precipitation will be implemented. The surface would be contoured by dozer to channel flow in a desired direction. The top surface would then be treated with a spray application of low cost material such as liquid asphalt to reduce permeability. Alternatively, the surface could be compacted or a

very thin synthetic membrane installed. This irregular barrier layer would then be covered with one or two new lifts of coarse ore and leached in a regular cycle. After this ore is depleted, it would be flushed to economic copper recovery limits and then the distribution system removed.

The purpose of this method would be to reduce the total amount of precipitation that would infiltrate the heap and also to minimize contact path length and time. The infiltrated water on the top lift would be minimally affected and report to the containment ponds downgradient for evaporation.

The lift of rock over the asphalt will protect the barrier and may be suitable for natural revegetation with time.

Ponds

Several new ponds are currently in construction to contain runoff from existing leach basins. These ponds will continue to function for this purpose after closure. Leach solution remaining at closure will be evaporated to the extent possible in the existing system. The remaining volume will be transferred to the barren pond for storage and evaporation. The barren pond does not contain stormwater runoff and should function well as an evaporation area.

Waste Dump

When mining operations cease, reclamation would begin. The dump face would be left at the angle of repose. To the extent reasonable, the top would be graded to conform with the surrounding topography. This would be followed by the placement of 0 to 6 inches of growth medium and seeding with a BLM-approved seed mix. Existing diversion drainages would remain in place.

Haul and Access Roads

All ancillary roads not needed for continuing access would be reclaimed by scarification and reseeding. Reclamation of the haul and access roads would begin with removal of culverts to allow for natural drainage through the area. All compacted surfaces would then be ripped to loosen material for seeding. The area would then be reseeded with BLM-approved seed mix. Any safety berms built during construction would be breached.

Ancillary Facilities

All facilities including fuel, chemical and bulk storage would be salvaged and removed. Prior to salvaging, all lines would be cleared, dismantled and removed. The required safety berms around these facilities would be breached to establish free drainages. Buildings would also be salvaged; and any concrete foundations on non-private land would be buried with previously stockpiled soil and/or waste rock.

The cost of building removal is generally covered by the salvage value. Only an approximate general clean-up cost is therefore tabulated for this portion of the plan.

Groundwater and Surface Water Monitoring

The monitoring system at Zonia will consist of several downgradient point of compliance wells which are strategically placed to ring the site boundary. Two additional wells in the insitu area are presently located to provide a pumping barrier. Water samples are also collected quarterly from surface water in French Gulch below the mine. Water quality data will be reported quarterly to ADEQ.

Monitoring of the water near the mine site is planned for a period of five years after closure and will be scheduled on a monthly basis throughout the period of active operations. Quarterly sampling will be scheduled thereafter. Should significant contamination be detected, a contingency plan suitable for the problem will be developed and implemented.

Final Reclamation Cost Estimate

Water Quality Analyses (140 at \$90 Each)	\$ 13,000
Hydrologist Review at \$2,500/Quarter	50,000
Post Closure Labor/Maintenance	70,000
Active Closure Labor/Maintenance at \$2,240/month/man	81,000
Dozer (2 months at \$130/hr)	42,000
Permeability Reduction of Heap 5 (interim costs for LB 3,4 absorbed in operations budget)	195,000
Electricity for Pump Operation 250HP Projected/2 Months	15,000
Removal of Organic Reagents/Recycle	6,000
Seed and Miscellaneous Supplies	<u>3,000</u>
TOTAL	\$475,000

Arimetco, Inc.
Zonia Mine
A.P.P. Drawing List

		<u>Disk No./Size/Update</u>	<u>Date Sent</u>
<u>General Sheets</u>			
65-00-GS-01	Zonia Mine A.P.P. TitleSheet w/ Index	ZON-CAD-0011	10/11/94
65-00-GA-01	Zonia Mine General Arrangement	ZON-CAD-0012/13	10/11/94
<u>Leach Basin No. 3</u>			
65-60-GA-31	Leach Basin No. 3 (Existing) General Arrangement		
65-60-GA-32	Leach Basin No. 3 (Existing) Ore Heap Section and Details		
65-65-GA-31	Leach Basin No. 3 Primary Pond Plan / Section and Details	ZON-CAD-0015	10/11/94
65-65-GA-32	Leach Basin No. 3 Secondary Pond Plan / Section and Details	ZON-CAD-0016	10/11/94
<u>Leach Basin No. 4</u>			
65-60-GA-41	Leach Basin No. 4 General Arrangement	ZON-CAD-0010	10/11/94
65-60-GA-42	Leach Basin No. 4 Section and Details	ZON-CAD-0010	10/11/94

**Arimetco, Inc.
Zonia Mine
A.P.P. Drawing List**

		<u>Disk No./Size/Update</u>	<u>Date Sent</u>
65-65-GA-41	Leach Basin No. 4 SW Pond Plan and Details	ZON-CAD-0004	10/11/94
65-65-GA-42	Leach Basin No. 4 SW Pond Section and Details	ZON-CAD-0004	10/11/94

Leach Basin No. 5

65-60-GA-51	Leach Basin No. 5 General Arrangement	ZON-CAD-0007	10/11/94
65-60-GA-52	Leach Basin No. 5 Ore Heap Section and Details	ZON-CAD-0008	10/11/94
65-65-GA-51	Leach Basin No. 5 Primary Pond Plan and Details	ZON-CAD-0018	10/11/94
65-65-GA-52	Leach Basin No. 5 Primary Pond Section and Details	ZON-CAD-0019	10/11/94
65-65-GA-53	Leach Basin No. 5 Secondary Pond Plan and Details		
65-65-GA-54	Leach Basin No. 5 Secondary Pond Section and Details		

Truck Shop

65-40-GA-01	Truck Shop General Arrangement	ZON-CAD-0003	10/11/94
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Arimetco, Inc.
Zonia Mine
A.P.P. Drawing List

		<u>Disk No./Size/Update</u>	<u>Date Sent</u>
65-40-A-03	Truck Shop Building Elevations	ZON-CAD-0017	10/11/94

Fueling Station

65-44-GA-01	Fueling Station General Arrangement		
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Acid Unloading Station

65-46-GA-01	Acid Unloading Station General Arrangement		
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Misc. Containment Ponds

65-65-GA-01	Barren Solution Pond General Arrangement As-Built		
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65-65-GA-11	Leach Basin No. 1 Primary Pond Plan / Section and Details	ZON-CAD-0014	10/11/94
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65-65-GA-12	Raffinate Pond (LB#1 Secondary) General Arrangement As-Built		
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Plant Site

65-05-GA-01	Plant Site General Arrangement	ZON-CAD-0006	10/11/94
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65-05-GA-02	Plant Site Elevations and Sections	ZON-CAD-0009	10/11/94
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Electrowinning House

65-20-GA-01	Electrowinning House General Arrangement	ZON-CAD-0001	10/11/94
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Arimetco, Inc.
Zonia Mine
A.P.P. Drawing List

		<u>Disk No./Size/Update</u>	<u>Date Sent</u>
65-20-GA-03	Electrowinning House Building Sections	ZON-CAD-0002	10/11/94
65-20-FS-01	Electrowinning House Flowsheet	ZON-CAD-0005	10/11/94

Solvent Extraction Plant

65-10-GA-01	Solvent Extraction Plant General Arrangement	ZON-CAD-0006	10/11/94
65-10-FS-01	Solvent Extraction Plant Flowsheet	ZON-CAD-0005	10/11/94

Tank Farm

65-30-GA-01	Tank Farm General Arrangement	ZON-CAD-0006	10/11/94
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December 01, 1994

Mr. Michael D. Greenslade, P.E.
Mining APP Unit
Water Quality Division
Arizona Department of Environmental Quality
3033 N. Central Avenue
Phoenix, AZ 85710

Sir:

As per your letter of November 8, 1994, enclosed is the additional information necessary to process the Zonia Mine Aquifer Protection Permit Application. The enclosures should be inserted into the application as the technical review appendix.

I trust the draft APP will be forthcoming. Thank you for your help and cooperation.

Sincerely,

A handwritten signature in cursive script that reads 'Harrison Matson'. The signature is written in dark ink and is positioned above the printed name and title.

Harrison Matson
Chief Geologist

Zonia Mine Aquifer Protection Permit Application
Technical Review Appendix



Arimetco, Inc.
900 N. Finance Center Dr.
Tucson, AZ 85710

Zonia Mine Aquifer Protection Permit Application
Technical Review Appendix

<u>INDEX</u>	<u>PAGE</u>
Land Status/Claims	1-11
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Financial/Assurance/Costs	15
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Key Statistics	17
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County Zoning Letter	19-21
Flood Plain Assessment	22
Discharge Impact Area determination	23-24
Asphalt Liner	25-29

Map Pocket

Land Status Map	ZEE009
100 Year Flood Plain Map	ZEE007

List of design plans submitted with appendix

65-60-GA-31	Leach Basin 3	General/Arrangement
65-60-GA-32	Leach Basin 3	Sections & Details
65-65-GA-53	Leach Basin 5	Secondary Pond Plan & Details combined as one drawing with 65-65-GA-54
65-44-GA-01	Fueling Station	General/Arrangement
65-46-GA-01	Acid Unloading Station	General/Arrangement
65-65-GA-01	Barren Solution Pond	General/Arrangement
65-65-GA-12	Raffinate Pond	General/Arrangement

Demonstration of Technical Capability

The project design was handled jointly by Arimetco Inc. staff engineers and geologists in cooperation with Western States Engineering and Construction, Inc.. Western States is an Arizona based, registered, consulting engineering firm with a staff of approximately 40 experienced engineers. The Arimetco engineering department staff has been responsible for the design, construction and operation of three separate solvent extraction/electrowinning plants for the recovery of copper by oxide leaching. Aside from the hydrometallurgical recovery facilities designed and constructed, the staff was also responsible for all mine planning and development duties including metallurgical testing, leach pad design and environmental analysis.

Arimetco currently operates and manages the operations of five mine/plant facilities. These are the Yerington, Nevada, open pit copper mine and SX-EW Plant, the Johnson Camp, Arizona, open pit copper mine and SX-EW plant, the Emerald Isle, Arizona, open pit copper mine and SX-EW plant, the Whitecliff, Arizona, natural diatomite mine, and air classification plant, and the Andacaba, Bolivia, underground lead/zinc/silver mine and sulphide concentrator. All properties are supervised by experienced mining engineers.

November 28, 1994

Mr. Mike Rozycki, Director
Planning & Zoning Department
Yavapai County
255 E. Gurley Street
Prescott, AZ 86301

Sir:

I am writing to provide advance notice that Arimetco, Inc. has submitted an application with the Arizona Department of Environmental Quality to construct a new copper mining and processing facility in Yavapai County. The facility is to be located at the site of the Zonia Mine in the Walnut Grove Mining District about six miles southeast of Kirkland Junction.

As you may already know, Arimetco first entered the property in 1993 and began a water quality remediation program which implemented measures to immediately control historic discharge problems. These ongoing efforts have been successful in cleaning up a chronic problem.

The new facility will be a zero discharge design utilizing best available pollution control technology. High purity copper will be produced which will be shipped directly to the consumer without need of smelting. The process is a closed cycle, solvent extraction/electrowinning method of copper production from oxide ores following heap leaching.

The new facility is expected to employ up to seventy people and produce 50,000 pounds per day of copper. Construction will begin once permits are secured, possibly in early spring of 1995.

The principal components of the facility are:

- 1) Five to seven million ton per year open pit mine
- 2) Four ore heaps which will be fully contained with synthetic liners
- 3) Three overburden stockpiles containing non-reactive rock
- 4) Six, doubly lined, primary solution containment ponds

Page two

- 5) A 5,000 gpm solvent extraction and electrowinning plant with full secondary containment and leak detection monitors.
- 6) Fuel and Reagent offloading and storage areas with full secondary containment.
- 7) Truck and equipment repair shop, two bay with aboveground oil recycling storage.

The open pit mine and plantsite are located entirely on private land, which encompasses over 700 acres. The ground is held under a 1993 purchase option from the Zonia Company of Prescott, Arizona.

It is understood that a facility of this type does not come under the jurisdiction of the County Planning and Zoning Department, but that notification is required. Should you need further information on the proposed Arimetco project at Zonia, we would be pleased to provide it. A copy of the Air Quality Permit application will be forwarded to your department when completed.

Sincerely,



Harrison Matson
Chief Geologist

P 899 973 494



Certified Mail Receipt
No Insurance Coverage Provided
Do not use for International Mail
(See Reverse)

Sent to	
YAVAPAI CO PLANNING & ZONING	
Street & No.	
255 E. Gurley	
P.O., State & ZIP Code	
Prescott AZ 86301	
Postage	\$
Certified Fee	
Special Delivery Fee	
Restricted Delivery Fee	
Return Receipt Showing to Whom & Date Delivered	
Return Receipt Showing to Whom, Date, & Address of Delivery	
TOTAL Postage & Fees	\$
Postmark or Date	

PS Form 3800, June 1990

100 Year Flood Plain Assessment

An additional copy of ZEE-007, the 100 year flood plan map is appended. This map was derived by a combination of fieldwork, inspection of aerial photographs and calculation of runoff using SCS curves. Due to the relatively high relief in the Zonia mine area, only the channel of French Gulch lies within the Flood Plain. As the channel constricts or widens, the flood plain does the same.

Two monitor wells may at some time, be affected by flooding in French Gulch. The Z601 and cabin wells are located on terraces along the channel. The relatively low level of risk associated with temporary flooding at these sites does not merit preventative action other than normal surface seal construction.

The only facility component which could be adversely affected by location adjacent to the flood plain is the raffinate pond below the plant. Precautions which will be taken to prevent damage to this structure include channel deepening, widening and installation of a concrete, erosion control wall. This erosion control/scour protection wall will be installed on the south bank of French Gulch, along the entire length of the channel where it parallels the pond.

Previously existing PLS solution piping which was located within the French Gulch flood plain has been removed. All pipelines which carry process solutions will be located outside of, or above the maximum limit of the flood plain.

Discharge Impact Area Map

The appended map showing the worst case discharge impact area boundary was derived from data collected and empirical observations performed during the course of the hydrogeologic investigation conducted on the property in 1993. The results of that evaluation are detailed in the study submitted to A.D.E.Q. in November of that year titled Report on the Hydrogeologic Conditions at the Zonia Mine, Yavapai Co., AZ by Harrison Matson. The graphs on pages 54 to 58 specifically deal with the concentration vs. distance from source issue. A 6,000' to 7,000' distance along the ground water flow path was found to attenuate metal concentrations to background levels. The boundary shown reflects this distance as modified by the actual groundwater flow directions at the site.

Asphalt Membrane Liners

The existing leach basins at Zonia were originally prepared for use by installation of an asphalt membrane type liner system. This system has remained an effective containment method over time as evidenced by groundwater monitoring immediately adjacent to the basins.

A similar asphalt membrane system is proposed as an alternate construction method for the secondary liner in new applications. The preferred method submitted with plans for leach pads, calls for a 12 inch compacted native soil liner under the primary synthetic HDPE liner. However, the lack of abundant on-site clay soil and local steep slope site conditions may at times necessitate an alternate method for both economic and engineering reasons. Use of an asphalt membrane beneath the primary synthetic liner will more than meet B.A.D.C.T. standards in that the asphalt liner when used alone, has been demonstrated to be an effective containment method.

Several pages from Asphalt in Hydraulic Structures follow which provide general information on acceptable construction practices. Any new asphalt membranes installed will be placed using manufacturers recommended application rates and standard industry construction practices.

January 4, 1995

Michael D. Greenslade P.E.
Mining APP Unit
Water Quality Division
Arizona Department of Environmental Quality
3033 North Central Ave.
Phoenix, AZ 85012

Sir,

In response to your letter of December 23, 1994 requesting additional information to complete the technical review of the Zonia Mine APP application, the following documents are provided:

- 1) Complete set of non-proprietary design plans as required for descriptive/permitting purposes.
- 2) APP Drawing List, revised 12/28/94.
- 3) Quality Assurance/soil liners & asphalt liners.
- 4) Emergency Response Plan
- 5) Surface Water Sample Points Map.
- 6) Water Quality Monitoring Plan.

The facility design plan(s) referred to in your letter are synonymous with the design drawings as submitted. The plan 65-65-GA-54, also listed was incorporated into 65-65-GA-53 as listed in the technical review appendix and the revised drawing list.

As you will see from the enclosed plans, additional areas have been included in the design for a No. 6 leach basin and a No. 4 waste rock dump. The leach basin is adjacent to the No. 5 and incorporates the same BADCT measures for design. The 100 year/24 hour precipitation event is contained within a primary and secondary pond system. The primary pond will be doubly lined with a 1 foot minimum thickness clay under 60 mil HDPE synthetic liner. The clay liner once compacted will meet a 1×10^{-7} cm/sec coefficient of permeability standard. The leach basin or pad will also have a 60 mil HDPE liner over a 12 inch minimum, compacted native soil subbase. Details are provided on the plans.

The No. 4 rock dump will provide an alternate site to place overburden and below cutoff rock from the open pit mine. The site is over low permeability granitic bedrock. Only material which has been determined to have negligible acid generation potential will be placed in this area. Yearly monitoring for compliance verification is proposed using laboratory predictive testing of the rock.

Since we had hoped to begin construction of the plant at Zonia in February 1995, I greatly appreciate your efforts to complete the review and formulate a new permit. I will telephone in about a week to see if any design clarifications are needed.

Sincerely,

A handwritten signature in cursive script that reads "Harrison Matson".

Harrison Matson
Chief Geologist

Ground & Surface Water Monitoring

Surface water sample collection will be performed weekly at the following points:

- 1) French Gulch above Zonia Gulch
- 2) Zonia Gulch above French Gulch
- 3) French Gulch below Zonia Gulch

All samples will be field tested for pH and conductivity. Surface water flow measurements will be recorded concurrently with sampling.

Surface water samples will be collected quarterly from the following points:

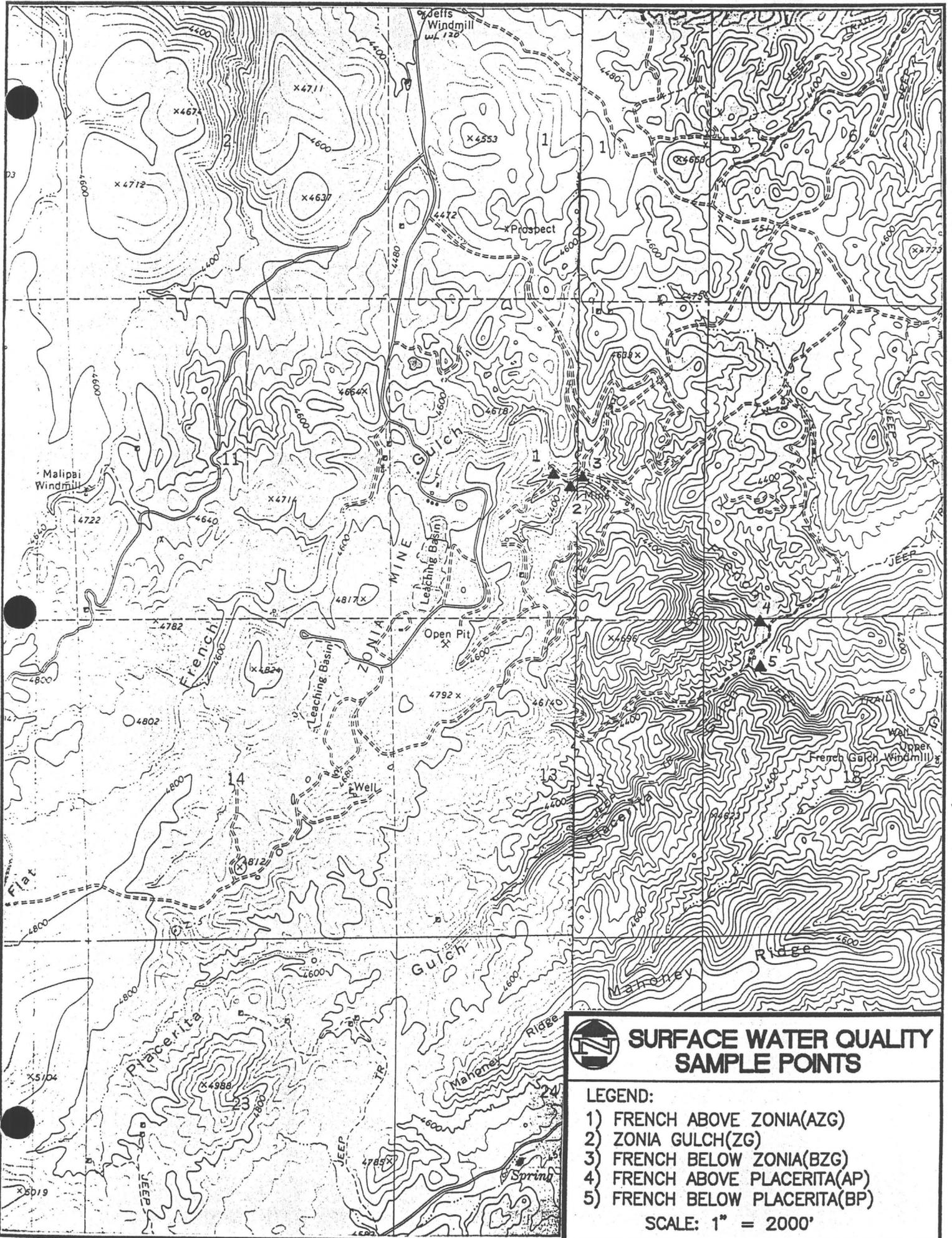
- 1) French Gulch below Zonia Gulch
- 2) French Gulch above Placerita Gulch
- 3) French Gulch below Placerita Gulch

These samples will be field tested for PH and conductivity. A two liter sample will be collected from each point, bottled, preserved and handled using approved methodology. Quarterly samples will be delivered to a state certified water quality laboratory and tested for a suite of parameters. Total metal analysis will be conducted for copper, lead, iron, arsenic, beryllium, cadmium, chromium, mercury, nickel, selenium, zinc and manganese. Nitrate, sulfate and total dissolved solids will also be determined.

Ground water monitoring will be conducted monthly at the following wells:

- 1) A14
- 2) A16
- 3) Z605
- 4) Z602
- 5) Z601
- 6) cabin

Field tests at the well head will be made to determine pH and conductivity. Like the surface water samples, a two liter volume will be collected following standard procedures for delivery to the laboratory. The samples will be tested for total copper, manganese, sulfate and TDS. Analyses for the same comprehensive suite of elements as the quarterly surface sampling program will be conducted yearly.



**SURFACE WATER QUALITY
SAMPLE POINTS**

LEGEND:

- 1) FRENCH ABOVE ZONIA(AZG)
- 2) ZONIA GULCH(ZG)
- 3) FRENCH BELOW ZONIA(BZG)
- 4) FRENCH ABOVE PLACERITA(AP)
- 5) FRENCH BELOW PLACERITA(BP)

SCALE: 1" = 2000'

Arimetco Inc.

Results of the surface and groundwater monitoring program will be reported to ADEQ on a quarterly basis. Due to laboratory reporting lagtime, this report date should be scheduled as 8 weeks after the end of each quarter. Collection of data necessary to calculate alert levels is currently in progress. Alert levels will be proposed to ADEQ and mutually agreed upon, prior to activation of major process components.

Contingency Plan for Alert Level Exceedance

Alert level exceedance maybe caused by 1) Solution leakage from a control area. 2) Ambient fluctuations in groundwater quality caused by seasonal precipitation variability. 3) Incorrectly determined alert levels. 4) Analytical or sampling error.

An event reported as an alert level exceedance will be immediately investigated to determine the cause. All containment structures or controls will be reexamined and evaluated for effectiveness. Should the inspection reveal possible leakage, corrective measures will be taken immediately.

The monthly samples from the monitor wells will be routinely tested for copper, manganese, TDS, sulfate, pH and electroconductivity. In the next two sampling intervals following an exceedance the samples will also be tested for a 16 ion range of water quality parameters to thoroughly evaluate the anomalous results. If the discrepancy is not by this time resolved, a report will be provided to ADEQ with conclusions as to the source of the exceedance and recommendations on corrective action. This corrective action will be suited to the reason for and degree of the alert level exceedance.

If the exceedance is directly traced to solution leakage from the leaching or plant operations, corrective measures may entail temporary shutdown of the noncomplying system until such time as containment can be assured. In the event of recurrent problems with alert level exceedance traced to leakage, a barrier well system will be installed to intercept the solution and return it to the system. Such measures would be fully coordinated with ADEQ.

Arimetco Inc.

Quality Assurance

Native Soil Subliner

Verification that compaction specifications will be met will be provided ADEQ through the use of a third party, independent geotechnical engineering firm. A technician will intermittently visit the construction site and perform in-place compaction tests on the soil liner. For leach pad soil liner preparation, compaction tests will be collected on a 200'x 200' grid spacing. Test areas which fail compaction specifications will either be recompacted or a soil amendment added and recompacted. Moisture testing to verify compaction within 2% of optimum will be conducted at the same time as the compaction testing.

Specification for compaction will range from 95%-98% modified proctor depending on results of a soil characterization study which will correlate hydraulic conductivity to compaction for each leach pad area. The appended laboratory test results from clay soil used in dam core and pond liner construction (SHB Job No. C93-6522) illustrate the method. The coefficient of permeability standard for clay pond liners shall be 1×10^{-7} cm/sec.

Asphalt Membrane Liner

Quality assurance/control for asphalt membrane liners will be provided by a third party, independent construction contractor review followed by an Arimetco engineer's inspection. The inspection will be a visual search for cracks, holes and thin or weak areas in the membrane. Corrections will be made by hand spray application.

Application rate shall be at or above manufactures specification, not less than 0.5 gallons per square yard.

Subgrade will be dressed by dragging or dozer blading. A high level of compaction is not required so test work will be limited to random sand cone tests to verify 90% modified proctor for subgrade soils. Asphalt membrane placement is planned as an alternative liner system for use in shallow rocky soil which would not meet permeability standards even at high compaction. All asphalt liners are to be installed with a soil, rock or synthetic covering as protection from deterioration by sunlight.

ARIMETCO, INC.
ZONIA MINE
EMERGENCY RESPONSE PLAN

Introduction

This Emergency Response Plan (**ERP**) has been developed for the Zonia Mine using industry and regulatory approved handling, storage, containment, response and notification waste management practices. Arimetco, Inc's intent is to give the highest priority to the protection of human health, safety and the environment.

Operation, Maintenance and Safety

Operating procedures in this **ERP** are primarily related to on-site movement, handling and use of chemicals. Employees involved in these activities will be instructed in safe work procedures. These will include:

- 1) Storing chemicals safely in designated areas.
- 2) Driving vehicles safely to avoid collisions or ruptures to storage and solution components.
- 3) Safe spill clean up methods and exposure hazards.
- 4) Checking to make sure solution pipelines and containment areas are secure with leak detection devices functional.
- 5) Observation and reporting of potential problem areas to immediate supervisor.

Maintenance

Inspection of the temporary storage facilities and solution components will be conducted on a regular basis when chemicals are present. The inspection includes checking for visible signs of leakage; checking containers for any sign of weakness, tears or ruptures; and checking for cracks or breaks in the containment berms. Any observed problems will immediately repaired.

Warnings signs are part of the chemical spill prevention program and will be posted at all material storage and use areas. These signs are posted to remind workers of the nature of the chemicals being used and to promote safe practices. Copies of the **ERP** will be posted in several highly visible locations. Workers will be instructed as to the actions that must be taken if a spill occurs.

**ZONIA MINE
EMERGENCY RESPONSE PLAN**

WORKER SAFETY

The Zonia Mine is subject to both the Mine Safety and Health Administration (MSHA) regulations and Arizona State Mine Inspectors office regulations. MSHA requires mining companies to comply with comprehensive laws governing the health of employees and the design of buildings associated with processing.

Heap Leach Processing Reagents

In the event of an accident, spill or leak, the following steps are to be initiated.

If a worker is not familiar with the heap leach process or process reagents and discovers an accident, leak or spill, he should not attempt to follow the steps below, but rather should immediately notify his Supervisor or the Shift Foreman.

- 1) Determine the nature and extent of the problem. DO NOT take any action until the proper course of action can be determined based on the nature and extent to the accident, leak or spill.
- 2) Put on the proper body and face protection and a breathing apparatus, if necessary, and implement measures to protect all potentially exposed individuals.
- 3) Attempt to stop or contain the flow of material.
- 4) Notify immediate Supervisor. Supervisors are to report directly to the Field Manager or Project Manager. The Project Manager will take further corrective and notification actions, if necessary.
- 5) Begin neutralization activities, if necessary.
- 6) Begin clean-up activities.
- 7) Implement spill and spill path monitoring, if necessary.

Table 1 lists proper protection, clean-up and monitoring for heap leach reagents.

The above outline does not represent a complete list of all actions and incident-specific responses that will be required. Incident-specific responses must always be established.

Table 1: Reagent Spill Handling

Chemical	Protection	Spill Handling
Lime	<ul style="list-style-type: none"> *Wear protective clothing, gloves and eye protection *Wear an approved dust respirator 	<ul style="list-style-type: none"> *Stop and/or contain the spill *Shovel into approved containers
Weak Sulfuric Acid Solutions	<ul style="list-style-type: none"> *Wear protective clothing *Wear approved eye protection *Wear an approved respirator 	<ul style="list-style-type: none"> *Stop and/or contain the spill *Add lime to neutralize the sulfuric acid *Pump or divert to proper storage area *Implement spill monitoring if it is necessary *Remove contaminated soil, if necessary *Implement notification of appropriate agencies, if necessary *Implement notification of appropriate agencies, if necessary
Strong Sulfuric Acid	<ul style="list-style-type: none"> *Full acid protection suit with helmet and face shield <p>See attached MSDS</p>	<ul style="list-style-type: none"> *Warn others, stop spill *Pump to containment area using extreme caution *Violent reaction possible if acid comes in contact with small quantities of water *Pump acid into tank or large volume of water such as RAFF pond *Neutralize contaminated soil *Implement notification of appropriate agencies, if necessary
Organic Diluent	<ul style="list-style-type: none"> *Use adequate ventilation, or in confined space supplied air respirator *Wear eye protection and face shield if splash possibility exists *Rubber gloves and/or suit for skin protection *See attached material safety data sheet 	<ul style="list-style-type: none"> *Check for fire hazard *Ground equipment *Pump to contained area or soak up with absorbent *Remove contaminated soil to lined composting area *Implement notification of appropriate agencies, if necessary
Organic Extractant	<ul style="list-style-type: none"> *Use adequate ventilation or in confined space supplied air respirator *Wear eye protection and face shields if splash possibility exists *Rubber gloves and/or suit for skin protection *See attached material safety data sheet 	<ul style="list-style-type: none"> *Check for fire hazard *Ground equipment *Pump to contained area or soak up with absorbent *Remove contaminated soil to lined composting area *Implement notification of appropriate agencies, if necessary
Petroleum Products	<ul style="list-style-type: none"> *Eye protection *Skin protection 	<ul style="list-style-type: none"> *Evaluate combustion danger *Stop or contain the spill *Monitor release *Pump or divert to storage area *Remove contaminated soil to compost area.

**ZONIA MINE
EMERGENCY RESPONSE PLAN**

The Emergency Response Plan may be updated periodically to reflect any changes in the storage and/or use of additional chemicals/reagents on site. Employees will be trained on how to manage these chemicals and respond to spillage and clean-up activities specific to each chemical.

Accident and Injury Contingency Plan

First aid supplies will be available during project construction and during all operations. The first aid supplies, emergency control services and emergency action notification lists are located in the plant office and truck shop office. All personnel will have first aid training.

Any medical emergency dial 911

Ambulance Service - Dispatched by Yavapai County Sheriff's Office: 911 or 771-3260

Spill or Discharge Contingency Plan

A list of chemicals that will be stored on site in significant amounts is shown in table 2.

Table 2: Zonia Mine Chemical Storage Inventory

COMMON NAME	CHEMICAL NAME, COMPONENTS CONCENTRATION	PHYSICAL STATE	QUANTITY
Lime	Calcium hydroxide	S	1,000 lbs.
Sulfuric Acid	Sulfuric Acid - 93% to 96%	L	90,000 gal.
Diluted Sulfuric Acid	PLS & Raffinate - 17g/l	L	+ 500,000,000gal.
Organic Diluent	Hydrocarbon C-9 C- 16	L	18,000 gal.
Organic Extractant	5-Nonyl- Salicylaldoxime w/ C-9 C-16	L	500 gal.

**ZONIA MINE
EMERGENCY RESPONSE PLAN**

Clean-Up

The emergency response plan will include specific training in clean-up and neutralization for selected employees. One or more specifically trained employee(s) will be on site during operational hours. In the event of a spill employee(s) will be immediately dispatched to the site to assist in the clean-up efforts. Appropriate equipment will be available to neutralize solutions, contain spills and to transport contaminated material for ultimate disposal in accordance with applicable rules and regulations.

In the event of a potentially hazardous material spill, the plan will be to protect human health and safety, contain, detoxify, if necessary and clean-up. Agents for sulfuric acid neutralization will be kept available at the minesite for use. Clean-up personnel will be trained in the proper procedures for each type of material on site. Lime can be added directly to a spill area in the powder form or in the form of solution, and will be used for weak sulfuric acid solution neutralization. The lime solution will be added directly to the spill area until the pH levels reach acceptable levels. Concentrated sulfuric acid spills require great caution during clean-up due to the possible violent explosive nature of neutralization reactions. Simple dilution with water may cause extreme heat generation and eruption. Acid should be transferred at low rates into a volumetrically much greater amount of diluent such as in the Raffinate pond.

Any spill of other fluids such as fuel or oil will be excavated to uncontaminated and undisturbed soil. The excavated soil will be refilled with fresh borrow soil to the original form. The excavated soil will be removed to a prepared composting containment area for biodegradation.

Spill Monitoring

In the event of an accident, spill or leak with the potential to migrate from the point of occurrence, spill monitoring will be implemented. The exact nature and extent of the monitoring will be determined by the nature of the spill and the potential hazards created by the spill. The Field Manager or other senior staff present at the time of the spill will determine appropriate spill monitoring. The potential for spills of heap solutions migrating from the point of occurrence is minimal. All heap solutions will be used and stored in engineered containment facilities. The facility is designed for collections and containment of all spills.

**ZONIA MINE
EMERGENCY RESPONSE PLAN**

Spill monitoring equipment will be available on site to ensure monitoring in the unlikely event of spills migrating away from the point of occurrence. Spills will be monitored and decontaminated or removed as necessary. More comprehensive spill-specific monitoring requirements will be developed in conjunction with the appropriate regulatory agencies, if necessary.

Spill and Emergency Action Reporting

Arimetco will endeavor to keep all appropriate agencies informed about incidents that may occur. Small incidental, controllable spills that do not pose a human health or environmental hazard shall be remedied immediately by trained personnel. Spills or situations that represent a potential threat to human health or the environment will be immediately reported to all responsible agencies. Notification will depend upon the nature and extent of the spill or potential hazards resulting from the spill.

A spill or release is defined as a loss of solution containing a hazardous substance to an uncontrolled or protected area. Spills at the Zonia Mine may consist of concentrated sulfuric acid, dilute sulfuric acid-water solutions (raffinate and PLS) and organic reagents or hydrocarbons.

Spills have been categorized into the following three classes:

Class I Spill:

Any spill totalling less than the following quantities within a 24 hour period:

- A. Four (4) gallons of concentrated sulfuric acid;
- B. Four hundred (400) gallons or approximately 53 cubic feet of (g/l) raffinate solution;
- C. Eight hundred (800) gallons or 106 cubic feet of dilute PLS solution.

Class II Spill:

Any spill totalling more than a Class I spill, but less than a Class III spill.

**ZONIA MINE
EMERGENCY RESPONSE PLAN**

Class III Spill:

- A. Seventy-one (71) gallons or 1,000 pounds of concentrated 93% sulfuric acid;
- B. Seven thousand (7,000) gallons or 935 cubic feet of 17g/l raffinate solution;
- C. Fourteen thousand (14,000) gallons or 1,870 cubic feet of dilute PLS solution;
- D. Twenty-five (25) gallons of petroleum product in an unprotected area.

Class I Spills are reportable by log entry within 24 hours with repairs and clean-up immediately initiated.

Class II Spills are reported by log entry and quarterly reporting to the ADEQ, with repairs and clean-up being immediately initiated upon the discovery of the spill.

Class III Spills are reportable by log and phone to the Arizona Department of Emergency Affairs, ADEQ and the Federal Emergency Management Agency. Repairs and clean-up will be initiated immediately upon discovery. Operations may be temporarily suspended to promote immediate repair and clean-up.

Any hazardous substance spills will be documented on the date of occurrence in the operating log, which will include the following details:

- A. Type, concentration and quality of hazardous substance spilled;
- B. Location of the spill;
- C. Descriptions of actions taken to contain, clean-up and/or neutralize the spill.

The following agencies will be contacted per the above:

Arizona Department of Environmental Quality.
3033 North Central Ave.
Phoenix, AZ 85012

Emergency Response: (602) 257-2330
General Number: (800) 234-5677

**ZONIA MINE
EMERGENCY RESPONSE PLAN**

Environmental Protection Agency, Region IX
San Francisco, CA
(415) 556-8200

Arizona Department of Emergency Affairs
5636 E. McDowell Rd.
Phoenix, AZ 85008

Hazardous Material Phone: (602) 231-6309
Main Number: (602) 244-0504

A nationwide notification system has been established for potentially hazardous material spills during shipping.

The Chemical Manufacturer Association
Chemical Transportation Emergency Center (CHEMTREC)
Washington, D.C.
(800) 424-9300

The information specialist on duty will ask the name and location of the caller, the name of the shipper, the product, the shipping point and destination, what happened, weather conditions, proximity to population centers, etc. He will then give the caller recommendations on controlling the emergency situation until the information specialists can relay help. CHEMTREC will immediately notify the shipper of the emergency and a specialist will get in touch with the caller promptly.

The **ERP** will be implemented by placing it in strategic locations at the minesite. These are:

- 1) The maintenance shop
- 2) The plantsite office
- 3) The Arimetco offices at the Zonia Mine

In conjunction with this, all employees will receive instructions on the content of the plan, along with periodic instruction on the nature, transportation and handling of hazardous materials.

Emergency Personnel and Telephone Numbers

Company Representatives

A supervisory personnel contact list will be added to the document prior to operation.

MAGMA COPPER COMPANY

San Manuel Division
Post Office Box M
San Manuel, Arizona 85631

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MATERIAL SAFETY DATA SHEET

MARCH 31, 1989

24-Hour Emergency Telephone:
(602) 385-3349 Monday-Friday 0730-1600 Hours
(602) 385-3269 All Other Times
Chemtrec: 1-800-424-9300

Section I - Product Information

RTECS NO: WS 56000000	CAS #7664-93-9
Chemical Name/Synonyms:	Sulfuric Acid, Hydrogen Sulfate, Oil of Vitriol, BOV, Dihydrogen Sulfate, Dithionic Acid
Trade Name:	Sulfuric Acid, Concentrated
Chemical Family:	Inorganic Acid
Formula:	H ₂ SO ₄ Mixture
CERCLA Ratings (scale 0-3):	Health=3 Fire=0 Reactivity=2 Persistence=0
NFPA Ratings scale (0-4):	Health=3 Fire=0 Reactivity=2

Section II-A - Product Composition

<u>No.</u>	<u>Ingredient</u>	<u>Percent</u>
1.	Hydrogen Sulfate	92-98.5
2.	Water	Balance*
3.	Trace elements (individually)	< 1

*Material is obtained by the reaction of SO₃ and water. Can contain low impurity levels. Properties may vary with H₂SO₄ content.

Section II-B - Acute Toxicity

<u>No.</u>	<u>Oral</u>	<u>Eye</u>	<u>Inhalation</u>
1.	H ₂ SO ₄ LD50 2140 mg/kg rat	1380 ug severe	LC50 18 mg/M ³ guinea pig
2.	Water N/A	N/A	N/A

Section II-C - Occupational Exposure Limits

<u>No.</u>	<u>OSHA</u>		<u>ACGIH</u>	
	<u>PEL/TWA</u>	<u>PEL/Ceiling</u>	<u>TLV/TWA</u>	<u>TLV/STEL</u>
1.	1 mg/M ³	---	1 mg/M ³	---
2.	Not Indicated			

NIOSH has a 10-hour TWA; 40 hour work week exposure limit of 1 mg/M³

Section III - Health Information/Emergency and First Aid

The health effects listed below are consistent with the requirements under OSHA 29 CFR 1910.1200.

Eye Contact

Sulfuric acid is a strong mineral acid, an oxidizing agent, and a dehydrating agent that is rapidly damaging to all human tissue with which it comes in contact. Will cause severe or permanent injury including blindness. Sulfuric acid mist severely irritates the eyes. Dilute acid is a milder irritant. Repeated exposure to mist causes chronic conjunctivitis.

Immediately flush eyes with plenty of running water for at least 15 minutes, including under the eyelids (lift upper and lower lids). Speed in flushing and diluting the acid with copious amounts of running water is absolutely essential if permanent eye damage is to be minimized and/or avoided. Get medical help immediately.

Skin Contact

Concentrated sulfuric acid is rapidly irritating and destroys all tissue. Dilute forms act as mild irritant due to acidic properties. The concentrated mist is severely irritating to the skin. Repeated exposure to mist causes chronic dermatitis.

Immediately flush affected areas with copious amounts of running water removing contaminated clothing while under the safety shower. Wash with water for at least 15 minutes and seek medical attention immediately.

Inhalation

Sulfuric acid mist is severely irritating to the upper respiratory tract. It may cause pulmonary edema, thickening of the alveolar walls, pulmonary airway resistance and reflex broncho-restriction. It will impair ventilatory capacity. It may cause pulmonary fibrosis, residual bronchitis and pulmonary emphysema.

Remove to fresh air. If breathing has stopped, perform artificial respiration. Keep affected person warm and at rest. Get medical attention immediately.

Ingestion

The highly corrosive nature of the substance causes serious mucous membrane burns of the mouth, esophagus and stomach.

If liquid sulfuric acid or solutions of sulfuric acid have been swallowed and the person is conscious, dilute acid immediately with large quantities of milk or water, then give milk of magnesia to neutralize. Do not induce vomiting. If it occurs spontaneously, wait, then continue to administer fluids when vomiting has ceased. Observe patient for delayed onset of pulmonary edema. Seek medical help immediately.

Section IV - Supplemental Health Information

In human subjects concentrations of 5 mg/M³ are objectionable causing coughing, impairment in ventilatory capacity and increase in respiratory rate. Workers exposed to concentrations of 12.6 to 35 mg/M³ had incidence of erosion and discoloration of teeth. Repeated exposure of workers to the mist will cause chronic conjunctivitis, tracheobronchitis, stomatitis, dermatitis and dental erosion.

Section V - Physical Data

	<u>93-98% H₂SO₄</u>
Molecular Weight:	98.08
Boiling Point (°C):	290
Melting Point (°C):	10
Specific Gravity (H ₂ O = 1):	1.84
Vapor Pressure, mmHG @ 100°F:	< 1 (93.2% H ₂ SO ₄)
Deg. Baume:*	66 (93.2% H ₂ SO ₄)
Vapor Density:	3.4
Odor Threshold:	> 1 mg/M ³
Solubility:	Completely miscible in water

Description: Clear, colorless, dense, hygroscopic oily liquid with no odor. A marked acid taste when pure.

* Density of H₂SO₄ is often reported in degrees Baume Be. Formula is degrees Be = 145 - 145/sp gr for liquids heavier than water.

Section V - Fire and Explosion Hazards

Flash Point: Nonflammable; negligible fire hazard when exposed to heat or flame.

Sulfuric acid itself is not combustible but is highly reactive and capable of igniting finely divided combustible materials on contact. Fires involving small amounts of combustible materials may be smothered with a suitable dry chemical. Water, when applied directly to sulfuric acid causes evolution of heat and splattering. Cool exterior of storage tanks of H₂SO₄ with water to avoid rupture if exposed to fire. The acid, especially when diluted with water, can react with metals to liberate flammable hydrogen gas and sulfur-oxides. Sulfuric acid mists and vapors from a fire area are corrosive. Firefighters must wear self-contained breathing equipment and full protective clothing.

Section VI - Reactivity

Violent exothermic reaction with water. Acid should always be added slowly to water.

Hazardous polymerization will not occur under normal conditions of use and storage.

Incompatibilities: Organic materials (eg. chlorates, carbides, fulminates), bases, and metals. The concentrated acid is a strong oxidizing agent and will cause ignition of combustible materials on contact. The concentrated acid is also a dehydrating agent, picking up moisture from the air and other materials.

Sulfur oxides can result from decomposition and from oxidizing reactions of sulfuric acid.

Hydrogen gas may be generated within an H₂SO₄ container. Vent drums cautiously.

Section VII - Employee Protection

Respiratory protection: Provide general ventilation to meet current TLV requirements in the workplace. Where PEL/TLV is exceeded wear approved NIOSH/MSHA respirators.

Avoid eye contact by use of face shields (8-inch minimum) or chemical safety goggles. Impervious protective clothing such as rubber gloves, aprons, boots and suits are recommended to prevent the possibility of repeated or prolonged contact with this acid.

Eyewash foundations and safety showers should be readily available where this material is handled or stored.

Section VII - Spill and Leak Procedure

Ventilate area of spill or leak. Notify Safety personnel. Prevent contact with the acid. Minor leaks or spills can be diluted with water and neutralized with soda ash, crushed limestone or slaked lime. If water is not available, cover contaminated area with sand, ashes, or gravel and neutralize with soda ash or lime. Collect spilled or leaked material in the most convenient and safe manner possible.

Major spills must be handled by a predetermined plan. Prevent entry into the environment by diking. Dilute and neutralize if possible.

Prevent contact with skin by wearing appropriate protective clothing as described. Restrict persons not wearing protective equipment and clothing from entering the area until cleanup has been completed.

Disposal: Follow all Local, State and Federal Regulations. Runoff to sewer may create hydrogen gas, which is a fire or explosion hazard.

Section IX - Special Precautions

Use extreme caution when transferring or unloading acid. Keep storage facilities separate from areas where metallic powders, chromates, chlorates, nitrates, carbides and oxidizables are stored. Soda ash, lime or sand should be kept in general storage or work areas for emergency use. Sulfuric acid is highly corrosive to most metals especially below 77% H₂SO₄. Avoid contact with skin and breathing mists or vapors. Do not add water to concentrated sulfuric acid. Do not smoke. Use non-sparking tools and vapor-proof type electrical fixtures.

Section X - Transportation Requirements

DOT Classification: Corrosive Material Label: Corrosive
I.D. No. UN1830

THE INFORMATION CONTAINED HEREIN IS BASED ON THE DATA AVAILABLE AND IS BELIEVED TO BE CORRECT. HOWEVER, MAGMA COPPER COMPANY MAKES NO WARRANTY, EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF. MAGMA COPPER COMPANY ASSUMES NO RESPONSIBILITY FOR INJURY OR ILLNESS FROM THE USE OF THE PRODUCT DESCRIBED HEREIN.

Prepared By: Pat Y. Brown Date: 4-6-89

Magma Copper Company
Industrial Hygiene Department
Post Office Box M
San Manuel, Arizona 85631

MATERIAL SAFETY DATA SHEET

4893

ZENECA Inc.

Wilmington, Delaware 19897
 Phone (24 hr.) Technical: (302) 886-3000
 Medical: (800) 327-8633

Issue Date: 04/25/94

Rev.: A
 CIDS: 15510

SECTION 1 NAME & HAZARD SUMMARY

Material name: ACORGA® M5640

Hazard summary (as defined by OSHA Hazard Comm. Std., 29 CFR 1910.1200):

Physical hazards: Combustible liquid

Health hazards: Irritant (skin, eye, respiratory passages), harmful (oral).

Based on aromatic oxime - harmful (central nervous system depression,
 kidney injury). Based on kerosene - harmful (gastrointestinal
 disturbance).

Read the entire MSDS for a more thorough evaluation of the hazards.

SECTION 2 INGREDIENTS

OSHA PEL

5-Nonyl-salicylaldoxime (CAS 50849-47-3)	Not listed
Kerosene, hydrodesulfurized (CAS 64742-81-0)	Not listed
Other solvent	Not listed

Ingredients not precisely identified are proprietary or nonhazardous. Values are not product specifications.

SECTION 3 PHYSICAL DATA

Appearance and odor: Clear, amber liquid

Boiling point: No data

Vapor pressure (mm Hg at 20°C): No data

Vapor density (air = 1): No data

Solubility in water: Insoluble

pH: No data

Specific gravity: 0.96 at 25°C

% Volatile by volume: No data

SECTION 4 FIRE AND EXPLOSION HAZARD DATA

Flash point: 192°F, 89°C (PMCC)

Autoignition temperature: No data

Flammable limits (STP): No data

Extinguishing media:

Carbon dioxide, foam, dry chemical, halogenated agents. Water spray may be used to cool containers, but a water stream may spread flames.

Special fire fighting protective equipment:

Self-contained breathing apparatus with full facepiece and protective clothing.

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MATERIAL SAFETY DATA SHEET (continued)

ACORGA M5640

SECTION 4 FIRE AND EXPLOSION HAZARD DATA (continued)

Unusual fire and explosion hazards:

Combustible liquid by OSHA 29 CFR 1910.1200. If heated above the flash point, heavy vapors can flow along surfaces to distant ignition sources and flash back.

SECTION 5 REACTIVITY DATA

Stability:

Stable under normal conditions.

Incompatibility:

Strong oxidizing agents.

Hazardous decomposition products:

Combustion products: Carbon dioxide, carbon monoxide. Nitrogen oxides, ammonia.

Hazardous polymerization:

Will not occur.

SECTION 6 HEALTH HAZARD ASSESSMENT

General:

No toxicity information is available on this specific preparation; this health hazard assessment is based on information that is available on similar preparations.

Ingestion:

The acute oral LD50 in rat is probably above 1,000 mg/kg. Relative to other materials, a single dose of this product is slightly toxic by ingestion.

Acute tests in animals indicated that kidney is probably the target organ for aromatic oxime toxicity.

Severe gastrointestinal disturbance is associated with ingestion of kerosene solvent. Ingestion of excessive quantities can also induce signs of central nervous system depression (e.g., drowsiness, dizziness, loss of coordination, and fatigue). Small amounts of the kerosene solvent, if aspirated into the lungs during ingestion or subsequent vomiting, may induce severe lung congestion resulting in labored breathing, coma, and death.

Eye contact:

This material will probably irritate human eyes following contact.

Skin contact:

This material will probably irritate human skin.

Skin absorption:

Systemically toxic concentrations of this product will probably not be absorbed through the skin in man.

Inhalation:

Vapors and aerosols can irritate eyes, nose and respiratory passages.

MATERIAL SAFETY DATA SHEET (continued)

ACORGA M5640

SECTION 6 HEALTH HAZARD ASSESSMENT (continued)Other effects of overexposure:

Central nervous system depression (e.g. headache, stupor) may be associated with vapor and aerosol exposures to the aromatic oxime. Kidney injury developed in animals administered repeated oral doses of the aromatic oxime.

Inhalation of high concentrations of kerosene may cause headache, dizziness, confusion, excitement, or drowsiness. In a lifetime skin painting study in mice, kerosene showed a minimal to moderate potential to cause skin tumors. Kerosene is not, however, listed as a carcinogen by NTP, IARC, or OSHA. Prolonged skin contact with this product should be avoided.

Because exposure potential is a critical element in the expression of a potential health hazard, this product, if handled in accordance with good industrial hygiene practice, will not present an actual hazard in the workplace.

First aid procedures:

Skin: Wash material off of the skin with plenty of soap and water. If redness, itching, or a burning sensation develops, get medical attention. Wash contaminated clothing and decontaminate footwear before reuse.

Eyes: Immediately flush with plenty of water for at least 15 minutes. If redness, itching, or a burning sensation develops, have eyes examined and treated by medical personnel.

Ingestion: Give 1 or 2 glasses of water to drink and refer person to medical personnel. (Never give anything by mouth to an unconscious person.)

Inhalation: Remove victim to fresh air. If a cough or other respiratory symptoms develop, consult medical personnel.

Note to physician: This material is considered to be only "slightly toxic" by ingestion. The potential complications associated with removing material from the GI tract, the amount ingested, and time since ingestion should be taken into account when developing a treatment plan.

SECTION 7 SPILL OR LEAK PROCEDURESSteps to be taken in case material is released or spilled:

Eliminate sources of ignition and ventilate spill area. Wear skin, eye, and respiratory protection during cleanup. Contain spill. Keep out of sewers and drains. Soak up material with absorbent and shovel into a chemical waste container. Cover container and remove from work area. Wash residue from spill area with water containing detergent and flush to a sewer serviced by a wastewater treatment facility.

Disposal method:

Discarded product is not a hazardous waste under RCRA, 40 CFR 261. This material is toxic to fish. Do not contaminate waterways by cleaning of equipment or by disposal of wastes. Untreated effluent should not be discharged where it will drain into lakes, streams, or ponds.

Container disposal:

Empty container retains product residue. Observe all hazard precautions. Keep away from heat, sparks and flames. Do not weld or use a cutting torch on or near container. Do not distribute, make available, furnish or reuse empty container except for storage and shipment of original product. Remove all product residue from container and puncture or otherwise destroy empty container before disposal.

MATERIAL SAFETY DATA SHEET (continued)

ACORGA M5640

SECTION 8 SPECIAL PROTECTION INFORMATION

TLV® or suggested control value:

No ACGIH TLV or OSHA PEL assigned. Minimize exposure in accordance with good hygiene practice.

Ventilation:

Use local exhaust if aerosol is generated.

Respiratory protection:

If needed, use MSHA-NIOSH approved respirator for organic vapors.

Protective clothing:

Gloves determined to be impervious under the conditions of use. Depending on conditions of use, additional protection may be required such as apron, arm covers, or full body suit. Wash contaminated clothing before rewearing.

Eye protection:

Chemical tight goggles and full faceshield.

Other protective equipment:

Eyewash station and safety shower in work area.

SECTION 9 SPECIAL PRECAUTIONS OR OTHER COMMENTS

Special precautions or other comments:

Follow procedures specified in the National Fire Protection Association codes and standards for handling combustible liquids. Prevent skin and eye contact. Avoid breathing vapors or aerosols.

SECTION 10 REGULATORY INFORMATION

TSCA (Toxic Substances Control Act) Regulations, 40 CFR 710:

All ingredients are on the TSCA Chemical Substance Inventory.

CERCLA and SARA Regulations (40 CFR 355, 370, and 372):

This product does not contain any chemicals subject to the reporting requirements of SARA Section 313.

The information herein is given in good faith
but no warranty, expressed or implied, is made.

Prepared/Reviewed: 09/22/92

***This line or section contains revisions or new statements since
the last issue date.

Keed
5-16-94

August 30, 1991



Material Safety Data Sheet

ORFOM[®] SX-7 (SOLVENT EXTRACTION DILUENT)

PHILLIPS 66 COMPANY
A Subsidiary of Phillips Petroleum Company
Bartlesville, Oklahoma 74004

PHONE NUMBERS
Emergency: (918) 661-3865
Business Hours (918) 661-8118
After Hours (918) 661-8118
General MSDS Information: (918) 661-8327

A. Product Identification

Synonyms: Solvent Extraction Diluent
Chemical Name: Hydrotreated Distillate, Light C9-C16
Chemical Family: Paraffinic and Aromatic Hydrocarbon
Chemical Formula: Mixture
CAS Reg. No.: 64742-47-8
Product No.: Not Applicable

Product and/or Components Entered on EPA's TSCA Inventory: YES

This product is in U.S. commerce, and is listed in the Toxic Substances Control Act (TSCA) Inventory of Chemicals; hence, it is subject to all applicable provisions and restrictions of 40 CFR, section 721 and 723.250.

B. Components

Ingredients	CAS Number	% By Wt.	OSHA PEL	ACGIH TLV
Hydrotreated Distillate, Light C9-C16	64742-47-8	100	5 mg/m3*	5 mg/m3*

* As oil mist.

NA - Not Applicable NE - Not Established

C. Personal Protection Information

Ventilation: Use adequate ventilation to control exposure below recommended exposure limit.

Respiratory Protection: For concentration exceeding the recommended exposure limit, use NIOSH/MSHA approved air purifying respirator. In case of spill or leak resulting in unknown concentration or in confined spaces or other poorly ventilated areas, use NIOSH/MSHA approved supplied air respirator.

Eye Protection: Use safety glasses with side shields. For splash protection, use chemical goggles and face shield.

Skin Protection: Use protective garments to prevent skin contact. Use impervious gloves such as neoprene or nitrile rubber.

NOTE: Personal protection information shown in Section C is based upon general information as to normal uses and conditions. Where special or unusual uses or conditions exist, it is suggested that the expert assistance of an industrial hygienist or other qualified professional be sought.

D. Handling and Storage Precautions

Do not get in eyes, on skin or on clothing. Avoid breathing vapors. Wear protective equipment and/or garments described in Section C if exposure conditions warrant. Wash thoroughly after handling. Launder contaminated clothing before reuse. Use with adequate ventilation.

Store and use in well-ventilated area away from ignition sources. Bond and ground during liquid transfer. Store in a closed container.

E. Reactivity Data

Stability: Stable
Conditions to Avoid: Not Applicable
Incompatibility (Materials to Avoid): Oxygen and strong oxidizing agents.

Hazardous Polymerization: Will Not Occur
Conditions to Avoid: Not Applicable
Hazardous Decomposition Products: Carbon oxides and various hydrocarbons are formed when burned.

F. Health Hazard Data

Recommended Exposure Limits:

See Section B.

Acute Effects of Overexposure:

Eye: May be mildly irritating to the eyes.

Skin: May cause severe skin irritation, especially upon repeated contact.

Inhalation: May cause headache and dizziness.

Ingestion: May be mildly irritating to intestines. May be aspirated into the lungs if swallowed resulting in pulmonary edema and chemical pneumonitis.

Subchronic and Chronic Effects of Overexposure:

No known applicable information.

Other Health Effects:

Long term exposure to high oil mist concentrations may cause non-debilitating lung changes.

Health Hazard Categories:

	Animal	Human		Animal	Human
Known Carcinogen	—	—	Toxic	—	—
Suspect Carcinogen	—	—	Corrosive	—	—
Mutagen*	—	—	Irritant	X	X
Teratogen	—	—	Target Organ Toxin	X	X
Allergic Sensitizer	—	—	Specify - Lung-Aspiration Hazard		
Highly Toxic	—	—			

First Aid and Emergency Procedures:

Eye: Flush eyes with running water for at least fifteen minutes. If irritation develops, seek medical attention.

Skin: Immediately wash with soap and water for fifteen minutes. Seek medical attention.

Inhalation: Remove from exposure. If illness or adverse symptoms develop, seek medical attention.

Ingestion: Do not induce vomiting. Seek immediate medical attention.

Note to Physician: Gastric lavage using a cuffed endotracheal tube may be performed at your discretion.

G. Physical Data

Appearance: Colorless Liquid
Odor: Mild, Characteristic
Boiling Point: 370-525F (187-274C)
Vapor Pressure: 0.2 psia (Reid) $\pm .35$
Vapor Density (Air = 1): 4.5
Solubility in Water: Negligible
Specific Gravity (H₂O = 1): 0.81-0.82 at 60/60F (16/16C)
Percent Volatile by Volume: 100
Evaporation Rate (Ethyl Ether = 1): <1
Viscosity: 2.0-2.2 cSt at 25C (77F)

H. Fire and Explosion Data

Flash Point (Method Used): 155-165F (68-74C) (PMCC, ASTM D93)
Flammable Limits (% by Volume in Air): LEL - 0.7
UEL - 5.0

Fire Extinguishing Media: Dry chemical, foam, carbon dioxide (CO₂).

Special Fire Fighting Procedures: Evacuate area of all unnecessary personnel. Wear appropriate safety equipment for fire conditions including self-contained breathing apparatus (SCBA) and other equipment and/or garments described in Section C if exposure conditions warrant. Shut off source, if possible. Do not spray water directly on fire - product will float and could be reignited on surface of water. Water fog or spray may be used to cool exposed equipment and containers.

Fire and Explosion Hazards: Carbon oxides and various hydrocarbons are released when burned.

I. Spill, Leak and Disposal Procedures

Precautions Required if Material is Released or Spilled:

Evacuate area of all unnecessary personnel. Wear protective equipment and/or garments described in Section C if exposure conditions warrant. Shut off source, if possible and contain spill. Protect from ignition. Keep out of water sources and sewers. Absorb in dry, inert material. Transfer to disposal containers using non-sparking equipment.

Waste Disposal (Insure Conformity with all Applicable Disposal Regulations):
Incinerate or place in a permitted waste management facility.

J. DOT Transportation

Shipping Name: Combustible liquid, n.o.s. (Paraffinic and aromatic hydrocarbons)
Hazard Class: Combustible liquid
ID Number: NA 1993
Packing Group: III
Marking: 1993 on Bulk Containers
Label: None
Placard: Combustible/1993
Hazardous Substance/RQ: None
Shipping Description: Combustible liquid, n.o.s. (Paraffinic and aromatic hydrocarbons), Combustible liquid, NA 1993, PG III
Packaging References: 49 CFR 173.150, 173.203, 173.241

NOTE: The above information is applicable when the product is shipped in containers larger than 110 gallons. If shipped in 110 gallon or smaller containers it is not regulated by the DOT Hazardous Material Regulations.

K. RCRA Classification - Unadulterated Product as a Waste

Not Applicable

L. Protection Required for Work on Contaminated Equipment

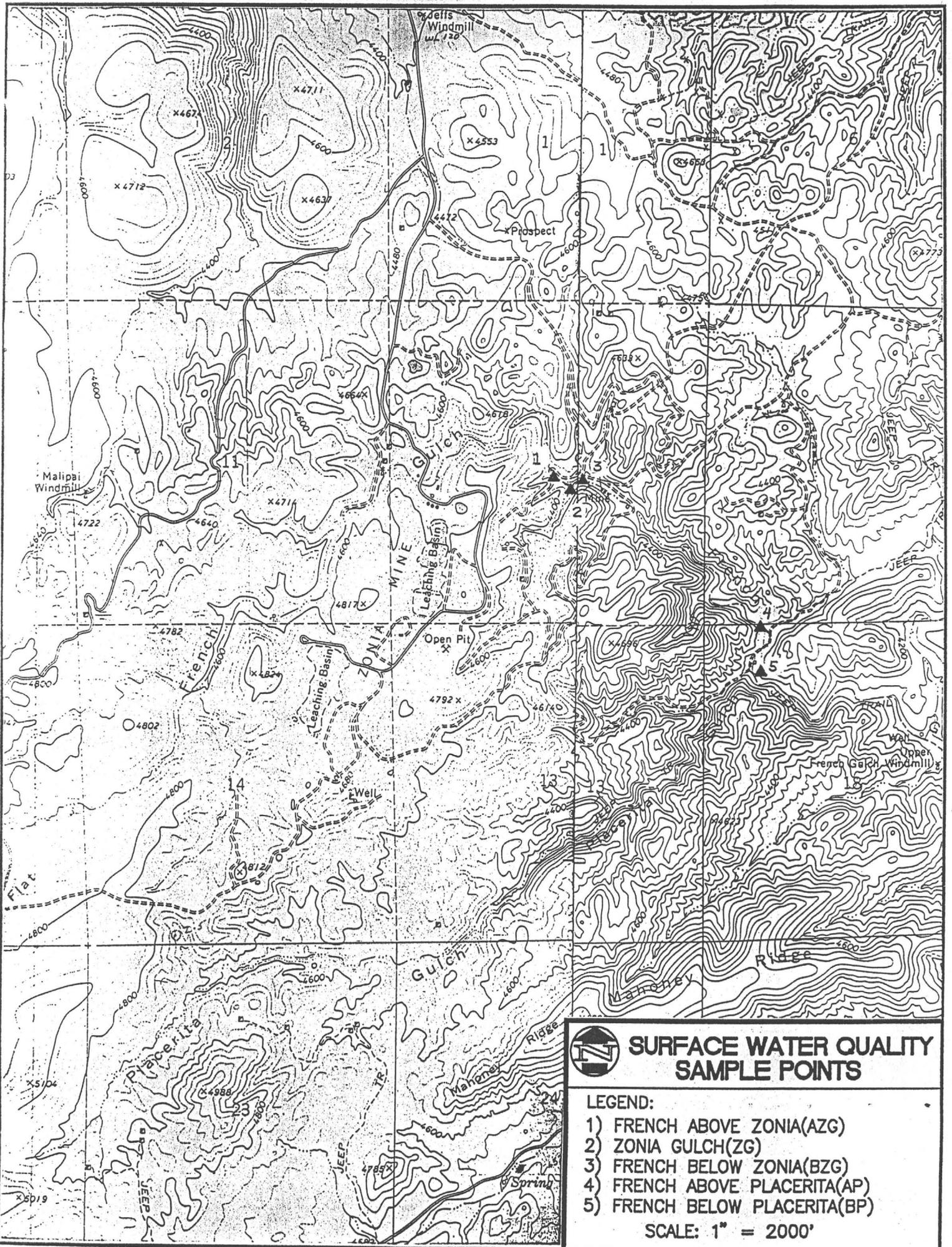
Contact immediate supervisor for specific instructions before work is initiated. Wear protective equipment and/or garments described in Section C if exposure conditions warrant.

M. Hazard Classification

This product meets the following hazard definition(s) as defined by the Occupational Safety and Health Hazard Communication Standard (29 CFR Section 1910.1200):

<input checked="" type="checkbox"/> Combustible Liquid	<input type="checkbox"/> Flammable Aerosol	<input type="checkbox"/> Oxidizer
<input type="checkbox"/> Compressed Gas	<input type="checkbox"/> Explosive	<input type="checkbox"/> Pyrophoric
<input type="checkbox"/> Flammable Gas	<input checked="" type="checkbox"/> Health Hazard (Section F)	<input type="checkbox"/> Unstable
<input type="checkbox"/> Flammable Liquid	<input type="checkbox"/> Organic Peroxide	<input type="checkbox"/> Water Reactive
<input type="checkbox"/> Flammable Solid		

Based on information presently available, this product does not meet any of the hazard definitions of 29 CFR Section 1910.1200.



 **SURFACE WATER QUALITY SAMPLE POINTS**

- LEGEND:**
- 1) FRENCH ABOVE ZONIA(AZG)
 - 2) ZONIA GULCH(ZG)
 - 3) FRENCH BELOW ZONIA(BZG)
 - 4) FRENCH ABOVE PLACERITA(AP)
 - 5) FRENCH BELOW PLACERITA(BP)

SCALE: 1" = 2000'